ESPI

European Space Policy Institute

SPACE POLICIES, ISSUES AND TRENDS IN 2007/2008

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TABLE OF CONTENTS

Introduction

Background

From 2002 until 2005, the European Space Agency (ESA) published annual reports that provided an overview of the European space sector in a global context. These reports entitled "The European Space Sector in a Global Context" took into account the geopolitical and economic changes that occurred in a given year and which were of importance for the European space sector. These aspects were then analysed in a boarder context. ESA's annual analysis also presented facts and figures of other space powers in order to be able to view the development of the European space sector in a larger perspective.

Objectives of this Study

In 2006, ESA's DG Policy Office tasked the European Space Policy Institute (ESPI) based in Vienna (Austria) under a specific contract to conduct a nine-month study on global issues and trends in the space sector covering the period 1 January 2006 to 30 June 2007. ESA's DG Policy Office commissioned a similar study in 2007 for the period 2007/2008. The ESPI study "Space Policies, Issues and Trends in 2007/2008" aims to present in a single document, comprehensive data and analyses characterising global space activities from 1 July 2007 to 30 June 2008.

This report provides an overview of the European space sector in a global context. It takes into account geopolitical and economic changes that are of relevance and importance for current and future developments in the European space sector. It provides facts and figures on the latest European activities, while putting them into perspective with the situations of other major space-faring countries, notably the United States, Russia, Japan, China and India.

Chapter 1 - Global political and economic trends

2007 and the first half of 2008 was a period marked by the confirmation of several key trends that appeared in recent years such as the economic and political rise of powers from the "South" like China and India as well as the recovery of Russia, while the "North" witnessed limited growth, particularly the United States. Climate change and global warming are increasingly being perceived as serious global threats demanding an urgent and coordinated global response. In addition, skyrocketing prices of natural resources such as oil and gas, but also the rise of primary products' prices is further aggravating the global economic situation.

1.1 Global economic outlook

The expansion of the world economy remained robust in 2007 (Table 1). However, global economic growth slowed markedly in the final quarter of 2007 following major losses in the financial sector originating in the U.S. subprime sector and the associated losses reported by banks. The financial crisis is now spreading beyond the U.S. subprime market, and financial institutions in other countries have also been affected. The International Monetary Fund (IMF) is anticipating potential losses and write-downs in the financial sector of about 945 billion U.S. dollars, with banks suffering slightly more than half of total losses, with the rest affecting insurance companies, pension funds, hedge funds and other investors. [2] Consequently, near-term growth prospects of all major economies have weakened (Table 1).

According to the IMF, the world output in 2007 reached 5%: a similar level to 2006 (Table 1). Global economic growth is projected at 4.1% in 2008 and 3.9% in 2009 (Table 1). The projections for advanced economies have been reduced significantly in recent months and there are looming threats of recession for the second half of 2008. This is the result of deteriorating market conditions and limited U.S. growth which are affecting economic activities in other advanced economies. The main risks to the outlook for global growth are that on-going turmoil in financial markets (partly due to liquidity shortages and increasing credit risks) would further reduce domestic demand in advanced economies and therefore create significant spillovers into emerging markets and developing economies. Nonetheless,

Country	2006	2007	2008 (projection)	2009 (projection)
The United States	2.9	2.2	1.3	0.8
Germany	2.9	2.5	2.0	1.0
France	2.2	2.2	1.6	1.4
Italy	1.8	1.5	0.5	0.5
Spain	3.9	3.8	1.8	1.2
The United Kingdom	2.9	3.1	1.8	1.7
Euro zone	2.8	2.6	1.7	1.2
European Union	3.3	3.1	1.8	1.7
Japan	2.4	2.1	1.5	1.5
Russia	7.4	8.1	7.7	7.3
China	11.6	11.9	9.7	9.8
India	9.8	9.3	8.0	8.0
World output	**5.1**	**5.0**	**4.1**	**3.9**

Table 1 Overview of the World Economic Outlook Projection (Source IMF)[1]

[1] International Monetary Fund "World Economic Outlook Update: Global Slowdown and Rising Inflation." 17 July 2008.

[2] International Monetary Fund "Global Financial Stability Report: Containing Systemic Risks and Restoring Financial Soundness." Apr. 2008.

emerging economies are expected to continue to grow at a rapid pace in 2008. This could counterbalance moderate growth in major economies.

In the United States, the Federal Reserve has been cutting interests rates in response to increasing downside risks to activity. However, the United States could fall into recession in 2008 and recover only modestly in 2009. The projected growth rate for 2008 in the United States has been lowered to 1.3% for 2008 down from 2.2% in 2007 (Table 1). In 2007, the euro zone expanded at a robust pace, with growth estimated at 2.6% (Table 1). However, growth has been lowered to 1.7% for 2008. Growth in the European Union (EU) was 3.1% in 2007 and is projected at 1.8% in 2008, but recent estimates are less optimistic (Table 1). Japan has been quite resistant to the global economic downturn up to now, with a forecasted growth of 1.5% in 2008 compared to 2.1% in 2007 (Table 1).

As aforementioned, unlike advanced economies, emerging economies have been less affected by the financial market turbulence thus far and have continued to grow at a rapid pace. These economies have, in particular, benefited from the strong momentum of domestic demand. According to IMF projections, emerging and developing economies, including in Africa and Latin America, are expected to witness strong growth rates. Nonetheless, growth in emerging markets and developing economies is expected to ease moderately from 8% in 2007 to 6.9% in 2008.[3] China's economy will sustain further momentum despite the fact that its growth is projected to decelerate from 11.9% in 2007 to about 9.7% in 2008. India's economy is also expected to continue to grow very rapidly (about 8% in 2008, down from 9.3% in 2007) as well as Russia's (7.7% in 2008 down from 8.1% in 2007) (Table 1).

Despite market turmoil and slow growth in major economies, prices of energy commodities reached record prices when expressed in U.S. dollars in the first half of 2008 (i.e. crude oil) reflecting solid growth in demand in the face of sluggish supply and on-going geopolitical concerns. Several staples like soybean, corn, and wheat, prices reached also high price levels due to among others higher biofuel demand in the United States and the European Union. As a consequence, the cost of feeding livestock is rising. Furthermore, poor harvests in many countries have led to further price hikes causing some major food shortages in certain parts of the world, triggering public protests (e.g. Haiti, Senegal). Inflation has increased considerably since mid-2007 in both advanced and emerging market economies driven by a combination of increasing food and energy prices as well as credit growth and sustained demand.

1.2 Political developments

In 2007/2008, transnational security threats and particularly terrorist attacks as well as significant military events and new and emerging conflicts menacing world peace and stability and are calling for increasing reliance on space technologies and activities to monitor some of these events.

1.2.1 Europe

The threat of terrorist attacks on European soil remained high in the past months, particularly as German security forces arrested in September 2007 three suspects thought to be planning a massive terrorist attack on American targets in Germany, including the Ramstein Air Base on Frankfurt airport. The arrests came a day after eight terrorist suspects were apprehended in Denmark.

1.2.2 Asia

Pakistan witnessed several destabilising moments in recent months. First, in July 2007, a week-long siege of the Lal Masjid or Red Mosque in Islamabad, lead to nearly 100 deaths as about 200 Pakistani commandos stormed the compound and met strong resistance from militants sheltering inside. Then, a series of bombs exploded throughout the country in response to this event. Fierce fighting occurred also in the South Waziristan region of Pakistan between the army and Taliban militants in January 2008. Benazir Bhutto, twice prime minister of Pakistan, also returned home after eight years in exile to participate in the general election. However, her assassination on 27 December 2007 led to times of political turmoil. Finally, at the end of March 2008, Yousaf Raza Gillani (Pakistan People's Party) became Prime Minister as chief of a coalition government.

International inspectors confirmed in July 2007 that North Korea's plutonium-producing nuclear reactor at Yongbyon, north of Pyongyang, and four other facilities there have been shut down. Consequently, American and North Korean officials held

[3] Ibid.

talks in Geneva (Switzerland) in September 2007 where both sides agreed that North Korea should reveal and disable all its nuclear facilities by the end of the year. However, in April 2008 the United States expressed concern that North Korea had still not kept its promise to declare all its nuclear programmes which it was supposed to divulge by the end of 2007. In June 2008, North Korea finally handed in a list of nuclear facilities, thus complying with its international obligations.

While North and South Korea held the first inter-Korean summit since 2000 in October 2007, at which Kim Jong Il, North Korea's dictator, met South Korea's President, Roh Moo-hyun and agreed to seek a formal end to the civil war of the 1950s, tensions heightened again in the Korean peninsula. North Korea expelled South Korean officials from their joint industrial park at Kaesong in April 2008. It also issued a warning that the policies of newly elected South Korea's president, Lee Myung-bak would lead to catastrophe.

In September 2007, heavy protests led by monks in Myanmar (the country formerly known as Burma) were violently repressed. Furthermore, a cyclone devastated the southern part of the country flooding large areas with salted water and killing an estimated 78 000 people with 56 000 reported as missing. The junta in power was severely criticised after it failed to evacuate the risky areas and refused to let international aid into the country in the early aftermath of the catastrophe.

In Sri Lanka, following a series of bomb attacks by the Liberation Tigers of Tamil Eelam, the government abrogated a 2002 ceasefire agreement with the Tigers in January 2008.[4]

In Afghanistan, the Taliban continued their resurgence despite the surge in soldiers sent in the context of the NATO-led mission; the killings of foreign troops in Afghanistan are now at a similar level as in Iraq. Moreover, in mid-June, an attack was staged by Taliban against a prison in Kandahar, freeing about 1200 prisoners, including 450 Taliban members. A United Nations report showed that Afghanistan's opium production has also climbed sharply. It is now producing twice the amount it did just two years ago, and accounts for 93% of heroin on global markets. There is also increasing evidence of direct involvement in the business by Taliban insurgents to finance part of their activities.

[4] The agreement has remained notionally in force despite the return of all-out conflict over the past two years.

1.2.3 Africa

Several conflicts, as well as contested elections, occurred in Africa in the past few months threatening regional peace and stability.

In Congo, fighting in the North Kivu province between the army and rebels of General Laurent Nkunda has resulted in some 500 000 displaced civilians since the beginning of 2007. In February 2008, forces loyal to Chad's president, Idriss Déby, thwarted an attack by rebels on the country's capital, Ndjamena. An African Union force of more than 1300 troops invaded Anjouan on 11 March 2008, one of the three islands that make up the Comoros off the coast of Mozambique, and toppled its rebel leader, Mohamed Bacar. He had taken power in July 2007 after winning an election that the Comorian president declared illegal.

However, the Horn of Africa remains the centre of attention on the continent. The United Nations Security Council voted in August 2007 to send a peacekeeping force of up to 26,000 soldiers and police to the Darfur region of Sudan, where at least 200 000 people have been killed and about 2.5 million made homeless since 2003. In Somalia, humanitarian agencies estimate that 20 000 people a month were fleeing violence in Mogadishu. [5] Food and sanitary problems, already major issues, continue to worsen.

Protests in Kenya against the re-election of President Mwai Kibaki in December 2007 led to widespread violence and a death toll that exceeded 1 000, most of which occurred between rival ethnic groups throughout the country, especially in the Rift Valley. Negotiations between representatives of the incumbent, Mwai Kibaki, and his challenger, Raila Odinga, were held under the aegis of the former United Nations (UN) Secretary-General, Kofi Annan.

Following the 29 March 2008 elections in Zimbabwe, the country has been plunged into a political crisis with the government refusing to announce who won the race for Presidency between the President Robert Mugabe and its rival Morgan Tsvangirai. It appears that Morgan Tsvangirai should be the winner of the first race, but as a consequence to the latter's incarceration and violent repression of his followers, Mr. Tsvangirai chose not to participate in the second electoral process, leaving Mr. Mugabe as the

[5] Islamic fighters control part of South Somalia, and Ugandan and Ethiopian troops present on the ground struggle to maintain the status quo.

only candidate, and as such, "winner". The international community has actively been denouncing these elections and economic sanctions will be implemented against Mr. Mugabe's government.

South Africa witnessed xenophobic violence and assassinations by indigenous gangs against immigrants from Mozambique, Malawi and Zimbabwe that were accused of stealing jobs and of being criminals.

Terrorism is also becoming of major concern on the African continent. Nigeria's oil-rich Niger Delta region witnessed frequent attacks on oil infrastructure as well as the kidnapping of foreign oil workers. Piracy attacks on foreign vessels on the shore of Somalia also increased in the first half of 2008. A suicide bomber in Algeria killed more than ten people in an attack on barracks in July 2007. Then, Al-Qaeda in the Islamic Maghreb, an Algerian group affiliated to Osama bin Laden's organisation claimed responsibility for two car-bombs in Algiers in December 2007 which killed 76 people, including 11 United Nations employees.

1.2.4 Americas

The situation of hostages held by the left-wing Revolutionary Armed Forces of Colombia (FARC) guerrillas was a focal point in Latin America in the past months. Venezuelan President, Hugo Chávez tried to secure an agreement under which the rebels would release their kidnapped hostages in exchange for the liberation of guerrilla prisoners. However, as Colombian forces bombed a guerrilla camp just across the border in Ecuador in March 2008 killing one of the FARC's senior commanders, Ecuador and Venezuela (temporarily) broke diplomatic relations with Columbia. The FARC's situation is becoming more precarious after the death of their spiritual leader and the diminution of their occupied territories.

Fidel Castro's brother, Raul Castro was designated as the former leader's successor. Raul wishes to raise living standards in Cuba, but not to depart from socialism.

1.2.5 The Middle East

In July 2007, the Israeli air force bombed a target in Syria suspected of being a nuclear power plant in development, but neither the Israelis nor the Syrians disclosed what the target was.

Lebanon witnessed its worse political crisis since the 1975-1990 civil war due to the fierce power struggle between the pro-Western government and the Syria-backed opposition. The Lebanese Parliament has unsuccessfully attempted for nine months since September 2007 to vote for a President. After months of delay, on 25 May 2008, General Michel Sleiman, the Commander of the Lebanese Armed Forces was elected President as the consensus candidate.

U.S. President George W. Bush hosted a Middle East Peace Summit in Annapolis (USA) on 27 November 2007 to try to bring peace and stability in the Middle East region. Besides the Israeli and Palestinian delegations, Saudi Arabia, Syria and other Arab states attended the summit. The conference ended with a commitment to the goal of a Palestinian state, and a promise of immediate talks, but with no mention of borders, Jerusalem or Jewish settlements on the West Bank. Despite this political effort, fighting flared across Israel's border with Gaza. Moreover, Hamas claimed responsibility in February 2008 for its first suicide-bombing since 2004, after two Palestinians attacked the Israeli town of Dimona. However, Israel accepted a truce with Hamas in June 2008 to prevent further rocket firing on Israeli territories as well as further violence from Israel on the Gaza strip.

In October 2007, the Turkish Parliament gave the government approval for a cross-border operation and military incursion into Northern Iraq after Turkish soldiers were killed by Kurdistan Workers' Party (PKK) rebels some of whom may have come from bases in northern Iraq. The Turkish ground offensive occurred in February 2008 and considerably weakened the Kurdish militants.

While in December 2007, a report by America's National Intelligence Council concluded that Iran did have a nuclear-weapons programme up until 2003, but that it had since been halted, in March 2008, the United Nations Security Council imposed a third, more punishing, range of sanctions against Iran for failing to stop enriching uranium. Mahmoud Ahadinedjad visited Iraq at the beginning of March 2008. As the first regional leader to do so, the Iranian President highlighted his country's influence on Iraq and on the Middle-East region in general.

In Iraq, the five-year old conflict is stabilising, as the number of Iraqi civilian deaths began to decline by 2007's end. In addition, the Iraqi Red Crescent reported that some 25 000 refugees (out of about 1.5 million) who had fled to Syria had returned to Iraq between September and the beginning

of December 2007. However, no hope of lasting and enduring peace and stability are expected in the near future, as attacks and conflicts continue throughout the country. Australian troops started withdrawing from the country in June 2008, as the death tolls of U.S. troops decreased.

1.3 Major scientific achievements

From mid-2007 until mid-2008, two international observance years relating to space occurred, namely the International Polar Year (IPY) and the International Heliophysical Year (IHY).[6] In addition, the official opening of the international Year of Planet Earth (IPYE) took place on 12-13 February at the United Nations Educational, Scientific and Cultural Organization (UNESCO) headquarters in Paris (France). The IPYE is a joint initiative by the International Union of Geological Sciences (IUGS) and UNESCO and was proclaimed by the 60th United Nations General Assembly as a United Nations International Year. The research themes of the year were chosen for their societal relevance, multi-disciplinarity and outreach potential (Groundwater, Climate, Earth and Health, Deep Earth, Megacities, Resources, Hazards, Ocean, Soil, Earth and Life). The IPYE addresses the decision-makers and the general public through a large series of national and international events on geo-scientific knowledge to support global society, as expressed in the IPYE's subtitle: Earth Science for Society.

The next related international observance related to space activities will be the 2009 International Year of Astronomy (IYA2009), which will coincide with the 400th anniversary of the first recorded astronomical observations with a telescope by Galileo Galilei and the publication of Johannes Kepler's *Astronomia nova* in the 17th Century. This initiative will be an opportunity for citizens to gain a deeper insight into astronomy and will serve as a platform to inform the public about the latest astronomical discoveries as well as emphasising the role of astronomy in science education.

In recent months, climate change has topped the political agenda of most of the countries around the world as the consequences of global warming are becoming increasingly salient. In particular, according to recent data from the National Oceanic and Atmospheric Administration (NOAA), the year 2007 was the fifth-warmest on record for global land and ocean surface temperatures. In addition, when taken separately, the global land surface was the warmest on record, while the global ocean temperature was the ninth-warmest since records began in 1880. Moreover, seven of the eight warmest years on record have occurred since 2001.[7] Consequently, the sea ice covering the Arctic has shrunk in September 2007 to its lowest level since satellite measurements began nearly 30 years ago or by about one million square kilometres over the past year, according to the European Space Agency (ESA).[8]

On 16 November 2007, the Inter-governmental Panel on Climate Change (IPCC) concluded its work on a "synthesis report" of the Fourth Assessment Report (AR4) on climate change in Valencia (Spain). The Synthesis Report brings together the work of the three previous Working Groups of the IPCC published in the first half of 2007 which dealt with the human origin of global warming (February 2007), the likely impacts of climate change (April 2007) and options for mitigating climate change (May 2007).[9] Therefore, the synthesis report provides an integrated view of climate change, as the final part of the IPCC's AR4.

Acknowledging the fact that climate change and global warming are threats demanding an urgent global response, a United Nations Climate Change Conference took place in Bali (Indonesia) on 3-15 December 2007. More than 10 000 participants, including representatives from nearly 190 countries and observers from intergovernmental and non-governmental organisations took part in this event. Negotiations on a successor to the Kyoto Protocol (post-2012 framework) dominated the conference. The "Bali Roadmap" consisting of a number of forward-looking decisions for more vigorous international action on climate change was adopted. This roadmap includes the "Bali Action Plan" which charts the course for a new negotiation process to end by the end of 2009 and designed to reduce greenhouse gas

[6] For more information see Peter, Nicolas. "Space Policy, Issues and Trends in 2006/2007." ESPI Report 6 Sept. 2007: 8-9.

[7] "2007 was Tenth Warmest for U.S., Fifth Worldwide." NOAA 15 Jan. 2008 <http://www.noaanews.noaa.gov/stories2008/20080115_warmest.html>.

[8] "Satellite Witnesses Lowest Arctic Ice Coverage in History." ESA: Observing the Earth 14 Sept. 2007 <http://www.esa.int/esaEO/SEMYTC13J6F_index_0.html>.

[9] For more information, see Peter, Nicolas. "Space Policy, Issues and Trends in 2006/2007." ESPI Report 6 Sept. 2007: 8.

emissions. The Bali Conference was followed by the United Nations Bangkok Climate Change Talks which took place on 31 March - 4 April 2008 in Bangkok (Thailand). An agreement was reached for a work programme structuring negotiations on a long-term international climate change agreement planned to be concluded in Copenhagen (Denmark) by the end of 2009 by delegates from 162 countries. The main elements of this agreement include a shared long-term vision and enhanced action on mitigation, adaptation, technology and finance. The next major UN Climate Change meeting was held in Bonn (Germany) in May 2008. This event addressed the issue of advancing adaptation to climate change through finance and technology.[10]

Climate change and global warming are thus increasingly being recognised as becoming some of the most important issues threatening long-term world peace and stability. Following the preoccupation of the 33rd G8 meeting held in Heiligendamm (Germany) on 6-7 June 2007, Climate Change was again on the agenda of the next G8 in Hokkaido (Japan) from 7-9 July 2008. The Nobel Peace Prize 2007 was also awarded on 12 October 2007, jointly to the former U.S. Vice President Al Gore and the IPCC for their "efforts to build up and disseminate greater knowledge about man-made climate change and to lay the foundations for the measures which are needed to counteract such change". [11] Moreover, on 3 March 2007, Javier Solana, the High Representative for the Common Foreign and Security Policy (CFSP)[12] released an eight-page report on "Climate change and international security" to the EU Council. The report highlights that climate change will have a growing impact on international security, due, among other things, to increasingly hostile competition between States for dwindling global resources. One of the possible consequences could be millions of "environmental" migrants or refugees fleeing the consequences of climate change.[13]

[10] The third major UN gathering on climate change will take place in August 2008 in Ghana and will look more closely at issues related to enhanced action on mitigation. Finally, a fourth meeting will be held in Poland in December 2008 to address the issue of risk management and risk reduction strategies, technologies and key elements of a long-term vision for joint action.
[11] "The Nobel Prize 2007" <http://nobelprize.org/nobel_prizes/peace/laureates/2007/>.
[12] Javier Solana is also the Secretary-General of both the Council of the European Union (EU) and the Western European Union (WEU).
[13] Paper from the High Representative and the European Commission to the European Council. "Climate Change and International Security." 4 Mar. 2008.

1.4 Selected Focus

1.4.1 Europe in 2007/08

EU's economy is projected to grow by about 1.8% compared to 3.1% in 2007, and the estimate for the euro zone is a 1.7% growth in 2008.[14] Europe's slowdown in late 2007 followed the bleak economic performance of the United States and the crisis in the financial sector as well as the increase in the prices of natural resources. In the spring and summer of 2008, amidst overall worsening of economic indicators, inflation reached record heights in the euro zone. Before this backdrop, the European Central Bank (ECB) raised its central rate in summer 2008 to keep inflation in check.

In continuation of the work commenced under the Portuguese Presidency of an Intergovernmental Conference (IGC), EU's leaders met on 18-19 October 2007 at an Informal EU summit in Lisbon (Portugal) and agreed to a new treaty: The "Treaty amending the Treaty on European Union and the Treaty establishing the European Community" known as the "Lisbon Treaty" is to replace the European Constitution, which was rejected by voters in France and the Netherlands in 2005. On 13 December 2007, during a special Summit also in Lisbon, EU heads of States and Governments officially signed the new Treaty, which incorporates most of the defunct EU Constitution. The Lisbon Treaty aims to enhance the efficiency of the EU with a major focus on the reorganisation of the institutional and decision-making processes. In particular, the Lisbon Treaty merges the "three pillars" into one single EU, which succeeds the European Community. It introduces a double majority rule for Council decisions, a permanent Council President, the position of High Representative of the EU for Foreign Affairs and Security Policy, a reduction of the number of Commissioners as well as of the number of Members of the European Parliament. Hungary was the first country to ratify the Treaty on 17 December 2007. As of end June 2008, the "Treaty of Lisbon" has been ratified by 23 countries (Austria, Belgium, Bulgaria, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Malta, Poland, Latvia, Lithuania, Luxembourg, Portugal, Romania, Slovakia, Slovenia, Spain, the Netherlands and the United Kingdom). However, the EU now faces a stalemate

[14] International Monetary Fund "World Economic Outlook Update: Global Slowdown and Rising Inflation." 17 July 2008.

because of Ireland's negative referendum on the Lisbon Treaty on 13 June 2008.

On 1 January 2008, Slovenia became the first of the ten new Eastern European members of the EU to take over the six-monthly rotating Presidency of the Council of the European Union. Slovenia's Presidency follows its trio partners Germany and Portugal. The central issue of the programme of this trio is the completion of EU's reform and constitutional process, the implementation of the Lisbon Strategy for Growth and Employment, as well as further progress towards the completion of the European area of freedom, security and justice (Cf. Chapter 7). The main priorities of the Slovenian Presidency were: the future of the European Union and timely entry into force of the Lisbon Treaty, the successful launching of the new Lisbon Strategy cycle, a step forward in addressing climate-energy issues, strengthening of the European perspective for the Western Balkans, and promoting the dialogue between cultures, beliefs and traditions in the context of the European Year of Intercultural Dialogue.

In the last few months, Science and Technology (S&T) has been at the top of the agenda in Europe. At the Competitiveness Council held on 22 November 2007, ministers in charge of competitiveness stressed the importance of making full use of small and medium enterprises' (SMEs) growth potential by improving their access to finance. Following a proposal from the Commission, the member States, through the Regulatory Committee for Executive Agencies accepted the creation of two executive agencies on 14 December 2007 to manage the research and development (R&D) project proposal and evaluation process for the EU's seventh Framework Programme (FP7) to increase the efficiency of research management of EU-funded projects. The "European Research Council Executive Agency" will support the implementation of the Ideas Programme of the FP7, which supports frontier research. The "Research Executive Agency" will administer the Marie Curie fellowships schemes, research for the benefit of SMEs and parts of the Space and Security research themes. It will also provide evaluation and support services to all other parts of FP7.

An important milestone for the EU was also that in 2008, for the first time ever, the largest share of the EU budget will be used for measures to boost economic growth and cohesion in the EU. On 18 December 2007, the European Parliament adopted the EU budget amounting to 129.1 billion euros in commitment appropriations for 2008 (an increase of 2.2% compared to 2007).[15] While agriculture will continue to receive over 40% of EU budget, about 45% of all EU spending will be devoted to competitiveness.

The European Institute of Innovation and Technology (EIT) was approved by the European Parliament on 11 March 2008, and concrete research, education and innovation actions are expected to start by 2010. The EIT will be a virtual network of universities, companies and other stakeholders expected to form Knowledge and Innovation Communities (KICs).[16] The first KICs will focus on renewable energy and next-generation information and communication technologies. The EIT will be based in Budapest (Hungary).

Reflecting the increasing worldwide concerns about climate change and global warming, a Strategic Energy Technology plan (STE) was proposed at the end of 2007. Its aim is to increase the use of "clean" or low greenhouse gases (GHGs) emitting energy technologies. On 23 January 2008, a package of climate and energy proposals suggested by the Commission was well received by EU member States and the European Parliament. Initially made in March 2007, the "20-20" commitments were translated into legislative proposals by the Commission in January 2008. This proposal is designed to bring the EU's emissions of GHGs down by 20% by 2020, while the use of renewable energies should increase by 20% during the same period. EU efforts to reduce GHGs emissions will be increased 30% by 2020 provided that an international agreement is reached for tackling climate change by the expiry of the Kyoto Protocol in 2012. According to conclusions agreed to during the spring European Council on 14 March 2008, "comprehensive deliberations" between the Council and the Parliament on the Commission's proposal should produce a deal before 2008 to be adopted at the latest in early 2009. A series of others initiatives have also been adopted in the last months. For instance, the "Clean Sky" Joint Technology Initiative (JTI)[17] was also launched on 5 February 2008 to help the aviation industry develop environmentally-friendly technology

[15] European Commission "General Budget of the European Union - The Figures." Jan. 2008.
[16] Each KIC must have at least three partner organisations, based in two or more member States with at least one of the partners being a university and at least one a private company.
[17] Joint Technology Initiatives (JTIs) are legal entities which are proposed as a new way of realising public-private partnerships (PPPs) in relevant industrial research and development fields at European level.

and reduce air and noise pollution. During the Competitiveness Council on 25 February 2008, EU research ministers also approved the essential elements for the launch of the EU "fuel cells and hydrogen" JTI to reduce GHGs and introduce hydrogen into the energy system.

The futures of the EU as well as its enlargement have been also a major element of the European political agenda in the past months. In particular, a new high-level "reflection group" to deal with long-term issues such as strengthening and modernising the European model of economic success and social responsibility, the rule of law, sustainable development energy and climate change etc. was launched at the European Council in December 2007.

On 8 November 2007, the EU justice and interior ministers cleared the way for the enlargement of the Schengen area to include nine of the new Eastern European member States.[18] The decision extended the passport-free travel system to Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovenia, Slovakia and the Czech Republic. Internal land and sea border checks were consequently abolished on 21 December 2007.

In December 2007, the EU initiated a pre-membership agreement with Bosnia-Herzegovina at a ceremony in Sarajevo. A full agreement to start the process which could eventually make the country a member of the EU depends, among other things, on the country's capacity to merge its ethnically separate police forces. An "indicative timetable" for concluding EU membership talks with Croatia by November of next year was presented by Commission President José Barroso in March 2008, with 2010 as the likely entry date provided that a number of conditions are met by Croatia. Turkey is also making steady progress in satisfying the EU's membership criteria to join the Union. In the mean time, Kosovo declared independence in February 2008 making it the seventh country to emerge from the dissolution of the former Yugoslavia. The declaration was met with demonstrations by Serbs in Kosovo as well as denunciations by the governments of Serbia and Russia, a split over recognition within the EU, and arguments between Russia and the United States at the United Nations.

[18] Thus far, 13 EU member States (Germany, Austria, Belgium, Denmark, Spain, Finland, France, Greece, Italy, Luxembourg, the Netherlands, Portugal and Sweden) and two non-EU countries (Norway and Iceland) have been participating fully in the Schengen *acquis*.

Cyprus and Malta became the 14th and 15th countries to adopt Europe's single currency – the euro – on 1 January 2008. The euro in Slovakia was approved on 7 May 2008 by the European Commission. Other EU newcomers wishing to follow suit will have to wait, because their inflation rates are too high. Denmark, however, is expected to have a referendum regarding its eventual euro zone membership within the next 18 months.

In the last few months, the EU also reinforced it position in the world stage by strengthening a series of partnerships.

The first-ever EU-Brazil Summit was held on 4 July 2007 in Lisbon (Portugal). A strategic partnership agreement with Brazil was concluded. It was agreed to enhance this longstanding bilateral relationship, and in particular, to reinforce the political dialogue at the highest political level. This agreement also raises the hope of deeper cooperation between the EU and Mercosur, the South American free trade zone.

An EU-African Union Summit in Lisbon was held on 8-9 December 2007. It was the first meeting of this kind in seven years since the Cairo meeting in 2000.[19] The Summit ended with the signing of a strategic political "partnership of equals" aiming to overcome the "traditional donor-recipient relation-ship".[20] A Joint EU-Africa Strategy providing a long-term vision for a strategic partnership between Africa and the EU was adopted as well as an initial Action Plan 2008-2010 setting out priorities that should be implemented in the next three years (Cf. Chapter 7). However, the EU-Africa Summit failed to reach agreement on comprehensive trade deals (the so-called Economic Partnerships Agreements).

The 17th EU-Japan Summit meeting took place under the Slovenian Presidency on 23 April 2008. The debates focused on global issues such as energy security and climate change as well as unresolved issues within the World Trade Organisation (WTO). Several regional issues in Asia and the Middle East were also discussed.

In spring 2008, the fifth EU-Latin America and the Caribbean (LAC) Summit was held in Lima (Peru) on 16-17 May 2008. The Summit

[19] The African Union (AU) is an intergovernmental organisation consisting of 53 African countries. Established on 9 July 2002, the AU was formed as a successor to the amalgamated African Economic Community (AEC) and the Organisation of African Unity (OAU). Its headquarters is in Addis Ababa (Ethiopia).

[20] "The Africa-EU Strategic Partnership: Joint Africa-EU Strategy and Action Plan." 9 Dec. 2007.

reiterated the great importance of the EU's relations with the LAC and its aspirations to strengthen the EU-LAC Strategic Partnership. The Lima Summit focused on the two themes: poverty, inequality, and inclusion; and sustainable development with a particular focus on: climate change; environment and energy.

Negotiations with Russia on a new Partnership and Cooperation Agreement (PCA) started in spring 2008, as the current PCA which came into force on 1 December 1997 was concluded for a ten-year period. The agreement is to be renewed automatically on an annual basis unless one side decides to withdraw.[21]

French President Sarkozy's push to create a "Mediterranean Union" has been accepted and its principle enlarged (under the new title "Union for the Mediterranean") at the European Council held on 13-14 March 2008.[22] The initiative aims at upgrading the EU's relations with its neighbours from North Africa and the Middle East which have thus far been dealt with under the umbrella of the Barcelona Process. The main focus of the new Union will be to improve energy supply, fight pollution in the Mediterranean, strengthen the surveillance of maritime traffic and "civil security cooperation", set up a Mediterranean Erasmus exchange programme for students, and create a scientific community between Europe and its southern neighbours. The agreement also foresees bi-annual summit meetings between the EU and its partner countries.

1.4.2 The United States in 2007/08

The subprime loan crisis has been the major focus of the U.S. economy in recent months, followed by growing trade deficit and the near collapse of the U.S. dollars in the spring of 2008. In 2007, the U.S. economy slowed markedly and grew only by 2.2% down from 2.9% in 2006. [23] Despite the Federal Reserve's policies, the burst of the housing bubble and the tightening of credit availability are having far-reaching effects resulting in a major contraction of consumption. In this context, President George W. Bush in his last state-of-the-union speech on 28 January 2008, urged the U.S. Congress to quickly pass a 150 billion U.S. dollar economic stimulus package to ward off a recession. Soon after, on 28 February 2008, the White House unveiled a 3.1 trillion U.S. dollars budget plan for 2009 which aims to boost national security, while stimulating economic growth.

The nominating process to choose the U.S.'s presidential candidates on both the Democratic and Republican side got under way just after Christmas 2007 with the Iowa caucuses on 3 January 2008 and the New Hampshire primary just five days later. In both camp, the economy, immigration, the war in Iraq, healthcare, and the environment dominated the campaign. The Democrat primary created some dramatic results, with stronger-than-expected results being attained by Senator Barack Obama creating an "Obamamania" among a large share of the Democrats. Nonetheless, Senator Hillary Rodham-Clinton stayed in the race and the face-to-face lasted until June 2008. Senator Barack Obama won the primary elections, thus representing the Democratic Party in the November 2008 presidential election. After a tight race against Senator Hillary Clinton, both politicians are now showing a united front in order to secure Democratic electors' votes. There was no such indecisiveness from the Republicans as Senator John McCain won enough delegates to deliver him the party's nomination as soon as March 2008.

Iraq was far from secure by mid-2008, but for the first time since the war started, the country has been edging toward stability. However, five years after the American-led invasion of Iraq began in March 2003, more than 4 000 U.S. soldiers have died in Iraq and Al-Qaeda remains the greatest threat to Iraq's security. Nonetheless, while 2007 culminated as the deadliest year in Iraq for U.S. soldiers in November 2007, the U.S. military reported that for several consecutive weeks, the number of car bombs, roadside bombs, mines, rocket attacks, and other violence had fallen to the lowest level in nearly two years. However, the conflict in Afghanistan worsened in spring 2008 with more U.S. soldiers being killed there than in Iraq. The estimated cost of the wars in Iraq and Afghanistan varies depending on federal agencies. It is, however, estimated that about 130 billion U.S. dollars have been spent on the Afghanistan conflict and about 450 billion U.S. dollars for the Iraq conflict since 2001.

[21] The formalisation of bilateral relations between the EU and individual partner countries has been achieved through the negotiation of PCAs. The aim of this particular PCA is to encourage political, commercial, economic and cultural cooperation between Russia and the EU.
[22] President Sarkozy has originally envisioned the new Union as involving only the EU's Mediterranean countries and its neighbours, but not the EU as a whole.
[23] International Monetary Fund "World Economic Outlook Update: Global Slowdown and Rising Inflation." 17 July 2008.

1.4.3 Russia in 2007/08

Since its collapse in the 1990s, Russia's recovery has continued. In 2007, real Gross Domestic Product (GDP) growth was sustained an 8.1% increase[24] principally due to high oil and commodity prices. However, inflation rose to almost 12% in December 2007, substantially exceeding the central bank's 6.5% to 8% year-end target and nearly attained 13% in February 2008.[25]

The last year has been a year of transition in Russia. First, Russia's President, Vladimir Putin, headed the United Russia ticket which won two-thirds of the votes in a parliamentary election in December 2007. Then, his first deputy Prime Minister, Dmitry Medvedev, was elected as new President of the Russian Federation on 2 March 2008 by winning about 70% of the votes. While Medvedev selected Putin as his Prime Minister, enhancing the power he will wield in his upcoming position, Vladimir Putin was elected on 15 April 2008 to lead the United Russia party after he steps down as President, therefore bolstering his chances for a potential return to the presidency.

The renewed involvement of Russia in major topics of world affairs witnessed in recent years continued in 2007/2008. In particular, Russia was awarded the 2014 Winter Olympics. Sochi won over bids from Pyeongchang (South Korea) and Salzburg (Austria). In August 2007, Russia also dispatched a highly publicised expedition to lay symbolic claim to part of the Arctic seabed to access potential reserves of natural resources. It sent two mini-submarines under the North Pole to scoop samples and put up a Russian flag.[26] Russia also continued to use its "energy superpower" status. In particular, it settled a gas dispute with Ukraine moments before Gazprom, Russia's state-controlled energy conglomerate, planned to switch off supplies as Ukraine owed back payments. Russia is not only enlarging its soft power portfolio, but also its hard power arsenal. On 12 September 2007 it tested a giant fuel-air bomb, claimed by its army to be the world's biggest non-nuclear explosive device; bigger than the U.S. Massive Ordnance Air Burst (Moab) which has unofficially been named the "Mother Of All Bombs". This thermobaric device, which has no known official name, has been dubbed "Father of All Bombs" by its Russian designers.

1.4.4 Japan in 2007/08

In 2007, the Japanese economy remained resistant to the global economic slowdown with an estimated annual real GDP growth of 2.1%.[27] While household spending remained weak, robust exports to other parts of Asia, as well as Europe, but also strong business investment supported most of the Japanese economy over that period. However, in spring 2008, the rise in inflation posed a major threat to the projected Japanese's economic growth.

Following the election of July 2007, the Liberal Democratic Party (LDP) is not the biggest party in the upper house of the Diet (parliament). However, the LDP still enjoys a big majority in the lower house. The upper house of Japan's Diet named as its president Satsuki Eda of the Democratic Party of Japan. It is the first time an opposition party has taken control of the upper house since the LDP came to power in 1955. Following the aforementioned defeat of the LDP, Shinzo Abe resigned on 12 September 2007 as Japan's Prime Minister, just a year after taking office. The LDP and the lower house of the Diet chose on 23 September 2007 the 71-year-old son of an earlier Prime Minister, Yasuo Fukuda as Japan's 91st Prime Minister. However, on 12 June 2008, a censure motion (which carries no legal weight) was voted against Prime Minister Fukuda.

In the last few months, Japan has been trying to reinforce its position on the world stage. For instance, it held the 34th G8 meeting in Hokkaido in July 2008. However, dire finances and an effort to curb bulging public debt, led Japan to fall in the ranking of overall overseas aid according to the Organisation for Economic Cooperation and Development. Japan's foreign aid has been used since the 1970s as a policy to boost its international profile to match its economic power. Japan nonetheless continues to reach out to developing countries. In particular, it invited 40 African leaders in May 2008 to Japan. The host country especially expressed its ambition to double its aid to Africa. Furthermore, in a buoyant regional context,

[24] International Monetary Fund "World Economic Outlook Update: Global Slowdown and Rising Inflation." 17 July 2008.
[25] International Monetary Fund "World Economic Outlook." Apr. 2008.
[26] Under international law, five countries lying partly in the Arctic Circle (Russia, the United States, Canada, Norway and Denmark) are limited to a 200 mile (320 kilometres) economic zone from their shores. Russia claims a larger slice, saying its continental shelf extends from Siberia to the North Pole.
[27] International Monetary Fund "World Economic Outlook Update: Global Slowdown and Rising Inflation." 17 July 2008.

the new President Yasuo Fukuda is also following the so-called "Fukuda Doctrine" that was asserted by its creator, the late Japanese Prime Minister Takeo Fukuda, to refocus Japan's attention in Asia. The "Fukuda Doctrine" consists of Japan being a country committed to peace, but also a country that builds up a relationship of mutual confidence and trust with Southeast Asian countries in wide-ranging fields.

1.4.5 China in 2007/08

In 2007, China's growth was about 11.9% driven by strong investment growth and net exports.[28] However, inflation keeps rising. In this context, China's Prime Minister, Wen Jiabao, opened the 11th annual session of China's parliament of the National People's Congress (NPC) on 5 March 2008 by warning of the dangers of inflation and of the fallout from U.S.'s subprime crisis. On this occasion, it was also announced that based on an improving economic structure, growing productivity, energy efficiency and environmental protection, GDP is expected to grow only by about 8% in 2008.

The last few months saw the reinforcement of the current political leadership as well as the preparations for future transition. China's ruling Communist Party opened its 17th five-yearly congress on 15 October 2007. Among others, the 17th National Congress of the Communist Party of China (CPC) adopted a resolution on the amendment to the CPC Constitution to enshrine the "scientific outlook on development". At the end of the congress, China's Communist Party unveiled its new leadership team. Hu Jintao remains party leader, but is expected to retire in 2012. Best placed to succeed him are Xi Jinping, the party chief in Shanghai, and Li Keqiang, his counterpart in the Liaoning Province. During the 11th annual session of China's parliament of the NPC in March 2008, China's Prime Minister, Wen Jiabao, also proposed the creation of new "super-ministries" in order to improve bureaucratic decision-making efficiency. In particular, a new ministry for the environment was created. China's 13-day-and-a-half session of parliament ended with the appointment of Li Keqiang as vice-prime minister. Mr. Li is foreseen as a candidate for top political positions when the current generation of leaders retires.

China and Japan's diplomatic relations improved with the visit of China's President Hu Jintao to Japan in May 2008. China's diplomatic relations with Taiwan were re-established as well through formal talks during a meeting in Beijing (China). An agreement to reschedule regular flights between the two countries was reached. China also continues to combine its diplomatic relations and foreign policy to address the need to find resources, Africa being a target of choice.[29] In the mean time, an alarming number of signs are threatening the future of its growth as well as its stability such as rising inflation, pollution etc. An earthquake devastated the Sichuan province on 12 May 2008, killing over 70 000 people and leaving five million people homeless. The authorities reacted immediately, sending rescue efforts to the region. Moreover, in early 2008 outbreaks of protest against Chinese rule in Tibet triggered repression from Chinese forces. These protests extended in ethnic-Tibetan areas of China, during which fire was opened by Chinese police. Tibetan uprisings generated reactions of support the world over, resulting in disruptions of the Olympic flame's relay in world cities.

1.4.6 India in 2007/08

In its 60th year of independence from Britain in 2007, India's economy grew by an estimated 9.3%.[30] India is now increasingly establishing itself as dominant economic actor for the future. Its companies are increasingly taking over major foreign companies and developing global strategies to gain market shares outside India. For instance, on 10 January 2008 Tata Motors presented the results of its attempt to manufacture the cheapest car in the world with the Nano (also called "the people's car"), but in late December 2007 Tata Motors was also the winning bidder in the auction for the two Ford Motor luxury auto brands: Jaguar and Land Rover.

The period between July 2007 and June 2008 was also one of political change for India. On 25 July 2007, India swore in its first female President, Pratibha Patil who succeeded Dr. A.P.J. Abdul Kalam. Moreover, in an important foreign policy move, India's Prime Minister, Manmohan Singh, visited China in early January 2008 for the first time since taking office in 2004. In particular, both countries promised to increase trade and

[28] International Monetary Fund "World Economic Outlook Update: Global Slowdown and Rising Inflation." 17 July 2008.

[29] For more information see Peter, Nicolas. "Space Policy, Issues and Trends in 2006/2007." ESPI Report 6, Sept. 2007: 11.

[30] International Monetary Fund "World Economic Outlook Update: Global Slowdown and Rising Inflation." 17 July 2008.

military cooperation. However, a major development of India's foreign policy is the growing ties with Africa to counter the influence of China in the region as India is looking for new sources of energy for its booming economy. In this context, in July 2007, the Indian government launched the Pan-African E-network project in cooperation with the African Union to develop Africa's information and satellite communications technologies. The initiative has been called Africa's largest infrastructure project. It aims to eventually connect 53 African countries to a satellite and fiber-optic network with education and telemedicine being the most important components of this cooperation including as well e-commerce, e-governance, infotainment, resource-mapping and meteorological services. Ethiopia, South Africa, Ghana and Mauritius are the initial countries involved in this project. The Indian government hopes thus to gain a foothold in Africa and create goodwill between India and Africa, but also increase its sales in information and communication technologies to Africa. The first India-Africa summit took place in New Delhi (India) on 8-9 April 2008 in order to build and expand India's economic and diplomatic ties across the African continent, but also to secure its access to the African rim of the Indian Ocean, which New Delhi has long seen as its strategic backyard. The two-day summit was attended by 14 African leaders.

Despite a booming economy and increasing international ties, as well as involvement in world affairs, India continues to be plagued by internal issues. In late August 2007, two bombs killed more than 40 people in Hyderabad. Another 19 bombs were discovered and disabled. Several bombs exploded in Jaipur in May 2008, revendicated by a group called Indian Mujahideen. Violence still occurs in the north, as the clash at the beginning of June led by the Gujjar tribe demonstrates. The tribe demands to be included in a list of disadvantaged tribal groups. Moreover, in September 2007, around 25 000 poor people, mainly landless farmers, converged on New Delhi after marching from various parts of India to demand a land reform and protest against the loss of their land to industrial development.

Chapter 2 - Global space sector - size and developments

The objective in producing this chapter is to establish a consistent and solid baseline of figures that are reliable to the extent possible to provide an easily identifiable measure of the size of the global space sector. This report aggregates the institutional budget and commercial revenues data for 2007 to obtain an overview of the size of the global space sector. Governmental space expenditures are not always easy to obtain, as neither every country nor space agency publishes detailed annual expenditure on space activities. Moreover, given the opaque nature of defence budgets, the task of tracking military space spending is extremely difficult. Sizing the commercial space sector is also difficult due to the secrecy surrounding commercial contracts etc., and it also depends on the definition of the sector adapted and the data source selected.

ESPI estimations of the space sector draw on many sources of publicly available information from published sources of industry trade associations, articles in the mainstream business press and industry magazines and, when available, private information sources, as well as interviews with space leaders from governments and industries. Widely used references for global economic data and space surveys use the U.S. dollar for their comparative analyses. ESPI therefore used the U.S. dollar as currency of reference in this Chapter despite the possible distortion linked to the fluctuation of exchange rates, especially with respect to the depreciation of the U.S. dollar versus the main other major currencies.[31]

2.1 Global space budgets and revenues

Estimating the overall size of the space sector is difficult since it depends on the definition of the sector adopted and the data source selected. Consequently the overall size of the space sector can only be approximated, and estimates will vary from one study to the other. However, there is a consensus that the annual revenues of the space sector keep increasing in overall terms from one year to the next due to higher institutional investments in space on the one hand, and to sustained demand for new applications and services on the other.

Global space budgets and commercial space revenues are estimated by ESPI to be about 185.610 billion U.S. dollars in 2007, up from 177.415 billion U.S. dollars in 2006.[32] The revenues of the total space industry are estimated to have reached 114.205 billion U.S. dollars up from 111.615 billion U.S. dollars in 2006 (Figure 1). Institutional space budgets (including civil and military budgets) accounted for an estimated 71.405 billion U.S. dollars in 2007, compared to 65.8 billion U.S. dollars in 2006 (Figure 1).

2.2 Overview of institutional space budgets

Institutional space budgets accounted for an estimated 38.4% of global space activities in 2007 with an estimated 71.405 billion U.S. dollars (+5.605 billion U.S. dollars compared to 2006) (Figure 1).[33] Public spending for space programmes at a global level remained robust in 2007 following the sustained budgetary allocation to the U.S. space budget as well as continued growth in space expenditure by the space agencies in Asia and Russia.

[31] Portraying national space budgets and commercial revenues in a single currency can result in strong distortions. What may look like growth in space expenditure could turn out to be no more than a reflection of a strengthening of a particular currency and vice-versa.

[32] The 2008 Space Report from the Space Foundation sizes the global space activity revenues and budgets in 2007 at 251.16 billion U.S. dollars. The difference in estimate is due to a narrower definition of the space sector and its actors by ESPI. The difference for the two main sub-sectors (institutional budgets and commercial revenues) is indicated as footnotes to the analyses.

[33] The 2008 Space Report estimates the size of the global institutional space budgets at 77.25 billion U.S. dollars. However, in this ESPI study only the direct unclassified activities of the U.S. Missile Defense Agency (MDA) are included in the analysis as opposed to the Space Report, which includes the overall MDA budget of 9.4 billion U.S. dollars in its analysis.

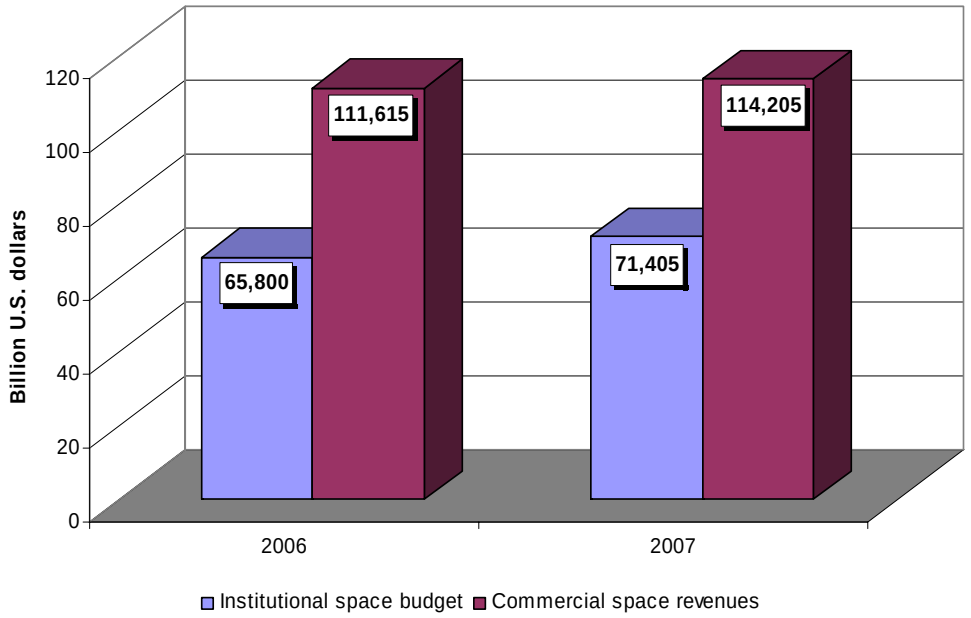

Figure 1 Overall size of the space sector in 2006 and 2007

However, the currency fluctuations have an insidious effect on the size of the overall institutional space sector. In particular, the effect of the depreciation of the U.S. dollars versus other major currencies, and especially the euro, has to be emphasised.[34] This tends to increase the size of institutional budget devoted to institutional space activities when expressed in U.S. dollar in parts of the world with strong currencies, while in fact, the budgets remain more or less constant when expressed in their national currency.

It is considered that military/intelligence investments represented, like in 2006, the biggest part of public allocations to space activities with about 52% of the world public budgets. The military/intelligence segment is dominated by the United States that invested an estimated 35.5 billion U.S. dollars in this domain in 2007. This figure includes DoD space, the National Reconnaissance Office (NRO), the National Geospatial-Intelligence Agency (NGA) and part of the Missile Defense Agency (MDA). However, the size of the overall military/intelligence sector is certainly underestimated due to the secrecy of defence budgets in general, particularly for Russia and China.

While the total budget for civilian space programmes are less important than the total budgets of space military/intelligence (34.34 billion U.S. dollars were dedicated to civilian space programmes in 2007), they are more commonly implemented. The continuing internationalisation and globalisation of space affairs is leading to an increasing level of institutional budgets allocated to civilian space activities at a global level.[35] However, while the number of countries investing in space is growing, the difference in investments among countries remains high, with the major space-faring countries representing an overwhelming majority of the world's institutional expenditures in space activities (and particularly military/ intelligence ones). In general, it has been observed that North America, Europe and Asia are the main regions investing in institutional space activities. The difference in dynamics in terms of institutional investments underlined in 2006 continued in 2007, with Asia, among others, improving its space efforts.

In 2007, the United States and Europe concentrated most of the resources with about 89% of world public funding for space activities. The United States with a budget of about 53.586 billion U.S. dollars (a similar level as 2006) was the main space power and clear hegemon according to the budget criterion. The United States accounted for 75% of global government space spending

[34] The euro has reached several record heights in the last few months compared to the U.S. dollar. On 20 September 2007, the euro was worth 1.40 U.S. dollars, then on 26 February 2008, 1.50 U.S. dollars and on 22 April 2008 1.60 U.S. dollars, compared to 1.17 U.S. dollars when the euro was introduced (+37%), but + 95% compared to its lowest level in October 2000 (0.82 U.S. dollars).

[35] Peter, Nicolas. "The changing geopolitics of space activities." Space Policy 22.2 (May 2006): 100-109.

based on available information. The relative stagnation of the United States' overall space budget in 2007 compared to 2006 is linked to the fact that many U.S. government agencies were subject to a "continuing resolution" for Fiscal Year 2007. This is a year-long spending resolution, also known as the Byrd/Obey plan (from Senator Robert Byrd (D-W.Va.) and Representative David Obey (D-Wis.) (Cf. Chapter 3). Most of the U.S. agencies were therefore funded at the same level as the previous year. In 2007, when considering Europe's consolidated budget, it spent an estimated 9.89 billion U.S. dollars on space activities representing about 14% of the world's public funding for space activities (Cf. Chapter 4).

When looking at individual countries, the United States is, as aforementioned, by far the biggest spender in space activities followed distantly by France, Japan, China,[36] Russia, Germany, Italy which are all estimated to have spent more than 1 billion U.S. dollars in 2007 (Figure 2). Without considering the increase in the estimation of size of the Chinese space budget, the hierarchy is similar to that of 2006.

While the budget devoted to space activities is a good indicator to appraise national efforts and support in that domain, for certain economies such as Russia, India and China, relying solely on the absolute volume of institutional funding is misleading due, among other things, to significant differences in production costs, standards of living, as well as purchasing power from one country to the other. Consequently other indicators have to be used, particularly the share of the Gross Domestic Product (GDP) devoted to institutional space activities in a country and the amount of money spent per capita, to appraise the overall national efforts and support to space activities.

When looking at the share of GDP devoted to institutional space activities, the United States is the clear leader followed distantly by Russia, France and India (Figure 3). Twenty-two countries spent more than 0.02% of their GDP on space activities (Figure 3).

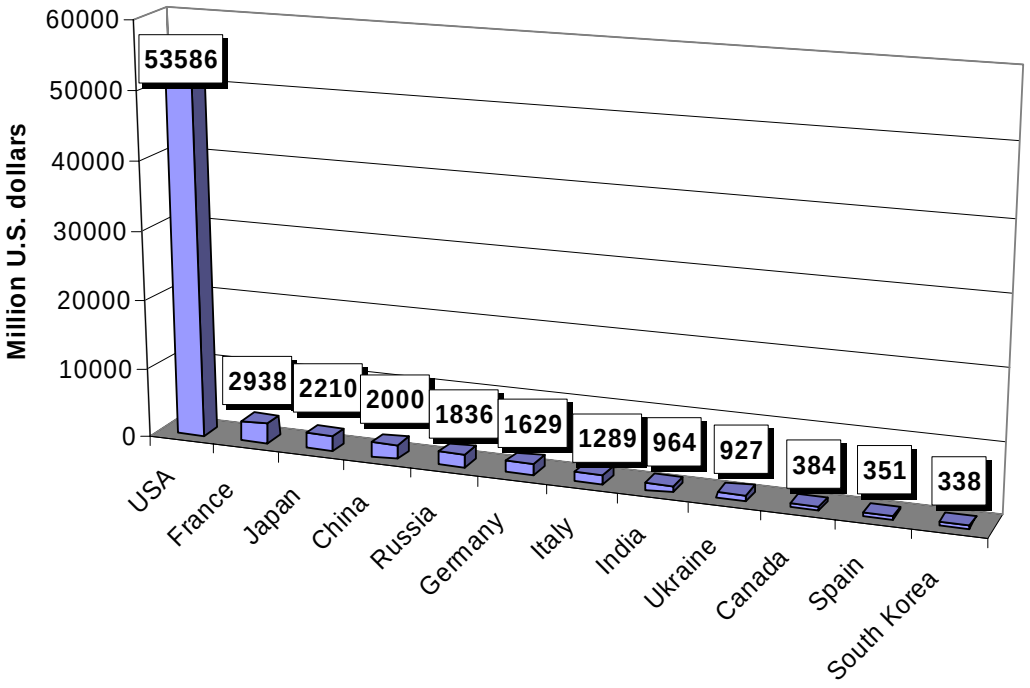

Figure 2 Estimate of the public space budgets of the major space powers in 2007

[36] China's space budget estimate generates much speculation and is complex to appraise. The figures presented in this study have to be considered with caution. The value for China is estimated to have increased by taking into account the new White Paper on Space, but also the plans of the Commission of Science, Technology and Industry for National Defence (COSTIND) and China Aerospace Science and Technology Corporation (CASTC).

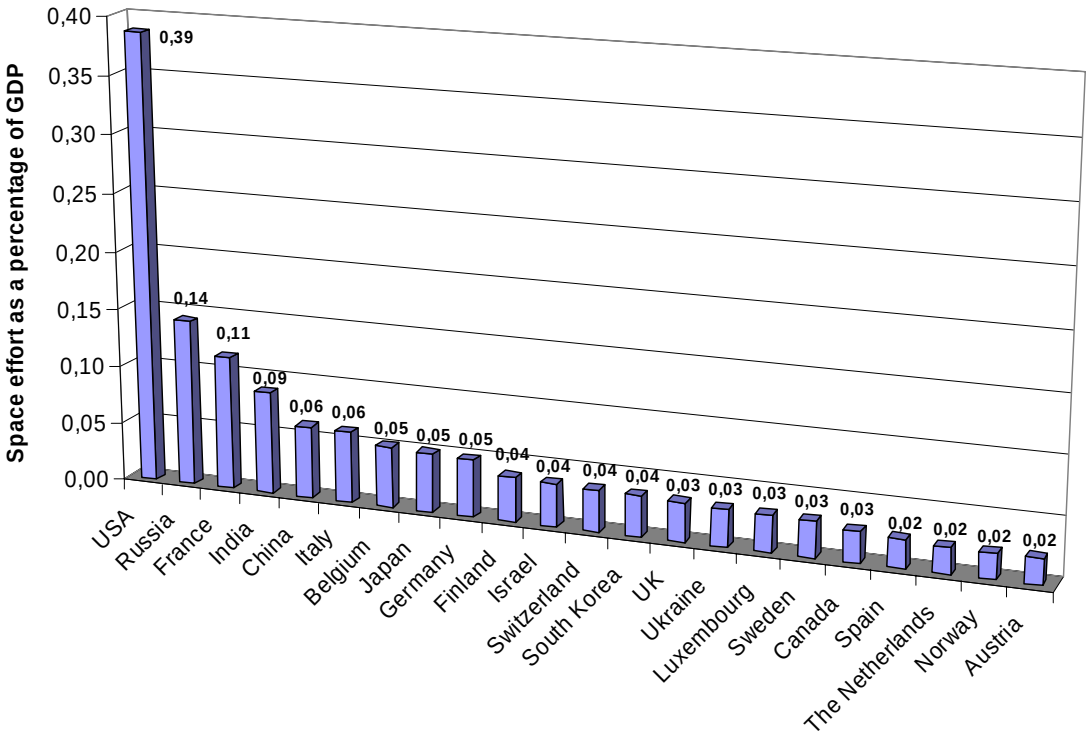

Figure 3 Estimate of the public space budgets as a percentage of GDP of the major space actors in 2007

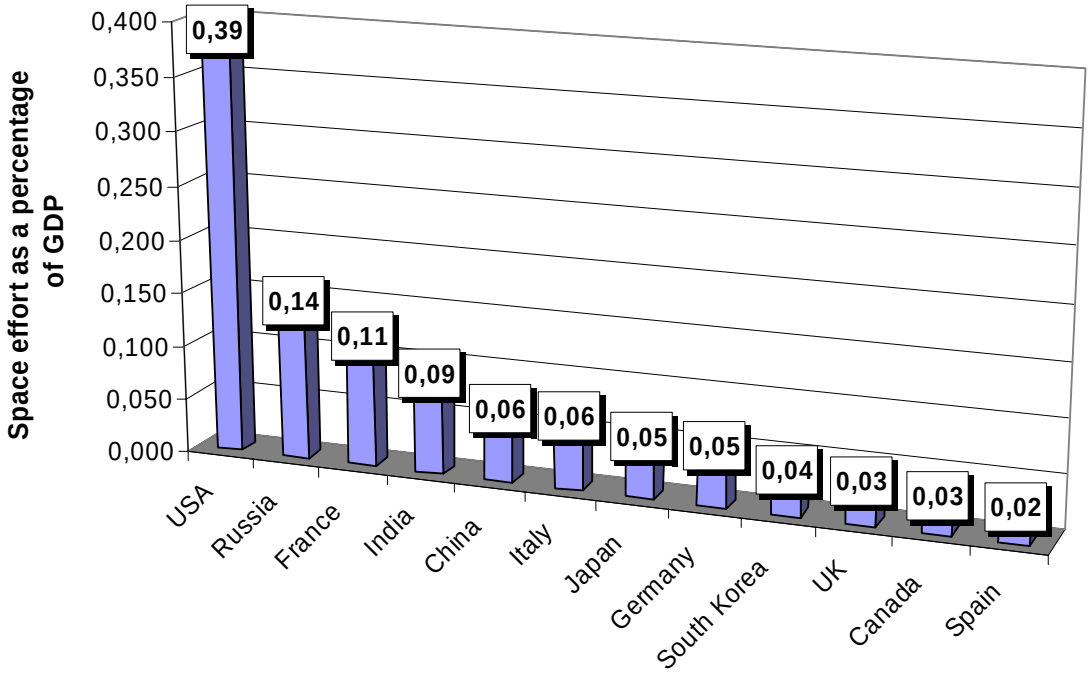

Figure 4 Estimate of the major space powers' public space budgets as a percentage of GDP in 2007

Most of the countries invest between 0.022% and 0.062% of their GDP on space affairs (Figure 3). The good performance of several European countries (Belgium, Finland Switzerland, Luxembourg Sweden, Norway, and the Netherlands) has to be underlined (Figure 3).

When looking at the countries investing more than 300 millions U.S. dollars in 2007, most of the space powers spent between 0.022% and 0.14% of their GDP for public space activities (Figure 4). A first cluster of countries investing more than 0.1% of their GDP is discerned in the group composed of Russia, France and the United States (Figure 4).

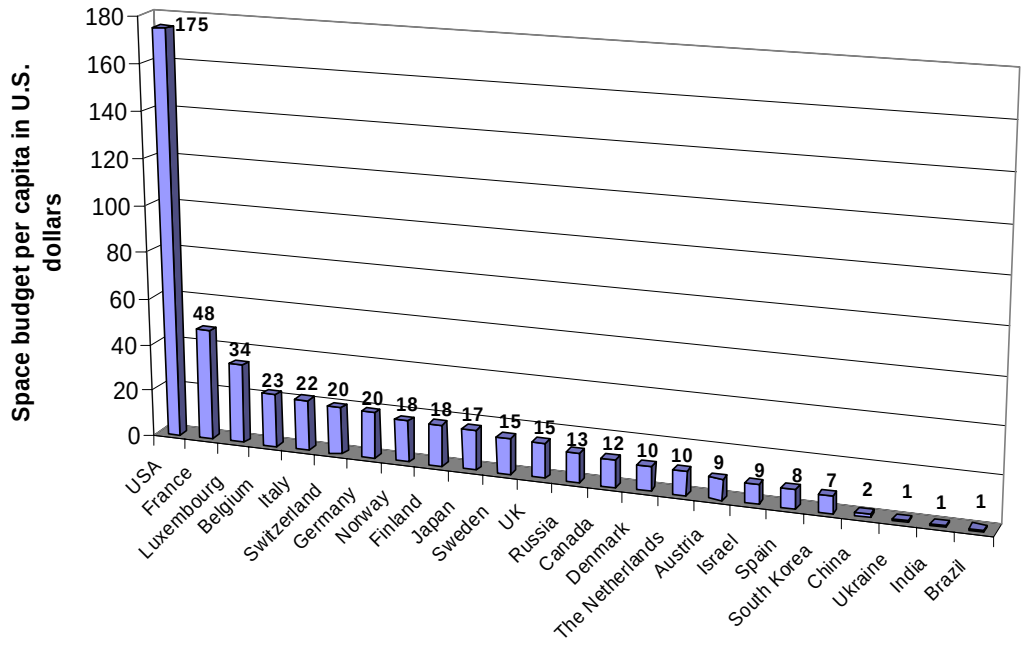

Figure 5 Estimate of the major space actors' public space budgets per capita in 2007

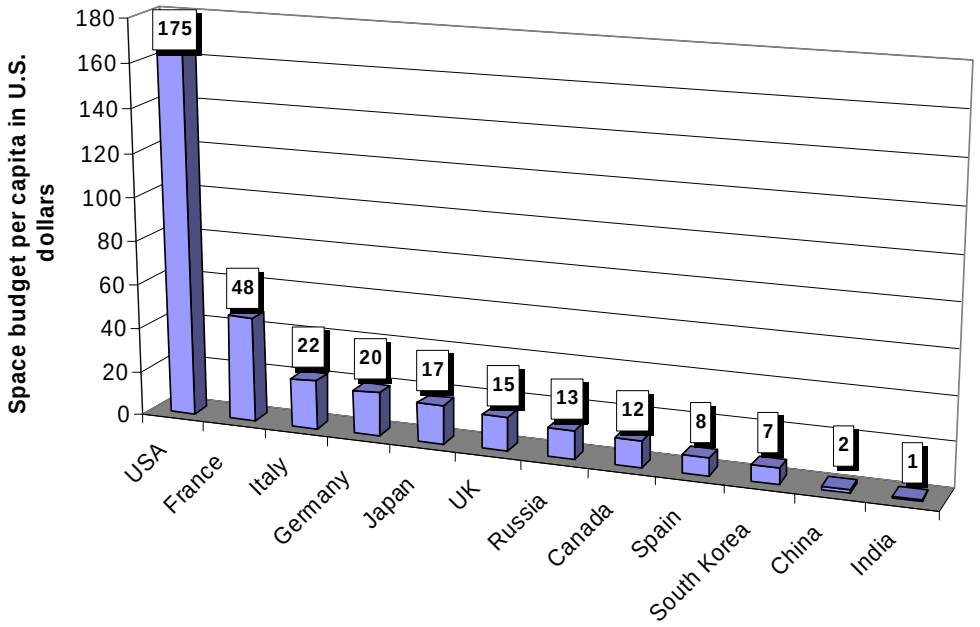

Figure 6 Estimate of the major space powers' public space budgets per capita in 2007

A second cluster of countries investing more than 0.05% and less than 0.1% of their GDP into public space activities consists of India, China and Italy (Figure 4). A third cluster of countries investing between 0.04% and 0.05% of their GDP is made up of Japan, Germany, and South Korea. A further cluster made of the United Kingdom, Canada and Spain which can be singled out as countries investing between 0.02 and 0.03% of their GDP in public space activities.

When looking at the national public investment per capita, the United States is again the leader and spent an estimated 175 U.S. dollars per citizen in 2007 (Figure 5). France, the second-biggest spender per capita, spent about 48 U.S. dollars per citizen for public space activities. Like for the previous indicator, the important national effort of Belgium, Switzerland, Norway, Finland, Sweden, Denmark, the Netherlands and Austria are noteworthy (Figure 5).

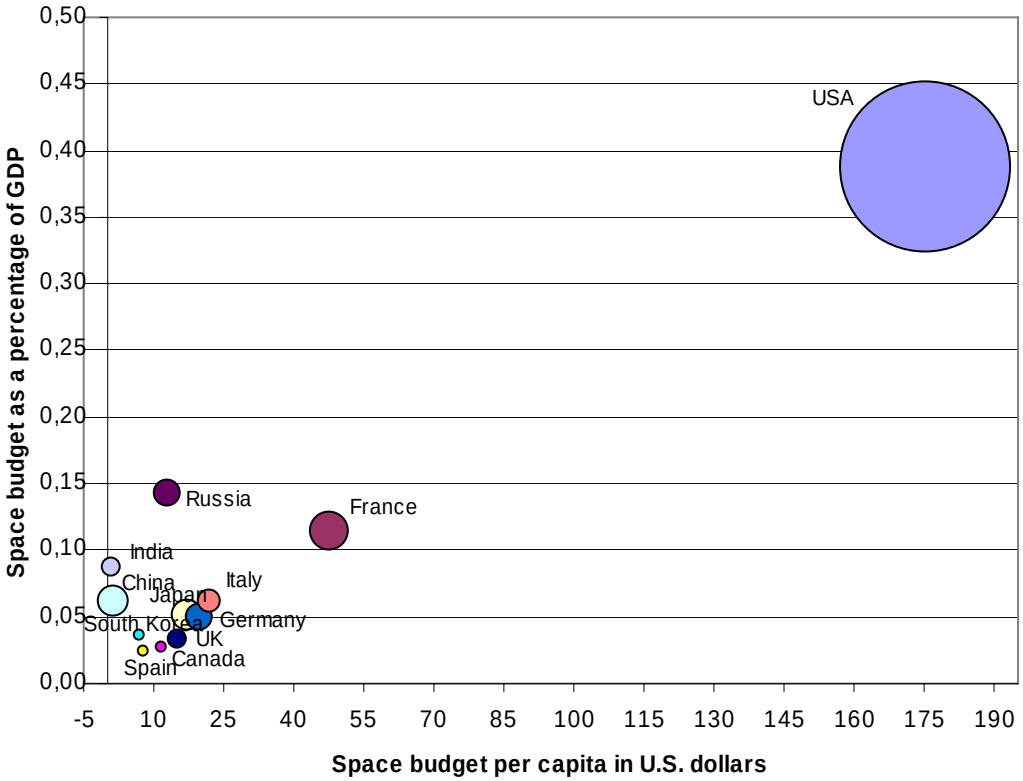

Figure 7 Mapping of the share of GDP devoted to institutional space expenditure compared to the spending per capita of the major space powers in 2007

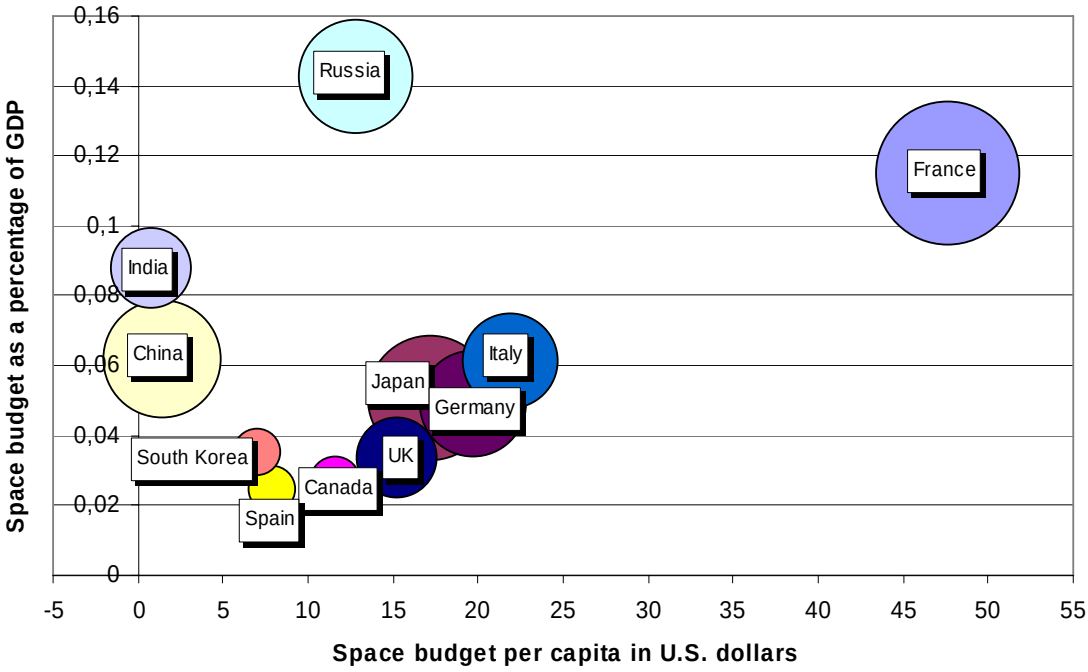

Figure 8 Mapping of the share of GDP devoted to institutional space expenditure compared to the spending per capita of the major space powers in 2007 (without the United States)

The major space powers, which invested more than 300 million U.S. dollars in public space investment in 2007, spent between 7 and 48 U.S. dollars per inhabitant (excluding the United States) (Figure 6). The limited performance of India and China on this metric is principally due to the size of their population.

Mapping the share of the budget devoted to space affairs as a percentage of GPD compared with the space budget per capita is another informative metric.[37] However, the singularity of the United States is again

[37] The diameter of the spheres in Figures 6 and 7 indicate the size of the national budget devoted to space activities as an element of comparison.

illustrated (Figure 7). It was the only country in 2007 that spent more than 0.15% of its GDP on space affairs and more than 50 U.S. dollars per citizen on space activities.

When looking at the other countries by removing the United States, several clusters can be distinguished (Figure 8). A first cluster made up of Russia and France is discerned, as both invest more than 12 U.S. dollars per capita and more than 0.1% of their GDP on public space activities (Figure 8). A second cluster of countries made up of Italy, Germany, Japan, and the United Kingdom can be seen. The countries of this cluster spend more than 15 U.S. dollars per capita and more than 0.033 of their GDP on public space actors (Figure 8). A third cluster made up of Canada, Spain and South Korea composed of countries spending more than seven U.S. dollars per capita and between 0.024% and 0.03% of their GDP on public space activities can be identified (Figure 8). The last cluster is made up of India and China, with both countries investing less than three U.S. dollars per inhabitants and between 0.06% and 0.09% of their GDP (Figure 8).

Civilian space spending is not always limited to a national space agency, but they represent the majority of a country's civilian space budget. When looking at the Top 10 agencies according to their budget, not surprisingly, the list is dominated by the United States, with five of the ten agencies being U.S. agencies. Like in 2006, the DoD is the biggest space agency in the world followed by NASA (Figure 9). These two agencies concentrate 54.30% of all public funding spent on space in the world (38.78 billion U.S. dollars in 2007). The United States also has two intelligence-related agencies in this Top 10: the NRO, in charge of developing and operating dedicated intelligence and reconnaissance space assets,and the NGA, in charge with exploiting the data gathered. The last U.S. agency in this Top 10 is the National Oceanic and Atmospheric Administration (NOAA), the U.S. meteorological agency. Europe has two agencies in this Top 10: ESA, the second biggest civilian space agency in the world, and CNES the French space agency. Japan, Russia and India complete the list (Figure 9).[38] Compared to 2006, a slight evolution of the rankings can be observed with CNES overtaking JAXA and Roskosmos overtaking NOAA in the 2007 hierarchy.

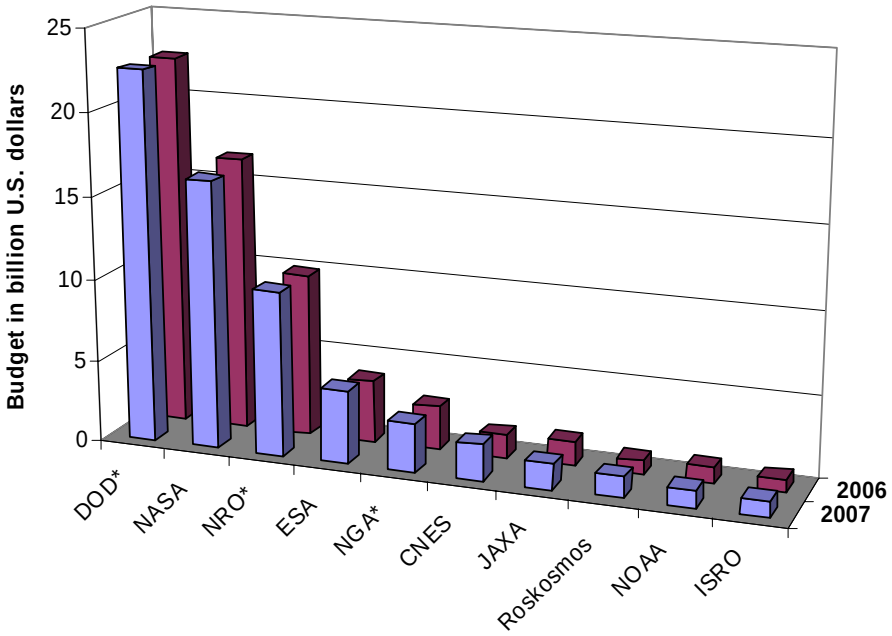

Figure 9 Estimate of the Top 10 space institutions according to their space budget in 2007 and 2006.
(* Estimation of the Space Foundation for the DoD, NRO and NGA data.)

[38] Chinese agencies are excluded from the list, because gauging their respective size is impossible.

2.3 Overview of commercial space markets

This section looks at the global economic activity associated with commercial space infrastructure and commercial space products and services. There are many estimates of the size of the commercial sector, but the lack of consistency as well as the absence of methodology for each analysis are common features of most of the information published. The quantitative information presented in this section comes mainly from sectoral overviews as well as open-source primary data from revenues published by selected firms in each sub-sector. Therefore, the compilation presented comes from multiple sources and reflects the best information available at the time of publication.

ESPI results indicate that the annual revenues of the commercial space sector increased in overall terms from 2006 to 2007. This is due, on the one hand, to the aforementioned sustained institutional investments in space and, on the other hand, to the growing demand for new applications and services in space communications as well as space-based positioning and new business models in space-based Earth observation (development of a web-based portal using satellites imagery). The revenues of the world commercial space markets reached an estimated 114.205 billion U.S. dollars in 2007 up from 111.615 billion U.S. dollars in 2006 and therefore represent the largest component of the global space sector (Figure 10). [39] Commercial space revenues were principally concentrated on satellite services and ground equipment. Those two segments combined represented about 95% of the world commercial space markets in 2007 (Table 2).

Most of the overall sectoral data comes from the Satellite Industry Association (SIA)/Futron 2008 Study entitled "State of the Satellite Industry Report". According to this publication the world satellite industry revenues reached 123 billion U.S. dollars in 2007 up from 106.1 billion U.S. dollars (+16%) in 2006 and attained an average growth of 11.5% for the period 2002-2007 (Figure 10).[40]

[39] The Space Foundation publication "The Space Report 2008" estimates the size of the global commercial space revenues at 173.91 billion U.S. dollars for 2007. The major difference with ESPI's estimate is due to the addition of the GPS equipment and chipsets markets in the Space Foundation study that is, however, already accounted for in its ground equipment section.

[40] This SIA/Futron estimate however takes both institutional and commercial revenues into consideration.

Sector of Activity	Revenues in Billion Dollars
Satellite manufacturing	3.8
Launch industry	1.54
Ground equipment	34.3
Direct Broadcast Services	57.5
Fixed Satellite Services	14.3
Mobile Satellite Services	2.1
Insurance	0.6
Space Tourism	0.065
Total	**114.205**

Table 2 Estimated breakdown of global commercial space revenues in 2007

2.3.1 Satellite services

Satellite services grew more than 18% from 2006 to 2007 reaching about 73.9 billion U.S. dollars compared to 19% from 2005 to 2006 (Figure 10). All segments of world satellite services revenues grew (Figure 10). Satellite services are the major source of commercial revenues for the space sector (Figure 10). In broad terms, the satellite services market is made up of three sectors: Direct Broadcast Services (DBS), the Fixed Satellite Services (FSS), and Mobile Satellite Services (MSS). Satellites telephony and DBS represented three quarters of total satellite services revenues in 2007 and reached an estimated 55.4 billion U.S. dollars, up from 46.9 billion U.S. dollars in 2006 (Figure 11). When adding satellite radio, the broadcasting segment totalled 57.5 billion U.S. dollars in 2007. MSS grew modestly to reach 2.1 billion U.S. dollars in 2007, up by 100 million U.S. dollars from 2006 (Figure 11). Finally, FSS and other elements such as transponder agreements, network management services, remote sensing and end-user broadband grew by 2.2 billion U.S. dollars to reach 14.3 billion U.S. dollars in 2007 (Figure 11).

Direct Broadcast Services

DBS is principally made up of direct-to-home (DTH) television and satellite radio services. In 2007, It represented the largest portion of communications satellite services and also satellite services revenues with 57.5 billion U.S. dollars as aforementioned (Figure 11). In the domain of DTH, High Definition Television (HDTV) has become a major driver in terms of the demand for satellite capacity for new services. In the United States, which is the biggest market, there are two major DTH services providers: DISH Network (formerly Echostar Communications Corporation) and Direct TV.

In the ESPI study, the government's space spending has been separated when possible from commercial revenues to avoid double counting.

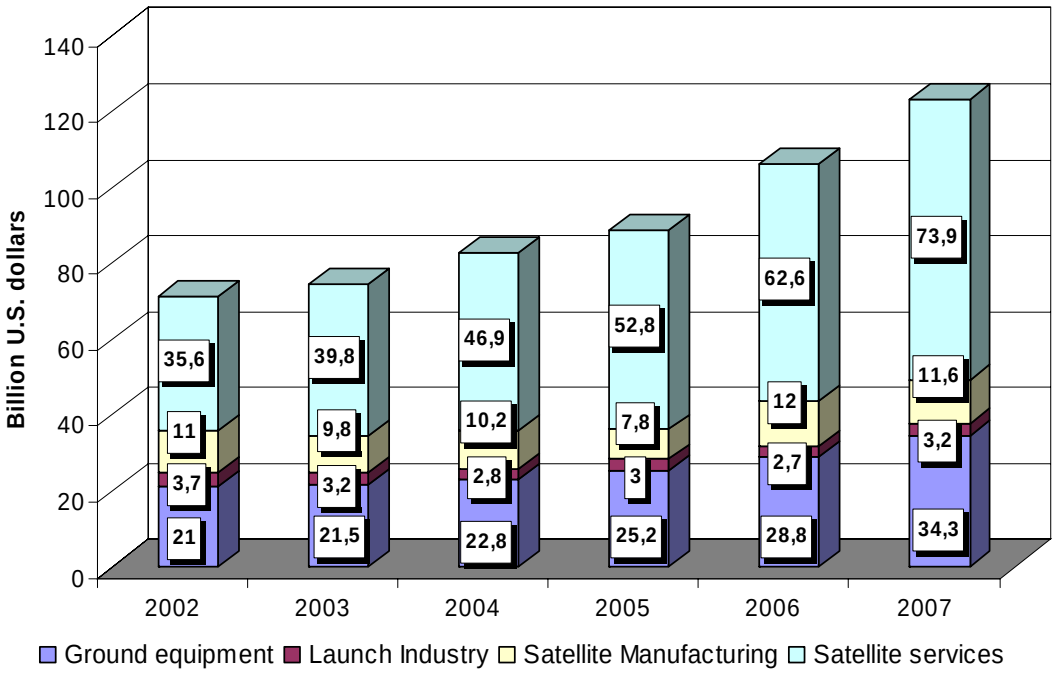

Figure 10 World satellite revenues per sector (source SIA/Futron)[41]

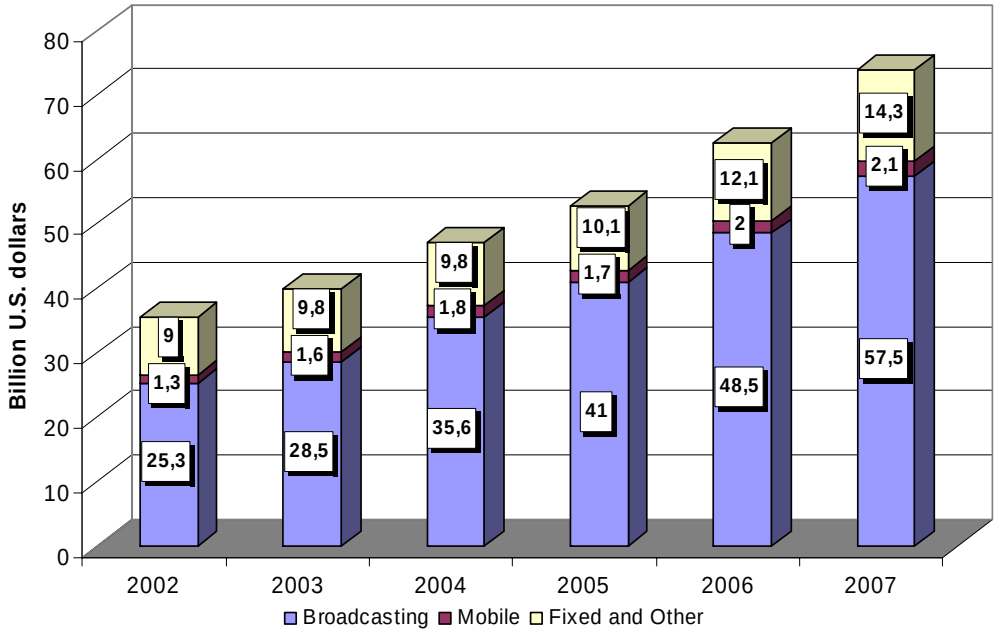

Figure 11 World satellite services revenues (source SIA/Futron)[42]

The revenues of the DTH market in the United States were estimated at about 26.617 billion U.S. dollars in 2007, up from 23.564 billion U.S. dollars in 2006. The largest provider of DTH in the United States is DirectTV, which at the end of 2007 had over 16.9 million subscribers and revenues estimated at about 15.527 billion U.S. dollars compared to about 13.744 billion U.S. dollars in 2006. For 2007, DISH Network reported total revenues of 11.09 billion U.S. dollars compared with 9.82 billion U.S. dollars in 2006, which is an increase of 13% from last year.[43] It added approximately 675 000 net

[41] Satellite Industry Association/Futron "State of the Satellite Industry Report." June 2008.

[42] Ibid.

[43] "DISH Network Reports Fourth Quarter 2007 Financial Results." Reuters Press Release, 26 Feb. 2008 <http://www.reuters.com/article/pressRelease/idUS145484+26-Feb-2008+PNW20080226 >.

Company	Revenues in 2007 in million U.S. dollars	Revenues in 2006 in million U.S. dollars	Subscribers in 2007	Subscribers in 2006
XM Satellite Radio	1136.542	933.417	9027.000	7629.000
Sirius Satellite Radio	922.066	637.235	8321.785	6024.555
WorldSpace	13.784	15.611	174.166	199.105
Total	**2072.392**	**1586.263**	**17522.951**	**13852.660**

Table 3 Satellite radio services revenues in 2007

new subscribers leading to a total of about 13.78 million subscribers at the end of 2007.[44]

While DTH is the dominant DBS segment, another of the fastest growing DBS segments is satellite radio. Satellite radio continued to experience strong growth in 2007 fuelled principally by subscriber growth. One of the factors explaining the growing market penetration of satellite radio is the increasing availability of receivers, pre-installed or offered as an option, in automobiles. In 2007, the revenues of this sector were of about 2.072 billion U.S. dollars from three firms, XM Satellite Radio, Sirius Satellite Radio and WorldSpace, compared to about 1.6 billion U.S. dollars in 2006 (Table 3). Most of the primary sources of revenues for this sector are U.S.-based and come from subscription fees, with most of the customers subscribing to satellite radio services on an annual or a monthly basis like for DTH. Additional revenues are derived from activation fees, the sale of advertising, and the direct sale of radios and accessories.

Fixed Satellite Services

The FSS sector is the most well-established sector in the satellite industry. According to SIA/Futron FSS, revenues reached an estimated 14.3 billion U.S. dollars in 2007 (Figure 11). Most of the revenues come from the leasing of transponder capacity to commercial and governmental customers for video distribution and broadcasting as well as for high-speed data distribution and internet access. However, video applications currently use most of FSS capacity representing about 71% of the total global C- and Ku- band FSS transponder revenues in 2007 according to the consulting firm Northern Sky Research (NSR). High demand in Europe, the Middle East/North Africa and some sectors of the North American market continue to drive growth in the FSS sector. Another element driving FSS growth is the emergence of new national operators launching their first satellites such as Vietnam's Vinasat and Venezuela's Venesat, or ordering new satellites this year like Malaysia's Measat.

Over the last several years, deregulation, privatisation and consolidation have significantly reshaped the FSS sector. In particular, regional and national operators have been acquired by larger companies and the shareholdings of several major groups have evolved in recent months (Cf. Chapter 5). The four biggest FSS operators now represent altogether about 72% of the global FSS market (Figure 12).[45]

The Luxembourg-based SES, the industry leader, reported strong revenues last year despite the weakness of the U.S. dollar, largely because of improvements at New Skies, which manages SES capacity outside of its core European and North American markets. SES reported revenues in 2007 of about 1610.7 million euros (about 2416 million U.S. dollars). [46]

Intelsat, the second FSS operator reported revenues of 2183.08 million U.S. dollars in 2007, an increase of about 520.4 million U.S. dollars from last year, [47] principally fuelled by the impact of the PanAmSat acquisition in July 2006.

Most of Intelsat revenues in 2007 came from transponder services (about 1654.321 million U.S. dollars) and by managed services (264.038 million U.S. dollars). When looking at sectors of revenues, network services represented 47% of Intelsat revenues followed by the media sector, which represented about 37% of its

[44] Ibid.

[45] Lardier, Christian and Théo Pirard. "Le Marché des Satcoms à l'Heure de l'Embellie." Air & Cosmos 22 Feb. 2008: 28-29.

[46] "SES Reports Another Year of Strong Financial Performance." SES Press Release, 18 Feb. 2008 <http://www.ses.com/ses/PDFs/MediaRoom/FY2007-et.pdf >.

[47] "Intelsat Reports Fourth Quarter and Full Year 2007 Results." Intelsat News Release, 20 Mar. 2008 <http://www.intelsat.com/_files/investors/financial/2008/2008-16.pdf >.

revenues in 2007. The commercial sector was the main source of revenues for Intelsat, but overall, the government sector represented 14% of Intelsat revenues in 2007, with the main customers being the U.S. government and NATO-countries, as well as military intelligence communities.

Eutelsat, the third ranking FSS operator has reported rising revenues. For the 2007/2008 period,[48] Eutelsat had revenues of 877.8 million euros, up 5.9% from the previous year, driven mainly by the strong dynamic of video applications and value-added services.[49]

Telesat is now the fourth-largest FSS operator in the industry following the takeover of Telesat Canada by Loral Space & Communications (Cf. Chapter 5). In 2007, its total satellite services revenues were about 241.2 million U.S. dollars with 123.4 million U.S. dollars coming from Loral Skynet and 117.8 million U.S. dollars coming from Telesat Canada.

In most market studies, remote sensing revenues are included in FSS data. Revenues for space-based Earth observation are growing due to continuing military and intelligence contracts as well as the increasing development of mapping services and, in particular, web-based portal-like Google Earth or Virtual Earth. The commercial high resolution Earth imagery industry is growing and is also becoming an increasing input in the rapidly expanding geospatial industry. The market of optical imagery can be split into two main segments: the Very High Resolution (VHR) satellites imagery market and the Medium Resolution (MR) satellite imagery market. According to BCC Research, the remote sensing market was estimated at about 7.3 billion U.S dollars in 2007, with an estimated 1.9 billion U.S. dollars for Earth imagery and related solutions for imagery and products with a resolution of three metres or better.[50]

The United States is the biggest market for remote sensing as producer and user of geospatial information, particularly for its military and intelligence sector. This reliance on commercial information and data is mainly policy-driven, principally following the 25 April 2003 "U.S Commercial Remote Sensing Policy" whereby it is required that U.S. Governmental agencies "rely to the maximum practical extent on commercial remote sensing capabilities for filling

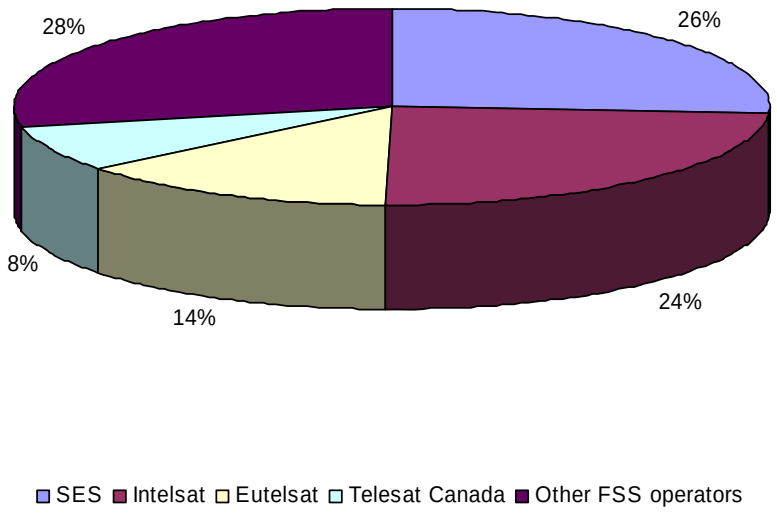

Figure 12 Estimated market shares of the main FSS operators in 2007

[48] Eutelsat yearly results go from July to June.
[49] "Eutelsat Communications Reports 2007-2008 Results Exceeding Objectives." 31 July 2008.

[50] Wilson, James. "Remote Sensing Technologies and Global Markets." BCC Research IAS022A Feb. 2007.

imagery and geospatial needs".[51] The major purchaser of commercial satellite imagery in the United States is the NGA.[52]

GeoEye and DigitalGlobe are the leaders of the Very High Resolution (VHR) market.[53] In 2007, GeoEye reported revenues of 183.8 million U.S. dollars (147.448 million U.S. dollars revenues from imagery and the rest from other services) up by 22% compared to 2006 revenues. The growth of 36.6 million U.S. dollars was attributable to a 13.3 million U.S. dollars increase on deliveries of production services to the U.S. Government, as well as a 10.4 million U.S. dollars increase in other imagery sales. While the U.S Government is GeoEye's largest single customer with about 100.5 million U.S. dollars in 2007 (55% of total revenues), 36% of GeoEye total revenues came form international customers (about 65.8 million U.S dollars). GeoEye (which operates the Ikonos high resolution and OrbView-2 low resolution satellites) is also in the final preparation stages of its new satellite GeoEye-1 scheduled to be launched in the second half of 2008.[54] GeoEye-1 will be the world's highest-resolution commercial remote sensing satellite with a ground resolution of 0.41 metres in panchromatic mode. In October 2007, GeoEye also announced its intention to construct and launch a new high-resolution satellite, GeoEye-2. The contracts for satellite equipments and parts have already been initiated. The contract with a satellite builder is expected to be signed in the second half of 2008.

DigitalGlobe had revenues estimated at 151.7 million U.S. dollars in 2007, up by 42% from the previous year (106.8 million U.S dollars). The company's biggest customer, accounting for 58% of its revenues, is the NGA. An overall 68.2% of its revenues come from defence and intelligence customers (both in the United States and international) and 31.8% from commercial customers. DigitalGlobe generated 76.3% of its revenues in the United States and Canada (compared to 71.2% in 2006) and 23.7% in the rest of the world (compared to 28.8% in 2006). In 2007, 90.9 million U.S. dollars revenues (or almost 88%) of its defence and intelligence revenues were generated within the United States and Canada while 12.5 million U.S. dollars of revenues were generated by other international defence and intelligence customers. In contrast, only 51.8% of its 48.3 million U.S. dollars commercial revenues were generated in North America compared to 23.3 million U.S. dollars in the rest of the world. DigitalGlobe, which owns the high-resolution QuickBrid satellite (launched in 2001), completed the commissioning on 26 November 2007 of the WorldView-1 satellite launched on 18 September 2007. WorldView-1 is part of the NGA NextView programme and was partially financed through an agreement with the NGA.[55] DigitalGlobe plans to complete the construction of its second next-generation satellite, WorldView-2 in late 2008 for a launch in mid-2009. On 14 April 2008, DigitalGlobe announced that the company filled a registration statement with the Securities and Exchange Commission (SEC) relating to a proposal initial public offering (IPO) of its common stock of up to 205 million U.S. dollars.

Spot Image is the leader of the Medium Resolution (MR) satellite imagery market.[56] In 2007, the company reported 94.6 million euros of revenues, a 30% increase over 2006.[57] Spot Image's main market in 2007 was in Asia-Pacific with 36% of revenues, followed by Europe (34%), North America (13%), the Middle East (6%), Africa (6%) and Latin America (5%).[58] The Spot 5 satellite, launched in May 2002, is the main source of revenues for Spot Image. The French company expects in 2008 to order a new medium-resolution spacecraft, tentatively named Spot 6, with a launch planned in 2012. In addition, while all five of Spot's previous satellites have been paid for by government funds, Spot 6 will be financed by private-sector partners. The French space agency, CNES, will not be a financial contributor to Spot 6, but the French Defence Ministry and other civilian governmental bodies are likely to remain major customers.

[51] "U.S Commercial Remote Sensing Policy." 25 Apr. 2003 <http://www.ostp.gov/galleries/press_release_files/fact_sheet_commercial_remote_sensing_policy_april_25_2003.pdf>.
[52] The NGA acquires imagery and derived products on behalf of its clients in the U.S defence, intelligence and law enforcement agencies.
[53] ImageSat International is another provider of VHR satellite imagery, but information about its activities and results are scarce.
[54] At the time the NGA Next View contract was signed, the launch of GeoEye1 was anticipated to take place during the first quarter of 2007.
[55] QuickBird has a 0.61 metre panchromatic resolution and a 2.44 metre resolution in multi-spectral and WolrdView-1 a 0.5 metre panchromatic resolution.
[56] Other actors in the MR segment are selling extra capabilities like India or Japan.
[57] de Selding, Peter. "Spot Image's Next Satellite Top Be Built Mainly with Private Capital." Space News 19.3 (21 Jan. 2008): 1+.
[58] Ibid.

Up to now the commercial satellite imagery business has consisted mainly of optical imagery. However, in 2007 the successful launches of TerraSAR-X and Radarsat-2 complemented the only operating Synthetic-Aperture Radar (SAR) satellite (Radarsat-1) and are consequently expected to boost the radar imagery segment in the near future.[59] The main actors in this segment are MacDonald, Dettwiler and Associates's (MDA) Geospatial Services and InfoTerra. MDA's Geospatial Services holds the exclusive distribution rights to Canada's SAR satellites including Radarsat-2 launched on 14 December 2007; it is a follow-on to the pioneer Radarsat-1 system launched in 1995. InfoTerra, a subsidiary of Astrium services, received the first data on 15 January 2008 acquired by its first commercial high resolution radar satellite TerraSAR-X. [60] It holds the exclusive commercial exploitation rights for TerraSAR-X imagery and provides a variety of geo-information products and services. Infoterra had in 2007 a turnover of over 60 million euros.

Mobile Satellite Services

In 2007, MSS revenues were estimated at about 2.1 billion U.S. dollars by SIA/Futron (Figure 11). MSS operators provide voice and data services using a network of one or more satellites in low-Earth orbit (LEO) or geostationary orbit (GEO) and associated ground facilities. The overall growth of MSS revenues was driven by a growing demand for TV and broadband as well as voice and data services, but also by the rollout of new applications requiring higher bandwidth. The increasing availability of lower-cost, lightweight terminals is also helping to drive up demand.

The main MSS actors are the global operators Globalstar, Iridium, Orbcomm, and Inmarsat as well as several regional operators providing voice, data and paging services.

Globalstar which operates a 48 in-orbit satellites fleet reported 21 324 new subscribers in 2007, for a total of 284 126 on 31 December 2007 compared to 262 802 at the end of 2006.[61] Globalstar posted for 2007 total revenues of about 98.398 million U.S. dollars (78.313 million U.S. dollars from service revenues and the rest coming from subscriber equipment sale) compared to 136.671 million U.S. dollars in 2006 (92.037 million U.S. dollars from service revenues and the rest coming from subscriber equipment sale).[62] In 2007, Globalstar's Top 10 customers accounted for, in aggregate, approximately 16% of its total revenues, with the revenues from its largest customer being 6.2 million U.S. dollars or 6%.[63] Service sales to U.S. government agencies constituted approximately 11% of its total service revenues for 2007.[64]

Iridium offers narrow-band data, fax and voice communications services through 66 low-Earth orbiting cross-linked satellites operating as a fully meshed network. In 2007, Iridium revenues were about 260.4 million U.S. dollars, a 23% increase over its 2006 revenues.[65] This growth was principally fuelled by an increase in the worldwide subscriber base, which reached 234 000 at the end of the year, a 34% increase over 2006. [66] Iridium reported continued strong growth in the machine-to-machine (M2M) market. It posted significant increases in the volume of voice and data traffic on its network in 2007 as well. North American traffic was up by about 44% and the volume of traffic in the Australia/Asia-Pacific region increased by 47% over the same period.[67] For Iridium, customers operating in international waters represent the biggest commercial user group (about 44%). Approximately 7% of its traffic also comes from polar regions situated outside the coverage provided by MSS providers using GEO platforms.[68]

Orbcomm operates a constellation of 29 LEO satellites in the global commercial wireless messaging system optimised for narrowband communications, particularly for M2M interface and telematics. In 2007, it began to provide terrestrial-based cellular communication services as well, through two re-seller agreements with major cellular wireless providers. At the end of last year, Orbcomm had approximately 351 000 billable subscriber communicators activated (an increase by about 56.2% compared to 2006). In 2007, Orbcomm registered total revenues amounting to 28.152 million U.S. dollars,

[59] The 5 RapidEye radar satellites will also be launched in the second quarter of 2008.
[60] TerraSar-X was launched on 15 June 2007 and will be complemented by TanDEM-X in 2009.
[61] "Globalstar, Inc. Announces Annual and Forth Quarter Results for 2007." PrimeNewswire Press Releases 12 Mar. 2008.
[62] Ibid.
[63] Ibid.
[64] Ibid.
[65] "Iridium® Satellite Announces Q4 and Fiscal Year 2007 Results." Iridium Press Releases 25 Feb. 2007.
[66] Ibid.
[67] Ibid.
[68] "Iridium Use Grows Among Maritime, U.S. Customers." Space News 17 Sept. 2007.

compared to 24.250 million U.S. dollars in 2006 with 17.717 million U.S. dollars coming from service revenues and 10.435 million U.S. dollars from product sales.

The other main global MSS provider is the United Kingdom-based Inmarsat, which owns and operates a GEO satellite network and provides communications services, such as telephony, fax, video, email and high-speed data services. In particular, Inmarsat is the leading provider of satellite communications services to the maritime sector. In 2007, it posted revenues of 576.5 million U.S. dollars up from 500.1 million U.S. dollars in 2006.[69] In 2007, Inmarsat's maritime revenues increased by 9% to represent 57% of its revenues, land mobile sector increased by 8% to represent estimated revenues of 23%, aeronautical revenues increased by 44% to represent revenues of about 8%, and leasing revenues increased by 10% accounting for 12% of total revenues.[70]

Several regional MSS operators possessing GEO satellites are also providing satellite-based mobile telephone services to limited geographical regions. Mobile Satellite Ventures (MSV) provide a range of mobile satellite communication services using two GEO satellites and support data delivery of voice, fax and dispatched radio services in the United States and Canada. ICO Global Communications successfully launched its GEO satellite to cover North America on 14 April 2008, joining ICO's F2 MEO satellite already in orbit. Thuraya, the United Arab Emirates-based operator, launched its voice/data commercial services in the Asia Pacific region in spring 2008 following the launch of its third satellite, Thuraya-3 in January 2008. The Asian Cellular Satellite System (ACeS) provides combined cellular telephone and satellite communication services from GEO in the Asia Pacific Region, and particularly, throughout Southeast Asia, including Indonesia, Japan, South Korea, China and India.

Hybrid spectrum featuring L- and S-band digital broadcasting standards are an emerging domain of growth in the MSS sector. The hybrid system of smaller and less costly hand terminals and ground towers known as the "Ancillary Terrestrial Component" (ATC) substantially increases bandwidth and reception, including indoors.[71] This technology also allows for the development of new services like mobile TV/audio, two-way broadband etc. After the introduction of GEO mobile TV networks in South Korea and Japan in 2004, the first GEO spacecraft are poised for launch to cover North America by ICO, TerreStar to complement the recently launched MSV's satellite. In Europe, the European Commission adopted a resolution on the "harmonised use of radio spectrum in the 2 GHz bands for the implementation of systems providing MSS" on 14 February 2007.[72] Its aim is to simplify the licensing process and reduce the risk of market fragmentation by reserving S-band for MSS use and for hybrid MSS systems associated to a Complementary Ground Component (equivalent to the U.S. ATC system) (Cf. Chapter 3 and 7). Five companies are expected to bid for S-band MSS in Europe: Inmarsat, ICO Global, TerreStar Corp, Solaris Mobile (a joint venture Eutelsat and SES), and Ondas Media.

2.3.2 Satellite manufacturing

According to SIA/Futron satellite manufacturing revenues declined from 12 billion U.S. dollars in 2006, to 11.6 billion U.S. dollars in 2007 (Figure 13). However, satellite manufacturing revenues from commercial customers grew by 27% to reach 3.8 billion U.S. dollars in 2007.

Companies involved in this sector design and manufacture satellites, space systems and space systems components for commercial and government customers whose applications include DBS, FSS, MSS, space-based Earth observation or positioning, navigation and timing.

2.3.3 Launch sector

Worldwide launch industry revenues increased by 19% to reach 3.2 billion U.S. dollars in 2007, a similar level as 2003 (Figure 14).

[69] Inmarsat plc "Annual Report and Accounts 2007." Reuters News Release 3 Apr. 2008 <http://www.reuters.com/article/pressRelease/idUS122811+03-Apr-2008+RNS20080403>.
[70] Ibid.

[71] The U.S. government has granted mobile satellite operators the right to use their satellite spectrum for ground-based communications networks called Ancillary Terrestrial Components (ATCs).
[72] European Union. European Commission. "Commission Decision of the 14 February 2007 on the Harmonised Use of Radio Spectrum in the 2 GHz Frequency Bands for the Implementation of Systems Providing Mobil Satellite Services" 2007/98/EC. Official Journal of the European Union 15 Feb. 2007.

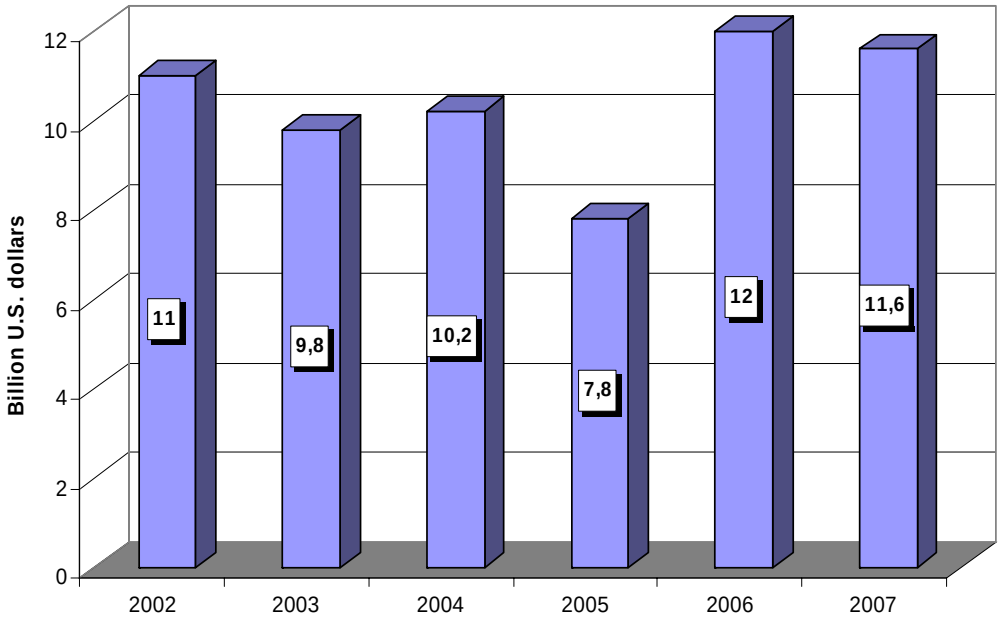

Figure 13 World satellite manufacturing revenues (source SIA/Futron)[73]

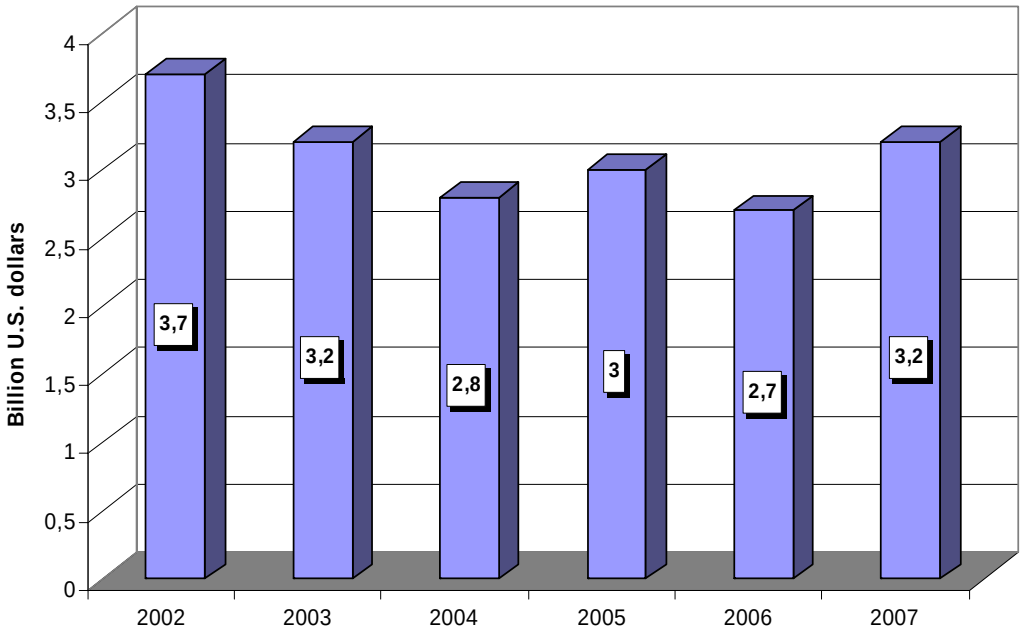

Figure 14 World launch industry revenues (source SIA/Futron)[74]

Based on estimates from the U.S. Federal Aviation Administration (FAA) in 2007, the revenues of the 23 commercial launches identified by ESPI were evaluated at about 1547.5 million U.S. dollars, an increase of about 125 million U.S. dollars from 2006. The breakdown of the international commercial launch sector in 2007 was as follows: Europe had about 840 million U.S. dollars in revenues, Russia had about 476.5 million U.S. dollars in revenues, and the United States an estimated 150 million U.S. dollars in revenues. Multinational revenues (Sea Launch) were estimated at about 70 million U.S. dollars and Indian revenues at about 11 million U.S. dollars.

The low level of revenues of Russian launch services providers compared to their high level of activity is mainly a result of the fact that they are particularly active in the LEO market which has a lower price tag than launches to deliver satellites to GEO, the

[73] Satellite Industry Association/Futron "State of the Satellite Industry Report." June 2008.
[74] Satellite Industry Association/Futron "State of the Satellite Industry Report." June 2008.

most lucrative market. On the contrary, Europe's good results can be explained by the fact that Arianespace is launching two payloads to GEO at the same time, and therefore has higher revenues per launch.

2.3.4 Ground equipment

In 2007, ground equipment was the largest source of revenues for space infrastructures. Worldwide ground equipment revenues, the second largest segment of space industry revenues, reached 34.3 billion U.S. dollars in 2007, which is up 19% from 2006 (Figure 15). This rise was fuelled mostly by revenues from consumer equipment due to an increase in end-user terminal numbers in all sectors.

Total ground equipment revenues include both network and consumer equipment. Ground equipment revenues include infrastructure elements (such as mobile terminals, gateways, control stations) as well as end-user equipment (like very small aperture terminals (VSATs) and ultra small aperture terminals (USATs)), but also consumer equipment (DTH broadcast satellites dishes, satellite phones and digital audio radio satellite (DARS) equipment) and GPS primary-use hardware. However, this estimate excludes revenues from consumer electronics incorporating GPS technology such as mobile phones.

The global market for satellite navigation hardware and services continued to soar in 2007. The sub-segment of end-user electronics incorporating GPS chip sets such as Personal Digital Assistants (PDAs) and cell phones is one of the fastest-growing markets. ABI Research estimates last year's market for satellite navigation hardware for the automotive industry alone at 33 billion U.S. dollars, a six billion U.S. increase compared to 2006.[76] This growth is believed to be linked to falling prices for all types of hardware and to the increase in the volume of Portable Navigation Devices (PNDs) from 12 million units in 2006 to more than 24 million units in 2007.[77] There are also an estimated 5.1 million mobile phones equipped with satellite navigation.[78] For 2008, the PND market is expected to continue to grow strongly by about 50% with 38 million units to be sold compared to 24.5 million units in 2007. The European market is expected to grow by 40% from 15 million units to 21 million units and in the United States by 80% from 9.5 million units to 17 million units.[79]

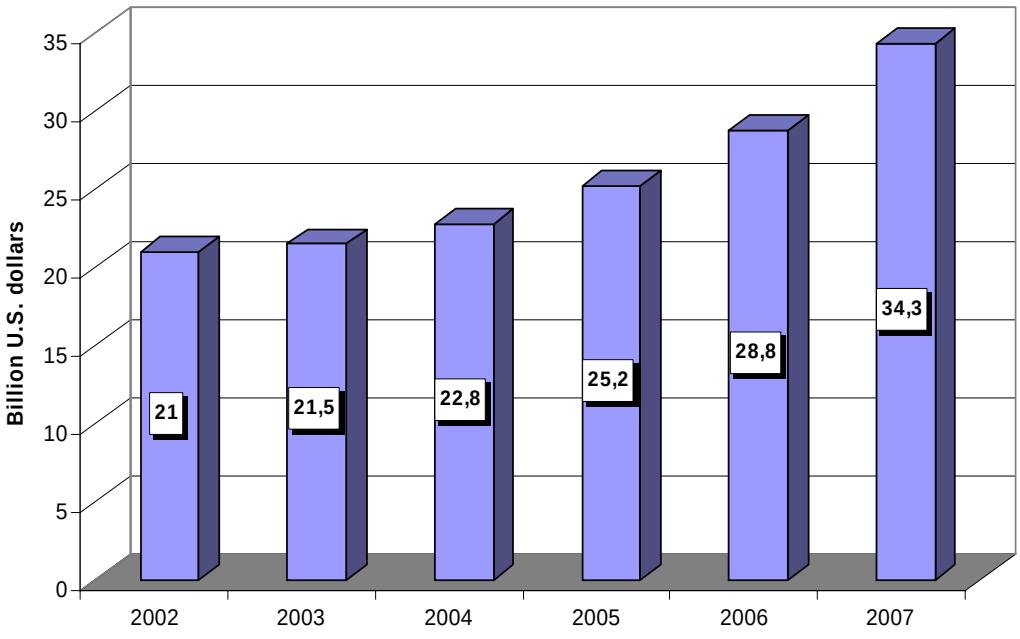

Figure 15 World ground segment equipment revenues (source SIA/Futron)[75]

[75] Ibid.

[76] Brinton, Turner. "Satellite Navigation Market Continues to Soar Worldwide." Space News 14 Jan. 2008.
[77] Ibid.
[78] Ibid.
[79] TomTom Reports Fourth Quarter and Full Year Results 2007." TomTom News 21 Feb. 2008 <http://www.tomtom.com/news/category.php?ID=4&NID=494&Year=2008&Language=1>.

The two leaders in PNDs, Garmin and TomTom posted record results in 2007 in terms of sales, as well as revenues. Garmin recorded total revenues of 3.18 billion U.S. dollars, up by 79% in 2006 due to strong sales in the automotive and mobile/segment and sold 12 million PNDs units in 2007.[80] TomTom posted revenues of 1.73 billion euros, up by 27% from 2006, and sold 9.6 million PNDs up by 104% compared to last year.[81]

2.3.5 Insurance sector

According to Aon, in 2007, the space insurance market was estimated to be worth about 600 million U.S. dollars in launch and in-orbit premium.[82] In this context, several new insurers entered the market including Atrium, Asia Capital Re, Axa Corporate Solutions, Elseco, Glacier Re and Korea Re. However, according to Aon, after several years of reducing premiums, space insurers are targeting premium increases up to 30% following losses in 2007. These included the failures of the Sea Launch rocket carrying the NSS-8 satellite, the Proton carrying the JCSat 11 and the Proton rocket carrying the AMC-14 satellite, as well as the helium leak of the Rascom 1 satellite. In total, claims are estimated to reach about 835 million U.S. dollars for 2007, prompting the aforementioned reassessment of insurer's premium rating.[83]

2.3.6 Emerging commercial markets

The size of the commercial orbital and suborbital human spaceflight sector was estimated at about 65 million U.S. dollars in 2007.

In the domain of orbital space tourism, in April 2007, Charles Simony became the fifth space tourist. Then, on 28 September 2007, Space Adventures announced that game developer and son of former NASA astronaut, Richard Garriott, would fly to the International Space Station (ISS) in October 2008 onboard a Soyuz as the sixth space tourist for a ten-day flight for an estimated 30 million U.S. dollars. Garriott will be conducting research for ExtremoZyme Inc., on protein crystallisation experiments with proteins, which have important cellular functions and are usually associated with common human diseases. It is expected that these experiments will enable researchers to learn more about the molecular details of these proteins which is essential for protein engineering and structure-guided drug design.

On 11 June 2007, it was announced that Google co-founder Sergey Brin put down a five million U.S. dollars deposit towards a future orbital flight as the first member of the newly established "Orbital Mission Explorers Circle" created by Space Adventures. This programme allows individuals to reserve seats on future orbital spaceflights. Six "Founding Explorer" positions in the "Orbital Mission Explorers Circle" have been created with Brin being the first "Founding Explorer". Space Adventures acquired Zero Gravity Corp in early 2008 which provides weightless flight experience (Cf. Chapter 5).

On 1 February 2008, Bigelow Aerospace announced that progress was being made in negotiations with United Launch Alliance (ULA) for six initial launches for Bigelow's commercial space station to begin assembly and early operation, starting around 2011. Once the orbital facility becomes fully operational, Bigelow expects to conduct a dozen launches per year. Bigelow and ULA have already been working together to study the possibility to human-rate the Atlas V launch vehicle.[84]

While it is difficult to accurately gauge the eventual size of suborbital space tourism as a space business, the emerging private space-travel industry has seen some developments in the past months that might lead to a price competition years before the first privately-financed vehicles are scheduled to begin flying. For the last few years, commercial suborbital spaceflight has been virtually synonymous with a single company: Virgin Galactic, but other newcomers are poised to enter the market.

In New York (USA), on 23 January 2008 Virgin Galactic unveiled the design of its launch system the SpaceShipTwo (SS2) planned to carry customers in space[85], and its carrier aircraft, the White Knight II (WK2). An estimated 250 prospective customers have signed up for suborbital trips through

[80] "Garmin Reports Best Quarter and Best Year in Company History, Announces Share Repurchase Program, Offers 2008 Guidance." PR Newswire 20 Feb. 2008 <http://www8.garmin.com/aboutGarmin/invRelations/releases/Q42007EarningsPressRelease.pdf>.
[81] "TomTom Reports fourth quarter and full year results 2007" TomTom News, 21 Feb. 2008 <http://www.tomtom.com/news/category.php?ID=4&NID=494&Year=2008&Language=1>.
[82] "Pivotal Time for Space Insurance as Insurers Look for Rates to Lift-off." Aon News Release 20 Mar. 2008.
[83] Ibid.
[84] For more information see Peter, Nicolas. "Space Policy, Issues and Trends in 2006/2007" ESPI Report 6 Sept. 2007: 27.
[85] While SpaceShipOne could carry only 3 persons, SS2 will carry 2 pilots and 6 paying customers.

direct contact with Virgin Galactic or its network of about 90 agents worldwide, generating about 35 million U.S. dollars in ticket purchases and deposits. Virgin Galactic has reported an after-tax profit of 274 800 U.S. dollars in the first publicly available financial account since the establishment of the company in June 2006.[86] Total costs for the project are estimated at 250 million U.S. dollars and the first commercial flight is foreseen for 2010-2011. About 100 million U.S. dollars are estimated to have been spent thus far. Pending successful developments, a fleet of two MK2s and five SS2s will be constructed and Virgin Galactic has an option to buy seven more SS2s. In the first year of operation, Virgin Galactic foresees one flight per week just over 40 weeks and generating 50 million U.S. dollars. However, after three years of operations, Virgin Galactic plans to conduct ten flights per week for 50 weeks generating revenues of about 600 million U.S. dollars per year.[87]

Virgin Galactic's first launch site will be in Sierra County in the United States. In this context, following the successful spaceport tax referendum in the Doña Ana County, New Mexico, towards the development of Spaceport America in April 2007, another successful referendum was conducted and passed in Sierra County, also in New Mexico on 24 April 2008. Like in the Doña Ana County vote, an increase in the sales tax in the county was at stake to finance part of the project.[88] Virgin Galactic's second launch site is foreseen to be at Sweden's Esrange launch site with flights beginning in the 2012-2013 timeframe. Swedish authorities hope in this context to lower the cost and regulatory barriers to the operation by having space tourism classified as a sounding rocket and granted the tax advantages of hot-air balloon flights. South Australia and Victoria, both in Australia, are also being considered as launch sites for Virgin Galactic.[89]

On 26 March 2008, XCOR Aerospace unveiled plans for a rocket-powered suborbital space plane, to be known as the Lynx, designed to carry a pilot and a passenger or payload taking off and landing from a conventional airport. The foreseen inaugural launch date for this two-seat spaceship is 2010. The vehicle will be substantially smaller, slower, and less expensive that other suborbital vehicles by flying only to a peak altitude of 60 kilometres above the Earth for a two-minute weightlessness period rather than above 100 kilometres. XCOR hopes to make its spaceflights available for considerably less than Virgin Galactic's ones, on the order of 100 000 U.S. dollars compared to 200 000 U.S. dollars for Virgin Galactic and 267 000 U.S. dollars for EADS Astrium. Moreover, the company would sell blocks of rides to resellers who would offer value-added services. The U.S. Air Force Research Laboratory has already agreed to use the Lynx as a platform to test the performance of space hardware in weightlessness conditions. In the future XCOR aims to roll out a more powerful version of the Lynx, featuring dual engines to reach higher altitudes.

On 13 June 2007, EADS Astrium disclosed the basic design of the space plane it proposes to build for suborbital space tourism venture. Astrium intends to build a four-passenger rocket-equipped jet designed to take off from a normal runway (liquid methane and liquid oxygen engine) by raising about one billion euros to complete the vehicle's development and order the first models. However, as of mid-2008, the search for financial partners was not successful.
In the field of suborbital flights, in 2007, nine flights were conducted under the authority of the FAA experimental permits for the development of reusable suborbital rockets,[90] three more than in 2006. All 2007 flights were conducted by two companies (Blue Origin and Armadillo Aerospace) and all nine flights used vertical-takeoff and landing with three different vehicles (Table 4).

Following the success of the ten million U.S. dollars Ansari X Prize, the X Prize Foundation launched a new space prize on 17 September 2007 by teaming up with Google Inc. to offer up to 30 million U.S. dollars for the first privately funded team to send a robot to the moon, travel 500 metres and transmit video (so-called "Mooncast"), images and data back to the Earth. The first team able to accomplish this before 30 December 2012 will win 20 million U.S. dollars.

[86] Coppinger, Rob. "Sales are Rocketing at Virgin Galactic." Flight Global 25 Mar. 2008 <http://www.flightglobal.com/articles/2008/03/25/222290/sales-are-rocketing-at-virgin-galactic.html >.
[87] Ibid.
[88] A provision of State law, indicate that the money that the tax would have collected in the Doña Ana County could not be spent until a spaceport "tax district" is created, and that cannot be done until another county or locality approves the tax.
[89] Deery, Shannon and Elissa Doherty. "SA on Shortlist for Space Base." 13 Apr. 2008 <http://www.news.com.au/adelaidenow/story/0,22606,23530233-2682,00.html >.
[90] For more information, see Peter, Nicolas. "Space Policy, Issues and Trends in 2006/2007." ESPI Report 6 Sept. 2007: 27.

Flight date	Operator	Vehicle	Launch Site
22 March 2007	Blue Origin	Goddard	West Texas Launch Site
19 April 2007	Blue Origin	Goddard	West Texas Launch Site
2 June 2007	Armadillo Aerospace	Pixel	Oklahoma Spaceport
2 June 2007	Armadillo Aerospace	Pixel	Oklahoma Spaceport
20 October 2007	Armadillo Aerospace	MOD 1	Holloman AFB
27 October 2007	Armadillo Aerospace	MOD 1	Holloman AFB
27 October 2007	Armadillo Aerospace	MOD 1	Holloman AFB
28 October 2007	Armadillo Aerospace	MOD 1	Holloman AFB
28 October 2007	Armadillo Aerospace	MOD 1	Holloman AFB

Table 4 2007 FAA-Permitted Flight Events (source FAA)

After that deadline, the prize drops to 15 million U.S. dollars for two more years, and then expires entirely. Unlike the original Ansari X Prize, the Google Lunar X Prize has a second place with a purse of five million U.S. dollars with the deadline set at the end of 2014 as well. An additional five million U.S. dollars have been reserved for "bonus" prizes such as taking images of Apollo and/or other human artefacts left on the moon. Like the Ansari X Prize, the Google Lunar X Prize is intended for the private sector, since at least 90% of the funding for each team must come from private sources. A series of partnerships to help potential teams has also been announced, in particular, with Space X and the Universal Space Network providing services to teams at discounted prices.

On 22 February 2008, the X Prize Foundation and Google announced the first ten teams to register for the Google Lunar X Prize: seven are from the United States (Astrobotic, Chandah, FredNet, LunaTrex, Micro-Space, Quantum3, Southern California Selene Group (SCSG)) and three from Europe (Aeronautics and Cosmonautics Romanian Association (ARCA) from Romania, Odyssey Moon from the Isle of Man and Team Italia from Italy). As of the end of June, 13 teams were registered, the above plus a "Mystery Team", the team Stellar and JURBAN all from the United States and Advaeros, a multinational team. In the mean time, SCSG withdrew from the contest.

Chapter 3 - Global Space Policies and Strategies

In the period ranging from mid-2007 to mid-2008, major developments occurred in several space-faring countries at the policy and strategy levels, notably in Japan where the new "Basic Space Law" has finally been adopted. This period was, however, marked by fewer major policies put forth by the major space actors compared to the 2006/2007 period. Nonetheless, the new developments witnessed in the implement-tation of the policies recently adopted as well as in the developments of new strategies by emerging space actors in various parts of the world tend to underline the growing quest for enhancing national competitiveness in an ever-increasing international and global space context.

3.1 Europe

The period 2007/2008 was particularly dynamic and successful for Europe (defined as the EU, ESA, Eumetsat and their member States). Following the adoption of the first European Space Policy in May 2007, subsequent months focused on implementing this policy. Major developments also occurred at the programmatic-level such as the resolution of some of the difficulties of the Galileo programme, but also policy statements on space affairs by the executive or legislative branch in France, Germany and the United Kingdom.

3.2 European Space Agency

After the adoption of the European Space Policy, efforts in recent months have focused on implementing it and other programmatic elements as well as on preparing the ESA Council meeting at the Ministerial Level scheduled for November 2008. ESA was also particularly active in 2007/2008 on the technical and scientific side.

The year 2008 was a historical period for human spaceflight activities in Europe. First, the European Columbus orbital laboratory launched by NASA's space shuttle Atlantis (STS-122 mission) was attached to the International Space Station (ISS) on 11 February 2008. The hatch between the ISS and Columbus was opened a day later. This significant milestone marks Europe's new status as a full partner and co-owner of the International Space Station (ISS).[91] Second, the first ESA re-supply and reboot vehicle, the Automatic Transfer Vehicle (ATV) named Jules Verne, successfully performed a fully-automated docking procedure with the ISS on 3 April 2008. The 19-tons ATV aims to deliver cargo, propellant, water, oxygen and propulsion capability to the station.[92] As ESA now contributes to ISS operations mainly through ATV, the Agency can expect to regularly send European astronauts to perform long-duration stays onboard as members of the resident crew. Subsequent to these two milestones, ESA opened a call for astronauts on 19 May 2008 to recruit four candidates from its 17 member States to become join the European Astronauts Corps. This is the first call to recruit European astronauts since 1992. Final appointments will be officially announced in 2009.

Progress was also achieved in the Galileo and the Global Monitoring for Environment and Security (GMES) programmes to ensure the transition from the pre-operational phase to the operational phase.

For Galileo, GIOVE-B was successfully launched on 27 April 2008 and began transmitting navigation signals on 7 May 2008. Europe now has two GIOVE satellites in orbit (GIOVE-A and B). Following the re-profiling of the Galileo programme, ESA is now the maître d'oeuvre for the whole programme (Cf. Chapter 7). Finally, in late June 2008, the selection process for the Galileo contractor for the six work packages of the Galileo satellite navigation system started.[93] The Commission and ESA have

[91] Further European-built ISS elements are still under preparation to be launched to the ISS within the decade, such as the Material Science Laboratory (MSL), the Muscle Atrophy Research and Exercise System (MARES) and the European Robotic Arm (ERA), the Node-3 and the Cupola observation deck.
[92] The ATV carries about three times as much payload mass as Russia's Progress freighters.
[93] The six work packages are system support, ground

opted for the procurement procedure of "Competitive Dialogue" (Cf. Chapter 7).

On 27 September 2007, ESA's member States participating in the GMES programme approved the transition to Phase-2 of Segment 1 of the GMES Space Component Programme allowing it to make progress on the development of the Sentinel satellite series and, in particular, to build Sentinel 1, 2 and 3 with the necessary ground segment. The oversubscription of the programme by the ESA Council at the Ministerial Level in Berlin (Germany) in 2005 was confirmed with an oversubscription to Phase-2 of 116%. On 14 April 2008, Thales Alenia Space signed a 305 million euros contract to provide the Sentinel-3 satellite, which is dedicated to oceanography and land vegetation monitoring, with a planned launch for 2012. Then, on 17 April 2008 ESA and Astrium signed a 195 million euros contract for the Sentinel-2 satellite devoted to monitoring the land environment with a planned launch for 2012.

On 27 May 2008, ESA and Astrium also signed a 263 million euros contract for the development of the sixth Earth Explorer mission of ESA's Living Planet Programme, the Earth Care satellite. This satellite will address the need for a better understanding of the interaction between clouds, radiative and aerosol processes that play a role in climate regulation. It is scheduled for launch in 2013.

In the field of communications, ESA and Inmarsat announced on 23 November 2007 the formal signature of the contract for the Alphasat satellite, making Inmarsat the first customer of the Alphabus platform jointly developed by Astrium and Thales Alenia Space and initiated by a partnership between ESA and CNES. Alphasat will be available for launch in 2012. In addition to the Inmarsat payload, it will carry three ESA-produced Technology Demonstration Payloads (TDPs).

The development of ESA future scientific missions is also on-going. Among others, on 18 January 2008, the industrial contract of BepiColombo was signed between ESA and Astrium. BepiColombo will consist of two spacecraft, one orbiter for planetary investigation led by ESA, and one for magnetospheric studies led by the Japanese space agency (JAXA). After a six-year journey BepiColombo is expected to make the most extensive and detailed study of Mercury ever attempted.

New scientific missions are also being considered for development in the context of the ESA Cosmic Vision 2015-2025, with the themes ranging from the conditions for life and planetary formations, to the origin and future of the solar system, and the origin, structure and evolution of the universe. The initial selection of missions was made in summer 2007. Nine missions were selected from 50 proposals gathered within the framework of a dedicated call in spring 2007. For the domain of the solar system the following missions were short listed: Laplace, a mission studying the Jovian system; Tandem a new mission to Saturn; Titan and Enceladus; Cross-scale to study near-Earth space, and Marco Polo an asteroid sample-return mission.. In the field of astronomy, Euclid a mission to study dark matter and energy, Plato a planet finder mission, Xeus a next generation X-ray space observatory, Spica a next generation infrared observatory, and LISA a space interferometer to detect gravitational waves were short-listed. The assessment cycle will end in 2011, with a first selection foreseen in 2009. At the end of this process two missions (one class M mission and one class L mission) will be selected to be launched in the 2017-2018 horizons.

ESA was also active in defining future exploration activities individually or within the framework of international cooperation. In particular, the International Space Exploration Conference was organised by ESA and DLR on 8-9 November 2007 in Berlin (Germany) to discuss future missions to the moon, Mars, and beyond. The conference was a first step for the definition of a roadmap for space exploration which will be presented to the ESA Council on Ministerial Level in November 2008.

Progress was also made on launch vehicles development such as on rocket engines in the context of ESA's Future Launchers Preparatory Programme (FLPP) with the first hot firing test in February 2007 of a reduced-scale demonstrator version of a staged combustion rocket engine. Major milestones in the development of the Vega launcher, which will serve the small to mid-sized satellite launch market, were also achieved in 2007/2008. A prototype of the P80 rocket motor which will power the first stage of the 3-stage vehicle was successfully tested on 4 December 2007 at the Guiana Space Centre (GSC), concluding the qualification of the engine. Then, on 27 March 2008, the second stage engine, Zefiro 23, completed a static firing test at the Salto Di Quirra Inter-force Test Range in Italy, achieving the qualification testing of the engine. Progress on the construction of Soyuz's launch site at

mission segment, ground control segment, space segment (satellites), launch services and operations.

the GSC continued and the assembly work on the Soyuz launch pad is expected to start in August 2008. The first Soyuz launch from Kourou is planned for spring 2009.

In the last few months, ESA's membership has evolved. An agreement on closer cooperation between ESA and Slovenia was signed on 28 May 2008 making Slovenia the second recent EU member State to sign a cooperative agreement with ESA after Estonia in June 2007. It is now expected that in a few years Slovenia will become a European Cooperating State. On 28 April 2008, Poland signed the Plan for European Cooperating State Charter as a follow-up to its signature of the European Cooperating State Agreement in April 2007. Poland is the fourth country to subscribe to the Plan for European Cooperating State (PECS) after Hungary, the Czech Republic and Romania.

ESA also continues to expand its international cooperation efforts. On 8 May 2008, the cooperation agreement between Argentina and ESA was renewed for five years. ESA also reinforced its cooperation with China. The ESA ground station network, and in particular, its three ESTRACK (European Space Tracking) stations provided direct support to critical phases of Chinese Chang'e-1 lunar mission. In return for ESA's tracking services, China will share scientific data generated by the mission. Furthermore, following the success of the Earth observation Dragon Programme, the programme's second phase, Dragon 2 started in May 2008 for four years. From 16 projects in Dragon 1, the number of projects has been increased to 25 under Dragon 2. The Dragon Programme is designed to encourage increased exploitation of ESA and Chinese Earth observation satellite data by China. ESA continued as well to investigate potential cooperation with NASA, particularly in the domain of space exploration. ESA and NASA worked on comparative lunar architectures as well as preliminary elements of Mars sample return missions.

The European Space Astronomy Centre (ESAC) located on the outskirts of Madrid (Spain) was inaugurated on 7 February 2008, making it the sixth ESA establishment (plus ESA headquarters, liaison offices in Washington and Moscow and an office in Brussels) and the first in Spain. ESAC is ESA's centre for space science covering astronomy as well as solar system exploration activities.

3.3 European Union

While the EU does not yet have direct responsibility for space issues despite the adoption of the May 2007 European Space Policy, it is foreseen that the role of the EU will increase in the near future with the entry into force of the "Lisbon Treaty", or an alternative document.[94] A new treaty, the "Treaty amending the Treaty on European Union and the Treaty establishing the European Community" known as the "Lisbon Treaty" is set to replace the European Constitution, which was rejected by voters in France and the Netherlands in 2005 (Cf. Chapter 1).[95] The "Lisbon Treaty" aims to enhance the efficiency of the EU with a major focus on the reorganisation of the institutional and decision making processes of the EU. It creates the legal framework for action by the EU in certain areas not previously explicitly covered including space. Using a very similar wording as in the Treaty Establishing a Constitution for Europe of 2004 ("the Draft Constitutional Treaty"), the Lisbon Treaty refers to "space" in two articles.

Article 4.3 states that:

- "In the areas of research, technological development and space, the Union shall have competence to carry out activities, in particular to define and implement programmes; however, the exercise of that competence shall not result in Member States being prevented from exercising theirs."

Article 189, included in the Title XIX headed "Research and technological development and space", states that:

- "To promote scientific and technical progress, industrial competitiveness and the implementation of its policies, the Union shall draw up a European space policy. To this end, it may promote joint initiatives, support research and technological development and coordinate the efforts needed for the exploration and exploitation of space.
- In order to reach the objectives referred to in paragraph 1, the European

[94] The consequences of the rejection on 12 June 2008 of the referendum in Ireland for the adoption of the "Lisbon Treaty" are still unclear, but the ratification process is expected to continue and no major modifications to the articles dealing with space affaires are foreseen should a new document be drafted.

[95] This treaty was scheduled to enter into force on 1 January 2009 provided that all 27 member States would have ratified it.

Parliament and the Council, acting in accordance with the ordinary legislative procedure, shall establish the necessary measures, which may take the form of a European space programme, excluding any harmonisation of the laws and regulations of the Member States.
- The Union shall establish any appropriate relations with the European Space Agency.
- This Article shall be without prejudice to the other provisions of this Title."

The provisions of the Lisbon Treaty thus clearly assign the area of competence for the space field as a "support competence" to the European Union.

In the 2007/2008 period, the three main areas of activities of the EU and its services were their involvement in the Galileo and the GMES programmes, as well as the mobile satellite services (MSS) regulations.

The Commission Communication of 19 September 2007 entitled "Progressing Galileo: Re-Profiling the European GNSS Programmes" reassessed the importance of Galileo both geopolitically and commercially. This Communication aimed at salvaging the European Global Navigation Satellite System (GNSS) programmes, and in particular, to clarify that Galileo and EGNOS project deployment phases will be funded by the European Community. In an effort to secure those projects, a proposition to use unspent agriculture funds as well as administration funds has been made for a total of 2.42 billion euros for the 2007-2013 period (Cf. Chapter 7). [96] Subsequently, a proposed amendment to the "Decision of the European Parliament and of the Council, amending the Inter-institutional Agreement of 17 May 2006 on budgetary discipline and sound financial management as regards the multi-annual financial framework" was presented by the Commission on 5 December 2007 in order to adjust the 2007-2013 budget of the EU to extract 2.7 billion euros for the Galileo and the European Institute of Innovation and Technology projects. [97] , [98] Following the adoption of the aforementioned amended proposal by the European Parliament and Council, the management structure of the programme was modified with, among others, the creation of a Galileo Inter-institutional Panel (GIP) composed of seven representatives (three from the Council, three from the European Parliament and 1 from the Commission) scheduled to meet four times per year to cooperate on decisions on annual work programmes (Cf. Chapter 7). Furthermore, while ESA is now the maître d'oeuvre and has the authority to issue the contract, the EU rules will prevail over the ESA geographic return policy, since Galileo is being funded by EU funds. Altogether, the developments of the last few months illustrate that for various political stakeholders in Europe, Galileo remains a justifiable enterprise solely on the basis that it will provide Europe with autonomy regarding space-based global positioning, naviation and timing rather than just for economic motives. On 25 June 2008, the Commission issued an Invitation to tender for the six work packages of the Galileo satellite navigation system, and on 1 July 2008, the Commission and ESA launched the pro-urement of the programme (Cf. Chapter 7).

At a technical level, major progress on Galileo was also made in 2007/2008. The U.S. and the EU "joint compatibility and interoperability working group" solved technical challenges in July 2007 to ensure that the Galileo and the GPS systems are compatible for joint security issues and commercial purposes.[99] However, because of this agreement to make compatible signals between the future GPS III and Galileo satellites, GIOVE-B's launch was delayed from March to April 2008 in order to modify the Navigation Signal Generation Unit *(*NGSU*)* and to wait for seasonal eclipse phenomena to pass. [100] GIOVE-B was successfully launched on 27 April 2008 on a Starsem rocket from the Baikonur Cosmodrome and since 7 May 2008, it has been transmitting the GPS-Galileo common signal.

Progress was also made on the other EU flagship programme, GMES. In particular, the European Commission approved new funding to purchase a new family of space-based

[96] It is estimated that altogether, Galileo's cost should be about 4.9 billion euros with 1.5 billion euros already spent, 1 billion euros previously set aside and the supplementary 2.4 billion euros.

[97] "Decision of the European Parliament and of the Council, amending the Interinstitutional Agreement of 17 May 2006 on budgetary discipline and sound financial management as regards the multiannual financial framework." presented by the Commission, COM (2007) 783 final, Brussels 5 Dec. 2007.

[98] On 11 December 2007, the Council adopted the amended version of EU's financial framework for 2007-2013.

[99] "US and EU Announce Final Design for GPS-Galileo Common Civil Signal." IP/07/1180 27 July 2007.

[100] Coppinger, Rob. "GIOVE-B signal generator modified as launch slips to April." Spaceflight 16 Jan. 2008 <http://www.flightglobal.com/articles/2008/01/16/220838/giove-b-signal-generator-modified-as-launch-slips-to-april.html >.

platforms.[101] On 28 February 2008, ESA and the European Commission signed an agreement for transferring the management of funds of a volume of 624 million euros of the Commission's budget to ESA in order to build GMES components. Funding will be distributed into two stages: 419 million euros for segment 1 and 295 million euros for segment 2.[102]

Another major development in European space affairs is the proposal for the selection and authorisation of systems providing MSS that has been presented by the Commission and agreed upon by the European Parliament and the Council. This initiative aims to promote a competitive internal market for MSS to ensure that those transnational services work at their best potential. On 22 August 2007, the Commission transmitted to the European Parliament and the Council, a proposal providing a legal framework for new mechanisms on the selection and authorisation of systems providing MSS (Cf. Chapter 7). It lays down Community procedure for the common selection at EU-level of MSS operators; it also mentions provisions for the coordinated authorisation by national authorities of selected operators to use the radio spectrum for the operation of such systems in the EU.[103]

The Commission proposal has been subsequently examined by the Transport, Telecommunications and Energy (TTE) Council during the Portuguese and Slovenian Presidencies (Cf. Chapter 7). Negotiations with the European Parliament started under the Slovenian Presidency, and on 18 April 2008, a compromise was reached on the Commission proposal. On 21 May 2008, the European Parliament adopted on the basis of a first-reading compromise the Commission's proposal (652-16-10) with only one provision stating that no more than 15 MHz from Earth to space and 15 MHz from space to Earth can be assigned to one applicant. Then, on 16 June 2008, a decision of the European Parliament and the Council on the selection and authorisation of systems providing MSS was published. Finally, the Council (on Agriculture and Fisheries) adopted a decision taken by a qualified majority vote of the European Parliament and the Council on 23 June 2008, establishing a common framework for the selection and authorisation of systems providing MSS. The target date for completing the EU selection process is early 2009.

Space is increasingly being used as a tool for foreign diplomacy by the EU and its services.[104] The EU established a series of bilateral dialogues with other space powers, particularly the United States and Russia.

The most recent EU-US Dialogue on Civil Space cooperation took place on 28 May 2008.[105] The agenda items of the meeting were space policy updates, satellite navigation, space exploration, regulatory issues, Earth observation, United Nations issues and security issues. The information exchange was considered very positive by both sides and specific areas of cooperation have been identified in Earth observation by the United Nations Committee on the Peaceful Uses of Outer Space (UN-COPUOS) regarding coordination and security issues.

The third meeting of the Steering Board of the EU-Russia Dialogue on Space Cooperation took place on 24 June 2008 in Paris (France). Set up in March 2006, the dialogue covers space applications (satellite navigation, Earth observation and communications) access to space (launchers and future space transportation systems) space science and space technology development. At the last meeting, the three partners (EC, ESA and the Russian Federal Space Agency) reported on the progress in establishing a regular dialogue at the working level in the aforementioned fields. The Steering Board identified priorities for the period 2008-2009 in each of the following sectors: Earth observation, satellite navigation, satellite communication, fundamental space science, applied space science and technology, launch systems and Crew Space Transportation System.

While the EU already has existing relations and cooperation with major space powers, it is also extending its reach. In particular, during the EU-Africa Summit, a "GMES for Africa" event was organised in December 2007.[106] Mutual commitments and strategic partnerships have been reiterated and eight

[101] de Selding, Peter. "Europe Makes Earth Observation a Priority." Space News 19.14 (7 Apr. 2008): 20.
[102] "GMES secures European Commission funding." Space News, business report 15 Feb. 2008.
[103] Under current EU communications' rules, national authorities licence operators of satellite communications and, the existing regulations of the International Telecommunication Union (ITU) only have procedures for radio frequency coordination to avoid unacceptable interference between satellites, but not for licensing those systems.
[104] Peter, Nicolas. "The EU's Emergent Space Diplomacy." Space Policy 23.2 (May 2007): 97-107.
[105] This dialogue set up in 2006 aims to facilitate the exchange of information and to foster mutual understanding of policies, programmes, priorities and structures.
[106] Pisani, Pierre-Henri. ""GMES and Africa" A Hopeful Case for Euro-African Cooperation in Space Development." ESPI Perspectives 6 Apr. 2008.

priority actions have been proposed, including one action explicitly concerning space activities (Cf. Chapter 7).

Within the EU, a "space Code of Conduct" is currently under development within the European Council's Working Group on Global Arms Control and Disarmament matters (CODUN) that discusses small arms and other disarmament issues including space (Cf. Chapter 6).[107]

Finally, following Vice-President for Justice, Freedom and Security Marco Frattini's resignation in April 2008, a series of leadership changes occurred in the Commission. Vice-president Jacques Barrot previously in charge of Transport replaced Mr Frattini as Vice President for Justice, Freedom and Security for the rest of the mandate. Consequently, on May 2008, Antonio Tajani replaced Mr Barrot as Vice-President for Transport.

3.4 Eumetsat

In 2007/2008, the European Organisation for the Exploitation of Meteorological Satellites (Eumetsat) continued its evolution by starting new activities. During its 63rd Council meeting in December 2007, several decisions were taken:

- The green light was given for the necessary activities to start in January 2008 for the Meteosat Third Generation (MTG) preparatory programme;
- A six-year contract for EUNETCast Europe Service (2009-2014) was approved;
- The EUMETCast South America service was extended for an additional 2 years;
- A cooperation with NOAA on the use of the McMurdo station in Antarctica was approved in order to receive data from Metop-A;
- A memorandum of understanding (MOU) was approved with Canada to foster cooperation regarding weather, climate and environment monitoring activities.[108]

Following the successful launch of the first Metop polar-orbiting satellite (Metop-A) in October 2006, Eumetsat continued to expand its core mission of providing operational meteorological observations in recent months. In particular, it included ocean surface topography in its portfolio, following the successful launch of Jason-2 ocean altimetry satellite on 20 June 2008. Jason-2's Ocean Surface Topography Mission is expected to provide a vital contribution to the monitoring of climate change, ocean circulation and weather. It is the continuation of the existing successful cooperation between the United States (NASA, NOAA) and Europe (CNES, Eumetsat). Eumetsat will act as an interface for near-real-time product distribution to European users. On 27 March 2007, Eumetsat and the European Commission's Joint Research Centre (JRC) also signed an agreement to initiate collaboration in order to join their efforts regarding environmental challenges created by climate change, with an emphasis on developing countries.[109]

Completing Eumetsat's push into new activities, the European meteorological agency continues to broaden its geographical presence. In addition to cooperation with the United States on its Meteosat spacecraft placed over the Indian Ocean Region, Eumetsat will continue its involvement in South America (see above), but also in Africa. On 4 April 2008, Eumetsat and the African Union Commission have signed a MOU on how Eumetsat will contribute to the African Monitoring of the Environment for Sustainable Development (AMESD) project by providing data from its satellites as well as technical assistance and training.[110] Eumetsat continued to reinforce its trans-Atlantic ties as well. Besides the Jason-2 mission with the United States, on 18 October 2007, as aforementioned, it initiated a MOU with Canada to advance cooperation in satellite monitoring activities. In particular, under this agreement, Europe and Canada will work together to improve weather, climate and environmental monitoring through the observation of the atmosphere and oceans.

[107] The Working Group on Global Arms Control and Disarmament (CODUN) is one of the two preparatory bodies of the General Affairs and External Relations Council (GAREC) which meets at ministerial level, the other is the Working Group on Non-Proliferation. CODUN meets once a month in Brussels and is attended by senior disarmament and non-proliferation officials from the EU member States. The Working Groups are served by personnel from the non-proliferation and disarmament sections of the Council's General Secretariat. Officials from the EC participate in all meetings.

[108] "Eumetsat Agrees to provide Data for GMES." Eumersat Press Release 3 July 2008 <http://www.eumetsat.int/Home/Main/Media/Press_Releases/706470?l=en >.

[109] The agreement signed foresees the provision of data generated by the JRC's African, Caribbean and Pacific (ACP) Observatory for Sustainable Development to African countries via EUMETCast, which is Eumetsat's near-real-time broadcast system for environmental data.

[110] AMESD, is the follow-on initiative to Preparation for the Use of Meteosat Second Generation in Africa (PUMA). It is an international cooperation programme aimed at providing all African countries with the resources required to manage their environment more effectively and ensure long-term sustainable development in the region.

Finally, Eumetsat also extended it membership in 2007/2008, with Slovenia becoming the latest full member of the organisation in February 2008. It now has 21 member States (Austria, Belgium, Croatia, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom) and nine cooperating States (Bulgaria, the Czech Republic, Estonia, Hungary, Iceland, Latvia, Lithuania, Poland and Romania).

3.5 National governments

The major European space countries (France, Germany, Italy and the United Kingdom) were the most active in 2007/08 in terms of policy and strategy development. However, other European countries are also updating their national guidelines. In particular, Finland is currently in the process of developing its sixth national strategy for space research and development activities covering all national public sectors activities.

3.5.1 France

A series of high-level policy documents were released in France in the past months, illustrating the sustained support of space at a high political level.

On 11 February 2008, the French President, Nicolas Sarkozy, gave a structuring policy speech underlining that the highest French authorities recognize space activities as critical strategic assets. The tenets of this speech can be analysed as follow: politicize space issues through a dedicated Presidential speech; indicate and frame the orientations of the upcoming French EU Presidency and its main objectives; recall the importance of the European dimension of space activities as a condition for the success of an ambitious space policy; foster space cooperation for building up the European Security and Defence Policy (ESDP); build bridges between civil space and defence; encourage a growing involvement of the EU in space affairs by bringing, among others, Galileo to a successful outcome and by funding the Guiana Space Centre (GSC); strengthen Europe's assets in space exploration and set up a strong cooperation with the United States; underline Ariane's role as a cornerstone of space policy and European space autonomy.

One of the core messages was that the EU should embrace more responsibilities in space affairs. In his speech, the French President mentioned four "programmes" to reinforce the EU's role: navigation (Galileo), Earth observation (GMES), climate change, and space surveillance. He also expressed his wish to significantly increase France's national space defence budget. President Sarkozy also underlined the importance of space in a national and European defence policy context, Europe's autonomous decision-making capabilities and as a significant building block of the ESDP (Cf. Chapter 6). Finally, he called for the creation of a stricter set of rules to regulate States behaviour in space.

On 17 June 2008, the French White Paper on defence and national security was presented. The White Paper describes France's defence and security programme for the next 15 years. A modification of defence decision-making processes, as well as a reorientation of spending are described in order to address new security threats (transnational terrorism, etc.) and more traditional ones (ballistic missile and nuclear, bacteriologic and chemical threats, etc.). In particular, this document underlined that France's plans to greatly expand its military space capabilities is part of a move to reinforce its reconnaissance/intelligence capabilities by increasing public support for military space and by developing and acquiring new capabilities (Cf. Chapter 6).

Following the publication of the report issued on 7 February 2007 by the French Parliamentary Office for the Evaluation of Scientific and Technological Choices on Europe's space policy (the so-called "Cabal Report"),[111, 112] a new report led by Serge Grouard and Odile Saugues was published by the French Parliamentary Committee on National Defence and Armed Forces on 5 February 2008 underlining the importance attached to space affairs by the French legislative branch. This report addresses the strategic and industrial roles of the space sector. Furthermore, a colloquium entitled "Space at the service of the European citizens" organised by the French Parliamentary Group for Space (GPE) on 5 June 2008 was held in the French National Assembly. Four main themes were considered: space and competitiveness, access

[111] For more information see Peter, Nicolas. "Space Policy, Issues and Trends in 2006/2007." ESPI Report 6 Sept. 2007: 34.
[112] For more information see Madders, Kevin. "The Cabal Report of the French Parliament on Space Policy- A Blueprint for European Space Ambitions or Another Cry in the Wilderness?" Yearbook on Space policy 2006/2007: New Impetus for Europe. Eds. European Space Policy Institute: Kai-Uwe Schrogl, Charlotte Mathieu and Nicolas Peter. Wien: Springer, 2008: 128-135.

to space, space exploration, and the governance of European space activities.

A French space law was adopted in spring 2008 after years of discussions.[113] This new law provides France with a legal framework for activities in space. It stresses that the evolution of the space sector, with the role of new actors from the private sector, highlights the need for a national legal framework regulating relations between the French government and private operators. Therefore, the main objective is to create a safe national framework, while ensuring the competitiveness of space activities. The Act on space activities was adopted by the French Parliament on 9 April 2008 and entered into force on 3 June 2008. The main propositions focus on the creation of an authorisation regime allowing French authorities to have effective control over space activities. This authorisation is necessary in all the cases in which the French State might be considered responsible and liable. Moreover, the text establishes a financial guarantee by the State above a certain ceiling amount payable by the operator in case of damages caused by its activities. The Act also provides an insurance coverage obligation for risks in orbit. There are also more specific points like the governance of the Guiana Space Centre, Intellectual Property (IP) Rights (in particular any discovery made on board of a satellite registered in France will be considered made on French territory and will be covered by the French IP regime).[114]

As a result of the recent policy changes, CNES, the French space agency, is observing a shift in its funding management and distribution which should expand through the 2008-2013 period. Indeed, expenses are redirected from "mutualised resources" and central directions to the benefit of programmes such as launchers, space science, and the preparation for the future of defence and security.[115]

3.5.2 Germany

Chancellor Angela Merkel expressed her views on space matters on 14 February 2008 while discussing with the STS-122 crew and particularly the European Astronauts Klaus Schlegel and Leopold Eyharts during the commissioning of the Columbus module.[116] Among other things, in her address, Chancellor Merkel showed concern regarding the necessity to address young people to embrace engineering professions and mentioned her willingness to create a favourable environment to this effect.[117] The cooperative nature of space activities was also highlighted. On the programmatic side, while she underlined the success of the Columbus orbital module she gave a "gentle warning" on Galileo.[118]

In reaction to Nicolas Sarkozy's speech in Kourou, DLR, the German space agency expressed its agreement that more space cooperation should be pursued with the United States regarding Mars exploration and that Europe should develop its own space surveillance technology in order to be autonomous in this area. However, it also expressed its desire that space issues remain with ESA and not be transferred to the EU, arguing that space remains a different priority depending on countries, thus responding to President Sarkozy's proposal that the EU should ensure the maintenance of the Kourou space centre.[119] In spring 2008, DLR underlined its willingness to continue to lead scientific research in the future regarding aviation and space exploration. For such purposes, DLR will promote relations between civilian and defence applications and will develop cross-sectional tasks, for example, business start-up support and promotion of young talents.[120]

The astronaut Thomas Reiter, who has spent almost a year conducting research in space, joined the Executive Board of DLR with responsibility for space research and development (R&D).[121]

[113] France was one of the last countries in Europe involved in space which still did not have a specific law regulating space activities.
[114] The reader can access the translated version of the Act by looking at Schmidt-Tedd, Bernhard and Isabelle Arnold. "The French Act Relating to Space Activities. From International Law Idealism to National Industrial Pragmatism." ESPI Perspectives 11 Aug. 2008.
[115] Lardier, Christian. "Le Cnes fait le plein de programmes." Air & Cosmos (1 Feb. 2008) : 38-39.
[116] STS-122 crew members included Schlegel, from Germany, and NASA astronauts Stephen Frick, Rex Walheim, Stanley Love, Alan Poindexter and Leland Melvin.
[117] Pisani, Pierre-Henri. "European leaders charter course for space." ESPI Flash Report 4 Mar. 2008.
[118] Ibid.
[119] de Selding, Peter. "Italian, German Space Officials Welcome Sarkozy's Space Proposals." Space News 19.7 (18 Feb. 2008): 5.
[120] "Research for the Future- shaping the future." DLR press release 28 May 2008 <http://www.dlr.de/en/desktopdefault.aspx/tabid-1/86_read-12602>.
[121] Thomas Reiter is the European astronaut who has acquired the longest experience of space.

3.5.3 Italy

In 2007, Italy held the chairmanship of the ninth European Interparliamentary Space Conference (EISC), a permanent forum to foster cooperation on space policy issues between European national parliaments. A series of events were organised in the course of the year by the VAST Committee (Committee for the Evaluation of Scientific and Technological Options) of the Chamber of Deputies among which was the EISC Plenary Meeting (Cf. Chapter 7).

In 2007, the first European-built module to be permanently attached to ISS, the Node 2 module, or "Harmony", was launched on 23 October 2007 onboard the STS-120 mission along with Italian astronaut Paolo Nespoli. Harmony was the first addition to the ISS work and living space in six years. It was developed for NASA under an ASI contract with Thales Alenia Space as prime contractor. On the programmatic level, the board of the Italian Space Agency, ASI, approved the funding of three new satellite missions: PRISMA (Earth Observation), MIOSAT (small optical mission) and ATHENA-FIDUS[122] (ASI-CNES geostationary satellite for communications).[123]

3.5.4 The United Kingdom

The British space policy is in transition. The House of Commons' Science and Technology Committee started a "major and wide-ranging inquiry" in the fall of 2006.[124] As a result, a report entitled "2007: A Space Policy" was released on 17 July 2007.[125] The report underlined the fact that space is a significant area of science and policy and that it is necessary for the Government to take a strategic approach to space activities such as robotic exploration, satellite navigation and Earth observation with a longer-term vision. The report called for a forthcoming civil space strategy to be able to inspire and motivate the UK space sector. It also emphasised the UK Government's commitment to space and the need for the British National Space Centre (BNSC) to outline its vision and activities for space, and called for more effective programme management. In particular, the need to strengthen the oversight of space programmes was underlined. The report called for new funding and mechanisms to increase support for small and medium enterprises (SMEs). It also considered UK's implication at the European level in ESA and EU's programmes. Finally, exploration and space tourism issues were also addressed. A memorandum from the Government which contained responses to the report was received on 26 September 2007.

On 14 February 2008, the British Government, following its spring 2007 consultation and a stakeholder event in summer 2007 as well as the aforementioned report from the House of Commons Science and Technology Committee, released its new strategy and proposals for the UK's future involvement in the space sector, the so-called "UK Civil Space Strategy: 2008 – 2012 and beyond". The main cornerstones of this strategy are:

- Continued UK involvement in Earth observation, space science and communications developments;
- Continued close cooperation with ESA and the establishment of an ESA facility at Harwell (Oxfordshire), which will focus on climate change, robotic space exploration and applications;
- Closer involvement in international initiatives on the future shape of space exploration to the moon, Mars and beyond;
- Setting up a National Space Technology Programme to support the development of new, innovative technologies and services.

The strategy identifies space as a "strategic economic sector" and as such the British government proposed a set of amendments to lower the insurance costs for space companies. This aims at the development of space commercial activities on its territory. Such changes target in particular launching companies and space tourism.[126] Furthermore, while the UK had rejected the idea of manned spaceflight since 1986, its position changed at the beginning of 2008 when the "UK Civil Space Strategy: 2008-2012 and Beyond" stated that the UK is now

[122] "Green Light for Three New Missions PRISMA, MIOSAT and ATHENA-FIdus.". ASI press release 21 Dec. 2007 < http://www.asi.it/SiteEN/ContentSite.aspx?Area=Comunicati+Stampa >.
[123] "ASI and Defence Join Forces on ATHENA-FIDUS: a Dual, Itlaian/French Telecommunication System." ASI Press Release 23 Jan. 2008.
[124] For more information, see Peter, Nicolas. "Space Policy, Issues and Trends in 2006/2007." ESPI Report 6 Sept. 2007: 35.
[125] United Kingdom, House of Commons. "House of Commons Science and Technology Committee, 2007: A space policy: government response to the Committee's seventh Report of session 2006-2007." HC 1042, ordered by the House of Commons to be printed 9 October 2007, London: The Stationary Office Limited, 23 Oct. 2007.
[126] de Selding, Peter. "British Government May Ease Regulations on Space Companies." Space News 19.7 (18 Feb 2008): 5.

interested in astronaut-related programmes, although neither deadlines nor budgetary estimations were detailed.[127]

3.6 The United States

Space is not usually mentioned during a U.S. Presidential campaign, but it has been on several occasions in the context of the 2008 U.S. campaign. The presidential candidates of the two big parties, Senator Obama for the Democrats and Senator McCain for the Republicans, have both issued statements or fact sheets concerning their positions on the U.S. space agenda.

Senator Obama has indicated that he would maintain a robust programme of human space exploration and fulfil NASA mission, reversing an earlier position in which he planned to delay the Constellation programme by five years and use up to five billion U.S. dollars from the NASA budget for education. Senator Obama announced it would also endorse a congressional plan to add another two billion U.S. dollars to NASA's budget and agreed to back at least one more space shuttle mission and to ensure that NASA has the necessary funding to support climate change research. Senator McCain is also a strong supporter of the U.S. space programme including the U.S. Space Exploration Policy (USSEP) and supports going to the moon by 2020, but has also called for a freeze of discretionary funding.

The Bill H.R. 6063 entitled "To authorize the programs of the National Aeronautics and Space Administration, and for other purpose" was introduced on 15 May 2008.[128] This Act would strengthen the exploration programme as well as aeronautics R&D, science research and applications. It represents a strong message of the U.S. Congress ahead of the next administration illustrating that NASA has a strong support and constituency in the U.S. Congress. However, the current administration objects the document as currently written and especially opposes the provision that would require NASA to fly an extra shuttle flight to the ISS to deliver the Alpha Magnetic Spectrometer (AMS).

In the United States, space security has become a major agenda item in high-level policy circles following the Chinese ASAT test of January 2007[129]. This event forced the United States to develop new strategies and capabilities. In particular, the White House issued a classified memorandum in the summer 2007 on the importance of space situational awareness (SSA) in order to monitor and identify space objects in space and determine whether they pose a threat.[130] A blue-ribbon panel, the so-called Allard Commission, has also been set up to consider major changes to the U.S. military space management and particularly to procurement and operational structures to improve governance efficiency (Cf. Chapter 6). Finally, an ASAT test was conducted by the United States in February 2008 to destroy an old reconnaissance satellite due to the risk it would pose upon re-entry to Earth (Cf. Chapter 6). However, confirming its longstanding position in the domain of international space security in international fora, the United States rejected both the annual Prevention of an Arms Race in Outer Space (PAROS) resolution as well as the new Russian and Chinese draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects (PPWT) presented on February 2008 (Cf. Chapter 7) arguing that cooperation, transparency and discussion are the best ways to continue to use space for peaceful purposes.[131]

3.6.1 National Aeronautics and Space Administration (NASA)

President George W. Bush signed a budget bill for the Fiscal Year 2008 for NASA on 26 December 2008. This delay in approving the budget was due to conflicting views between the U.S. executive and legislative branches. The biggest change for NASA between the request and the appropriation concerned the amount it is foreseen to spend on science mission and cross-agency support activities. More funds were allocated for science and

[127] Besides the House of Commons Science and Technology Committee report, a British space policy advisory group (the UK Space Exploration Working Group) recommended in a 90-page report on 13 September 2007 that Britain should ends its long-stranding opposition to all programmes involving astronauts.

[128] The Bill was agreed upon by the Space and Aeronautics Subcommittee on 20 May 2008, and the Full House Science and Technology Committee on 4 June 2008. The Bill proposal was then fully voted by the House of Representatives on 18 June 2008. It was then sent to the Senate and read twice and referred to the Committee on Commerce, Science and Transportation.

[129] For more information, see Neuneck, Götz. "China's ASAT Test- A Warning Shot or the beginning of an Arms Race in Space?" Yearbook on Space policy 2006/2007: New Impetus for Europe. Eds. European Space Policy Institute: Kai-Uwe Schrogl, Charlotte Mathieu and Nicolas Peter. Wien: Springer, 2008: 211-224.

[130] Butler, Amy and Michael Bruno. "With Antisatellite Threat to U.S. Military, War Planners Weigh Options." Aviation Week & Space Technology (7 Jan. 2008): 58.

[131] "US rejects Russian call for new space treaty." Space Daily 12 Feb. 2008.

Programme	FY 08 Enacted In millions U.S. dollars	FY 09 Request In millions U.S. dollars
Science	4706.2	4441.5
Exploration Systems	3143.1	3500.5
Aeronautics	511.7	446.5
Cross-Agency Support Programmes	3242.9	3299.9
Space Operations	5526.2	5774.7
Education	146.8	115.6
Inspector General	32.6	35.15
Total	**17309.4**	**17614.2**

Table 5 NASA enacted budget for Fiscal Year 2008 and 2009 budget request

aeronautics, and less than requested for exploration, as well as cross-agency. The NASA Fiscal Year 2008 budget is divided as follow:

The request for the Fiscal Year 2009 by the Government contains a modest rise for NASA, to reach 17.614 billion U.S. dollars (+1.8%), but about 500 million U.S. dollars lower than the Vision for Space Exploration's initial request back in 2004. The Exploration Systems Mission Directorate is planned to record an 11% increase over the 2008 budget, but the rate of growth would slow in 2010 (Figure 16). The proposed budget would keep the development of the space transportation infrastructure on track. While the Science Mission Directorate would see a budget decrease (Table 5) additional funds for Earth observation missions geared towards studying climate change are foreseen (+6.8%) as well as planetary science (+7%), but not astrophysics (-13%). The new budget proposal reflects a White House push for greater emphasis on Earth observation and climate change research. The budget plans for the upcoming year show a modest increase of 2.3% to 2.4% until Fiscal Year 2013 (Figure 16).

The appropriation for the Fiscal Year 2009 to fund government operations for October 2008-September 2009 has not yet been concluded. Furthermore, it appears that the

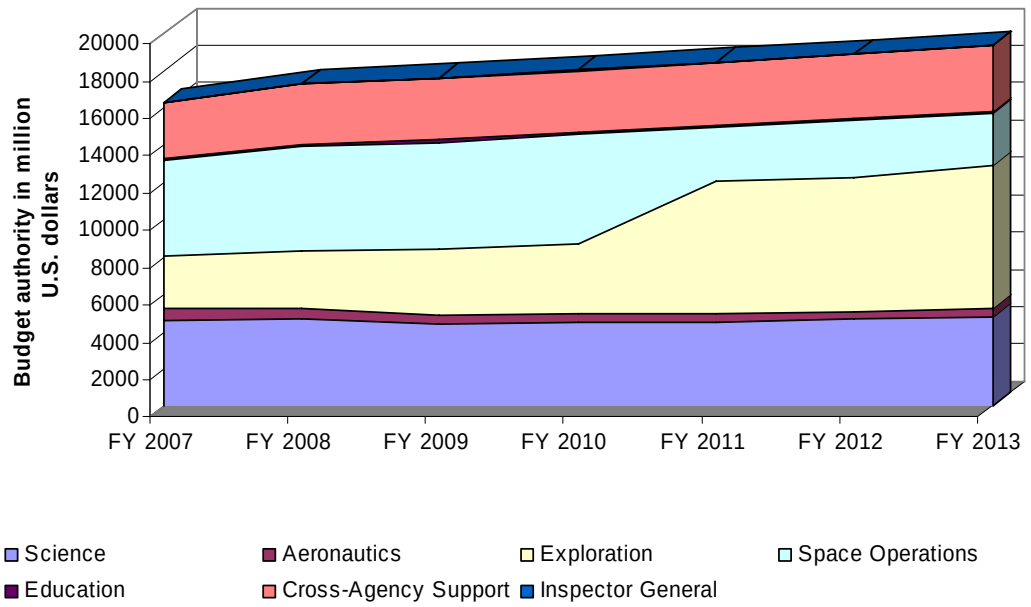

Figure 16 Summary of NASA Fiscal Year 2009 Budget request

Fiscal Year appropriations' cycle will only be finished in spring next year. Consequently, at least for part of 2009 budget year, NASA will have to accept a continuing resolution regarding its budget allocation. However, due to growing inflation this might lead to a smaller budget diminution. Consequently, NASA finds itself facing difficult choices with little room to manoeuvre to keep its programmes on track.

As the Shuttle is set to retire in 2010, a gap of several years is expected before the United States will have its new human spaceflight capabilities operational (most likely in March 2015). In this context, as the current exemption of the Iran, North Korea, and Syria Non-proliferation Act (INKSNA) is set to expire in 2011, NASA is currently seeking the U.S. Congress' acceptance for its request to amend the INKSNA (International Space Station Payments Act (S. 3103)). This would permit NASA to keep paying Russia to transport U.S. astronauts to and from the ISS beyond 2011.[132] However, NASA will not request the right to make further extraordinary payments to Russia in order to purchase more Russian Progress re-supply vehicles for the ISS after 2011.[133] Indeed, NASA intends to use one of the commercial vehicles from the Commercial Orbital Transportation Services (COTS) programme to provide ISS logistics starting in 2010.

In August 2006, NASA awarded two COTS Space Act contracts.[134] Space Exploration Technologies (SpaceX) completed a preliminary design in February 2008 for its Falcon 9 launch vehicle and Dragon spacecraft which will be part of NASA's COTS programme.[135] SpaceX , however, has renegotiated its COTS agreement with NASA with the first three planned demonstration flights deferred by nine months to June 2009; the second flight is now slated for November 2009 and the final demonstration flight is March 2010. SpaceX had to add new hardware development milestones as part of the agreement renegotiation. Since Rocketplane Kistler (RpK) failed to meet its COTS fiscal objective to build, NASA issued a new invitation to tender, and awarded Orbital Science Corp (OSC) a new COTS contract amounting to 171 million U.S. dollars. OSC will use the leftovers from the RpK contract as well as its own finances to develop a new launch vehicle called Taurus II and a service module named Cygnus. Taurus II is scheduled to make its first flight in late 2010 from the Mid-Atlantic Regional Spaceport located at NASA's Wallops Space Flight Facility in Virginia. The first hardware milestone is slated for June 2009.

NASA is currently focusing its efforts on developing a new launch infrastructure to implement its USSEP. The programme "Project Constellation" is composed of:

- The CEV, now renamed Orion, an exploration vehicle for the transportation of crew;
- The CLV, renamed Ares I, a two-stage launcher carrying the Orion vehicle;
- The Cargo Launch Vehicle (CaLV), named Ares V, a two-stage heavy-lift launch vehicle carrying an Earth Departure Stage together with the Altair vehicle
- The Altair lunar lander that will eventually be capable of landing four astronauts on the moon, providing life support and a base for week-long initial surface exploration missions and returning the crew to the Orion spacecraft that will bring them back to Earth.

Boeing Space Exploration obtained two major roles in NASA's new launcher programme Ares I in 2007/2008.[136] It won the contract for the Ares I upper stage that could be worth as much as 1.13 billion U.S. dollars. It also won another contract potentially worth up to 800 million U.S. dollars to build and outfit an avionics ring which will control the Ares launch vehicle in flight. This avionics ring will be mounted on Ares 1 upper stage and will be outfitted with all electronics needed to provide guidance, navigation and control for the entire Ares 1 rocket.[137]

NASA is currently studying lunar surface exploration architecture concepts to support humans returning to the moon before 2020, consistent with among others the principles of the Global Exploration Strategy (GES). In this context, during six months in 2008 representatives from NASA and ESA have been engaged in a detailed assessment of the

[132] Portions of that law (INKSA) adopted in 2005 prohibit "extraordinary payments" both "in cash" and "in kind" from the U.S. Government to the Russian government, Roscosmos, and entities under Roscosmos' authority for the ISS as long as Russia is viewed as a proliferation threat for nuclear and missile technology.

[133] Morring, Frank. "NASA Wants All-commercial ISS Resupply." Aviation Week & Space technology 17 Apr. 2008 <http://www.aviationweek.com/aw/generic/story.jsp?id=news/progress041708.xml&headline=NASA%20Wants%20All-commercial%20ISS%20Resupply&channel=space >.

[134] For more information see Peter, Nicolas. "Space Policy, Issues and Trends in 2006/2007." ESPI Report 6 Sept. 2007.

[135] "Space X Successfully Completes NASA Preliminary Design Review for Dragon Spacecraft Mission to Approach International Space Station." Businesswire 12 Feb. 2008.

[136] Work on Ares V has not yet started.

[137] Berger, Brian. "Boeing Wins Ares Avionics Contract" Space News, business report 13 Dec. 2007.

degree to which NASA and ESA's lunar exploration architecture concepts could complement, augment, or enhance the exploration plans of one another. On 20 June 2008, NASA also finished a study which will allow technical parameters needed for the preparation of vehicle requirements for manned missions to the moon to be established.[138] Finally, the launch of NASA's Lunar Reconnaissance Orbiter (LRO) and the Lunar Crater Observation and Sensing Satellite (LCROSS) will be delayed until spring 2009 due to the payload shift onboard an Atlas V with a DoD payload launched instead of NASA's spacecraft.

NASA has been actively involved in robotic exploration of other planetary bodies in 2007/2008. On 24 September 2007, NASA launched the Dawn mission, three months later than previously planned. This mission seeks to explore Vesta, a protoplanet and Ceres. This mission should help the further understanding of the "transition from the Solar System's inner planets".[139] However, despite the progress on the lunar front, the work on an updated Mars Design Reference Mission has been halted as a result of the language in the U.S. Appropriation Act of 2008 prohibiting funding of any research, development or demonstration activities related exclusively to the human exploration of Mars. Nonetheless, one of the milestones of NASA's exploration activities in 2007/2008 was the successful landing of the Phoenix mission near the North Pole of Mars on 25 May 2008. It has since performed a series of soil chemistry tests and discovered that Martian soil is remarkably Earth-like and could support a wide array of plants and organisms.

3.6.2 National Oceanic and Atmospheric Administration (NOAA)

NOAA's Fiscal Year 2009 total budget request is 4.109 billion U.S. dollars, an increase of 5.2% over the Agency's Fiscal Year 2008 budget. NOAA's satellite programmes are run by the National Environmental Satellite, Data, and Information Service (NESDIS), which would receive 1.2 billion U.S. dollars compared to 983 million U.S. dollars in 2008.[140] The main space budget item is the programme Geostationary Operational Environmental Satellite-R (GOES-R) requesting 477 million U.S. dollars for Fiscal Year 2009. However, as a result of last year's appropriation and the reduction in the current request for the GOES-R programme, the launch of the first satellite in the series will be delayed by five months to April 2015.[141] Another major space item in NOAA's budget request is the tri-agency (NOAA, NASA, DoD) National Polar-Orbiting Operational Environmental Satellite System (NPOESS) programme at 288 million U.S. dollars.

NOAA took part in the quadripartite programme Jason-2 along CNES, NASA and Eumetsat launched on 20 June 2008 as a follow-up to the Jason-1 mission launched in December 2001. Finally, on 1 October 2007, NOAA's Space Environment Centre changed its name to the Space Weather Prediction Centre.[142]

3.6.3 Department of Defense (DoD)

Following the upward trend of the overall DoD budget, the funding for space programmes continued to expand, however only slightly. The U.S. Air Force that is the executive agent for military space, requested 11.9 billion U.S. dollars for unclassified space systems and operations for the Fiscal Year 2009 compared to 11.3 billion U.S. dollars in Fiscal Year 2008, out of a total U.S. Air Force Fiscal Year 2009 budget request of 143.9 billion U.S. dollars (+7%).[143]

The spending plan of the Air Force budget includes, among others, 2.3 billion U.S. dollars for the Space-based Infrared System (SBIRS) missile warning constellation, the largest unclassified programme element. The Evolved Expendable Launch Vehicle (EELV) is another major budget item with 1.2 billion U.S. dollars requested. For the GPS III, space segment and GPS ground segment, a total of 1.182 billion U.S. dollars has been requested and 843 million U.S. dollars for the Transformational Satellite Communication System (T-Sat).[144]

3.7 Russia

Russia's space policy is currently in transition. While Russia is implementing three major civil space programmes: the

[138] Schierholz, Stephanie, Grey Hautaluoa, Lynette Madison and Josh Byerly. "NASA Study Provides Next Step to Establish Lunar Outpost." NASA press release 23 June 2008.
[139] United Nations Office for Outer Space Affairs. "Highlights in space 2007." New York 2008: 58.
[140] Springer, Jeremy. "GOES-R Weather Satellites Face Delay." Space News 4 Feb. 2008.
[141] NASA, acting on behalf of NOAA is expected to award the prime contract for two GOES-R satellite late this year.
[142] "NOAA Centre's New Name Reflects New Era in Space Weather." NOAA press release 26 Sept. 2007.
[143] Fabey, Michael. "USAF boosts budget by about 7 percent, hikes procurement request." Aerospace Daily (5 Feb.2008): 1.
[144] Ibid.

2006-2015 Federal Space Programme, the Federal Target Programme 2002-2011 on GLONASS and the 2006-2015 Federal Target Programme on the Development of Russia's cosmodromes, on 11 April 2008, Russia's Security Council approved a draft space policy for the period until 2020 and beyond. [145] The document determines Russia's national interests, key objectives, and priorities in the area of space research, the utilisation of space and international space cooperation. This policy thus aims at retaining Russia's status as a leading space power. Among the country's principal goals are guaranteed access to space and maintaining an independent space industry. President Vladimir Putin's speech given at this occasion unfolded into five main themes: guaranteed access to outer space; need for a clear outline to build up Russia's possibilities for orbiting constellations; increase Russian presence on the world market for space apparatus; modernise its technology and build a more dynamic human resource potential; need to make effective use of scientific and resource potentials of related scientific programmes.[146]

In March 2008, the Ministry of Economic Development and Trade also released the new policy of long-term development of Russia and the main space elements considered are:

- Development of the Glonass system;
- Development of orbital constellations (communications and meteorology etc.);
- Increase of Russia's share in the global space industry;
- Reorganisation of the Russian space industry in three or four holdings in 2015;
- Modernisation of the terrestrial space infrastructure and technological and industrial equipment and of launch pads.[147]

This new political drive is leading to new ambitions in space following its economic recovery in recent years. The Russian space industry is also in transition in order to increase Russia's competitiveness by consolidating the industrial base in national champions in each branch (Cf. Chapter 5). Recent main issues for Russia's space programme have been to reaffirm its role on the global scene as a supplier of launch vehicles, and to be recognised as a major partner in the ISS programme and the GNSS field.

Access to space has been one of the main areas of activities of Russia in recent months. The Federal Space Forces announced that they will close the Svobody base and that all military launches will be done from Plesetsk. President Putin also signed a decree on 6 November 2007 for the creation of a new launch site, the Vostochny Cosmodrome in the Amur region. The new launch site is expected to open in 2015 and will launch manned spacecraft in 2018, and all manned Russian space launches in 2020. In the meantime, the construction of the Angara launch pad will start in 2008 at Plesetsk. Russia's historic emphasis on human spaceflight has left a legacy of technical and operational competence. While there are no human spaceflight plans to the moon in the new Federal Space Plan (2006-2015), the long-term Russian space programme (until 2040) is considering a first human trip to the moon in 2025, and setting up a base in the 2027-2032 timeframe. With increasing funding, Russia is also reenergising its lunar and planetary programmes.

Russia continues its work on its GNSS constellation, the Glonass system that was developed during Soviet times. The Government promised to make Glonass fully operational by the beginning of 2008 but this was delayed by equipment and other technical failures. The system was supposed to have 24 satellites. This number dwindled after the 1991 collapse of the U.S.S.R., but the Russian government is currently replenishing and expanding the constellation (it is now planning a constellation of 30 satellites instead of 24 initially planned). Six satellites will be launched in 2008 and nine in 2009. In 2008, Russia will also launch its first meteorological satellite (Meteor-M1) since 1991. It has since been relying on foreign assets and data.

The renewed space interest at the highest political level in Russia combined with the budgetary increase devoted to space activities has led to the reinforcement of several cooperation and partnerships, particularly with India. Russia and India have signed a cooperative agreement to jointly develop a robotic orbiter and lander to be launched in 2013. The director of the Russian Space Agency, Anatoly Perminov and the

[145] The Security Council is a consultative body of the Russian President that works out the President's decisions on national security affairs. Composed of key ministers and agency heads and chaired by the President of Russia. It draws up crucial documents defining conceptual approaches to national security.
[146] Putin, Vladimir. "Opening Remarks at a Meeting with the Security Council on Russia's Space Exploration Policy for the Period through to 2020 and Beyond." President of Russia Official Web Portal, The Kremlin Moscow. 11 Apr. 2008.
[147] CNES Bulletin 235. French Embassy in Moscow 25 Mar. 2008.

chairman of ISRO Gopalan Nadhavan Nair signed the agreement on 12 November 2007. Russia also continues to use manned access to space as a foreign diplomacy tool. After the launch of the first Brazilian astronaut in space in early 2007, it helped both Malaysia and South Korea to have their first nationals in space in recent months.

3.8 Japan

In May 2008, Japan's new space law was finally endorsed by the Diet, the Japanese parliament. It was passed by the Lower House the week of 12 May 2008, and was approved by the Upper House on 21 May 2008.[148] The expansion of the use of space possibilities provided by the new law serves national security purposes as well as economic, and public safety aims.[149] Among others, it commits Japan to a series of major administrative and conceptual changes. [150] The new law pushes three main elements.

- Firstly, it sets up a new Minister for Space Development which will be appointed by and reporting directly to the Prime Minister and the creation of a "Space Development Headquarters" (a forum of user ministries with strong authority) which would reside in the Prime Minister's Cabinet Office to coordinate space policies governing civil, military and commercial activities of different ministries. The new law places all space-related projects into one unified programme, allowing for better coordination and strategy in space development.

- Secondly, the "Basic Law of Space Activities" reconsiders the assumption of the "exclusively peaceful purpose" clause in the Diet resolution of 1969 to allow the use of space assets by military authorities (Cf. Chapter 6).

- Thirdly, elements of the law concern ways and means to increase the competitiveness of the Japanese industry. In particular, the Basic Law calls for the strengthening of industrial capability and autonomous business foundation from the public budget to foster the effort of Japan's "industrialisation".

The first Space Development Minister Fumio Kishida, former science policy Minister, was appointed in June 2008.[151]

Japan Aerospace Exploration Agency's (JAXA) second mid-term plan (April 2008 – March 2013) has two main objectives: to contribute to a secure and prosperous society and to expand human frontiers. For the first objective, JAXA contributes by dealing with environmental issues and disasters on the global scale by focusing on three areas: global environment observation, disaster monitoring and communication, and satellite positioning. For the second objective, JAXA will make the most use of the Japanese Experiment Module (JEM), Kibo (hope), and will strive to produce world class results in selected scientific domains (e.g. X-ray astronomy etc.). JAXA will concentrate its resources on selected fields where Japan possesses technical advantage, or is thought to present societal benefits, or contribute to comprehensive security. JAXA has also transformed itself into a mission-oriented organisation by creating mission directorates in order to implement this mid-term plan.

Human spaceflight is one of JAXA's largest budget lines outside the general budget. Japan's participation to the ISS focuses on the development and exploitation of the JEM, along with the H-II Transfer Vehicle (HTV). The first two elements of JEM were launched on space shuttle missions STS-123 for the Experiment Logistics Module Pressurised Section (ELM-PS) (11 March 2008) and STS-124 (31 May 2008) for the Pressurised Module (PM). The third element is scheduled for launch on STS-127 in April 2009. The first HTV launch is foreseen in 2009. In spring 2008, a new call for recruiting astronauts was also opened for the first time in nearly a decade. Up to three applicants will be chosen for two-year training with NASA. JAXA will announce its selection in February 2009.

In 2007/2008 the country has also been actively pursuing robotic exploration. In particular, in 2007 Japan outpaced its Asian rivals by launching its lunar probe more than a month before China deployed its lunar mission and several months before India's lunar mission. The Selenological and

[148] Kallender-Umezu, Paul. "Japan Elevates Space Management, Lifts 1969 Ban on Military Satellites." Space News 19.21 (26 May 2008): 1+.
[149] "Japan's Improved Space Policy." Editorial. Space News 19.22 (2 June 2008): 18.
[150] For more information, see Suzuki, Kazuto. "Basic Law for Space Activities: a New Space Policy for Japan for the 21rst Century." Yearbook on Space policy 2006/2007: New Impetus for Europe. Eds. European Space Policy Institute: Kai-Uwe Schrogl, Charlotte Mathieu and Nicolas Peter. Wien: Springer, 2008: 225.238.

[151] "Japan Appoints First Space Development Minister Officials." Space Daily 17 June 2008 <http://www.spacedaily.com/reports/Japan_appoints_first_space_development_minister_officials_999.html>

Engineering Explorer (SELENE) renamed as "Kaguya" was launched on an H-IIA launch vehicle flight on 14 September 2007. Kaguya is JAXA's first large lunar explorer mission.[152] Furthermore, illustrating its commitment to space exploration on 1 April 2007, JAXA established a new branch for space exploration activities which is called JAXA's Space Exploration Center (JSPEC). The core tasks of the JSPEC are both robotics and human lunar and other planetary exploration activities.

On 23 February 2008, JAXA also launched the Wideband InterNetworking engineering test and Demonstration Satellite (WINDS) renamed Kizuna onboard a H-IIA launcher. Kizuna is part of the e-Japan Priority Policy Programme to establish the world's most advanced information technology network.

JAXA is continuing its effort to reinvigorate the Asia-Pacific Regional Space Agency Forum (APRSAF) by supporting Asian countries in various application programmes, and in particular, in Earth observation and education programmes. The last APR-SAF annual meeting was held in Bangalore (India) on 21-23 November 2007. The main theme of this 14th session was "Space for Human Empowerment". This event was co-organised by ISRO, the Japanese Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT), and JAXA. More than 130 participants from 19 countries and five regional and international organisations attended the event. The 15th APRSAF will be held in December 2008 in Hanoi (Vietnam) and will be jointly organised and co-sponsored by the Vietnamese Academy of Science and Technology (VAST), the Vietnamese Ministry of Science and Technology (MOST), MEXT and JAXA.

3.9 China

China has emerged in recent years as a major space power with ambitious goals backed by heavy investments and strong political support as illustrated by the release of the October 2006 Chinese White Paper on space activities and the 11th five-year space development plan in February 2007.[153] In this context, in order to implement those guidelines and to streamline and reorganise Chinese's institutional structure, at the beginning of March 2008, the COSTIND (Commission of Science Technology and Industry for National Defence), which was in charge of the military industrial complex, was merged into a new super Ministry called the Ministry of Industry and Informatisation (MII) and renamed as the State Administration for Science, Technology and Industry for National Defence (SASTIND).[154] The stated goals of the new organisation (MII) are to promote coordinated development between traditional industrial sectors and high technology and the information and communications technology industries, to play a leading role in the indigenous nurturing of key strategic industries and support civil-military integration.

2007/2008 was a symbolic year for China's space exploration activities, as it successfully launched its first lunar orbiter, Chang'e 1 on 24 October 2007 onboard a Chinese Long March 3A from the Xichang launch site. Chang'e 1 is part of the first phase of the China Lunar Exploration Programme (CLEP). This reflects China's ambitions to master all space activities and displays a major accomplishment in China's space efforts, which echoes its first human spaceflight launch. Chinese President Hu Jintao considers this successful mission to place China among countries with a real capacity for space exploration. He expressed his will that China's space technology development be based upon economic development and called on the Chinese scientific community to concentrate on "building an innovation-oriented country", recognising "independent innovation" as the key to "building up comprehensive national strength".[155]

Besides the aforementioned Chang'e-1 mission, China is also getting more and more involved in robotic space exploration activities. It aims to land a rover on the moon and eventually safely return lunar soil samples back to Earth. China also continues to work on its new launch vehicle the Long March 5. Initial tests were passed in spring 2008. The new launcher is intended to go into service in 2014 from the Wenchang launch base on the Hainan Island that will be ready by 2012. The Long March 5 is expected to be able to put 25 tons in LEO and 14 tons in GTO.

[152] Japan had previously launched Hiten in 1990, delivering the small lunar orbiter Hagomoro.

[153] For more information see Peter, Nicolas. "Space Policy, Issues and Trends in 2006/2007." ESPI Report 6 Sept. 2007: 41.

[154] Other government agencies merged into the MII along with SASTIND include the Ministry of Information Industries, State Council Informatisation Office, portions of the National Development and Reform Commission responsible for industrial and trade issues and the State Tobacco Monopoly Administration.

[155] "President Hu: China Joins Nations with Capability of Deep Space Exploration." Xinhuanet 12 Dec. 2007 <http://news.xinhuanet.com/english/2007-12/12/content_7233971.htm >.

The third manned Shenzhou mission (Shenzhou-7), which had been foreseen to take place in late 2007, will carry three astronauts in late 2008 one of whom is to perform an extravehicular activity (EVA).[156] In preparation for this upcoming EVA, China launched two new space tracking ships (Yuanwang) and its first data relay satellite (Tianlian I).

On 5 January 2008, China also launched a major project to monitor the space environment. The so-called Meridian Chain of Comprehensive Ground-Based Space Environment Monitors in the Eastern Hemisphere (the Meridian Project) will create a network of ground-based observations to monitor and forecast the space environment including space weather and SSA in general. This network of 15 stations will be completed within three years. It is coordinated by the Chinese Academy of Science's Space Science and Applied Research (CSSAR). The Meridian project will use 2 lines of observatories, one North-South running along the 120th East longitude with observatories in Mohe, Beijing, Wuhan, Hainan and the Zhongshan Antarctic station, and the other line of observatories being East-West along the 30th parallel of Latitude North with observatories located in Shanghai, Wuhan, Chengdu and Lasa.[157]

Chinese space activities are planned to ensure self-reliance, but the country remains open for international cooperation. For China, gaining prestige through space activities is an important motivation, particularly through cooperation with space powers to demonstrate its status, but also with less competent space actors to use space as an international diplomacy tool. ESA is a major partner of China with its support of the Chang'e-1 mission and the joint programmes Dragon-1 and Dragon-2. China is seeking cooperation with the "North", while at the same time entering in cooperative activities with countries from the "South" like Brazil in the context of the China-Brazil Earth Resources Satellite (CBERS) programme with the third CBERS satellite, CBERS 2B launched in September 2007. China will also design, manufacture, test and launch by the end of 2008, the Venesat-1 satellite also called the "Simon Bolivar Satellite" for Venezuela and Uruguay. [158] The Asia-Pacific Cooperation Organization (APSCO) is another element of China's portfolio to reach out to countries from the "South". It is a regional space organisation under Chinese leadership whose Convention entered into force on 12 October 2006. The first meeting of the Ad Hoc Committee for Programme Planning for APSCO was organised in Beijing (China) on 24-26 September 2007. About 40 participants from the nine signatory States to the APSCO Convention attended this meeting.[159]

3.10 India

India's space policy is currently in transition and shifting trajectory. Since its inception, the Indian space programme has been dominated by a pragmatic approach consisting of space activities being dominantly used to support the development of the country. Space applications have therefore been the main priorities of the Indian space programme as well as ensuring autonomy in access to space. However this is evolving. In a buoyant regional context, its space agency, the Indian Space Research Organisation (ISRO) is eager to start a human spaceflight programme.[160] A manned spaceflight programme would mark a very big step for India.

In spring 2008, ISRO submitted its project on the proposed first manned space mission in the 2014-2015 timeframe to the Indian government with a decision expected by the end of 2008. ISRO has carried out studies for about four years examining the technological challenges of a manned space mission and the Indian capability to undertake it. ISRO estimated the project leading to a first manned flight to cost 2.5 billion U.S. dollars.[161] The decision of the development of a man-rated GSLV has been taken and actions have been initiated. ISRO already validated its re-entry technology in January 2007 with the successful recovery of its space capsule, the Space-capsule Recovery Experiment (SRE-1). In the mean time, India is also considering sending one of its citizens into space on-board a Russian spacecraft to acquire the skills necessary for future manned space missions with a potential trip to ISS onboard a Soyuz by 2012.[162]

[156] Shenzhou-5 carried one taikonaut Yang Liwei in 2003, Shenzhou-6 carried two taikonauts in 2005 Fei Junlong and Nie Haisheng.
[157] "China launches major project to monitor space with network of observatories." CCTV.com 6 Jan. 2008.
[158] Uruguay later joined the 241 million U.S. dollars project, funding 10% of its costs.
[159] States which signed the APSCO Convention are: Bangladesh, China, Indonesia, Iran, Mongolia, Pakistan, Peru, Thailand and Turkey.
[160] India has had only one astronaut to date, Maj Rakesh Sharma, flying with Russia under the Soviet Intercosmos programme in April 1984 for a seven-day mission.
[161] Jayaraman K.S. "ISRO Seeks Government Approval for Manned Spaceflight Program." Space News 13 Nov. 2006.
[162] Ibid.

ISRO is also showing greater interest to space science and exploration as illustrated by the development of new programmes and particularly Chandrayaan-1, the first Indian planetary mission, foreseen to orbit the moon in the second half of 2008.[163] India is also working towards the establishment of a Deep Space Network (DSN) required for communication with the spacecraft. In order to improve space and scientific education, an Indian Institute of Space and Technology has also been created and inaugurated on 24 September 2007. This institute will be used to foster better education in these areas to meet India's space ambitions.[164]

However, the Indian programme remains application-driven with an emphasis on the policy of self-reliance. In this context, in 2007/2008 India continued the development of space applications. It launched its latest Earth observation, Cartosat-2A on 28 April 2008 along with nine other satellites (eight foreign ones). Cartosat-2A has a spatial resolution of less than one metre and complements Cartosat-2 launched on 10 January 2007. Cartosat-2A is widely speculated as the first satellite of a constellation dedicated to military use (Cf. Chapter 6). India also continued its work on developing more reliable and powerful launch vehicles. In this context, it has developed an Indian cryogenic engine to power the Geosynchronous Satellite Launch Vehicle (GSLV). In spring 2008, India also confirmed its entry into the commercial launch market. Following the successful launch in April 2007 of the Italian astronomical satellite AGILE onboard a PSLV, in early 2008, Israel's TechSAR spy satellite was successfully launched onboard a PSLV. These two launches signal India's intent to be a solid actor in the launch services market in the near future.

Indian leadership has continually supported its space programme politically and financially and in recent years, the growth in India's space budget has been unparalleled by any other country in the world. The increasing level of funding thus illustrates the priority status awarded by the Indian government to the national space programme, and the country's ambition in space. Furthermore, the 11th Five Year plan (1 April 2007 - 31 March 2012), approved by the National Development Council on 19 December 2007, announced India's will to undertake 70 space missions compared to about 26 missions since the 10th plan period as well as take measures to develop new technologies for future needs.[165] Its main direction and goal is to promote economic and social development through the expansion and improvements of space activities. Five main objectives were settled:

- Improve capacities of space communication and navigation (through R&D, use of high power Ka band satellites etc.)
- Become leaders in Earth observation (improvement of imaging capacity and data processing and applications relative to agriculture, land and water resource management, infrastructures etc.)
- Develop space transportation systems
- Develop the space science enterprise
- Promoting spin-offs [166]

India is also increasing its presence on the international scene with new international cooperation agreements with countries from the "South", as well as with countries from the "North" adding themselves to numerous existing ones. India has in recent months reinforced its historical cooperation with France in the domain of Earth observation and the United States in the domain of space exploration. However, India is also expanding its cooperation with Israel and Russia. Regarding India's cooperation with Israel, following the aforementioned successful launch of TechSAR on 21 January 2008, ISRO plans to launch more Israeli spy satellites onboard Indian rockets.[167] India is cooperating with Russia on updating Russia's Global Navigation Satellite System (Glonass) as part of a broad space cooperation plan. The Russo-Indian cooperation has also been extended to space sciences and exploration with an Indian instrument set to fly onboard the Russian Coronas-Photon satellite, Russia and India signed an agreement for Chandrayaan-2 mission on the 12 November 2007. This project includes a lunar lander and a rover, as well as the collection of samples.[168]

[163] Chandrayaan-1 was initially planned for launch on 9 April 2008.
[164] "India Space Institute of Technology Inaugurated." ISRO press release 24 Sept. 2007

[165] "India Plans 70 Space Missions in Five Years." The Hindu 4 Apr. 2008.
[166] Indian 11th Five Year plan presentation <http://www.cdi.org/pdfs/11th-plan.pdf>.
[167] Raghuvanshi, Vivek. "Indian agency plans more Israeli spy sat launches." Defence News Feb. 2008 <http://www.defensenews.com/story.php?i=3366868&c=MID&s=AIR >.
[168] Bagchi, Indrani. "Indian Study on Manned Moon Mission in 2008." The Times of India 14 Nov. 2007 <http://timesofindia.indiatimes.com/India/Indian_study_on_manned_moon_mission_in_2008/articleshow/2539048.cms >.

3.11 Emerging space powers

Besides the traditional space powers a variety of new actors have increased their involvement in space in the last months and have put forth new strategies and plans.

3.11.1 Africa

In Africa various multilateral projects on satellite applications are gaining momentum in Earth observation and communications. Progress on the African Resource and Environment Management Constellation (AMC) are on-going with the participation of Algeria, Kenya, Nigeria and South Africa. The first African communications satellite entirely dedicated to Africa covering the whole continent, RASCOM-QAF1, was launched on 21 December 2007 for the pan-African operator RASCOM (Regional African Satellite Communication Organisation)[169] and marks a great step forward for the continent. RASCOM-QAF1 aims to provide communications services to rural areas, as well as intercity and international phone lines, direct TV broadcast and internet access services. This project has been financed mainly by Libyan funds coming through GTPC (communications services provider) and LAIP (Libyan African Investment Portfolio), [170] a society created in 2006 to stimulate investments in Africa. RASCOM-QAF1 is operated by the private society RascomStar-QAF created to operate the satellite (shareholders include LAIP (33%), Rascom (26%), GPTC (29%) and Thales Alenia Space (12%)). However, due to a helium leak once Rascom-QAF 1 was in orbit, its lifespan has been estimated at 2 years compared to the 15 years originally planned.[171]

National developments are also on-going. For instance, in summer 2008 Angola announced that it will procure, launch and operate its first satellite with the help of Russia; the satellite is a communications satellite dubbed "Angosat". Other countries are also developing their strategies and plans, particularly South Africa.

While the involvement of South Africa in space affairs has been modest until now, it is developing new strategies and capabilities. Despite the fact that spending on space programmes remained low, more recently, the national space programme has been receiving greater support from the government. In 2005, South Africa embarked on a three year capacity-building and satellite development programme. As a result, a new satellite named SumbandilaSat is currently being prepared to be launched in LEO. On 5 December 2007, the Cabinet also approved the establishment of a national space agency. This agency will be tasked with coordinating the use of space technology and local science research. However the Bill entitled “South African National Space Agency Bill” is still being debated in the South African Parliament as of the end of June 2008. A draft of the first South African policy is also currently under development by the Department of Trade and Industry (DTI). The recently approved “Department of Science and Technology (DST) Ten Year Innovation Plan” includes space science and technology as one of the five grand challenges and consequently, a “National Space Science and Technology Strategy” has been drafted. It has been developed with a vision calling “for South Africa to be among the leading nations in the innovation utilisation of space science and technology that enhances economic growth and sustainable development in order to improve the quality of life for all”.[172]

3.11.2 Asia

In a buoyant regional context, major plans and activities were proposed by emerging space actors in Asia in 2007/2008.

South Korea, though it started later than its Asian counterparts in space activities, is making notable investments and progress in developing its indigenous space capability and it has significantly ramped up its space programme in recent years. Korea's first astronaut, Yi So-yeon went to the ISS onboard the Russian spacecraft Soyouz-TMA-12 in April 2008. [173] This astronaut project started on 16 November 2005 and is of very important technical and social significance for Korea with more leaps expected in the years to come. In line with Korea’s hope of becoming a major space-faring country, its

[169] RASCOM, established in 1993, is an intergovernmental treaty-based organisation which has as its prime objective the provision, on a commercial basis, of the satellite capacity required for national and international public communications services, including sound and television broadcasting in Africa.
[170] Lardier, Christian and Théo Pirard. “L’Afrique à l’Heure du Spatial.” Air & Cosmos 21 Dec. 2007.
[171] de Selding, Peter. “Pan-African Comsat Ready, but Service Might Last Only a Few Years.” Space News, Business report 5 Feb. 2008.

[172] Republic of South Africa. Department of Science and Technology. “National Space Science and Technology Strategy .“ <http://www.dst.gov.za/Draft%20National%20Space%20Science%20and%20Technology%20Strategy.pdf>.
[173] Yi So-yeon replaced Ko San one month prior the mission on Russia’s Federal Space Agency request because Mr Ko broke training centre rules.

programme has received increasing funding in recent years. Budget-wise, the government plans to invest 316 billion wons (or 336 million U.S. dollars) in 2008 to boost the country's space industry.[174] Furthermore, according to Korean authorities, the amount spent on space programmes in the next ten years will double relative to the last decade (from 1.7 trillion wons from 1996-2007, to 3.6 trillion wons).[175] Two-thirds of the space budget should be spent to build and launch satellites.[176]

Korea has also laid out a long-term plan for its space programme and released in 2007 its "Long-Term Plan for National Space Development Promotion" according to the Space Development Promotion Act of 2005. The long-term plan provides a vision and direction for national space policy through 2016. The objectives of the next decade as laid out in the long-term plan include the development of a reliable indigenous launch vehicle, more capable Earth observation systems but also exploration activities. Korea's strategic plan is to transform the country into a regional space leader. The plan, in particular, changes the focus from a programmatic-oriented approach to the acquisition of an independent core space technology and establishes milestones and strategies for the independent development of satellites and launch vehicles based on implemented space programmes. Korea is developing a launch vehicle: the Korea Space Launch Vehicle-1 (KSLV-1). However, due to a delay in the delivery by Russia of the ground test vehicle (GTV) used for testing the rocket engine and liquid-fuelled propulsion system, the maiden launch has been moved from 21 December 2008 to the second quarter of 2009.[177] Earth observation and acquiring autonomous launch capabilities are the centrepieces of Korean space activities, but space science and exploration activities have been limited thus far. However, this is evolving. In recent months, ambitious exploration aspirations have been proposed, particularly lunar robotic exploration activities, to demonstrate world class capabilities commensurate with economic growth. Korea plans to send several spacecraft to the moon including a lunar lander.

Another emerging space actor, Malaysia sent its first national into space in 2007/2008. On 10 October 2007, Sheikh Muszaphar Shukhuor was the first Malaysian astronaut or "Angkasawan" in space. However, six months after sending its first "Angkasawan" into space, the plan to send a second astronaut to space had to be put on hold due to lack of public funds. Nonetheless, the training of Dr. Faiz, the next "Angkasawan" should continue.

Vietnam was the latest Asian actor in the period 2007/2008 to launch its dedicated communications satellites on 18 April 2008. Vinasat-1 is the first satellite ever procured by Vietnam, illustrating the growing interest of the Vietnamese government in space activities.

3.11.3 The Middle East

In the Middle East, plans of the Gulf Cooperation Council (GCC)[178] to launch a joint remote-sensing satellite have been reported.[179] Furthermore, the United Arab Emirates' (UAE) first satellite DubaiSat-1, an Earth observation satellite will be launched by the end of 2008. UAE's communications company Thuraya has also completed the launch of its third communications satellite on 15 January 2008, aiming at improving communication capacities in the Asia-Pacific region.

In 2007/2008, Israel launched two satellites: a reconnaissance synthetic aperture radar satellite (TechSAR) in January 2008 by India (Cf. Chapter 6), and a communications satellite (Amos-3) on 28 April 2008 as the maiden launch of Land Launch (this satellite has been renamed Amos-60 since).

Iranian President Ahmadinejad has made Iran's scientific development one of the main themes of his presidency, and particularly nuclear and space activities. Iran has long declared a goal of developing a space programme. Following the launch of a sounding rocket on 25 February 2007, on 4 February 2008, a new suborbital test flight was successfully conducted using the two-stage rocket, Safir (Envoy in English). In summer 2008, Iran recorded its first orbital launch as a step towards the country's attempt to launch its first indigenous LEO research satellite called Omid (Hope in

[174] "Korea to invest W316 billion in space research." The Chosun Ilbo Jan. 2008.
[175] de Selding, Peter. "South Korea Outlines Space Spending Plan." Space News 16 Jan. 2008.
[176] Jin-seo, Cho. "Budget for Space Projects Remains Flat." Korea Times. 16 Jan. 2008.
[177] Korea also intends to develop another launch vehicle KSLV-2 for testing in 2017.

[178] The GCC established in 1981 is a regional political and economic bloc that consists of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates.
[179] "UAE to launch joint remote-sensing satellite with GCC countries." Xinhuanet 29 Apr. 2008.

English).[180] Iran is also collaborating on the Small Multi-Mission Satellite (SMMS) with China and Thailand[181] and is working on three other missions: Sina-2, Sepher and ZS4. In addition to the space segment, Iran has also been developing the ground segment for telemetry, tracking and command (TT&C) and data acquisition. Regardless of the technical characteristics of the launchers and payloads, the level of activities of the last months and the plans for the next years demonstrate Iran's continued intent to further advance and develop its space capabilities.

3.11.4 Oceania

While Australia was the fourth country to launch a satellite (WRESAT) from its territory on November 1967, its activities in space have been modest since the 1970s. However this situation is evolving due to greater interest in Australian space activities at the political level in the country. In particular, a bipartisan investigation was approved by the Australian Senate to review the capability and potential of Australia's space sector. This enquiry follows the release in October 2007 of a plan developed by the Australian space science community under the leadership of the Australian Academy of Science's National Committee for Space Science.[182] This overall inquiry is led by the Australian Senate Standing Committee on Economics and aims to look at ways to strengthen and expand Australia's position in space science, industry and education. Moreover, arguments for and against the expansion of Australian activity in space science and industry, and policy options providing solution for cross-sectoral technological and organisational challenges are sought. The preliminary findings of the Senate investigation were released on 23 June 2008 in order to be taken into account on time for the upcoming Green Paper on National Innovation System Review. The final report is due by October 2008.

3.11.5 South America

In 2007/2008, Brazil continued its involvement in space activities and, in particular, in the development of the Veículo Lançador de Satélite (VLS) and its successors by increasing the participation of the industrial sector and promoting the development of the Alcântara Launch Center including its commercial exploitation. Brazil is also developing the scientific satellite (Lattes) designed to observe atmospheric phenomena in the equatorial region such as luminescence, electric discharges etc. It continues its involvement in space applications within the scope of the "South-South" cooperation in Earth observation with the successful launch of CBERS 2B in September 2007 in cooperation with China. Brazil is also making preliminary studies on the development of a Brazilian geostationary satellite in order to meet the needs of the Brazilian government in the areas of secure communication, meteorology and air traffic management.

In recent months, the main policy directive was to promote the commercialisation of means of access to space. In this context, space activities were added to the PAC (Plan for Growth Acceleration) 2007-2011 intended to stimulate private and public investments. In the infrastructure section of the PAC, the implementation of the full infrastructure of the Alcântara Launch Center, including the commercial launch site is covered.

3.12 International sectoral comparisons

In order to appraise the strategies, plans and activities of the different space powers, a focus on key space activities such as the ability to launch missions as well as the number and type of missions launched is necessary.

3.12.1 Launch sector

Launch infrastructure and systems are key elements demonstrating a country's independence in space activities. The number of launches conducted as well as the level of activities of its bases indicates the dynamism of a country in the space sector and its position in the "space hierarchy".

In 2007, six countries plus Europe and the multinational private consortium, Sea Launch (referred to as multinational in the following figures) conducted 68 launches. When comparing the level of activity by actor, Russia was again the world's leader according to the launch rate criterion followed by the United States and China (Figure 17). The "space hierarchy" in this domain is very stable, as can be observed when looking at the same podium of last year.

[180] Omid will be Iran's second satellite. The first was the Russian-made Sina-1 launched on 27 October 2005. Omid will fly in near polar orbit at an altitude of 650 kilometres.
[181] Iran is also a member of the Asia-Pacific Cooperation Organisation (APSCO)
[182] Dayton, Leigh. "Boost for space program." The Australian 25 Mar. 2008.

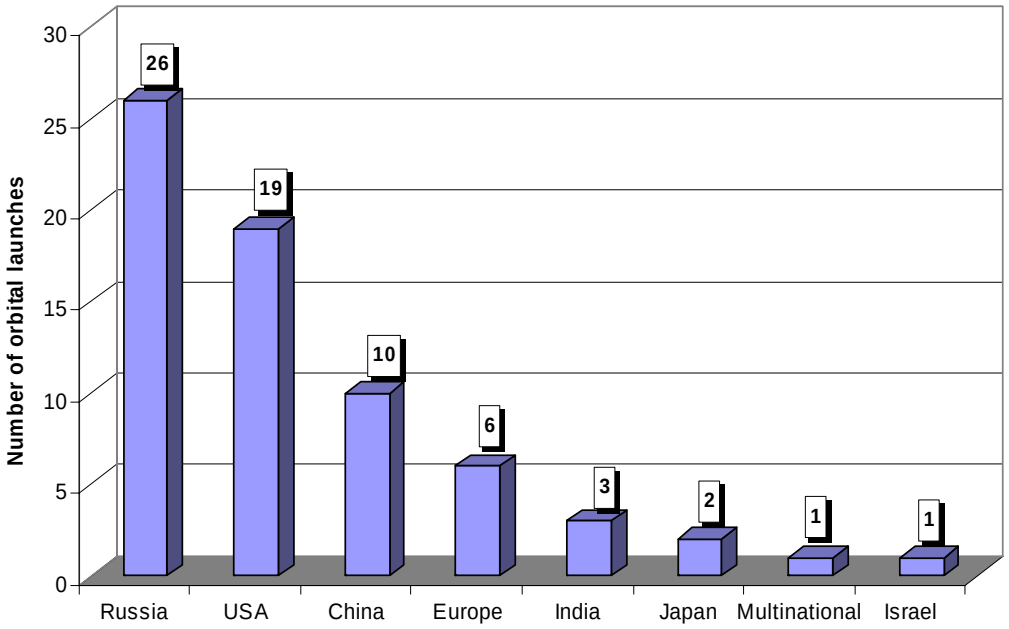

Figure 17 Total worldwide orbital launches per entity in 2007

Those 68 launches were distributed over 24 different launch systems (Figure 18). Russia used eight different launch systems followed by the United States which used seven different launch systems. China used three different launch systems and India two, while Europe, Japan, Israel and Sea Launch used only one launch system (Figure 18). Delta 2 was the most used launch system (eight launches) followed by the Soyuz-U, Proton M, Long March 3 and Ariane 5 all with six launches. Those five launch systems represented 47% of all launches performed in 2007 (Figure 18).

The number and degree to which space transportation infrastructures are used are also indicators of national capabilities and reflect the importance given to independent access to space by a country. In 2007, 15 launch sites were used to perform at least one orbital launch (Figure 19) including one mobile platform (Sea Launch Odyssey platform).

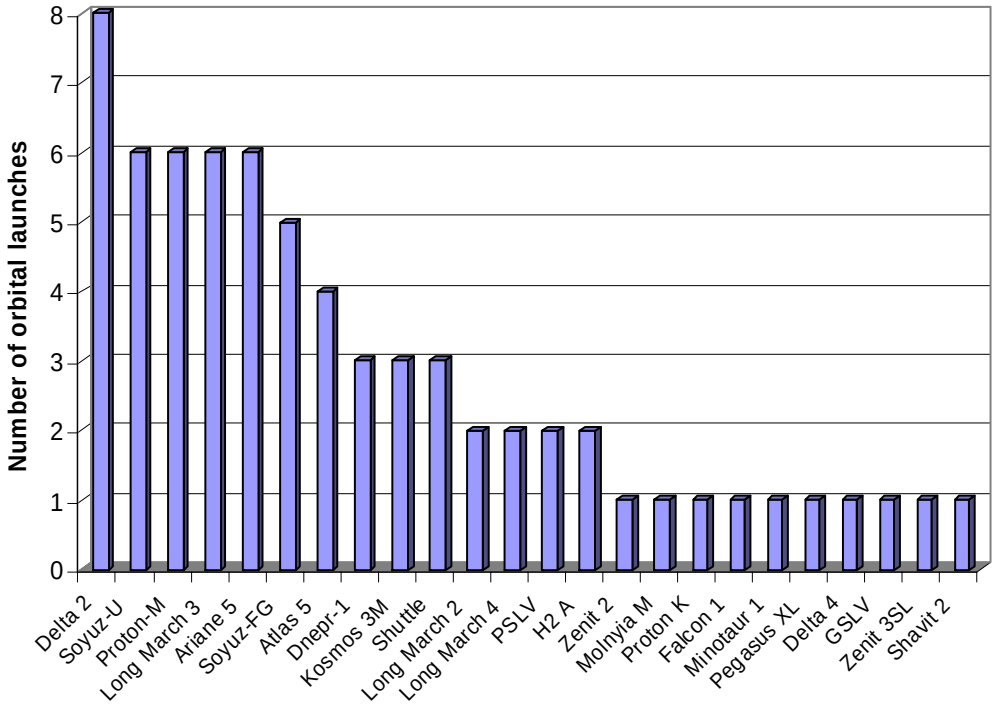

Figure 18 Worldwide orbital launches per launch system in 2007

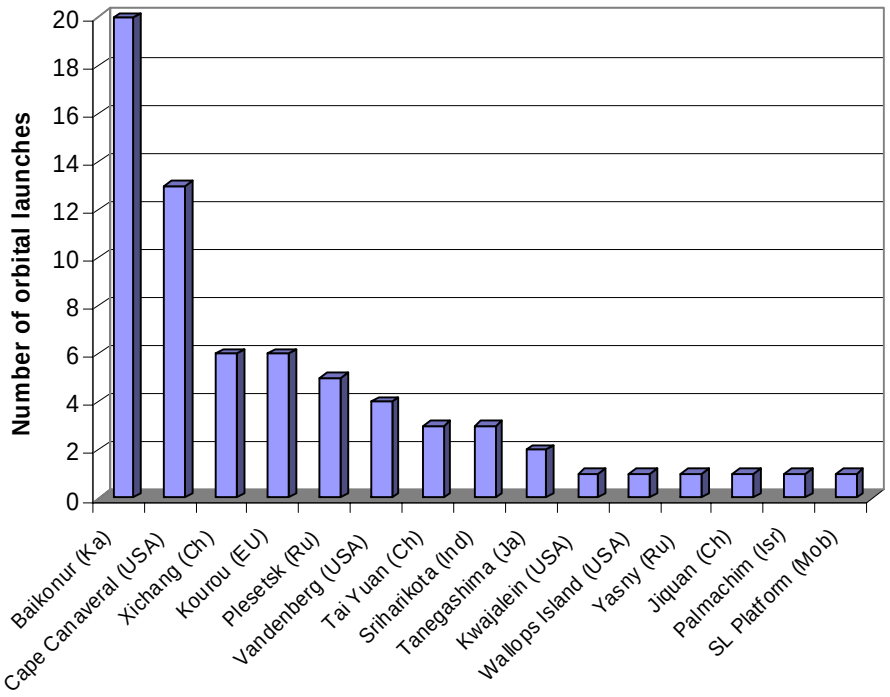

Figure 19 Launches performed by launch site in 2007

Baikonur in Kazakhstan (but operated by Russia) was the busiest launch site in 2007 with 20 launches (three more launches than in 2006) conducted from its different launch pads followed by Cape Canaveral in the United States with 13 launches (Figure 19) three more than in 2006 (ten launches). Xichang in China and Kourou in Europe completed this podium both with six launches performed in 2007 (Figure 19).

In 2007, the United States used four different launch sites (Cape Canaveral, Vandenberg, Kwajalelin and Wallops Island), while Russia used three different launch sites in 2007 (Baikonur, Plesetsk and Yasny) like China (Xichang, Tai Yuan and Jiquan). Europe, India, Japan, Israel and Sea Launch used only one launch site to perform their launches (Figure 19).

3.12.2 Missions launched

Completing the analysis of the activities linked to access to space, the variety of missions launched needs to be considered as well in order to comprehensively appraise the ability of a country to implement its space policy.

In 2007, 20 countries and five bilateral and multinational actors like ESA launched at least one spacecraft into space (Figure 20). When looking at the performance of individual countries, the United States was the world's leader according to the number of missions launched in space (almost 40% of the total of missions launched) followed by Russia (15%), China (8%) and Japan (6%). Compared to last year, China has overtaken Japan on the podium behind the United States and Russia (Figure 20). Europe, when agglomerated for 2007 launched about 10% of all payloads (Figure 20). In 2007, 14 actors launched only one payload (Figure 20).

Like in the case of the launch sector, the number of missions launched per year is highly concentrated among a small number of actors with the same top three actors (United States, Russia and China) concentrating 60% of all payloads launched and 80% of all launches performed in 2007.

Moreover, when looking at the scope of the missions launched, only a handful of countries launched several types of missions (Figure 21). In 2007, the United States had the most diverse set of missions launched (Figure 21) followed by Russia and China (Figure 21).

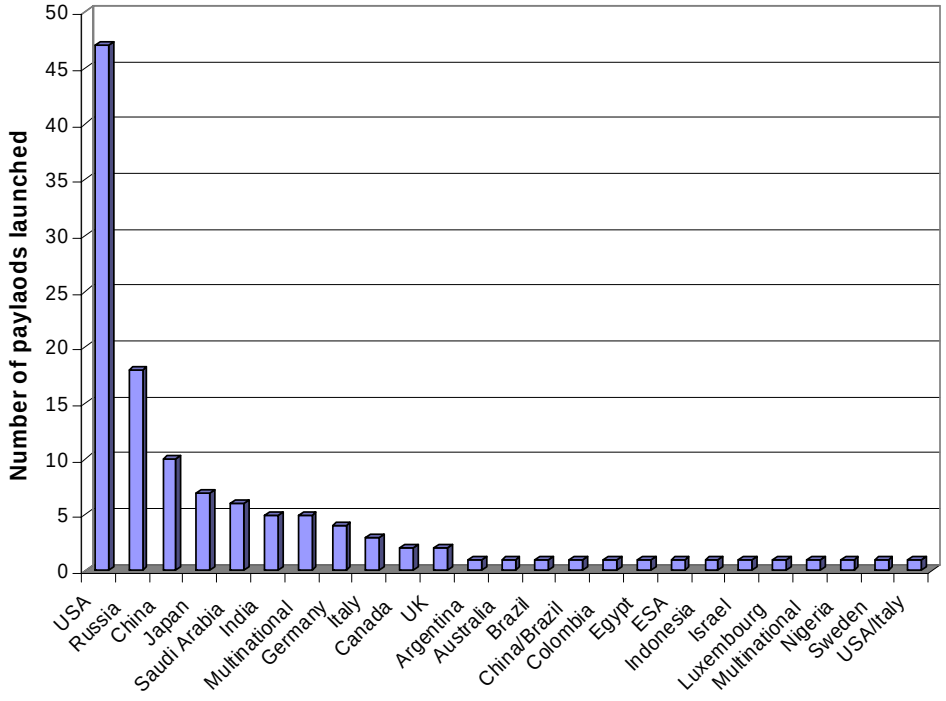

Figure 20 Number of missions launched into space in 2007 per country/institution

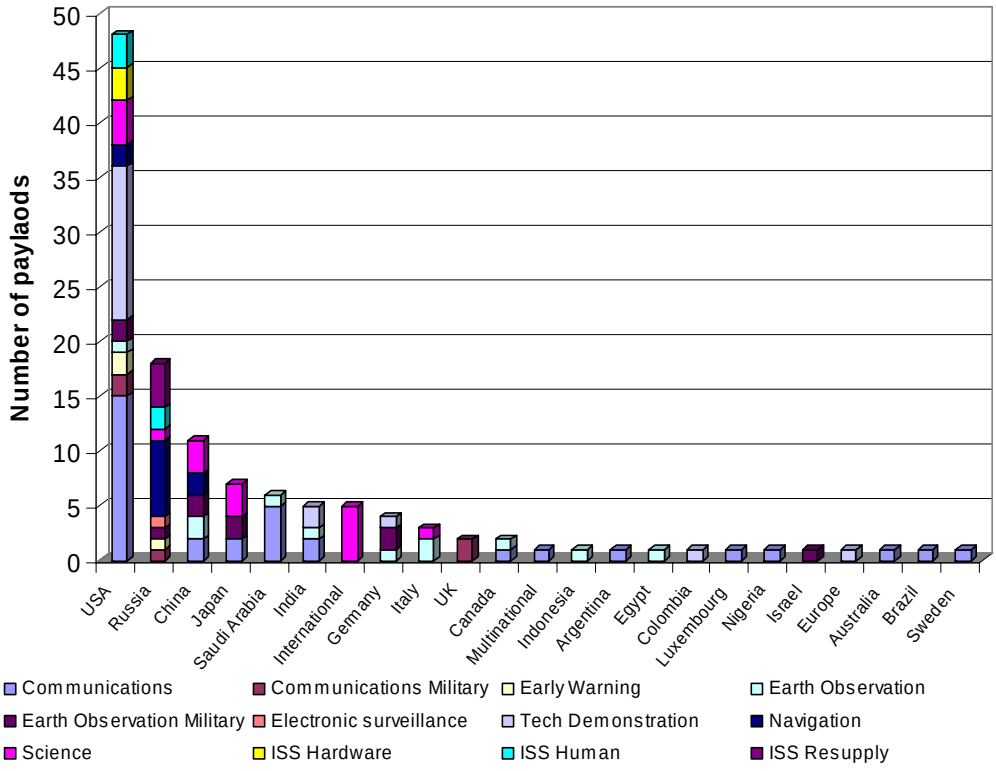

Figure 21 Types of missions launched into orbit in 2007 per country/institution

3.12.3 Overall assessment

When appraising the combination of activities of major space-faring countries (launch and satellites activities) in 2007, an evolution of the "space hierarchy" can be ascertained. While the United States and Russia continue to be the dominant space actors, China is now the third space actor both in the number of launches performed and in the number of missions launched (Figure 22). The United States is the leader in terms of the number of missions launched and Russia when using the launch rate criterion (Figure 22).

Europe confirmed its fourth position in 2007 in the "space hierarchy" with six launches performed and 12 missions launched. Japan which held the third position in this ranking in 2006 has now fallen to the fifth position. It launched seven missions and two launches compared to 14 missions and six launches in 2006. Finally, the buoyant regional context in Asia has again been demonstrated by the solid performance of not only China, but also Japan and India (Figure 22).

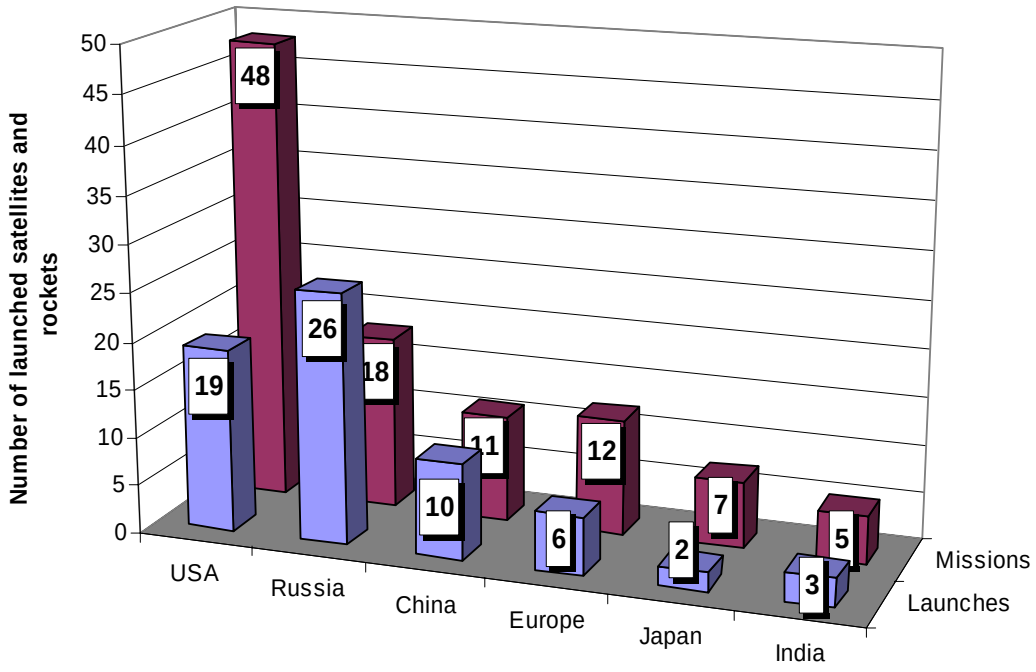

Figure 22 Assessment of major space powers' activities in 2007

Chapter 4 - European institutional market

The main purpose of the data on European institutional space expenditure is to provide an easily identifiable estimate of the scale of institutional resources spent on space in Europe and by proxy the volume absorbed by the European space sector in order to put it in perspective with other institutional markets, in particular, the United States.

4.1 European institutional market

European institutional space activities are characterised by a multi-layer structure. It combines national programmes as well as programmes within the framework of the European Space Agency (ESA), the European Organisation for the Exploitation of Meteorological Satellites (Eumetsat) and the European Union (EU). When considering consolidated European public space expenditure Europe is the second largest player in space (when referring to known space-related institutional budgets) (Cf. Chapter 2). Although Europe invests in defence programmes through several countries, the main institutional investments are overwhelmingly focused on civil space activities. Only a small number of countries invest in military/intelligence programmes and the share of the overall European space expenditure allocated to national or multinational defence programmes is modest, especially when compared to the United States. The total size of European institutional investments in 2007 was estimated at about 6.6 billion euros, with an estimated 83% being civilian funding and 17% military funding.

4.2 Civilian space expenditure

In 2007, overall civilian institutional expenditures were estimated to be about 5.497 billion euros, up by 267 million euros compared to 2006. While there is relative stagnation in the ESA budget and the national space programmes and Eumetsat budgets are shrinking, the funds devoted to space affairs by the European Commission increased in 2007 following the start of the new Framework Programme (FP7) (Figure 23).

ESA in 2007 concentrated about 54% of total civilian institutional resources followed by national space programmes (29%). As opposed to 2006, EU funding is now on the European podium for the first time,

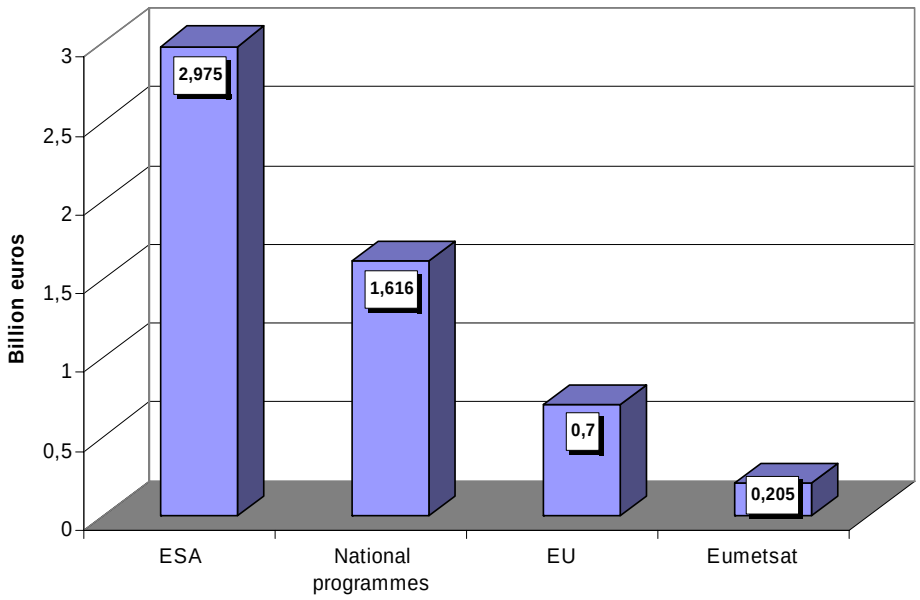

Figure 23 Estimated European civil public expenditures in 2007

representing about 13% of all European civilian institutional budgets followed distantly by Eumetsat (about 4%) (Figure 23).

4.3 European Space Agency

ESA accounted for the largest share of European civilian space expenditure in 2007 with about 2.975 billions euros devoted to space activities (Figure 23), a similar level to 2006. The activities of ESA are financed via its 17 member States and Canada as an associate member State. ESA activities are also financed by third parties for specific programmes such as Eumetsat.

The ESA budget for 2007 is split into ten major areas of activity covering the ESA Mandatory Programme and the Optional Programmes. Reflecting programme decisions taken in December 2005 and before, the biggest activity on ESA's budget is the launcher programme that represents 21% of ESA's budget (Figure 24). It is followed by Earth observation, science, Human spaceflight with about 13-15% each (Figure 24). Navigation and Telecommunications cover another 17.5% when added up (Figure 24).

Member States' contributions to ESA accounted for 2944.2 billion euros in 2007. France contributed to one-fourth of ESA's total budget, followed by Germany (19%), Italy (12%) and the United Kingdom (8%). The contributions of those four countries amounted to 64% of ESA's budget in 2007 (Figure 25).

4.4 Eumetsat

The European Meteorological Satellite Organisation, Eumetsat,[184] derives most of its budget from the contribution of its 21 member States (the same as ESA plus Croatia, Slovakia, Slovenia and Turkey) and nine cooperating States (Bulgaria, the Czech Republic, Estonia, Hungary, Iceland, Latvia, Lithuania, Poland and Romania). Their contributions are based on their Gross National Income (GNI). As illustrated by Figure 26, Germany, the United Kingdom, France and Italy represent 66% of the total member States contributions in 2007.

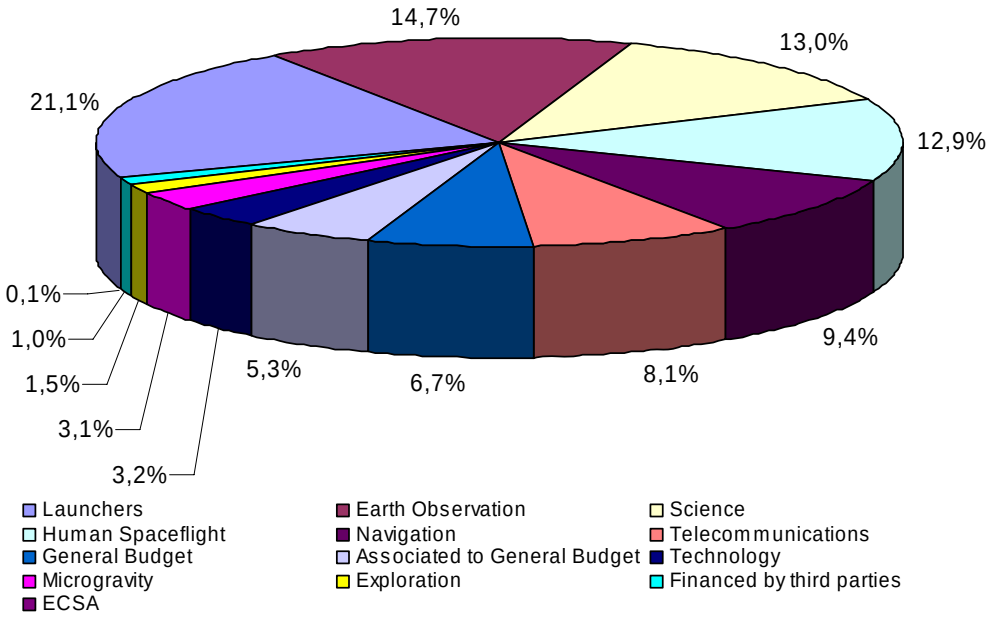

Figure 24 ESA programmatic budget allocations for 2007 (Source ESTMP)[183]

[183] "European Space Technology Master Plan." ESA ESTMP Issue 5 Dec. 2007.

[184] Eumetsat is in charge of providing satellite data and products to its member States for operational meteorology, climate monitoring and ocean surface topography.

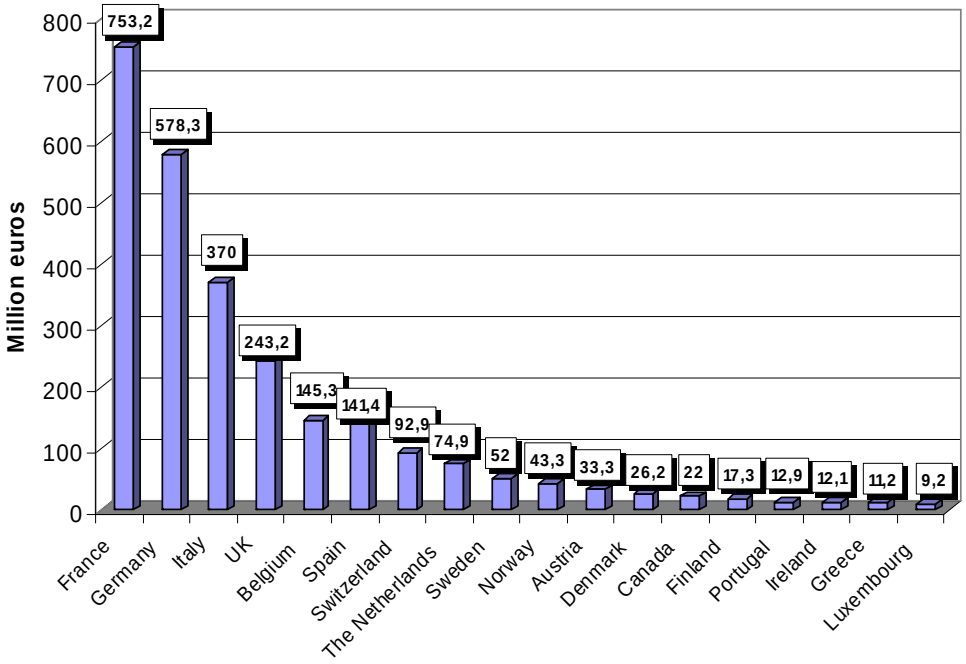

Figure 25 Member States contribution to ESA budget for 2007 (Source ESTMP)[185]

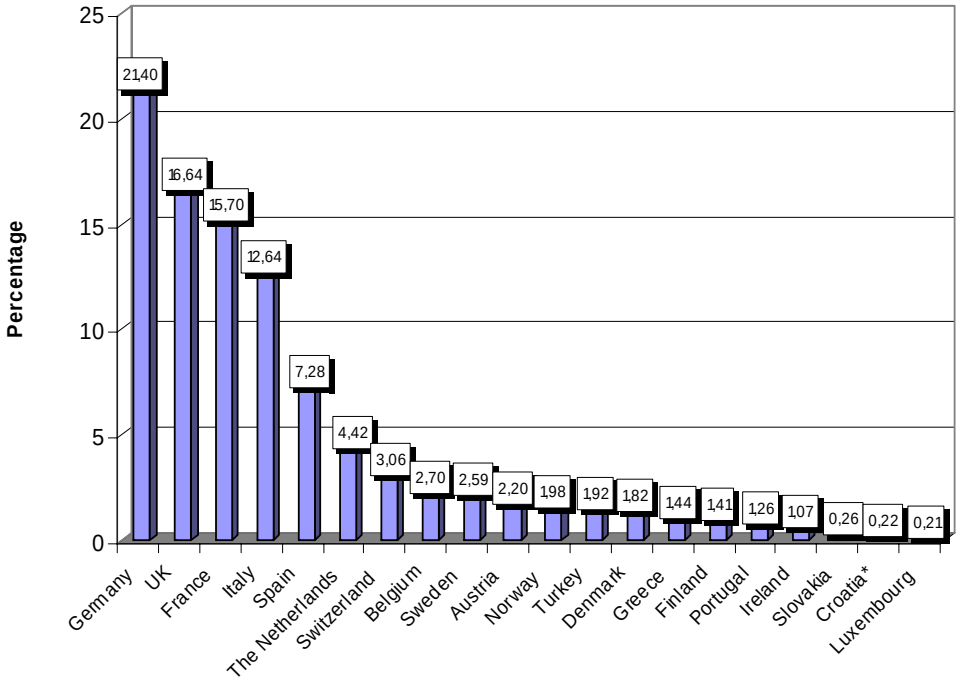

Figure 26 Member States contributions to Eumetsat for 2007 in percentage
(* joined in 2007 to be included in 2008 budget)

[185] Ibid.

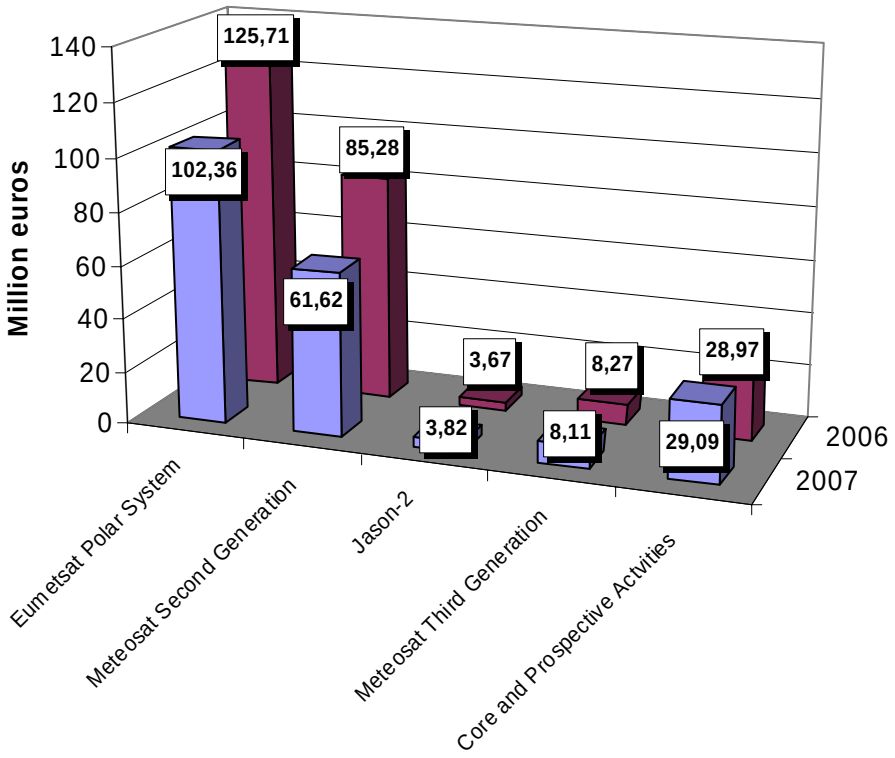

Figure 27 Major programmatic allocations of Eumetsat in 2006 and 2007

The Eumetsat budget for 2007 covered total expenditures of 205 million euros compared to 251.9 million euros in 2006, largely financed by its members' contributions as well as by limited additional income from licensed users of particular services. It had 175.91 million euros dedicated to programme-related activities down from 222.93 million euros in 2006. Similar to 2006, the biggest amount earmarked was for the Eumetsat Polar System (EPS) followed by the Meteosat Second Generation (MSG) programme (Figure 27).

4.5 National agencies

In addition to contributions to ESA, a majority of its 17-member States [186] and other EU-27 countries have a dedicated space agency, space office, or funds allocated to a domestic space programme. However, the institutional funding of space activities in Europe varies considerably among European countries depending on their national priorities and most European countries still funnel the majority of their investments to ESA (Figure 28).

There is an important heterogeneity of public support devoted to space activities in Europe. A trio of countries – France, Germany and Italy – concentrated the majority of European civilian expenditures in 2007. Consequently, the national agencies of those three countries: the Centre National d'Etudes spatiales (CNES) from France, the Deutsches Zentrum für Luft- und Raumfahrt (DLR) from Germany and the Agenzia Spaziale Italiana (ASI) from Italy garnered an overwhelming majority of European national civil expenditures (about 83% of all European civilian expenditure devoted to national civilian programmes) (Figure 29).

4.5.1 France

France has the largest national civilian budget in Europe with about 1466.2 million euros devoted to civilian space activities. In 2007, the CNES had a budget estimated at 713 million euros allocated to its national programme and the French contribution to ESA was about 753.2 million euros.[187]

[186] Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

[187] Ibid

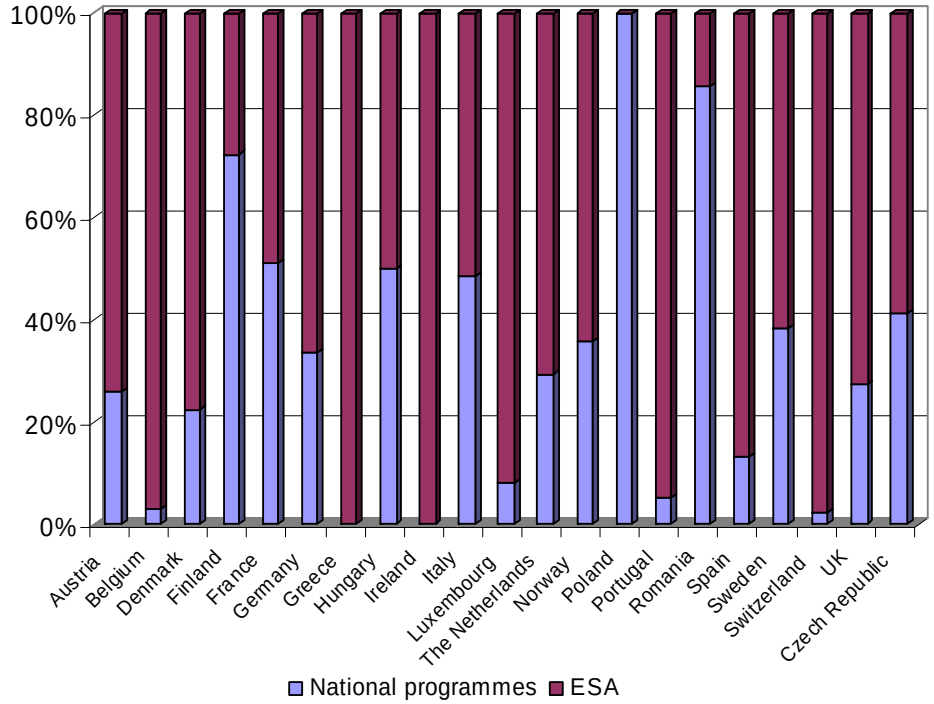

Figure 28 Estimated shares of national institutional investment in civilian space in 2007 (Source ESTMP)[188]

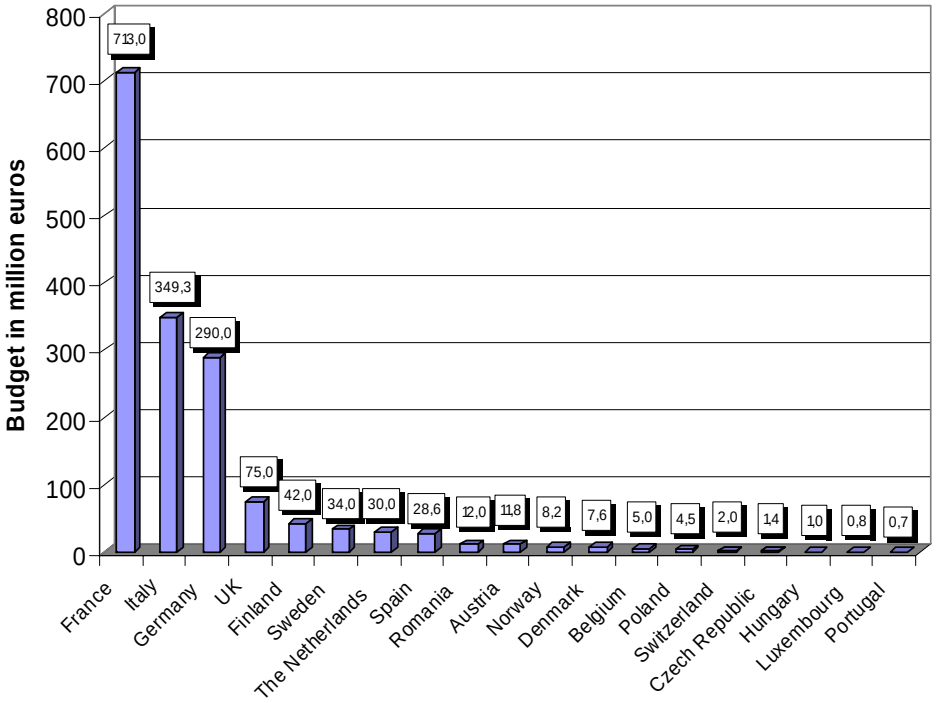

Figure 29 Estimation of the European national space budgets in 2007 (Source ESTMP)[189]

4.5.2 Germany

In 2007, Germany allocated an estimated 912.17 million euros to civilian space activities. It hence represents the second-biggest institutional space spender in Europe. An estimated 290 million euros were spent by DLR, and the German contribution to ESA was an estimated 578.2 million euros in 2007.[190]

[188] "European Space Technology Master Plan." ESA ESTMP Issue 5 Dec. 2007.
[189] Ibid.
[190] Ibid.

4.5.3 Italy

Italy is the third European space power budget-wise. It is estimated that Italy spent about 744 million euros in 2007 devoted to civilian space activities with 369.9 million euros going to ESA and about 349.3 million euros allocated to its national programme managed by ASI.[191]

4.6 European Union

The current EU expenditure spent by the European Commission on space-related activities is mostly concentrated in the context of the Framework Programme (FP)[192] rather than on operational programmes.[193] However, this is evolving with the extra budgetary allocation to the Galileo programme approved in April 2008 (Cf. Chapter 7).

The FP7 is organised in four specific programmes (cooperation, ideas, people and capacities) to create European poles of excellence. The largest programme is cooperation. It is organised in ten themes with one devoted to space activities. The objective of the FP7 space work programme is to contribute to fulfil the overall objectives of the European space policy, complementing the efforts of member States as well as ESA and other actors. EU member States earmarked 1.43 billion euros to fund them in the 2007-2013 timeframe. Thus, throughout the term of the FP7, an average of 205 million euros is planned to be allocated to space through the space theme alone. However, the amount of EC funds directly or indirectly dedicated to space varies from one year to another depending of the number of calls for proposals issued, the quality of projects presented and their costs. Two main clusters of activities are covered by the current space theme: space-based applications and R&D support to the foundations of space science, exploration, space transportation and space technology. About 85% of the funds of the FP7 are allocated to GMES and 15% to the rest. For 2007, a total of 88.7 million euros is to be committed through the FP focusing almost exclusively on GMES-related services (Fast Tracks Services and access to Earth observation data).

The first open call for proposals (FP7-SPACE-2007-1) closed on 19 June 2007 and had a budget of 34.5 million euros. The publication of the second call is scheduled for the second half of 2008. Besides the dedicated space thematic, other themes in the FP7 can provide additional sources of finances for the space sector, such as the theme Information and Communication Technologies, Security, Transport, etc. For instance, the call for proposals (FP7-GALILEO-2007-GSA-1), which closed on 29 February 2008 had a budget of 25 million euros.

Apart from the FP, part of the Trans-European Networks funds is also dedicated to space activities, specifically to the Galileo programme. With the budget agreed by the European Parliament on 23 April 2008, EU funds will finance a total of 3.4 billion euros over seven years for the Galileo deployment, or an average of 485 million euros per year. Another 70 million euros are allocated to space activities through the Competitiveness and Innovation Framework Programme (CIP).[194] Over the 2007-13 period, it is therefore estimated that the EC will spend on average about 700 million euros per year on space activities.

4.7 Security-related space expenditures

European space activities focus principally on civilian space activities, and consequently, European investments on space security-related activities are limited in size and scope. Europe's efforts in this domain rest mainly on member States with limited bi-national or multinational cooperation. However, with a greater involvement of the European Defence Agency (EDA) in space activities, this could change in the near future (Cf. Chapter 6).

Only eight European countries are substantially involved in security-related space activities (Belgium, France, Germany, Greece, Italy, Spain, Sweden and the United Kingdom). While sizing the global military space sector is difficult (Cf. Chapters 2 and 6), accessing European data is also difficult. It is estimated that the defence-related space investments in Europe in 2007 were about 1.103 billion euros. The volume of security-

[191] Ibid.
[192] Since 1984, the Framework Programme has been the EU's main instrument for funding research and development
[193] Peter, Nicolas. "The EU's Emergent Space Diplomacy." Space Policy 23.2 (May 2007): 97-107.

[194] The Competitiveness and Innovation Framework Programme addresses both technological and non-technological aspects of innovation, focusing on the downstream parts of the research and innovation process. One sub-programme, the Entrepreneurship and Innovation Programme (EIP), can be of support to space activities.

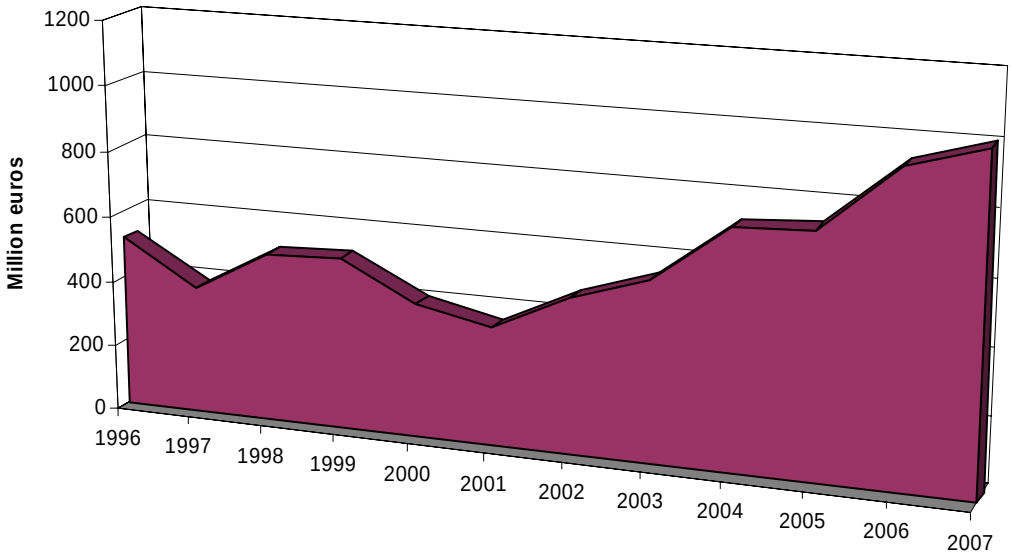

Figure 30 Evolution of the size of the military space contracts awarded for the European space industry (Adapted from Eurospace)[195]

related investments is therefore significantly less than the U.S. space investment in this domain (Cf. Chapter 2). However, the volume of European institutional investments in this domain have been steadily increasing since 2002/2003 as illustrated by Figure 30 that depicts the size of the military contracts awarded to the European space industry in the 1996-2007 period.

France is Europe's major investor in defence-related space activities with an estimated public effort of 460 million euros in 2007. However, while France has seen its budget stagnating in recent years, more modest historical contributors like the United Kingdom, Italy, Germany and Spain have seen their investments in security-related space activities increase, as they have been developing or procuring new national capabilities in Earth observation or communications (Cf. Chapter 6). In 2007, the United Kingdom spent an estimated 300 million euros on space military activities principally on

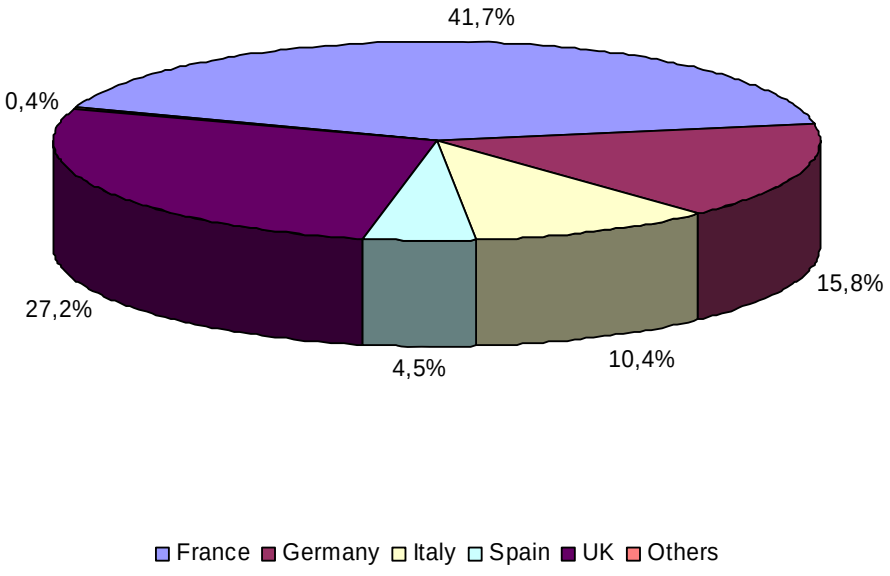

Figure 31 Estimated shares of military space investments in Europe in 2007

[195] ASD-Eurospace. "The European Space Industry in 2007 facts & figures." 12th edition June 2008.

communications systems, Germany spent 174 million euros mainly on reconnaissance systems, Italy spent 115 million euros also primarily on reconnaissance systems, and Spain spent about 50 million euros mostly on communications systems. In 2007, those five countries concentrated 99% of the total European investments in the domain (Figure 31). Other countries (Belgium, Sweden etc.) invested modestly in space military activities, as they continue to rely on cooperative programmes to reap the benefits of third-party military space assets through cooperation agreements. Other resources are also allocated by the European Union Satellite Centre (EUSC), for instance.[196] In 2007, the EUSC had an estimated budget of about 12 million euros.

4.8 The institutional market and its impact on the industrial base

In Europe, the institutional market has historically constituted the main source of funding of the European space industry. However European companies have to compete on the global market to increase their revenues due to the flat trend of the institutional market (Figure 32).

Therefore, the health of the communications sector is of particular importance, as it drives both the satellite manufacturing sector and the launch services sector (Cf. Chapter 5). However, the commercial sector is cyclical and is becoming increasingly competitive (Cf. Chapter 5). Hence, the institutional market constitutes a base for European activities allowing commitments in R&D activities to support European competitiveness.

However, it is not large enough to counterbalance the dependence of the European space industry on the commercial space market. Increasing international competition is also threatening Europe's position on the global commercial market, as many countries are rationalising their industrial base to increase their international competitiveness (Cf. Chapter 5).

The competitiveness of the European industry is also dependent on exchange rates, as most transactions are in U.S. dollars, but assets and services are produced in the euro zone. Therefore, a firmer EUR versus USD reduces the margins of European companies and lowers the price competitiveness of their products and services. Consequently, this could lead to a reduction of Europe's overall market share (Cf. Chapter 5).

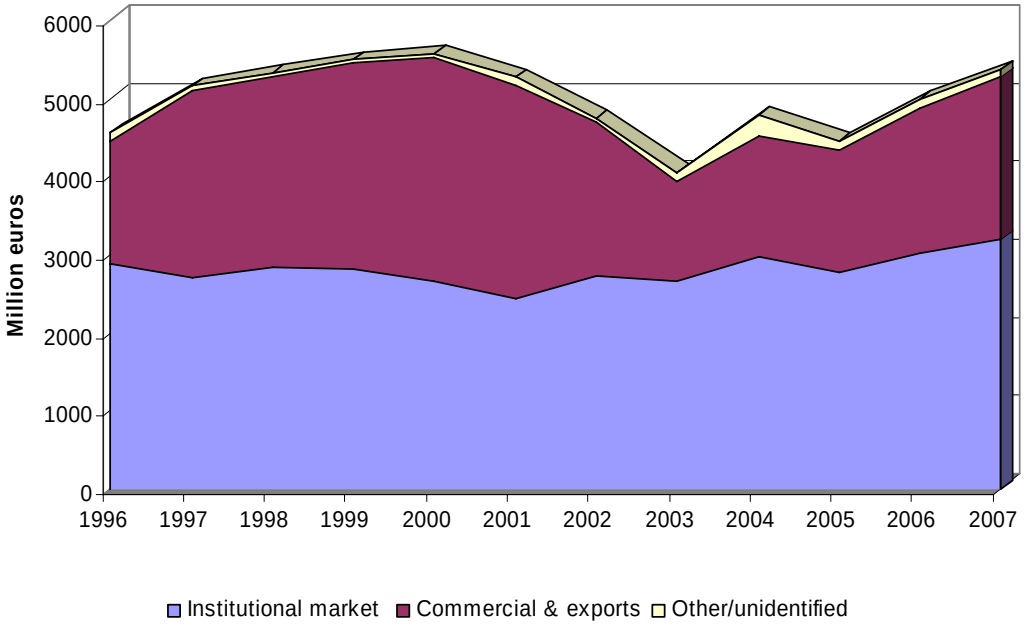

Figure 32 Evolution of the European industrial turnover per customer since 1996 (Adapted from Eurospace)[197]

[196] The EUSC is an Agency of the Council of the European Union that aims to support the decision-making of the EU by providing analysis of satellite imagery and collateral data.

[197] ASD-Eurospace. "The European Space Industry in 2007 facts & figures." 12th edition June 2008.

Chapter 5 - Space industry evolutions

The space industry is currently in transition with the number of consolidations, mergers and formation of strategic alliances increasing rapidly. This trend started a few years ago and is linked to the willingness to improve global competitiveness of the different stakeholders of the space sector.

5.1 Industrial evolutions in Europe

In recent months, the shareholdings of major European communications satellite operators continued to evolve as major takeovers occurred.

On 20 August 2007, the European Commission approved the acquisition of Telenor Satellite Services from the Norwegian communications group Telenor by the investment fund management Apax Partners for an amount of 400 million U.S. dollars.[198]

Spain's Abertis telecom that acquired 32% of the share capital of Eutelsat Communications[199] in January 2007 for 1.070 billion euros reached an agreement on 31 October 2008 with ENSAFECA Holding Empresarial and BBVA to acquire a 28.4% stake in the Spanish satellite operator Hispast for 199 million euros. This latest transaction was authorised on 15 February 2008 by the Spanish Cabinet, making Abertis the largest shareholder in Hispasat.[200] Abertis telecom's entry into Hispasat consolidates the strategy initiated by the acquisition of Eutelsat shares (also a Hispasat shareholder [201]) intended to complement Abertis telecom's position and to expand its geographic business base.

Lehman Brothers International, which reduced its share in the Mobile Satellite Services (MSS) operator Inmarsat by 50% from 9.6% to 4.8% in mid-January 2008, has since raised its stake in the company to 15%.[202] In the meantime, Harbinger Capital has become the largest shareholder with about 28.8% of Inmarsat, thus illustrating its interest in acquiring control of the MSS operator.

On 31 January 2008, Swedish Space Corp (SSC) exercised an option ("put option") under an existing agreement to sell an additional 15% of the satellite-fleet operator SES Sirius to the Luxembourg-based SES. This transaction increases SES's ownership of the Swedish operator from 75% to 90%. SSC will, however, retain a 10% stake in SES Sirius and will continue to provide tracking and control services for the three-satellite fleet.

In February 2008, in an effort to reinforce its presence over the Middle East, SES tried to purchase the rights for the upcoming Amos-3 satellite plus the Amos-2 satellite as well as the customers now using the Amos satellites from Spacecom of Israel. Shortly after this announcement Spacecom rejected the takeover bid arguing that the bid was underestimating the value of Spacecom's business and proposed to leave Spacecom with a single satellite (upcoming Amos-4) that would generate insufficient revenues to guarantee the future of the company.

A joint venture called Solaris Mobile (formed by Eutelsat and SES Astra) that provides services in the S-band selected Dublin (Ireland) as the company's headquarters on 18 June 2008. Solaris Mobile will provide MSS such as TV, video, and radio plus two-way communications to a variety of mobile devices.

In the domain of space manufacturing and services, a series of merger, takeovers and strategic alliances occurred in 2007/2008.

Following the recent investments in EADS by Dubai International Capital, a sovereign wealth fund from Dubai, and of Vnesh-

[198] Lawsky, ' David. "EU approves Apax buy of Telenor Satellite Services." Reuters 20 Aug. 2007. http://www.reuters.com/article/technology-media-telco-SP/idUSBRU00590120070820

[199] Abertis telecom acquired the share from the investment funds Texas Pacific Group, Spectrum, Cinven and Goldman Sachs making it the company's largest shareholder.

[200] Now that the Spanish government has authorised the deal, it must however be cleared by the anti-trust authorities.

[201] Eutelsat owns a 27.7% stake in Hispasat.

[202] de Selding, Peter. "Lehman Brothers Reinvests in Inmarsat Shares." Space News 13 Feb. 2008.

econombank (VEB) a state-controlled Russian bank,[203] France and Germany are discussing changes to EADS's corporate by-laws to prevent foreign investors building significant stakes in the company. Several options are considered, but the use of "golden shares" is the option currently favoured by Paris and Berlin as it will enable them to block stakes above 15% and would justify their privilege as vital to national security.

On 7 April 2008, EADS Astrium announced that it had acquired about 99% of Surrey Satellite Technology Limited (SSTL) from the University of Surrey.[204] This transaction was accepted by the University only after Astrium gave detailed assurance about SSTL's future independence. The all-cash sale is valued at about 89.7 million U.S. dollars in which Astrium will be purchasing 99% of SSTL's equity, with the University of Surrey retaining 1%.[205] Astrium also bought the 10% SSTL stake held by SpaceX and the 5% owned by SSTL employees under the same terms and conditions.[206] It is expected that SSTL will complement Astrium's existing space capabilities in the design and manufacture of small and micro satellites.

Following a cooperation agreement between EADS Astrium and India's Antrix, EADS signed an agreement in March 2008 to jointly supply with Khrunichev Centre (FGUP M.V.Khrunichev GKNPTs) with a new generation of high power spacecraft to the Russian Satellite Communications Co (RSCC).[207]

Thales Alenia Space concluded a wide-ranging cooperation agreement with NPO PM (Academician M.F. Reshetnyov Scientific and Production Association of Applied Mechanics) on 6 December 2007. They agreed to jointly develop a new low-cost high-power 8-12 kilowatt communications satellite bus, Express 400, based on Thales Alenia Space's Spacebus 4000, but also explore ways to supply both satellite lines with the same Russian-built equipment and subsystems.[208]

Telespazio announced on 31 October 2007, the takeover of 85% of Fileas, the software solutions editor and international operator for data broadcasting services by satellite and other networks. This operation aims to allow Telespazio to extend its range of satellite data broadcasting services and to intensify its efforts for developing its other service activities.[209]

On 11 December 2007, Saab AB announced that Saab Space Corp. (the Swedish space-hardware builder specialised in satellite payload electronics and in systems used to release satellites from launch vehicles) was for sale.[210] In summer 2008, the Swiss Company RUAG, concluded a share purchase agreement with Saab AB to buy Saab Space and its subsidiary Austrian Aerospace for an estimated amount of 56.3 million U.S. dollars. The closing of the transaction is expected to take place in September 2008.

On 30 January 2008, OHB Technology of Germany purchased a 50% stake in RST Raumfahrt Systemtechnik, a small German company specialising in airborne and space-borne radar technologies. OHB and RST have worked together on the German military five-satellite SAR-Lupe reconnaissance satellites system.

With navigation being a fast-growing business and with location-based services expanding rapidly into mobile communications devices, several major acquisitions occurred in recent months.

Nokia and NAVTEQ announced, on 1 October 2007, a definitive agreement for Nokia to acquire NAVTEQ for an aggregate purchase price of approximately 8.1 billion U.S. dollars.[211] NAVTEQ is a leading provider of digital map information for, among others, automotive navigation systems, mobile navigation devices and Internet-based mapping applications.

On 18 November 2007, the world's largest navigation solution provider TomTom acquired Tele Atlas; the transaction's aggregate value is about 2.7 million euros.[212] Tele Atlas delivers the digital maps and

[203] For more information see Peter, Nicolas. "Space Policy, Issues and Trends in 2006/2007." ESPI Report 6 Sept. 2007: 62.
[204] The University of Surrey put its company, SSTL, on the auction block in November 2007.
[205] de Selding, Peter. "Astrium Assurance of SSTL Independence Helped Seal Deal." Space News 7 Apr. 2008.
[206] Ibid.
[207] Taverna, Michael and Alex Komarov. "Khrunichev-Astrium Deal Changes Balance in Russian Satellite Market." Aviation Week & Space Technology (24 Mar. 2008): 35.
[208] Ibid.
[209] The remaining 15% is still held by Agence France Presse.
[210] Saab Space Corp. is Sweden's largest space contractor.
[211] "Nokia to Acquire NAVTEQ." PRNewswire 1 Oct. 2007 <http://www.prnewswire.com/cgi-bin/stories.pl?ACCT=ind_focus.story&STORY=/www/story/10-01-2007/0004673032&EDATE=MON+Oct+01+2007,+08:35+AM >.
[212] TomTom "Annual Report and Accounts 2007." < http://ar2007.tomtom.com/pdf/tomtom_Ar07.pdf >.

dynamic content for location-based services (LBS), particularly for Portable Navigation Devices (PNDs). The European Commission, however, opened an investigation into TomTom's proposed purchase of Tele Atlas, claiming that consumers could be hurt by a GPS hardware maker owning one of the two major digital map providers. Finally, in mid-May 2008, TomTom was able to buy Tele Atlas after the Commission concluded that the transaction would not have any significant effect on effective competition.[213]

5.2 Industrial evolutions in the United States

Several cross mergers and acquisitions involving U.S. entities occurred in recent months, as well as legislative initiatives to protect and promote the U.S. industrial base.

MacDonald, Detwiller and Associate (MDA) from Canada purchased Alliance Spacesystems LLC on 5 December 2007. Alliance Spacesystems LLC is a provider for the U.S. government and an aerospace customer of advanced technology solutions; it is also a leader in robotic and mechanical structures applied on a variety of space missions as well as terrestrial applications. Alliance Spacesystems became part of MDA Federal, the MDA subsidiary which includes all of the U.S. businesses of the MDA Information Systems Group.

Alliant Techsystems (ATK), which completed the acquisition of Swales Aerospace on 8 June 2007, announced on 8 January 2008 that it agreed to buy Canada's largest space hardware manufacturer (MDA) for 1.3 billion U.S. dollars. The acquisition of MDA Information Systems and Geospatial Information Services business would give ATK, among other things, superior capabilities in space-based radar systems and space robotics. This would also give ATK greater access to non-U.S. markets, and would allow ATK to market MDA's space-based radar capabilities to U.S. national security customers. However, while 99.9% of voting shareholders approved the deal, Industry Canada rejected the takeover on 10 April 2008 on the grounds that it is a bad deal for Canada. Moreover, Canadian Industry Minister Jim Prentice also indicated the importance of Radarsat-2, which MDA manufactures to safeguard Canada's sovereignty in the Artic region.[214]

On 7 February 2008, the start-up MSS operator, TerreStar, announced that EchoStar Corp. and private-equity investor Harbinger Capital as well as other unnamed investors agreed to invest 300 million U.S. dollars in the company, with two-thirds of the funds being available immediately. Harbinger Capital and EchoStar Corp. each were given seats on the TerreStar board in exchange for their cash investments.[215] The cash influx would allow TerreStar to complete the development and launch of TerreStar-1, but also to begin work on the TerreStar-2 satellite.[216] TerreStar is developing an S-band mobile two-way communication network for the United States.

On 4 February 2008, Intelsat, announced the successful closing of the acquisition of all the primary equity ownership of Intelsat Holdings valued at approximately five billion U.S. dollars by Serafina Holdings (an entity formed by funds advised by BC Partners, Silver Lake and other equity investors). Serafina Holdings bought the interests in Intelsat to the funds advised by or associated with Apax Partners Worldwide LLP, Apax Partners L.P., Apollo Management V, L.P., Madison Dearborn Partners, LLC and Permina Advisers LLC.

The Canadian firm Telesat was acquired on 31 October 2007 by Loral Space & Communications and the Public Sector Pension Investment Board (PSP) of Canada (a pension fund) through the joint venture company Acquireco for 3.25 billion Canadian dollars (about 2.79 billion U.S. dollars). Loral now owns 64% of the company and PSP owns the remaining 36%. However, to comply with Canadian laws (requiring Canadian ownership of communications carriers) Loral has 33.3% voting rights and the Canadian investors 66.7%.[217]

[213] Lawsky, David. "TomTom Wins EU Permission to Buy Tele Atlas." Reuters 14 May 2008.

[214] Galt, Virginia. "Prentice defends takeover veto." Globe and Mail 11 Apr. 2008 <http://www.theglobeandmail.com/servlet/Page/document/v5/content/subscribe?user_URL=http://www.theglobeandmail.com%2Fservlet%2Fstory%2FRTGAM.20080411.wprentice_space0411%2FBNStory%2FrobNews%2F&ord=89524609&brand=theglobeandmail&force_login=true >.

[215] The U.S. hedge fund Harbinger Capital has taken in recent months sizeable positions in several MSS companies. In addition of its involvement in TerreStar it owns as aforementioned 28% of Inmarsat, but it is also a major shareholder in Mobile Satellite Ventures (MSV).

[216] Having a backup satellite completed within a year of TerreStar's commercial debut is a requirement of the company's U.S. Federal Communications Commission (FCC) license.

[217] de Selding P. "At Deal's Close, Telesat, Loral Begin Merging Satellite Fleets." Space News 5 Nov 2007.

The U.S. Department of Justice issued an outright approval on 24 March 2008 for the merger of satellite-radio companies Sirius Satellite Radio and XM Satellite Radio. The review concluded that "evidence does not establish that combination of satellite radio providers would substantially reduce competition". [218] The decision of the Department of Justice was motivated by three factors: a lack of existing competition between Sirius and XM in important market segments, the prospect of alternative services which could become increasingly attractive to consumers, and finally, efficiencies from the merger which could benefit consumers. The proposed 4.5 billion U.S. dollars-merger was then approved by the U.S. Federal Communications Commission (FCC) in summer 2008.

Universal Space Network Inc. (USN), a leading provider of space operations and ground control and communications services purchased the satellite tracking and control assets of Honeywell Technology Solutions' Datalynx in February 2008. The transaction includes Datalynx assets such as the tracking and control antennas in Alaska and the control centre in Maryland (USA). As part of this transaction, USN also received a contract to provide tracking services for over 20 NASA orbiting satellites.[219]

Space Adventures (the firm selling trips aboard Russian Soyuz vehicles to the International Space Station) announced on 19 March 2008 its 1 January 2008 purchase of Zero Gravity Corp (also know as Zero-G) which provides commercial parabolic flights using a modified Boeing 727 aircraft known as G-Force One. [220]

In the United States, the State Department's export licensing programme is under scrutiny as it has been recognised as under stress and hurting the U.S. space industrial competitiveness due to underlying bureaucratic inefficiencies and problems. Furthermore, the U.S. Congress introduced wording in the Fiscal Year 2009 House Defence Authorization Bill that raises the possibility of punitive action against "a foreign-owned company that is engaged with the People's Republic of China in the development, manufacture or launch of certain satellites". The Bill calls for a review by the Defence Security that could prohibit the Pentagon from doing business for classified work with such companies in the future.[221] It also states that Pentagon funds could be denied to any business working with China on satellite technology, particularly those not covered by ITAR. [222] Such legislation would principally target the European Thales Alenia Space that has been marketing communications satellites that have no major U.S. components and therefore not subject to the International Traffic in Arms Regulations (ITAR). The Bill was received by the Senate on 3 June 2008 and was subsequently placed on the Senate Legislative Calendar.

Following a joint investigation by the Federal Bureau of Investigation (FBI) and NASA, U.S. federal authorities arrested a former Boeing engineer on 11 February for allegedly giving trade secrets related to several space programmes, including the space shuttle and Delta 4 rocket to China. The same day another espionage case was unveiled with a weapons systems policy analyst at the Defense Security Cooperation Agency (DSCA) and two Chinese citizens were arrested.

5.3 Industrial evolutions in Russia

In line with the adoption by the Russian government of a new Federal Space Programme (2006-2015) attempting to halt the decline of the country's industrial base and ending years of under-funding in October 2005 and the subsequent release in January 2006 of the "Strategy for Development of the Space Industry up to 2015", on 11 April 2008, Russia's President Vladimir Putin made a speech regarding space issues. He declared that Russia should not only be involved in orbiting foreign-made satellites and payloads, but should also promote its hi-tech developments and services, as an effective space programme is seen as having a significant factor in innovative economic development. [223] Furthermore, Vitaly Lopota,

[218] U.S Department of Justice "Statement of the Department of Justice Antitrust Division on its Decision to Close its Investigation of XM Satellite Radio Holdings Inc.'s Merger with Sirius Satellite Radio Inc." <http://www.usdoj.gov/opa/pr/2008/March/08_at_226.html>.

[219] "USN to expand global reach and TT&C service offerings with significant acquisition." Reuters Press Release 19 February 2008 <http://www.reuters.com/article/pressRelease/idUS205304+19-Feb-2008+PRN20080219 >.

[220] Space Adventures was already a substantial investor in Zero-G.

[221] Douglas, Barrie, MichelTaverna and Amy Butler. "Measure Would Thwart Efforts by Satcom Operators to Broaden Launcher Choice." Aviation Week and Space Technology (6 Aug. 2008): 36.

[222] Ibid.

[223] "Russia should promote hi-tech, not just space services - Putin." RIA Novosti 11 Apr. 2008.

the president of S.P. Korolev Rocket and Space Corporation Energia (also know as Energia), also on 11 April 2008, stated that he believes that space tourism is a forced measure to compensate for insufficient financing of the Russian space programme.[224]

Following the aforementioned policy documents, and particularly, the space industry strategy, several changes are expected for the near future. First, the formation of ten to eleven horizontally and vertically integrated structures by 2010; second, these integrated structures will be reorganised into three to four space corporations which would encompass most of the main enterprises of the field before 2015. The consolidation of the Russian industry into major holdings that started in 2006 has continued in recent months following the Presidential decrees.

A new holding company was created in fall 2007 around the Russian Scientific Research Institute for Space Instrument Engineering, known as RNII KP. This new entity focuses on Glonass and COSPAS-SARSAT-related activities and is the result of the merger of RNII KP with the Scientific Research Institute for Precision Instruments (NII TP), the Scientific Research Institute for Physical Measurements (NII FI), the Research and Production Association for Measurement Technology (NPO IT), the Scientific-Research Institute of Space Instrumentation (NII KP), the Orion Scientific and Production Organisation (NPO Orion) and the Special Design Bureau of the Moscow Institute of Power Engineering (OKB MEI).

On 29 February 2008, the Scientific and Research Institute of Chemical Engineering and the Scientific and Research Institute of Chemical and Construction Machine Manufacturing were reorganised into the Rocket and Space Industry Research and Test Centre.[225]

On 3 March 2008, further shifts were ordered for the ex-NPO PM (Academician M. F. Reshetnev Research and Development Association of Applied Mechanics). The Company underwent a State Registration at that time to become a joint-stock company named Academician M. F. Reshetnev Information Satellite System. It will be made up of a total of nine subsidiaries: the JSC Research & Production Enterprise (Geofizika-Cosmos), the JSC Research and Production Centre "Polyus", the Research & Production Entreprise "Kvant", the JSC Research & Production Enterprise of Space Instrument-Making, the JSC Siberian Devices and Systems, the JSC Testing Technical centre-NPO PM, the JSC NPO PM Small Design Bureau, the JSC NPO PM- Razvitie and the JSC Sibpromproekt.[226]

Finally, in May 2008, the State Rocket Centre Academician V.P. Makeyev Design Bureau was reorganised into the Makeyev State Rocket Centre (MSRC) and integrates four subsidiaries including, among others, the Zlatoust Machine-Building Factory, the Miass Machine-Building Factory, and the "Krasnoiarsk Machine-Building Factory.[227]

Russian space industries are also cooperating with international partners, particularly Europeans, in the domain of satellite manufacturing. Khrunichev Centre (FGUP M.V.Khrunichev GKNPTs) signed an agreement with EADS in March 2008 to jointly supply the Russian Satellite Communications Co (RSCC) with a new generation of high power spacecraft. NPO PM (Academician M.F. Reshetnyov Scientific and Production Association of Applied Mechanics) also concluded on 6 December 2007 a wide-ranging cooperation agreement with Thales Alenia Space to jointly develop a new low-cost high-power communications satellite bus.

Finally, in the launch sector the announcement was made on 29 May 2008 that Khrunichev State Research and Production Space Centre acquired the shares of ILS (International Launch Services) owned by majority shareholder, Space Transport Inc.[228] Financial details were not disclosed. ILS holds the exclusive worldwide rights to market and sell commercial launch services on the Proton launch vehicle, built by Khrunichev, as well as the Angara vehicle under development. ILS will remain a U.S.-based corporation, marketing commercial launches of the Proton vehicle.

[224] "Russia will not need space tourism when programs well financed – analysts." Interfax 11 Apr. 2008.
[225] "Putin Signs Decree to Set up Rocket-And-Space Research Centre." Space Daily 6 Mar. 2008.
[226] "Establishing a New Joint-Stock Company "Academician M.F. Reshetnev" Information Satellite Systems." 3 Mar. 2008 <http://www.npopm.com>.
[227] CNES, Moscow Office French Embassy, 19 May 2008.
[228] Space Transport Inc. is a British Virgin Islands-based company that was formed in 2006 for the sole purpose of holding an interest in ILS. Space Transport Inc. purchased ILS shares in October 2006 from Lockheed Martin.

5.4 Industrial evolutions in Japan

Japanese space policy is in transition (Cf. Chapter 3) and is endeavouring to increase the competitiveness of its industrial base.[229] In this context, SkyPerfect JSAT Corp. announced the purchase of Space Communications Corp. (SSC) on 13 February 2008 for about 270 million U.S. dollars, and as of October, SSC will be a division of SkyPerfect JSAT Corp. This acquisition consolidates JSAT's position as the world's fifth-largest satellite fleet operator. JSAT and SSC will combine ground operations as well as on-orbit operations, and expects to secure satellite launches and insurance contracts under better conditions. The aim of this transaction is to secure the competitive advantage in the satellite industry in order to promote expansion strategies in the "subscription multi-channel pay TV market".[230]

The first Japanese-built commercial satellite was also under development in 2007/2008 and launched in summer 2008. The Mitsubishi Electric Corp. (Melco) built Superbird-7 satellite for SCC, but it will be used by SkyPerfect JSAT Corp. following the aforementioned acquisition. Superbird 7 is the first made-in-Japan commercial spacecraft ordered by a Japanese fleet operator. This event illustrates Melco's interest in establishing a position in the commercial satellite manufacturing market as a competitive and reliable actor.

5.5 Industrial evolutions in China

As China is entering the international markets for commercial satellite manufacturing and launch services, it continues its efforts to develop and improve its space industry as well in order to have a mature space industry on par with its global aspirations (Cf. Chapter 3). The Chinese Aerospace Science and Technology Corporation (CASTC) unveiled a plan in summer 2008 to set up four more scientific and research and production bases in China's Bohai region, South China's Pearl River Delta and China's western area with a total of eight space industry centres in the coming years. CASTC ambitions are also to acquire up to 10% of the international commercial satellite market and 15% of the world commercial space launch services market by 2015.

5.6 Trans-Atlantic industrial comparison

Europe and the United States are the two major space actors investing the most in space activities (Cf. Chapter 2). They also have the most diverse and competitive industrial bases. An overview of their respective dynamism and capabilities is therefore necessary to assess the health and competitiveness of their respective industrial base. When compared to the United States, the European space sector receives far less institutional support and thus needs to be highly competitive on the open commercial market. On the other hand, the U.S. industrial base relies almost exclusively on contracts from the U.S. Government.

5.6.1 State of the European space industry

According to the results of the European space industry association (ASD-Eurospace), the consolidated turnover of the European manufacturing sector grew from 4.98 billion euros in 2006 to reach about 5.36 billion euros in 2007 (Figure 33). This revenue growth was mainly supported by an increase in commercial satellite and national programmes while the contribution of Eumetsat and the launch sector declined from the previous year.

In 2007, the revenues of the European space industry were dominated by institutional customers with almost 60% of its total consolidated turnover (or 3.19 billion euros) generated by the institutional market while commercial and exports markets generated 2.07 billion euros in 2007. ESA was again, in 2007, the main institutional customer for the European space industry with about 50% of the overall turnover (Figure 34). The European military programme represented the second sources of revenues followed by national civil programmes both in progression from 2006. The share of Eumetsat diminished while EC's remained stable at 13 million euros (Figure 34). Europe's civil institutional

[229] For more information, see Suzuki, Kazuto. "Basic Law for Space Activities: a New Space Policy for Japan for the 21rst Century." Yearbook on Space policy 2006/2007: New Impetus for Europe. Eds. European Space Policy Institute: Kai-Uwe Schrogl, Charlotte Mathieu and Nicolas Peter. Wien: Springer, 2008: 225.238.

[230] "Acquisition of Space Communication Corporation Shares." SKY Perfect JSAT Corporation News Release 13 Feb. 2008.

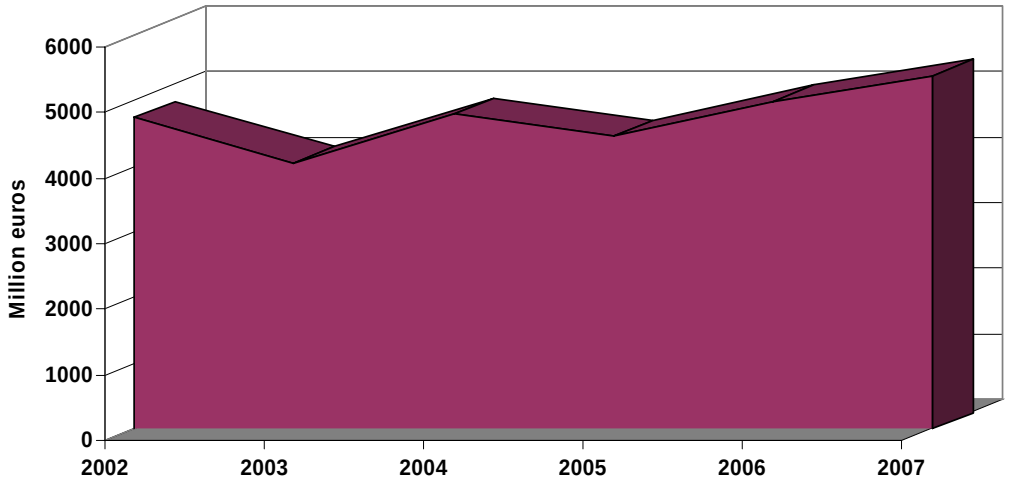

Figure 33 Estimated consolidated turnover of the European space sector for 2002/2007 (Adapted from Eurospace)[231]

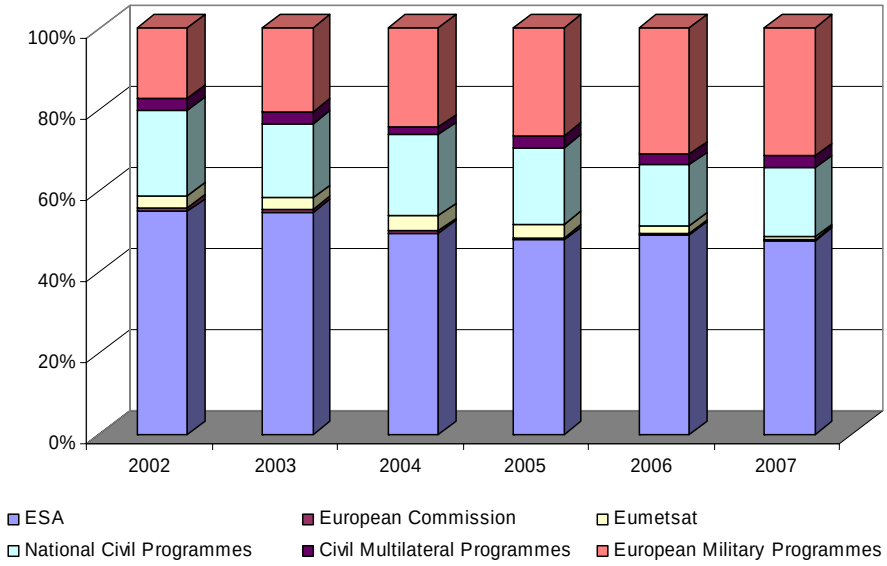

Figure 34 Estimated share of the European space industry consolidated turnover per institutional customer since 2002 (Adapted from Eurospace)[232]

programmes represent 68% of all space institutional revenues for the industrial sector. The rest comes from European military programmes (Figure 34).

The commercial turnover in 2007 of the European space industry was dominated by the commercial satellite sector, followed by operational launch system, an evolution from 2006 (Figure 35). GEO commercial systems were the main customers for the European space industry, generating almost half of the commercial turnover. Arianespace was the second-biggest European customer (Figure 35).

When looking at the distribution by activity, satellite applications and communications are the main activities generating revenues for the European industry (Figure 36). Satellite applications are followed by launcher activities (including both development and operational activities) and scientific as well as support activities (Figure 36).

In 2007, like in 2006, the main space industry turnover was generated by France, followed distantly by Germany, Italy and the United Kingdom (Figure 37).

[231] "The European Space Industry in 2007 facts & figures." ASD-Eurospace 12th edition June 2008.

[232] Ibid.

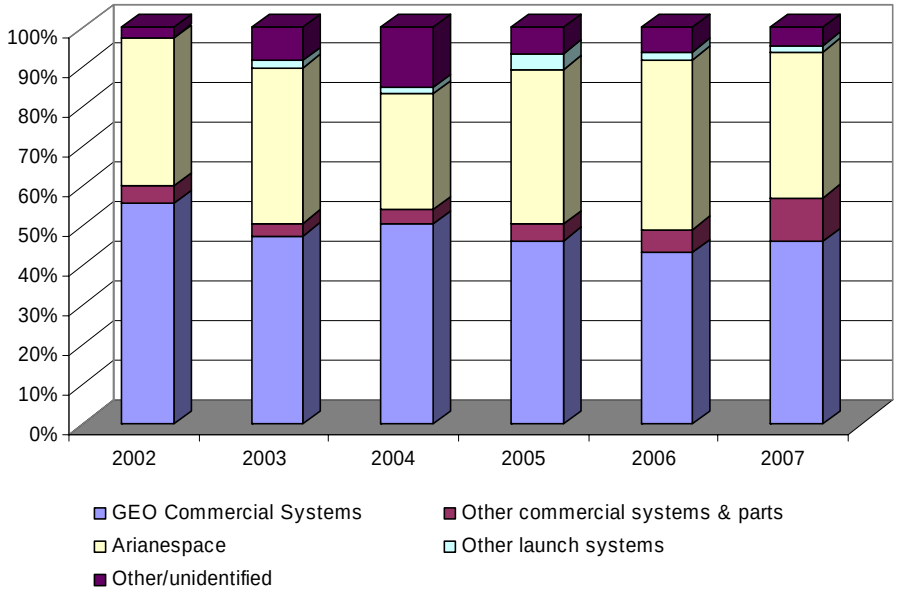

Figure 35 Estimated European space industry consolidated turnover per commercial customer since 2002 (Adapted from Eurospace)[234]

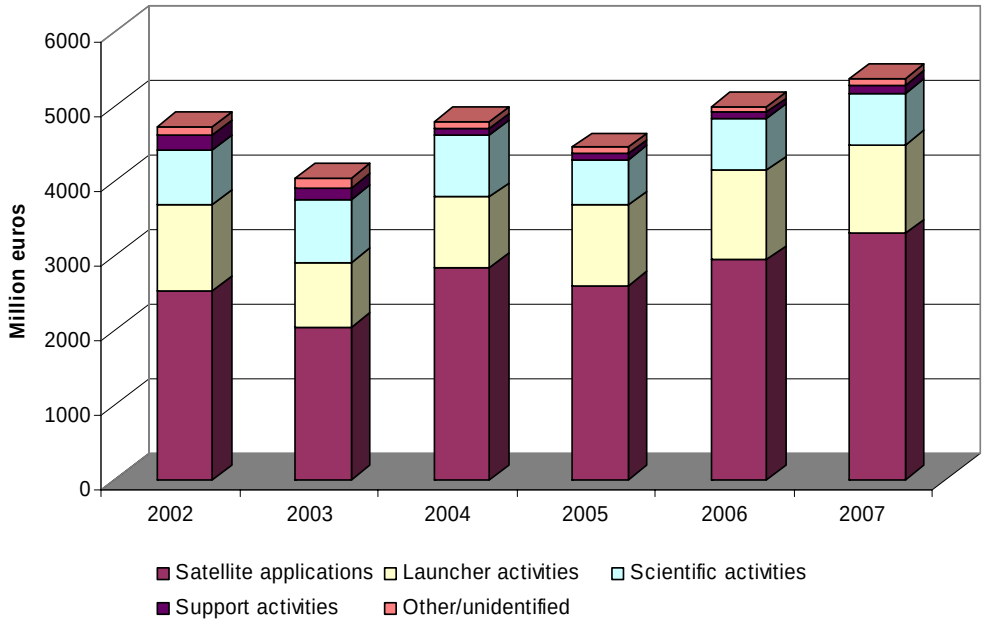

Figure 36 Estimated share of the European industry consolidated turnover per sector (Adapted from Eurospace)[233]

When looking at the consolidated turnover by customer and country in 2007, only France and Norway generated more revenues from commercial customers than from institutional ones (Figure 38).

There is also a relative specialisation of different countries, with applications being important in the United Kingdom, Spain, Norway, Portugal, Luxembourg, Germany, France, Finland and Austria while launch system activities are important in Switzerland and Ireland. Scientific activities are important in Denmark and the Netherlands (Figure 39).

[233] Ibid.
[234] Ibid.

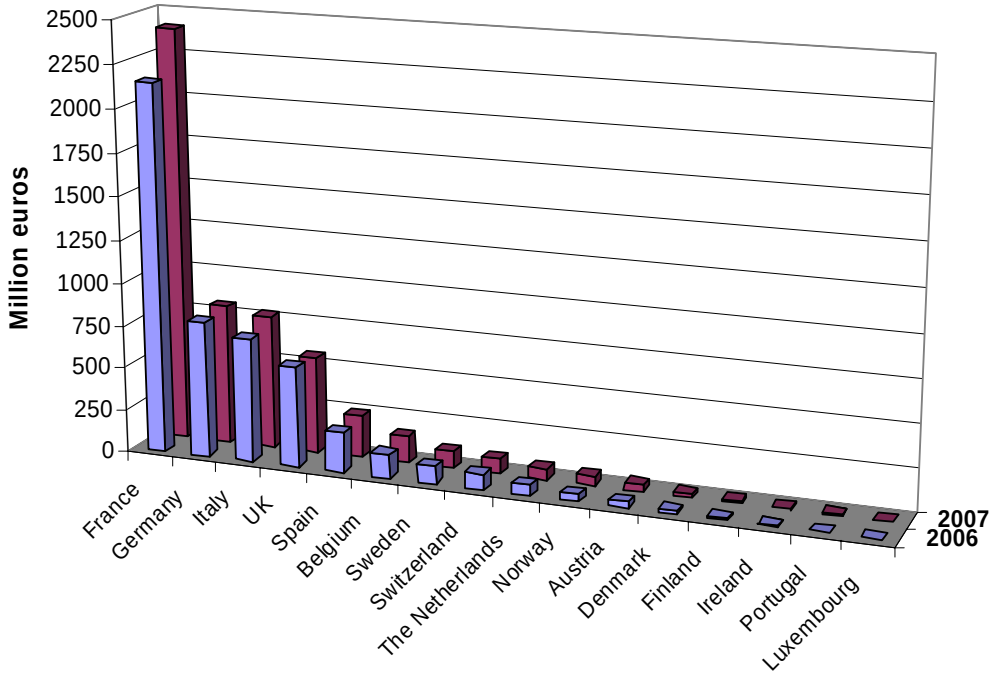

Figure 37 Estimated European industry consolidated turnover in 2006 and 2007 per country (Adapted from Eurospace)[236]

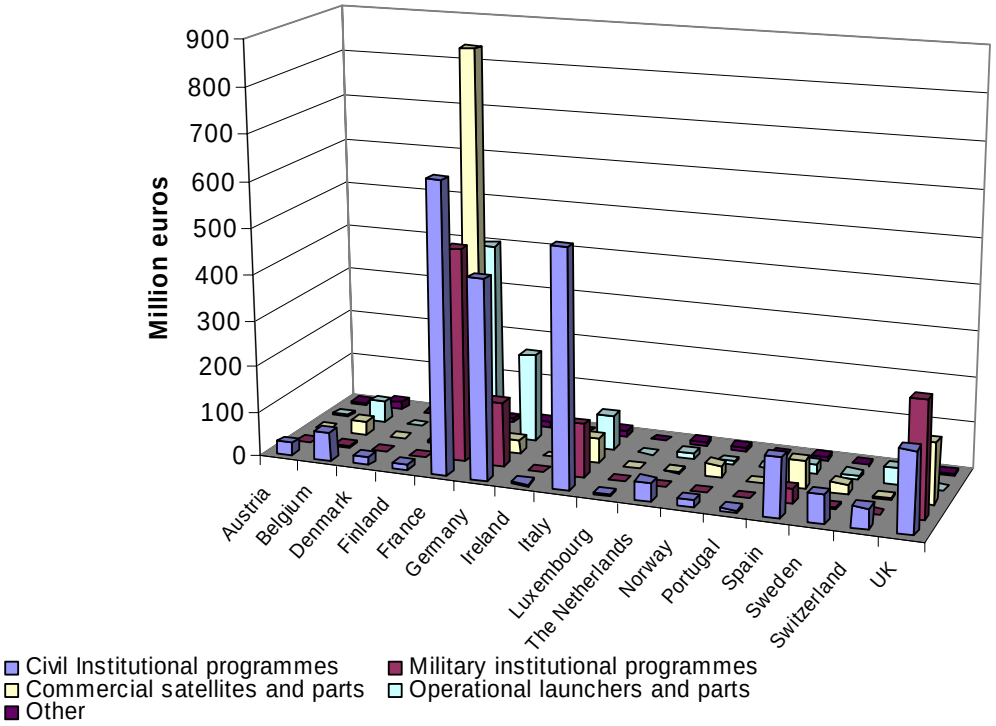

Figure 38 European consolidated turnover per customer and per country in 2007 (adapted from Eurospace)[235]

The space sector is a significant source of highly qualified European employment. The total direct employment of the European space industry grew from 30 938 in 2006 to 33 049 in 2007, including 3 412 external employees working on site, confirming the increase witnessed since 2005. Six European countries concentrate 90% of the total direct employment by the space industry (Figure 40). France leads with 38% of the overall total, followed distantly by a cluster composed by Germany, Italy, the United Kingdom, Spain and Belgium (Figure 40).

[235] Ibid.

[236] Ibid.

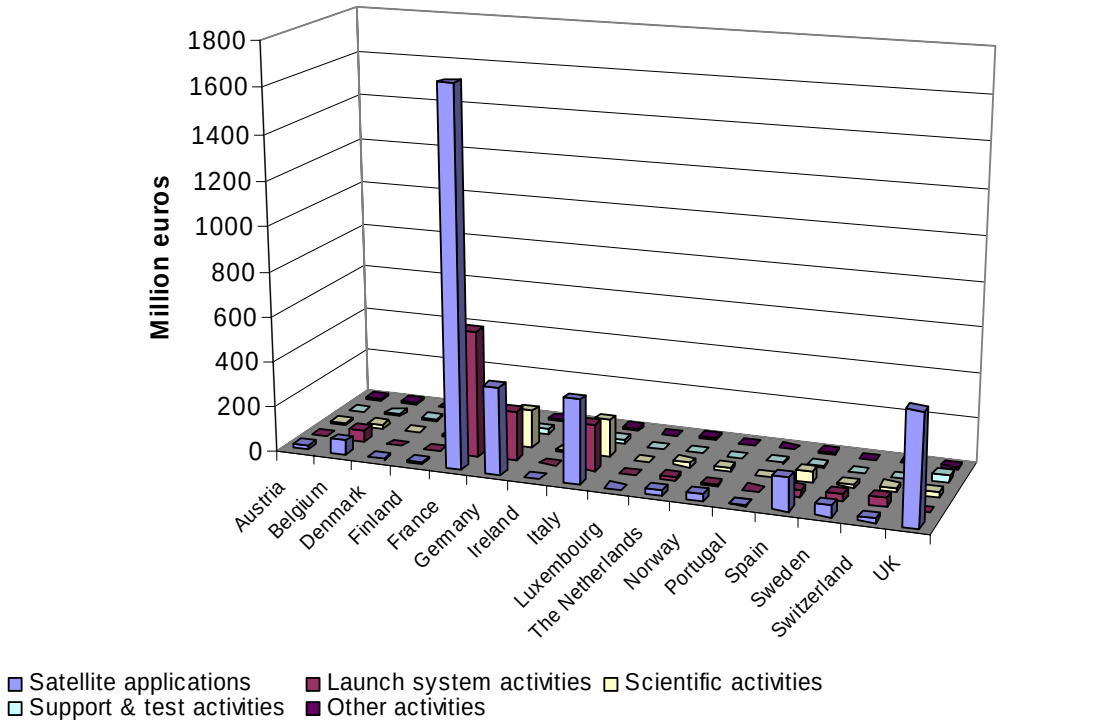

Figure 39 European consolidated turnover per applications and per country in 2007 (adapted from Eurospace)[237]

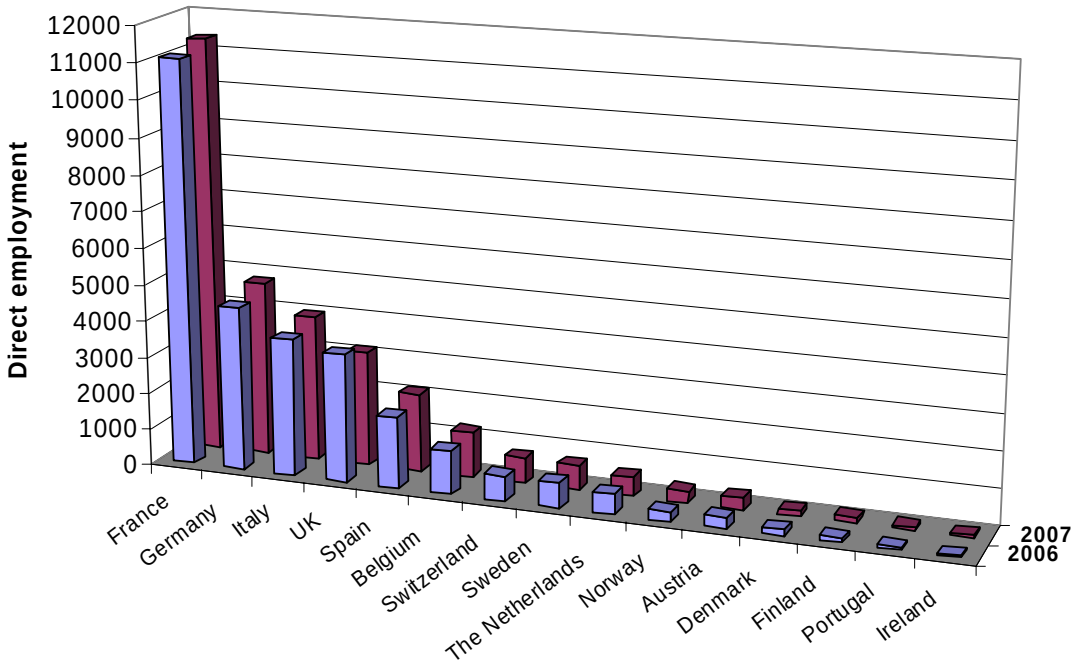

Figure 40 Space industry direct employment in 2006 and 2007 (adapted from Eurospace)[238]

5.6.2 State of the United States' space industry

According to the latest results of the U.S. Aerospace Industry Association (AIA), the total sales of the U.S. Aerospace Industry were approximately 199 billion U.S. dollars in 2007 (up by 8% from 2006), with 108 billion U.S. dollars coming from aircrafts sales (53.3 billion U.S. dollars for civilian aircrafts and 54.8 billion U.S. dollars for military aircrafts). The major sources of sales for the U.S. aerospace industry in 2007 were in direct aerospace products and sales with about 165.018 billion U.S. dollars compared to 33.7 billion U.S. dollars in related products and services. The total space-related sales reached an estimated 39.1 billion U.S. dollars in 2007, up from 38.5 billion U.S. dollars in 2006.

[237] Ibid.
[238] Ibid.

	1999	2002	2004	2006
Economic activity (in millions U.S. dollars)	61 313.711	95 025.746	98 086.960	13 962.027
Earnings (in millions U.S. dollars)	16 431.192	23 527.745	25 045.888	35 659.935
Jobs	497 350	576 450	551 350	729 240

Table 6 Total impacts on the U.S. economy generated by commercial space transportation and enabled industries in 1999, 2002, 2004 and 2006 (source FAA)[239]

Space-related sales therefore represented about 20% of the overall U.S. aerospace industry sales in 2007. The main U.S. space industry customers in 2007 were, like in 2006, institutional customers (DoD, NASA and other agencies). While the aerospace balance of trade estimated by the AIA was positive in 2007 (+ 56.465 billion U.S. dollars), most of the sales of the U.S. space industry are limited to the United States and only a fraction of its space sales are generated by exports.

Based on the latest results of the Federal Aviation Administration (FAA) study on "The economic impact of commercial space transportation on the U.S. economy" released in April 2008, commercial space transportation and enabled industries (including all other space sector activities) were responsible for a total of about 139.3 billion U.S. dollars in economic activity in 2006. They represented also about 35.7 billion U.S. dollars in earnings (salary and wages) and supported 729 240 jobs throughout the U.S. economy. All three impact measures increased in 2006 compared to 2004 (Table 6). During the 1999-2006 period, the total economic activity impact of commercial space transportation and enabled industries increased by 127%, earnings by 117% and the number of jobs supported rose by about 47% (Table 6).

Of the 139.3 billion U.S. dollars in economic activity generated by commercial space transportation and enabled industries, 88.4 billion U.S. dollars were generated by satellite services and 38.6 billion U.S. dollars by the ground equipment manufacturing sector in 2006 (Figure 41). The top two revenues contributors represented 91% of all revenues.

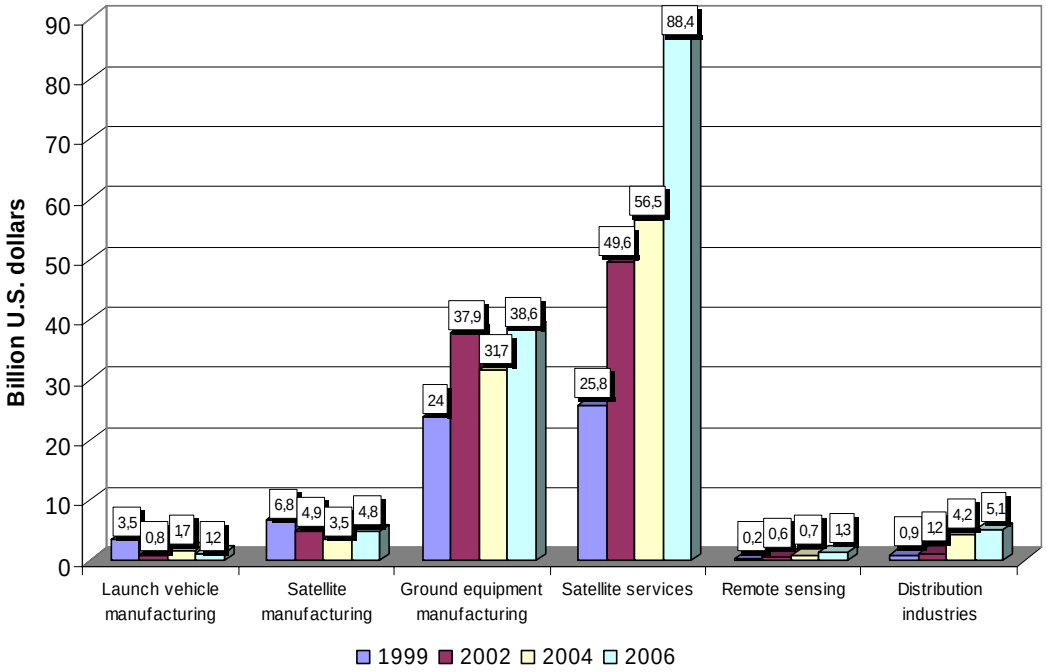

Figure 41 Total economic activity impacts on the U.S. economy of commercial space transportation and enabled industries in 1999, 2002, 2004 and 2006 (adapted from FAA)[240]

[239] Federal Aviation Administration. "The economic impact of commercial space transportation on the U.S. economy." Apr. 2008.

[240] Federal Aviation Administration. "The economic impact of commercial space transportation on the U.S. economy." Apr. 2008.

Launch vehicle manufacturing and services generated 1.2 billion U.S. dollars and the satellite manufacturing sector about 4.8 billion U.S. dollars of economic activity in 2006 (Figure 41). When comparing with previous years, some industry segments have performed better than others. In particular, the satellite services generated most of the growth in economic impact and increased the most, while the economic impact of the launch manufacturing sector diminished from 2004 to 2006 (Figure 41). Satellite services have been the largest space industry segment since 1999 and have demonstrated a steady growth over the seven-year period.[241] Its share in economic activity impacts grew from 42.1% to 63.5% from 1999 to 2006 (Figure 41). In the meantime the manufacturing component of the U.S. industry (launch vehicle, satellites and ground equipment) diminished from an agglomerated level of 56.1% in 1999 to 32% in 2006 (Figure 41).

As aforementioned, in 2006, a total impact on the U.S. economy of 139.3 billion U.S. dollars was generated by commercial space transportation and enabled industries. An estimated 23.24 billion U.S. dollars in direct impacts of economic activity was generated, 65.03 billion U.S. dollars of indirect impacts, and 50.99 billion U.S. dollars of induced impacts (Figure 42).[242]

When comparing the total employment impacts on the U.S. economy resulting from space activities between 1999 and 2006, a significant increase in impacts is revealed. In particular, there was an increase from 497 350 in 1999 to 729 000 jobs in 2006 (those numbers cover not only the space industry but all affected industries). Satellite services are the main job providers (65%) followed by ground equipment manufacturing (25%) (Figure 43). In 2006, the other four segments only represented an impact on the U.S. economy of 71 000 jobs (10% of all jobs supported within all industries). The only sector that witnessed a decline in employment impact from 2004 to 2006 is the launch vehicle manufacturing industry (Figure 43).

When looking at the employment of the satellite industry, according to SIA/Futron there were 268 411 direct space-related jobs in the United States in 2006 (Table 7). Ground equipment was the largest contributor (46%) followed by the launch industry (29%).

Satellite industry sector	Estimated U.S. Personnel
Satellite services	49 423
Satellite manufacturing	16 184
Launch industry	78 762
Ground equipment	124 042
Total estimated U.S. Employees	**268 411**

Table 7 Estimated U.S. personnel in 2006 (source SIA/Futron)

5.7 Sectoral overview

A sectoral analysis allows the appraisal of the latest developments of the main segments and markets of the space sector. Because of the strong link between the launch sector and satellite industries, neither can prosper without the other, and consequently, each must take the other's overall business health into consideration. The launch sector requires a steady stream of payloads and both satellite manufacturers and satellite operators need consistent access to launch services. In this context, to assess the overall state of the space industry three segments need to be appraised: the launch sector, the satellite manufacturing segment and satellite operators.

5.7.1 Launch sector

The launch sector is an enabler of other industries rather than a significant economic activity (Cf. Chapter 2). However, reliable access to space and affordable commercial launches are essential for maintaining existing satellites services markets.

The following definitions apply to the launch sector analysis. [243] A commercial orbital launch is defined as a primary payload for which the contract was internationally competed (the launch opportunity was available in principle to any capable launch

[241] Most satellite services revenues growth is due to DTH (Cf. Chapter 2).

[242] According to the FAA, direct impacts are the expenditures on inputs and labor involved in providing any final good or service relating to the industries analyzed. Indirect impacts involve the purchases (e.g., metals, composite materials, processors) made by and labor supplied by the industries providing inputs to the launch and enabled industries. Induced impacts are the successive rounds of increased household spending resulting from the direct and indirect impacts (e.g., a spacecraft solar array design engineer's spending on food, clothes dry-cleaning, or any other household good and service).

[243] Several differences can be observed when comparing the following results with other studies due to methodological discrepancies.

services provider) and/or the launch is privately financed without government support. Finally, launches are attributed to the country in which the main vehicle manufacturer is based, except in the case of Sea Launch which is designed as multinational.[244] However, no distinction has been made between the Ukrainian and Russian launch systems as major shareholders in most Ukrainian launch providers, as well as launch manufacturers, are Russian.

2007 results

2007 was a particularly active year for the launch sector. Launch providers from Russia, the United States, China, Europe, India, Japan, Israel and the multinational consortium Sea Launch, conducted a total of 68 launches compared to 66 launches from six countries plus Sea Launch in 2006. Three of those 68 worldwide orbital launches failed, two commercial launches and one non-commercial launch.

When comparing the level of activity country-by-country, Russia was, like in 2006, the world leader according to the launch rate criterion with a share of about 39% of all launches (26 launches). It was followed by the United States (about 28%) (Figure 44). China completed the podium with an about 15% market share of all launches conducted in 2007. [245] Europe followed with approximately 9% of market shares, India with about 4%, Japan 3% and finally Sea Launch and Israel both had a 1.5% share of all launches conducted last year (Figure 44). When added up, Europe had six launches compared to 15 for Asia.[246]

Twenty six Russian vehicles were launched in 2007 using eight different systems (Table 8). American launch vehicles carried 19 launches using seven different launchers. China used three launch vehicle systems to perform its ten launches. Europe conducted six launches in 2007, all with Ariane 5. India used two systems (PSLV and GSLV) for its three launches. All the other actors used only one system (Table 8).

Four actors launched the overwhelming majority of mass in orbit in 2007. Russia launched an estimated 34% of the total mass launched, followed by the United States with almost 32% (Figure 45). Europe completed the podium, with about 18% of the total mass in orbit being launched by European launchers (Ariane 5) (Figure 45). China conducted ten launches in 2007 (15%), but this represented only 10.3% of the total payload mass launched worldwide (Figure 45). The four other actors launched an agglomerated 6% of the mass launched worldwide last year compared to a combined 10.3% of all launches performed (Figure 45).

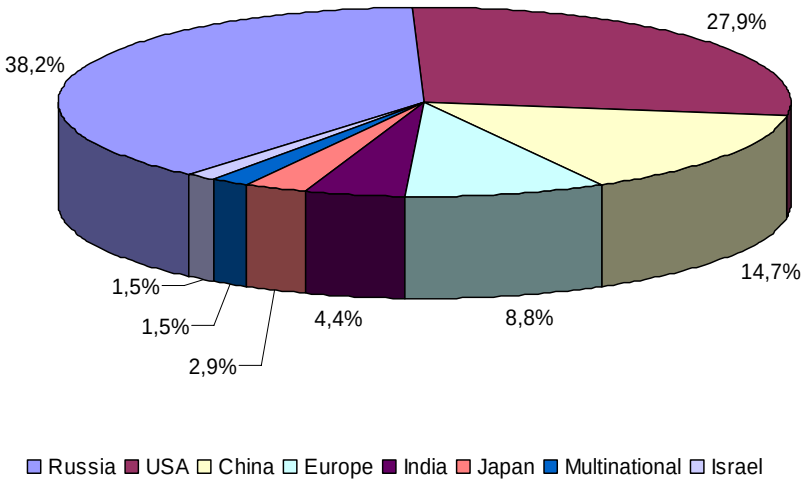

Figure 44 Worldwide launches by country/entity in 2007

[244] Boeing is the majority shareholder (40%) of Sea Launch. Other partners include S. P. Korolev Rocket and Space Corporation Energia of Russia (25%), Aker ASA of Norway (20%), and SDO Yuzhnoye/NPO Yuzhmash of Ukraine (15%).

[245] China conducted ten launches without including the ASAT test in 2007.

[246] In 2008, South Korea should launch its first indigenous rocket (KSLV-1) from the Naro Space Centre.

	Number of launch systems used	Total number of launches
Russia	8	26
USA	7	19
China	3	10
Europe	1	6
India	2	3
Japan	1	2
Multinational	1	1
Israel	1	1
Total	**24**	**68**

Table 8 Worldwide launches per country/entity and launch systems in 2007

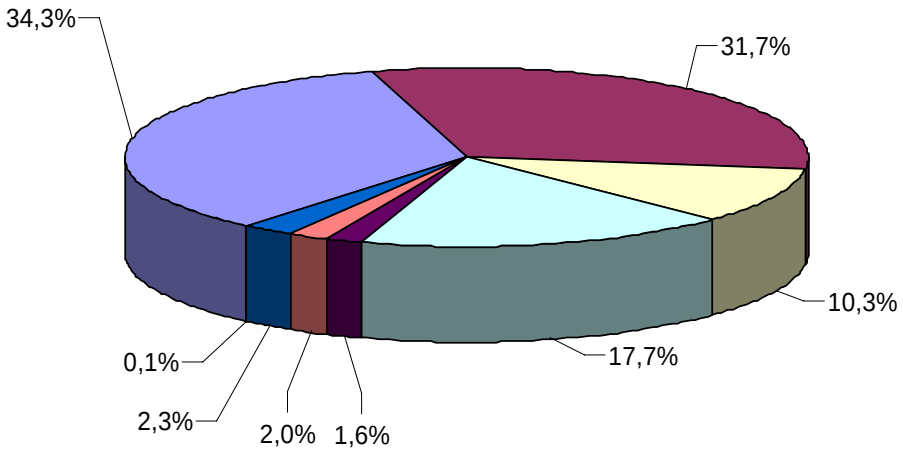

Figure 45 Total mass of payloads launched per country/entity in 2007

About 255 metric-tons were launched in space in 2007 with 66% being non-commercial and 34% commercial. Russia, in 2007, launched an estimated 89 tons into orbit including 30 tons of commercial payloads. The United States followed with about 80 tons launched, including six tons of commercial payloads (Figure 46). Europe led the amount of commercial mass launched with 44 tons, more than all the other commercial launches in 2007 (41 tons) (Figure 46). China launched 25 tons into orbit. Finally, regarding Sea Launch, Japan, India and Israel launched an aggregated 15.26 tons into orbit in 2007 (Figure 46).

Only five actors performed commercial launches in 2007, while six actors performed non-commercial launches, illustrating the different strategies among actors in the domain. Commercial launches are particularly important for Russia, Europe and Sea Launch (Table 9). By contrast, U.S. launch service providers continued to focus heavily on the lucrative governmental market which provides them with a robust source of income. Finally, China, Japan and Israel focused only on non-commercial launches (Table 9). However, a new trend emerged last year: the entry of India in the commercial launch sector when it performed its first commercial launch in 2007 successfully putting the Italian satellite, Agile, into orbit.[247]

The 23 commercial orbital launches which occurred in 2007 represented about 33% of total launches of the year, similar to last year's level (21 commercial launches out of a total of 66 launches). Russian-built vehicles

[247] U.S. export regulations are an issue for launching more international commercial payloads with Indian launchers, as India has not signed the nuclear Non-Proliferation Treaty. However, the relationship between the two countries is improving.

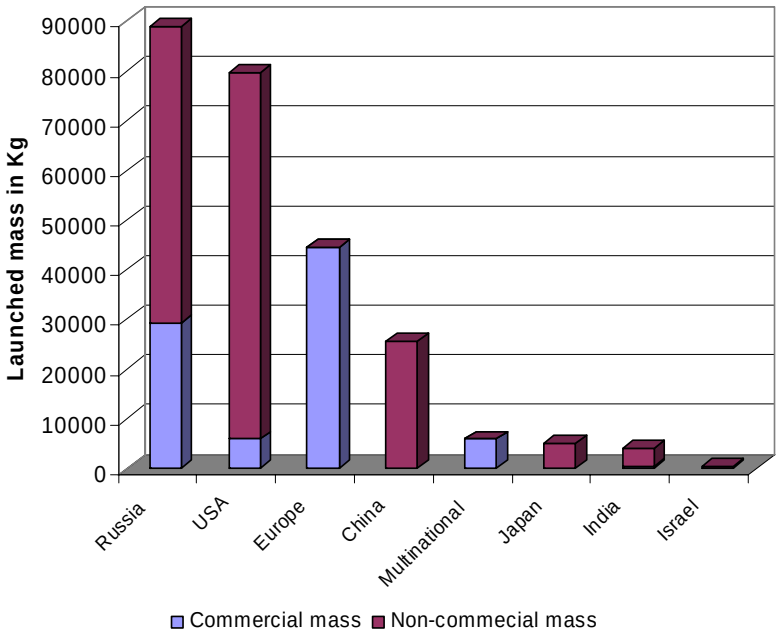

Figure 46 Estimate of the mass launched per country/entity and commercial status in 2007

Launchers	Commercial	Non-Commercial	Number of Launches
Russia	12	14	26
USA	3	16	19
China	0	10	10
Europe	6	0	6
India	1	2	3
Japan	0	2	2
Multinational	1	0	1
Israel	0	1	1
Total	**23**	**45**	**68**

Table 9 Worldwide orbital events per country/entity in 2007

conducted 12 commercial launches in 2007, accounting for an estimated 53% of the market (Figure 47). Europe conducted six commercial launches capturing 26% of the worldwide commercial market share (Figure 47). The United States conducted only three commercial launches, representing 13% of the global commercial launch market (Figure 47). Finally, both Sea Launch and India had one commercial launch (4% market share each).

When looking at the performance of commercial launch services providers, Europe posted solid results in 2007. In the same year, 22 payloads to be launched were accessible to Arianespace.[248] Those payloads were mainly devoted to communications (17 payloads), Earth observation and technology (four payloads), and science and exploration (1 payload). Ariane 5 launched 55% of the total accessible number of payloads and 71% of the total of number of payloads launched to GEO, followed by ILS with 24% of the payload launched to GEO and Sea Launch with 6%. However, when looking at payloads accessible to Arianespace in non-geostationary orbit, none of the five payloads accessible were launched with an Ariane 5. One payload was launched with a Soyuz, one with a PSL, one with a Delta-2, and 2 payloads were launched with Dnepr rockets.

When looking at the commercial mass launched per launch service provider, Arianespace dominated with 64% of the total commercial mass launched to Geostationary transfer orbit (GTO) in 2007. ILS launched about 27% of the total commercial mass launched to GTO and Sea Launch 9% (Figure 48). For non-GTO, Boeing launched 35% of the total commercial mass launched followed by Starsem (34%) or about six metric tons each. Kosmotras and AKO Polyot launched

[248] The market accessible to Arianespace as defined by ESA regroups the payloads for which the launch was competed and the European payloads for which the launch was not competed.

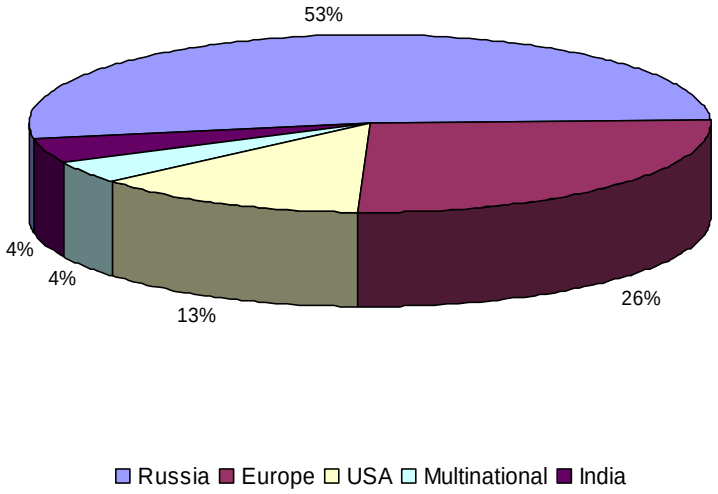

Figure 47 Worldwide commercial market shares per country/entity in 2007

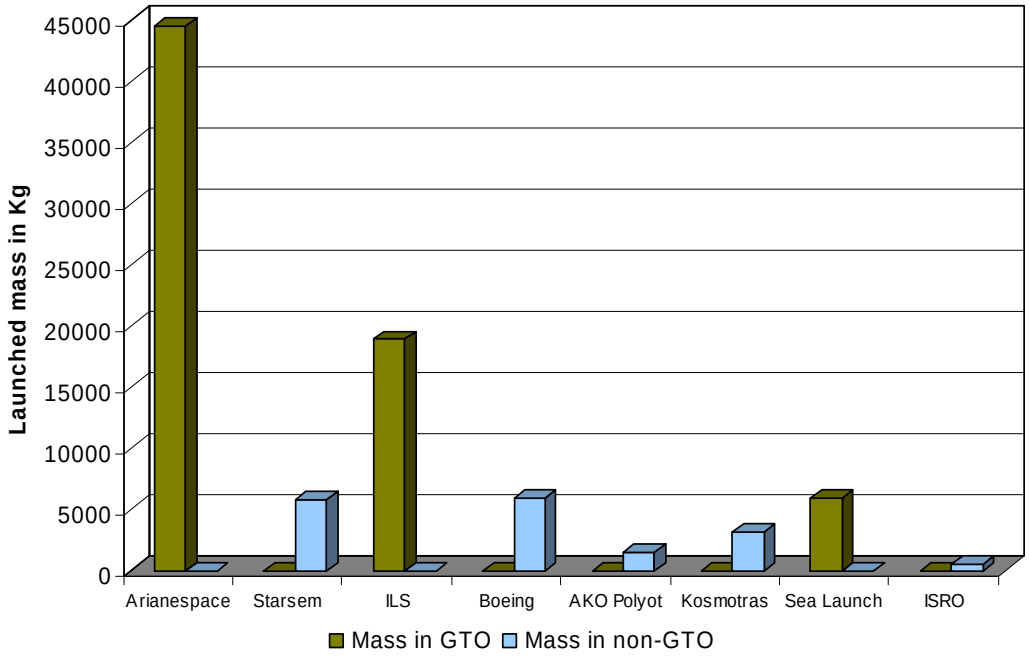

Figure 48 Estimate of the commercial mass launched per launch services providers per orbits in 2007

19% and 9% respectively of the commercial mass to non-GTO (Figure 48).

Launch contracts awarded in 2007

An estimated 37 contracts for geostationary communications satellites were signed in 2007.[249] The main actors in this domain were Arianespace, International Launch Services (ILS) and Sea Launch (Figure 49).[250]

In 2007, Arianespace confirmed its position as the dominant commercial launch service provider. Six successful Ariane 5 launches were performed from Kourou as well as three Soyuz launches from the Baikonur Cosmodrome. In total, 21 payloads were put into orbit by Arianespace in 2007. In particular, Arianespace launched 12 of the 15 commercial communications satellites launched into GEO; it orbited three satellites originally planned for competitor's launchers as well. Its subsidiary, Starsem, conducted

[249] This total includes the two 5-satellite framework contract signed by both Arianespace and ILS with SES.

[250] Boeing is the majority shareholder (40%) of Sea Launch. Other partners include S. P. Korolev Rocket and Space Corporation Energia of Russia (25%), Aker ASA of Norway (20%), and SDO Yuzhnoye/NPO Yuzhmash of Ukraine (15%).

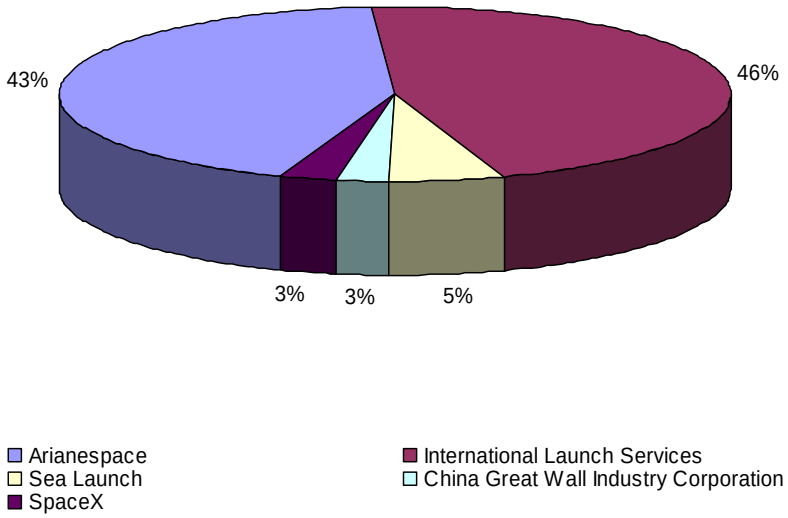

Figure 49 Worldwide shares of GEO orders signed per launch services providers in 2007

three successful launches orbiting nine satellites (eight satellites for the Globalstar constellation as well as the Radarsat-2 satellite).

In 2007, Arianespace won 13 new "Service and Solutions" contracts for launches into geostationary orbit and two contracts to orbit 24 satellites for the Globalstar constellation for four Soyuz launches, as well as four Elisa (ELectronic Intelligence by SAtellite) satellites which will be launched as auxiliary passengers on the launch of the first Pleiades satellite in late 2009. Due to its dense launch order book, seven to eight Ariane 5 are planned to be launched in 2008, including the first Automated Transfer Vehicle (ATV) "Jules Verne" launched on 9 March 2008. The same launch rate is expected for 2009 by which time Soyuz and Vega will start commercial services from the CSG. [251] In June 2008, Ariane 5 recorded its 25th straight launch success.

While ILS planned to launch up to six satellites in 2007 pending satellite delivery schedules, it only launched three satellites successfully last year (Anik F3, Direct TV and SIRIUS-4). This limited number of launches was due to the fact that ILS suffered a launch failure on 6 September 2007 (JCSAT-11) due to damaged wiring harness. ILS's launcher, the Proton launch vehicle, was consequently grounded for almost two months in the fall of 2007.

In its first year as an independent company marketing to commercial satellite operators the Proton Breeze M vehicle from the Baikonur Cosmodrome, [252] ILS signed 17 launches including a five-launch agreement with SES. [253] ILS reportedly received 1.5 billion U.S dollars in new launch orders in 2007 and was expected to conduct seven to eight missions in 2008 and in 2009. However, an anomaly on 15 March 2008 left an SES Americom AMC-14 spacecraft in an incorrect orbit when the Proton's Breeze M upper stage shut down prematurely. [254] This incident might hurt ILS business in 2008 as the Proton was grounded again for an extensive amount of time, barely three months after its return to service.

In 2007, Sea Launch conducted only one launch. This launch was unsuccessful and resulted in the loss of the NSS-8 satellite for SES New Skies on 30 January 2007. Consequently, the 25th mission of Sea Launch was delayed for almost a year until 15 January 2008 due also to satellite delays, as well as difficult conditions in the Pacific Ocean. As a result of this accident, Sea Launch entered into an agreement with the satellite operator SES which owns SES New

[251] Arianespace will act as launch services operator of the Vega launcher for five consecutive launches following the qualification flight within the framework of the Vega Research and Technology Accompaniment (VERTA) programme decided at the 2005 ESA Council Meeting at Ministerial Level.

[252] ILS expects to inaugurate a second commercial Proton-M launch pad at the Baikonur Cosmodrome in 2008.

[253] Arianespace that has been awarded the same type of contract by SES put only 2 satellites of its contract in its 2007 order book.

[254] After studying potential options to raise the satellite's orbit and get some useful life out of the spacecraft, SES Americom declared the satellite a total loss and filed a claim with insurers. AMC-14 will not be replaced and the contract between SES and EchoStar for the satellite has been cancelled. The satellite was subsequently sold to the U.S. Department of Defence.

Skies to use the land launch (using a Zenit-3SLB vehicle) initially slated to launch the AMC-21 commercial satellite for the launch of another satellite for the SES group. [255] Land Launch, which is a joint venture of Boeing-led Sea Launch and Space International Services entered into service on 28 April 2008 with the successful launch of Amos 3.

Sea Launch signed two contracts in 2007 compared to five satellites orders in 2006, and expects to conduct five missions in 2008.[256]

A newcomer in the commercial launch services provider market is China Great Wall Industry Corporation (CGWIC) which signed one contract to launch communications satellite to GEO in 2007. The Palapa-D communications satellites for PT Indosat, to be built by Thales Alenia Space, will be launched in late 2009 aboard a Chinese Long March 3 B rocket.[257] China's Long March is currently barred from launching satellites with critical U.S. components. It can only launch a limited number of payloads. However, a continuing supply shortage may help it to gain market share in the open market.

Finally, Space Exploration Technologies Corporation (SpaceX) which is developing the Falcon series of launch vehicles (Falcon 1, 5 and 9) signed a contract with the UK-based Avanti Communications Group (Avanti) in 2007 for the launch of Avanti's HYLAS satellite to GTO on board a SpaceX Falcon 9.[258] Up to three additional satellite launches are included in the contract signed on 14 September 2007.

Despite the successful year in terms of orders, with launch failures occurring at two of the three principal commercial launch services providers in 2007 (Sea Launch and ILS), there is now more pressure on the launch services providers with respect to their agenda for 2008, as there are no alternative near-term launch options. Moreover, in a tight market, the recent failure of Proton M breeze (the third in two years), as well as the Zenit 3SL failure in early 2007 are raising questions about systemic problems affecting Russian-Ukrainian launchers. Those difficulties for Sea Launch and ILS have consequently led Arianespace to take the lion's share of the orders of launch contracts for commercial geostationary-orbit satellites in 2007. It is, however, of vital importance to ensure the reliability of Arianespace's fleet to secure continued commercial success as new players are entering the market.

In this context of shortage of reliable access to space, 2007 saw a continuing trend of price increases in the launch sector, partially due to higher costs of raw materials and production (particularly in Russia and Ukraine). A spike in helium prices is also hitting the launch systems industry due to an increase in gas prices as the users of helium increase, particularly, for scientific research to make, for instance, semiconductors, flat-panel displays, fibre optics etc. Consequently, prices for launch providers have now almost returned to the level similar to the one prior to the satellite market collapse a decade ago. Furthermore, with the satellite orders expected to remain strong in the immediate future, there might be a shortage of available launch slots which could lead to higher prices. However, a continuing supply shortage could help China's Long March to return to the open commercial market as well as Boeing's Delta 4 and Lockheed Martin's Atlas V. Japan's Mitsubishi Heavy Industries (MHI) that markets the H-2A rocket also expects to win its first commercial satellite to be launched by 2009, [259] and India is confirming its entry in the sector.

A new emerging trend in the commercial launch sector is the framework contract signed in June 2007 by SES separately with both ILS and Arianespace for a batch of five slots to launch SES satellites on ILS' Proton Breeze M vehicles, and Arianespace's Ariane 5 and Soyuz launchers between 2009 and 2013. The flights will be available to SES operating companies (SES Americom, SES Astra, SES New Skies and SES Sirius). This innovative multi-buy contract gives SES flexibility in terms of matching payloads and launch periods to meet its future deployment needs. These multi-launch agreements ensure, in particular, that each SES satellite will have a primary as well as a back-up vehicle each with two launch slots. Those agreements reportedly grant attractive terms and conditions for SES[260] but represent the

[255] AMC-21 is now planned to be launched by Arianespace onboard an Ariane 5.
[256] Due to logistical constraints linked to the length of the voyage of the Pacific Ocean floating platform, Sea Launch is limited to 6 launches in a given year.
[257] Thales Alenia Space has developed a product line (Spacebus 4000) that is devoid of U.S. parts that require U.S. State Department export approval (so-called ITAR-free platform).
[258] Of the seven Falcon 9 launches this is the first commercial geostationary order.
[259] MHI was chosen by the Japanese government in 2002 to operate the H-2 fleet following the privatisation of the project. H-2A launches have all been institutional ones
[260] Financial details were not disclosed by SES, ILS or Arianespace.

largest single launch services contract for both Arianespace and ILS, however, with lower price for each launch.

5.7.2 Satellite manufacturing sector

Space-based communications is the most mature market of all space applications and constitutes the core business for the satellite manufacturers (Cf. Chapter 2). The health of the commercial satellite communications market thus determines to a great extent the sustainability of the space industry. However, the definition of what constitutes a commercial satellite, or even what constitutes a new satellite remain subject to debate and can lead to major differences in the results obtained by different studies. Nonetheless, a look at the satellite manufacturing market share of the geostationary communications satellites ordered for a particular year is a good proxy to assess the vitality of a domestic space industry, as it reflects its competitiveness in the most lucrative segment of the satellite manufacturing market.

2007 results

A total of 115 payloads were launched in 2007,[261] (compared to 101 in 2006) with 27% being commercial (compared to 23% in 2006).

The United States was the leader in the number of payloads manufactured and launched in 2007, with about 38% of all payloads launched (Figure 50). Russia manufactured about 15% of all payloads launched, followed by Europe which manufactured 12 payloads launched in 2007 (Figure 50). China had an 8% share of payloads launched (Figure 50).

Out of the 27 commercial payloads launched in 2007, 14 aimed at geostationary orbit and 13 at other orbits. When looking at the performances per satellite manufacturer, Space Systems/Loral (SS/L) was particularly active in 2007 as well as Lockheed Martin with eight and seven payloads respectively manufactured launched in 2007 (Figure 51). They were followed by Boeing with six payloads (Figure 51).

In the domain of commercial satellite manufactured, the United States was the leader with nine U.S.-built satellites launched into geostationary orbit (64% of market shares). Europe had about 29% market shares of all commercial satellites manufactured with three satellites built by Thales Alenia Space and one by EADS Astrium. In 2007, China manufactured a commercial satellite confirming its increasing involvement in the domain.

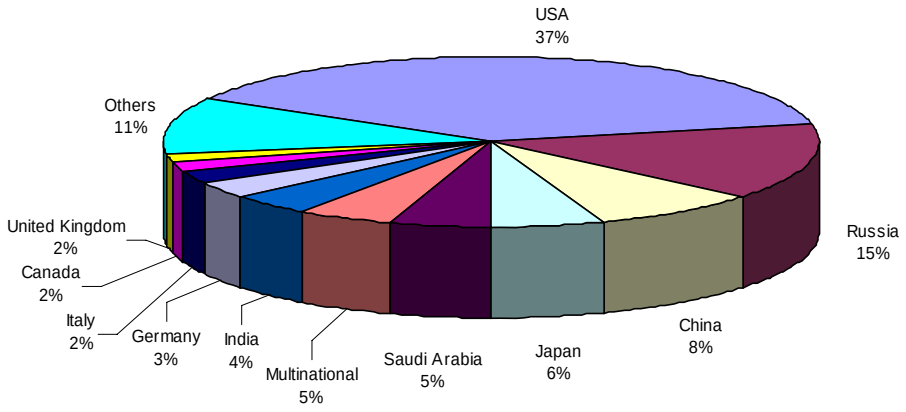

Figure 50 Estimated shares of missions launched in 2007 per country/entity[262]

[261] When including human spaceflight payloads and the failures, a total of 123 payloads were launched in 2007.
[262] The "others category" is made of Argentina, Australia, China/Brazil, Colombia, Egypt, ESA, Indonesia, Israel, Luxembourg, Nigeria, Sweden and USA/Italy. Each launched one spacecraft into space in 2007.

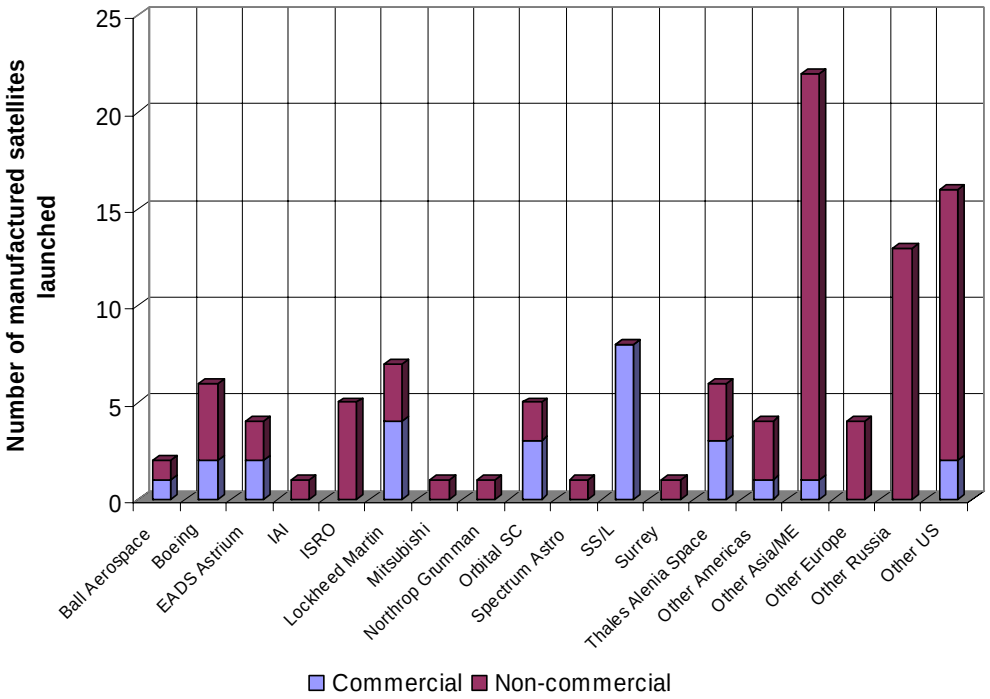

Figure 51 Satellites launched in 2007 per manufacturer and commercial status
(Source Futron)

Satellite contracts awarded in 2007

2007 was a solid year in terms of orders. High-definition television and satellite mobile communications continued to drive the core of the new orders. According to company announcements and industry officials, 25 firm geostationary-orbiting communications satellites were ordered in 2007.

The U.S. manufacturers won, in 2007, 14 contracts for geostationary communications satellites, 11 being commercial (Table 10). Europe followed with eight contracts, all commercial ones. China won two contracts and Israel one (Table 10).

In 2007, 20 commercial GEO communications satellites were ordered. Orbital Sciences Corp (OSC) was the leader with five orders, four being domestic (Figure 52). SS/L had four firm orders, 75% being domestic. The European "primes" (EADS Astrium, Thales Alenia Space) together had eight firm orders with five orders coming from outside Europe demonstrating the competitiveness of their products and services (Figure 52). Despite the entry of new actors from the "South" in this market, European and U.S. companies are still the leaders of the commercial satellite manufacturing market.

Last year, five GEO non-commercial communications satellites were ordered, with three orders from the United States and two from China (Figure 53). Like in 2006, no single manufacturer was able to win a non-commercial GEO communications satellite outside its captive domestic market.

In 2007, OSC was the overall world leader in terms of GEO communications satellites orders with five orders; it was followed by SS/L and Boeing both with four orders (Figure 54). Thales Alenia Space had seven orders, but this total includes five satellites to

Companies from countries having won contracts	Commercial	Non-commercial
USA	11	3
Europe	8	0
Israel	1	0
China	0	2
Total	**20**	**5**

Table 10 Total firm GEO communication satellite orders in 2007 per country/entity

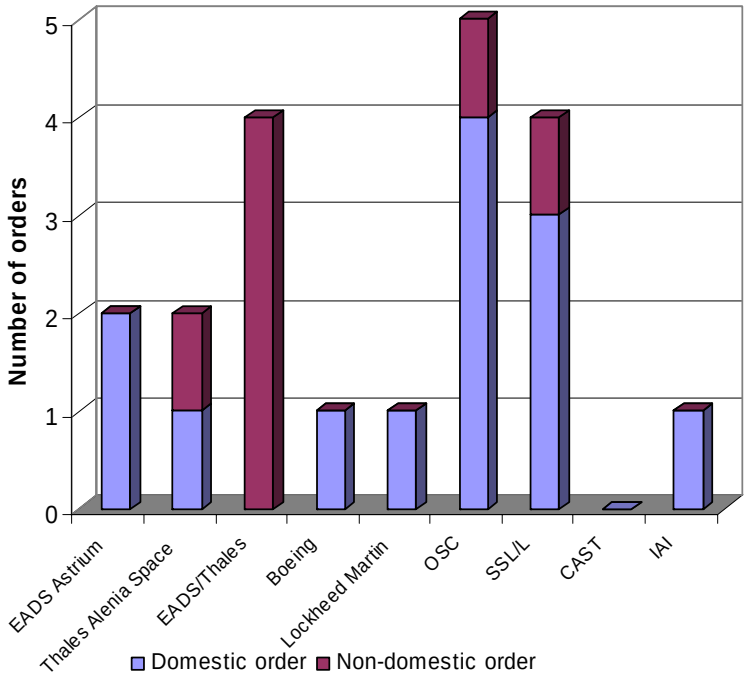

Figure 52 Commercial GEO satellite orders in 2007 per manufacturers

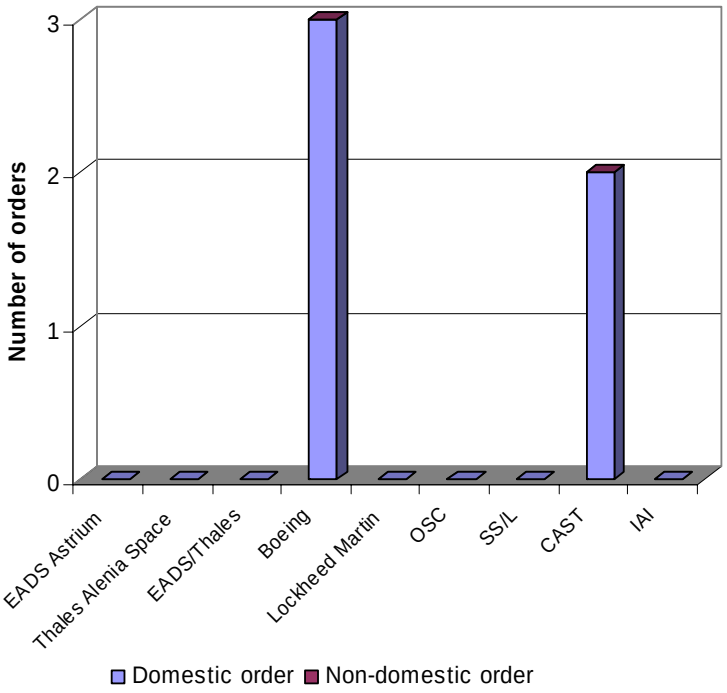

Figure 53 Non-commercial GEO satellite orders in 2007 per manufacturers

be developed by EADS as co-prime. EADS had six orders (including five satellites to be developed jointly with Thales Alenia Space) (Figure 54). Finally, Lockheed Martin, CAST and IAI had four orders in total last year. In 2007, the continuing trend witnessed in recent years continued as the two-largest space hardware manufacturer Boeing and Lockheed Martin were not very active in the commercial market (only one order each), focusing their efforts on the U.S. governmental market.

It is expected that strong demand for Mobile Satellite Services (MSS) applications as well as broadband and broadcasting services will drive the market in the coming years. However, unlike satellite operators and launch providers, satellite manufacturers have continued to be hurt from downward price pressure. The satellite manufacturing industry has suffered from substantial overcapacity worldwide for a number of years, resulting not only in extreme competitive pressure on pricing terms and

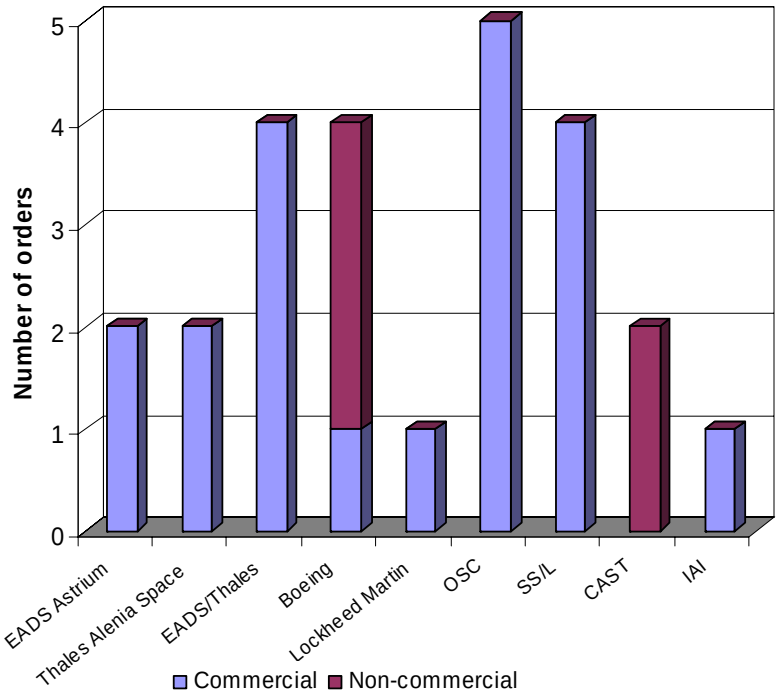

Figure 54 GEO commercial and non-commercial satellite orders won in 2006 per satellite manufacturers

other material contractual terms, but also on the allocation of risks between the manufacturer and its customers. Buyers, as a result, have had the advantage over suppliers in negotiating prices, terms and condition resulting in reduced margins. The recent trend of industry consolidation has resulted in the formation of satellite operators with greater satellite resources and increased coverage consequently leading to reduced demand for new satellite construction due to a rationalisation of the capacity available in certain geographic regions. Furthermore, it has also resulted in the increasing "bargaining power" in the hand of large customers which could increase pressure on pricing and other contractual terms.[263]

In this overall context, EADS and Thales Alenia Space were particularly successful in 2007 in gaining orders outside the European market, demonstrating the competitiveness of Europe's industry. However, the performance of European manufacturers is dependent on their abilities to generate a sustainable order rate and to continue to increase their backlog. Moreover, the increasingly unfavourable dollar-euro exchange rate may erode the future market share of European manufacturers, as most prices are fixed in U.S. dollars and the costs are in euros. A potential solution for European manufacturers is therefore to increase purchases in the dollar zone and low-cost countries, and expand cooperation with manufacturers in emerging markets. However, while European manufacturers benefit from current U.S. legislation (as U.S. satellite manufacturers must contend with export control regulations which put them at a relative disadvantage when competing on the open commercial market), increasing competition from emerging low-cost competitors from India, Russia and China is expected in the near future.

5.7.3 Satellite operators

Space-based communications in 2007 continued to be a major source of revenues for the space industry (Cf. Chapter 2). The economic activity generated by satellite services goes well beyond the segment considered. The most established sector of the satellite industry is the Fixed Satellite Services (FSS) sector made up of operators which lease the capacity of their GEO satellites for voice and data communications to commercial and governmental customers.[264] The FSS segment is therefore one of the main drivers of the space industry, both for the satellite manufacturing segment and for launch services.

[263] For instance, the satellite-fleet operator SES Global signed an agreement in May 2007 with OSC that calls for four or five communications satellites to be delivered at a rate of one per year starting in late 2009 as part of SES fleet expansion.

[264] Television is the principal driver for growth in this segment.

In 2007, according to Space News, the hierarchy of the Top FSS operators evolved with SES taking the first place in front of Intelsat and Eutelsat (Table 11). Behind this trio, there is an important quantitative gap with other FSS operators having only between three and twelve satellites in orbit compared to 37 for SES, 54 for Intelsat and 24 for Eutelsat (Table 11). With the purchase by Loral Skynet of Telesat Canada, Telesat has now confirmed its position as the world's fourth-largest satellite fleet owner (Table 11).

The Top 3 FSS operators generated 64% of all revenues generated by the FSS operators in 2007 (5.81 billion U.S. dollars), 52% of all satellites in orbits and 38% of the satellites on order (Table 11).

Asia now has ten operators in the Top 25, followed by Europe with seven operators and North America with three. With the mergers and consolidations which occurred in spring 2008, the hierarchy is expected to change next year. The strong performance of European actors in this sector has however to be stressed and demonstrates the competitiveness of the European space industry.

Rank	Company	Country	2007 revenue in million U.S. dollars	Satellites in orbit	Satellites on Order
1	SES	Luxembourg	2370	37*	9*
2	Intelsat	Bermuda/USA	2200	54*	4*
3	Eutelsat	France	1240	24*	6
4	Telesat Canada	Canada	684.7	12	3
5	JSAT Corp.	Japan	347.4	8*	3*
6	Star One	Brazil	207.4	7*	0
7	Hispasat	Spain	188.6	3	1
8	Singtel Optus	Australia	172.2	4	1
9	Russian Satellite Communications Co.	Russia	161	11	3
10	Space Communications Corp.	Japan	151.4	4	1

Table 11 Top 10 FSS operators in 2007 (adapted from Space News)[265]
* Includes co-owned satellites

[265] "Top Fixed Satellite Service Operators." Space News 19.26 (30 June 2008): 12.

Chapter 6 - The defence perspective

Space assets are increasingly being recognised as a central element of modern armed forces. [266] In 2007/2008, the militarisation of outer space broadened, as a growing number of countries, and not only the six space powers (Cf. Chapter 3), are committing efforts to obtain dedicated military systems (be it reconnaissance and communications satellites), or "multi-purpose assets" particularly in the field of Earth observation. Furthermore, civilian capacities are increasingly being used by military stakeholders, particularly civilian communications bandwidths or commercial imagery.

Any analysis of governmental activities in the space security field is limited by the public information available. The classified nature of many of the existing systems and the absence of details for some of the known programmes complicates attempts to provide accurate depictions of the level of efforts made by various stakeholders. The data and analysis presented in this section should therefore be regarded as descriptive of general trends.

6.1 Recent trends in military expenditure

According to the Stockholm International Peace Research Institute (SIPRI) global military spending reached an estimated 1339 billion U.S. dollars in 2007, which is a 135 billion U.S. dollars increase compared to 2006, and a 45% increase since 1998.[267] The combination of rising world market prices of natural resources and particularly of minerals and fossil fuels aided the upward military spending trend. Other factors like countries' foreign policy objectives, participation in multilateral peacekeeping operations and existing threats explain this increase.

World military expenditures, like the space sector, are unevenly distributed between regions and countries, with the Top 15 countries having the highest military spending accounting to about 83% of the world total in 2007 (Table 12). The Americas is the region having the biggest military expenditure followed distantly by Europe, Asia and Oceania. The United States is the biggest spender on military items and accounts for 45% of the world total, followed by the United Kingdom, China, France and Japan with 4 to 5% each (Table 12). Despite the overall stability compared to 2006, certain modifications to the Top 15 from previous years need to be underlined. While the United States is still, by far, the biggest spender, China has now overtaken France in the third position; Saudi Arabia has done the same with Italy in the eighth position. Brazil also climbed in the hierarchy from the 14th to the 12th position overtaking Australia and Canada. Brazil is now the second-ranking military spender in the Americas (Table 12)

Rank	Country	World Spending Share (%)
1	USA	45
2	UK	5
3	China	5
4	France	4
5	Japan	4
6	Germany	3
7	Russia	3
8	Saudi Arabia	3
9	Italy	3
10	India	2
11	South Korea	2
12	Brazil	1
13	Canada	1
14	Australia	1
15	Spain	1
Other countries		17

Table 12 World defence expenditure per country in 2007 (Source SIPRI)

6.2 Global space military context

Like the world military expenditures, spending on military space activities are very unevenly distributed between countries. Only

[266] The terms "military" and "security" are used interchangeably in the text as beyond semantic differences the use of space assets for military or security purposes overlap considerably.

[267] Stockholm International Peace Research Institute. "Yearbook 2008: Armaments, Disarmament and International Security" Executive Summary. 9 June 2008: 11.

a limited number of countries invest a substantial amount of money in military space activities.[268] The United States is the clear leader in this domain in terms of public funding allocated to security-related space activities (Cf. Chapter 2) and despite the increasing number of space military actors, the leadership of the United States according to the military space budget criterion is unlikely to be challenged in the near future. While Russia and China are modernising and upgrading their military space assets, their capabilities as well as financial support are no match to the United States.[269] Other countries investing significantly in space-security activities include Canada in North America; Argentina and Brazil in South America; China, India, Japan, South Korea and Russia in Asia; Iran, Israel and Turkey in the Middle East and Belgium, France, Germany, Greece, Italy, Spain, Sweden and the United Kingdom in Europe.

In 2007, 32 dedicated military spacecraft or explicitly recognised "dual-use" satellites have been launched in space representing 26% of all payloads launched in space that year. This is an increase from 2006 where only 18 military-related payloads were launched in space. Like in 2006, eight countries launched dedicated space military assets. However, from one year to the next only China, Germany, Japan, Russia and the United States launched at least one military spacecraft in 2006 and 2007. Moreover, no new country launched dedicated military space assets in orbit in 2007.

When comparing the levels of activity country by country in 2007, Russia was again the world's leader in military space activities according to the number of payloads launched with 11 satellites (Figure 55). It was followed by the United States with eight spacecraft, Europe with six satellites and China with four military satellites. Japan launched two security-related satellites and Israel one (Figure 55).

Russia and the United States were the actors having the biggest variety of different assets launched in space (Figure 55). China was the only other actor having different types of military assets launched to space (reconnaissance and navigation satellites) (Figure 55). Europe when taken has a whole (Germany, Italy, and the United Kingdom) launched two types of military assets as well

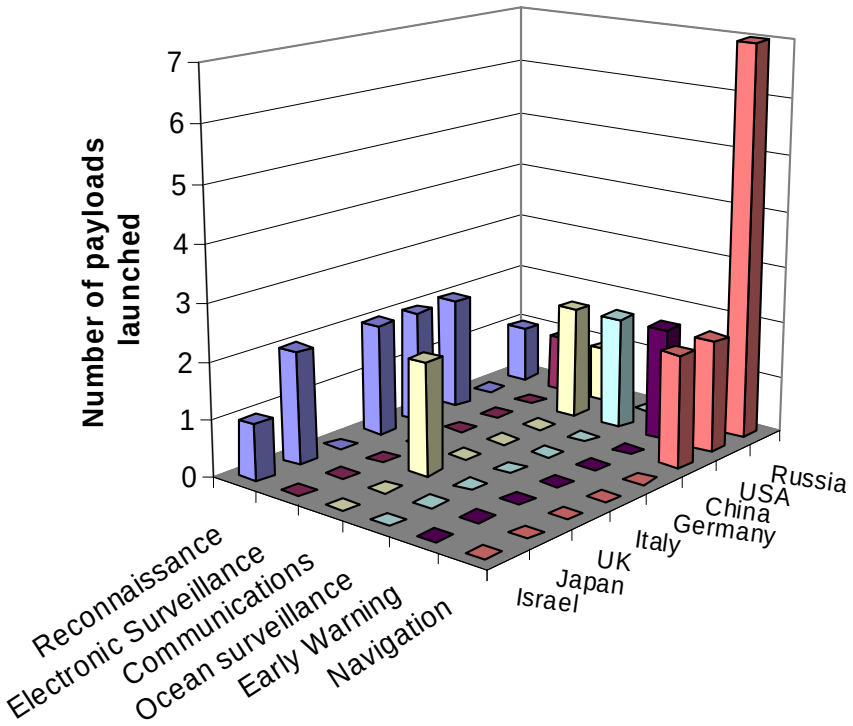

Figure 55 Military spacecraft launched in 2007 per country

[268] Tracking space military-related budget is difficult due to the absence of distinct budget items in the various national budgets or the fact that large portion of those budgets are classified.

[269] Analysing however the size of the overall military/intelligence activities for Russia and China is extremely difficult.

(reconnaissance satellites and communications satellites) (Figure 55).

Military navigation satellites were the most-frequently launched type of spacecraft in space in 2007 (11 spacecraft), but only by three countries (Russia, the United States and China), while ten reconnaissance spacecraft were launched from six countries (Russia, China, Germany, Italy, Japan, Israel) (Figure 55). Five dedicated military communications satellites were launched from three countries (Russia, the United States and the United Kingdom). The United States and Russia were the only space actors launching early warning satellites, Russia the only one launching an electronic surveillance satellite, and the United States two Ocean surveillance satellites (Figure 55).

6.3 European space military context

The positioning of Europe vis-à-vis military space has been changing in recent months. An increasing number of European countries are acknowledging the strategic character of space for military and security activities. The importance of space in the European security arena is therefore increasingly being recognised by policymakers, as illustrated by the inclusion in the May 2007 European Space Policy of a chapter dedicated to "security and defence". However, while this document was backed by 29 European countries, only a limited number of European countries are involved in military space, far less than in civilian space activities.

6.3.1 National initiatives

European national space projects related to security are limited in size (only eight countries are involved substantially in military space: Belgium, France, Germany, Greece, Italy, Spain, Sweden and the United Kingdom) and scope (European activities do not focus on tactical applications). The amount of public funding spent on military space activities in Europe are rather modest and only represent about 17% of the total European spending on space affairs in 2007 with an estimated 1.103 billion euro (Cf. Chapter 4), about 20 times less than the U.S. investment in military space. [270]

Consequently, due to their limited investment in military space infrastructure, European actors depend heavily on civilian and commercial space systems to support their military and security activities for technical and historical reasons.[271]

France has been the historical European leader of military space activities. However, it has in recent years reduced its efforts and financial support to this type of space activities (Cf. Chapter 4). Nonetheless, while France did not launch dedicated military space assets in 2007/2008, on 11 February 2008, the French President, Nicolas Sarkozy, gave a structuring policy speech in which he stressed that the highest French authorities recognise space assets as critical and strategic. He expressed his wish to significantly increase France's national space defence budget (Cf. Chapter 3). President Sarkozy underlined the importance of space in a national and European defence policy context, but also to support Europe's autonomous decision-making capabilities and as a significant building block of the European Security and Defence Policy (ESDP). The main programmatic elements highlighted in his speech were the establishment of MUSIS (six member states cooperating for the common development of a future space-based reconnaissance satellite system) and space surveillance activities. President Sarkozy also mentioned the principles of self-defence and the importance of access to space and satellite integrity.

Subsequently, the French White Paper on defence and national security presented on 17 June 2008, underlined France's plans to greatly expand its military space capabilities as part of a move to reinforce its reconnaissance/intelligence capabilities over the next 15 years (Cf. Chapter 3).[272] Annual space spending is prognosticated to double from the current level out of a total of 377 billion euro earmarked to be spent on defence from 2009 until 2020. [273] A Joint Space Command for military oversight to be implemented and managed by the French Air Force and placed under the authority of the Chairman of the Joint Defence Staff has been created. The main focus of the space effort as outlined in the White Paper will be to develop new operational capabilities to fill existing gaps and ensure the continuity and

[270] According to the latest data from the European Defence Agency (EDA) the total expenditure of its 26 member Sates in the complete spectrum of defence activities were 201 billion euros or 412 euros per capita in 2006 compared to 491 billion euros and 1640 euros per capita in the United States.

[271] For more information see Peter, Nicolas. "Space Policy, Issues and Trends in 2006/2007." ESPI Report 6 Sept. 2007.

[272] This in-depth review of the French defence policy supersedes the last exercise from 1994.

[273] The White Paper recommendations are expected to be transformed into a new five year spending plan for 2009-13 in fall 2008.

modernisation of observation and communications satellites. One of the new projects is Ceres, a signal intelligence (SIGNIT) constellation drawing on the experience from Elint. Another project is an early warning satellite system to protect against intermediate ballistic missiles, building upon the forthcoming Spirale system. Space situational awareness (SSA) is also a major new programmatic development. Furthermore, despite these plans, it was underlined that like all its EU partners, France opposes the weaponisation of space and will continue its diplomatic efforts in favour of the demilitarisation of space (see below).

In Germany, the increasing interest in military space activities over recent years is illustrated by the growing budget allocated to security-related space activities (cf. Chapter 4). Germany launched two reconnaissance synthetic aperture radar (SAR) satellites (SAR-Lupe 2 and 3) in 2007 (Figure 55).[274] In March 2008, the fourth SAR-Lupe satellite was also launched onboard a Kosmos-3M. Finally, the last satellite in this constellation (SAR-Lupe 5) was launched in July 2008. German military authorities have also ordered study contracts on a next-generation reconnaissance system. Furthermore, SATCOMBW 2a and 2b, two military communication satellites (SHF/UHF bands) will be launched onboard an Ariane 5 in the coming months. The developments of these dedicated military capabilities underline the recent paradigm change in military and political circles, reversing the longstanding German position.

In 2007, the United Kingdom launched two dedicated communications satellites (Skynet 5A and 5B) and a third one in 2008 (Skynet 5C). Skynet 5 is the programme used to update the British Ministry of Defence's satellite communication capability. The operator for the programme is Paradigm Secure Communications (a company entirely owned by EADS) through a Private Financing Initiative (PFI) model.[275] Britain has up-to-now preferred to rely on privileged access to U.S. assets for intelligence purposes with the notable exception of communications. However, the increasing realisation of the importance of space is causing military planners to reassess UK's position with the consideration to procure a satellite technology SAR demonstrator drawing on the experience of the demonstration satellite TopSat. Furthermore, the revision of the Defence Industrial Strategy (DSI), referred to as DIS 2.0, is expected to include a chapter on space.[276]

Italy launched two dual-use X-band radar satellites COSMO-SkyMed on 7 June and 6 December 2007 (Figure 55). Italy is also planning to launch its new military communications satellite (SICRAL 1B) in the second half of 2008. Furthermore, demonstrating the increasing cooperation with France, a Letter of Intent (LOI) for the Ka-band French-Italian dual-use satellite, ATHENA-FIDUS was signed during the Franco-Italian summit in Nice (France) on 30 November 2007. The joint programme would be used for two-way military and non-military broadband communications. The Italian Space Agency (ASI) and the Defence Ministry also started to define a second generation of Italian Earth observation which would be lighter, but possess the same radar performance capacity.

While Spain already has its own dedicated military communications satellites (Spainsat launched in March 2006) and uses backup capability with XTAR-EUR (launched in 2005), the Spanish government is also considering the development of dedicated reconnaissance satellites. Spain is already involved in the French-led Helios 2 satellite, but it has decided to build its own high resolution radar (Paz) and medium resolution optical satellite (Ingenio) for military and civil security applications. Both are scheduled to be launched in 2012.

Despite these national developments, as no single European country can afford to independently develop a wide range of space assets like the United States and Russia, European countries are realising that they need to pool resources and rationalise investments. However, while Europe has significant assets in security-related space activities, its current generation of military or dual-use satellites has been designed independently with limited operability.

[274] OHB System, the satellite manufacturer, signed a contract with Germany's Federal Office of Defence Technology and Procurement (BWB) for about 350 million euros for the construction, launch and operation of the constellation. It also features an obligation by OHB to provide imagery within? 24 hours of the order for a 10-year duration.

[275] Astrium Services is free to sell un-used capacity on the Skynet 5 satellites to other customers. For instance it has booked orders from among others Canada, NATO, the Netherlands and Portugal.

[276] The first DIS was adopted in 2005 and provided for the first time a policy framework for how government and industry should meet the needs of the frontline and provided a strategic view of each sector of the defence industry. The soon-to-be released DIS 2.0 will emphasise flexibility, agility and responsiveness to the needs of the Armed Forces.

Nonetheless, efforts of coordination, harmonisation and consolidation are currently on-going. As aforementioned, Italy and France are cooperating to develop a dual-use communications satellite called ATHENA-FIDUS. Furthermore, MUSIS, or MUltinational Space-based Imagery System, is intended to ensure that the next generation of European reconnaissance satellites is designed to have a common ground segment. Six countries are cooperating on this project. Current efforts are also on-going to coordinate SSA.

6.3.2 European Union level

At the EU-level initiatives, space is now increasingly recognised to be an "enabler", which can support EU's Common Foreign and Security Policy (CFSP) and European Security and Defence Policy (ESDP).[277] In particular, GMES and Galileo are the two programmes having a clear mandate to support these overarching policies. The EU also has two dedicated agencies carrying out tasks in the context of space and security: the European Union Satellite Centre (EUSC) and the European Defence Agency (EDA).[278]

The EU Satellite Centre based in Torrejon (Spain) aims to support the decision-making of the EU in the domains of the CFSP and ESDP by providing products and services resulting from Earth observation imagery, among others. It gives supports to EU deployed operations and humanitarian aid missions, as well as peacekeeping missions, but is also involved in contingency planning and periodical monitoring tasks. The EUSC is involved in reflections on GMES security domains. Moreover, as stated in its 2008 annual work programme, the specific short-term objectives of the EUSC are to improve access to new sources for both commercial and non-commercial data and foster workforce development, but also develop new services and products like 3D maps. It will also seek to strengthen working relations with the Commission and others institutions such as EDA, ESA, UN, NATO, etc.[279]

The EDA based in Brussels (Belgium) is designed to support the Council as well as the EU member States in their efforts to improve European defence capabilities in the field of crisis management and to sustain the ESDP. It is in charge of defence capability development, armaments cooperation, research and technology (R&T), as well as defence technology and industrial base.[280] The EDA has also been progressively encroaching more and more space activities, in particular, satellite communications (SATCOM), maritime surveillance and intelligence surveillance-reconnaissance (ISR) activities. This has been followed by the endorsement of the 2007 European Space Policy by all EU member States calling, in particular, for increasing cooperation between ESA and EDA in the field of space and security. Consequently, the first official meeting between the heads of these agencies occurred in January 2008. Moreover, on EDA's 2008 work programme, several topics are related to space such as SATCOM, which aims to establish a pilot EU commercial satcom cell in the short term, and draft Common Staff Requirements for the next generation of military communications satellites in the long-term. The TIES (Tactical Imagery Exploitation Station) is another project in EDA's work plan linked to space. It is a workstation for imagery analysis, capable of receiving imagery data in different formats and fusing them into usable and workable intelligence product. TIES is intended to support EU operations and deployment in the future. The EDA is also getting involved in space surveillance activities, with the aim to develop a plan to assess the requirements and options for space surveillance by early 2009. In this context, a dedicated workshop was held in June 2008.

Illustrating the fact that space security in Europe has become an issue of growing interest, a series of high-level conferences and reports have been taking place or released in recent months. Furthermore, EU's member States are pursuing an initiative on the elaboration of a Space Code of Conduct on Outer Space Activities (hereinafter referred to as Space CoC) (Cf. Chapter 3).

The Space CoC is the EU's "concrete proposal" reply to the United Nations General Assembly (UNGA) Resolution 61/75 on

[277] Peter, Nicolas. "The EU's Emergent Space Diplomacy." Space Policy 23.2 (May 2007): 97-107.

[278] Other EU agencies are involved in security issues and rely on space-based info such as FRONTEX (European Agency for the Management of Operational Cooperation at the External Borders of the Member States of the European Union) and the EMSA (European Maritime Safety Agency) or on policy studies (EU-ISS).

[279] A long term work programme 2009-2010 has also been detailed. It unfolds several areas of activities and development: products and services, stakeholder engagement, processes and procedures, personnel and organisation, information technology systems, training and infrastructure.

[280] In recent months the EDA made progress in developing and implementing long-term strategies and in particular the Capability Development Plan (CDP), as well as the implementation of the European Defence Technological and Industrial Base Strategy, the development of a European Defence Research and Technology Strategy and a European Armaments Strategy.

"Transparency and Confidence Building Measures in Outer Space Activities".[281] It is expected that the Space CoC could strengthen existing agreements and codify new best practices for a safe and secure use of space. The discussions on a Space CoC were initiated by Italy and further developed during the German Presidency of the Council of the European Union (first half of 2007) in order to build consensus about an instrument below treaty-level. The idea was generated as an item of arms control.[282] However, the concrete issues identified in the E-Task Force under the Portuguese Presidency (second half of 2007)[283] had a number of overlaps with the civil use of outer space. The "EU Food for Thought Document on a Comprehensive Code of Conduct for Space Objects" initially put forth was subsequently iterated from the end of 2007 in COREU (CORespondance EUropéenne).[284] The General Principles of this document are defined as follows:

- Commitment to make progress towards adherence to and full implementation of the relevant existing treaties, Codes of Conducts and guidelines regarding the peaceful use of space;
- Commitment to prevent space from becoming an area of conflict, namely by harmfully using space objects towards other space objects;
- Recognition that satellites and use of space in general are essential to safeguard national security and strategic stability;
- Commitment to resolve, by peaceful means, through the formulation of concrete proposals and in compliance with the United Nations Charter, any conflict created by actions in space.

The aim of this initiative is therefore to lower the risks of misinterpretation of incidents occurring in space, to avoid collisions and deliberate explosions and to provide reassurance through improved information exchanges, transparency and notification measures. From the very beginning, the EU intended to elaborate an instrument open for adherence to all space-faring countries. Moreover, after being sent to major space powers for comments, the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) and the Conference on Disarmament (CD) should thereafter be consulted before the adoption of a final resolution by the UNGA. The Space CoC is currently in its final drafting stages in the EU working group on UN Disarmament (CODUN).

6.3.3 European Space Agency

Following the evolution of ESA's member States vis-à-vis the Agency's position regarding security activities, European governments now agree that ESA may develop systems and run space programmes, which European institutions could use for non-aggressive security activities.[285] This was further agreed in the 2007 the European Space Policy, which as aforementioned, calls for greater cooperation between ESA and the EDA.

In 2007/2008, ESA continued to be involved in activities supporting synergies between space and security such as GMES, Galileo and communications activities. It is also continuing its efforts in the domain of SSA. In particular, ESA is pursuing an activity to define the European need for a SSA architecture as a first step towards its realisation. ESA is also leading the Heterogeneous Mission Accessibility (HMA) project. HMA aims to establish a portal facilitating uniform access to heterogeneous Earth observation data from multiple missions (including national missions and future ESA Sentinel missions) through standard interfaces for cataloguing, ordering, mission planning and online data access.

6.3.4 Other European Institutions

Several parliamentarian initiatives dealt with space security issues in 2007/2008 demonstrating that space is now recognised at the political-level as an important asset for Europe.

The European Parliament's Subcommittee on Security and Defence (SEDE) responsible for the CFSP and ESDP in the European Parliament held a series of activities linked to space security issues in recent months. A study entitled "The cost of non Europe in the field of satellite based systems" was requested by the European Parliament to the Policy Department in the Directorate-General

[281] Resolution 61/75 invites all member States to submit to the Secretary-General before its sixty-second session concrete proposals on international outer space transparency and confidence-building measures in the interest of maintaining international peace and security and promoting international cooperation and the prevention of an arms race in outer space.
[282] Paper of the Council Working Group on Global Arms Control and Disarmament CODUN.
[283] Portugal continued this work under the Slovenian Presidency (first half of 2008).
[284] The COREU is a communication network between the member States and the European Commission for cooperation in the fields of foreign policy.

[285] For more information see Peter, Nicolas. "Space Policy, Issues and Trends in 2006/2007." ESPI Report 6 Sept. 2007: 88.

for External Policies (DG EXPO) and was published on 18 December 2007. It states that more cooperation is needed among member States within the institutional framework of the EU in order to improve military, defence and security capabilities in space. It examines the different aspects of European space activities, and recommends that security and defence be addressed jointly to improve European security-related space capabilities. Furthermore, in recommendations to the European Parliament, it mentions the importance to increase military space spending, particularly for space-based communications and Earth observation as priorities, and finally suggests that more institutional framework and authority be developed within the EU.[286]

On 14 February 2008, DG EXPO held a workshop on "Space Policy and the European Security and Defence Policy" on behalf of the SEDE. It provided an occasion to focus upon a report being developed by the SEDE Chairman Karl von Wogau on the ESDP and Space Policy. The workshop also provided an opportunity to exchange views on technology and policy in the European space sector, and the relevance and impact on ESDP. Then, on 14 April 2008 "The contribution of space assets to ESDP" was a Subcommittee meeting agenda item. Several exchange of views occurred with the Director of the EU Satellite Centre (EUSC) or with the Executive Director of the European GNSS Supervisory Authority (GSA). However, the aforementioned "own-initiative" report by the SEDE Chairman entitled "Draft Report on the contribution of space-supported systems to ESDP" was submitted to the Committee on Foreign Affairs on 8 April 2008 and was subsequently adopted by this committee on 3 June 2008. Members of the European Parliament noted the need for a common approach to defend European interests in space. The "Report on space and security" underlines the need for space assets in order for the political and diplomatic activities of the EU to be based on independent, reliable and complete information. Furthermore, while the European Parliament agrees that the European space policy should not support the weaponisation of space, it nevertheless recognises the need for Galileo to serve the EU's defence and security, which is a shift from its earlier stance on the issue. The report also advocates the creation of "an operational budget for space assets and strongly favours putting space operations under the Community budget".[287,288]

In 2007/2008, the Assembly of the Western European Union (WEU), which is an inter-parliamentary security and defence assembly that allows national parliamentarians to monitor security and defence issues, released in June 2008, a report through the Technological and Aerospace Committee on "Space Systems for Europe's Security: GMES and Galileo - reply to the annual report of the Council".[289] Subsequently, a recommendation was adopted unanimously during the 54th Plenary Session on 4 June 2008.

6.4 The United States

In 2007, the United States launched 25% of all military satellites, without taking into account several technology demonstration projects. The United States launched two communications satellites, two early warning satellites, two navigation satellites and two ocean surveillance satellites (Figure 55).

The United States is the country investing the most in space including space-security related activities (Cf. Chapter 2). The unclassified budget for space programmes of the U.S. Air Force (including R&D, procurement and operations and maintenance) reached about 11.3 billion U.S. dollars for Fiscal Year 2008 (cf. Chapter 3). However, the classified spending for other DoD and National Reconnaissance Office (NRO) space programmes is not publicly released. In this context, in the Fiscal Year 2008 Defense Appropriation bill, the U.S. Congress asked the DoD to develop a Major Force Program (MFP) budget category which would aggregate space spending in a single budget line. Moreover, as the procurement of future U.S. capabilities continues to be plagued with difficulties, unclassified appropriations for defence R&D and procurement have shifted notably in 2007/2008. For instance, the funding for the Air Force's Advanced Extremely High Frequency (AEHF) programme has been

[286] Directorate General External Policies of the Union: Policy Department External Policies. "Study: The Cost of Non Europe in the Field of Satellite Based Systems." Dec. 2007.

[287] von Wogau, Karl. European Parliament. Committee on Foreign Affairs. "Report on Space and security." (2008/2030(INI)) 10 June 2008.

[288] The European Parliament adopted with a large majority (483-99-20) on 10 July 2008 the report, effectively making it a resolution.

[289] The WEU is composed by the Council of the WEU and the Assembly of the WEU. The Parliamentary Assembly supervises the work of the Council, but it does not impose any obligations on the Council as it is a consultative institution.

drastically reduced. Furthermore, key sensors have driven up the cost of the next generation of U.S. polar-orbiting weather satellites (the National Polar-orbiting Environmental Satellite System or NPOESS) causing the DoD to threaten to withhold its share of programme funding in the joint U.S. Air Force-NOAA programme.[290] However, the Air Force's Operationally Responsive Space programmes dedicated to tactical satellite development and responsive lift has seen its budget increase in the same period.

A Panel was congressionally mandated as part of the 2007 Defense Authorization Bill to assess the organisation and management of U.S. national space security due to current suboptimal capabilities (delay, cost overruns and failures of national security space systems). Most of the work of the so-called "Allard Commission" took place in spring 2008). In particular, a National Security Space Authority (NSSA) would be created. This position would lead to a new organisation, the National Security Space Organization responsible for the acquisition and operation of all U.S. military and intelligence space assets. The establishment of a National Space Strategy is being considered as well as the reestablishment of the National Space Council to be led by the National Security Advisor.

In the United States, the Chinese anti-satellite weapon test of January 2007 brought increased attention and urgency to the consideration and evaluation of national security space programmes.[291] In particular, the concern about potential threats to U.S. space capabilities has gained momentum in high-level policy circles. In this context, in the Fiscal Year 2008 Appropriation agreed on 8 November 2007, the programmes enhancing SSA were boosted. Furthermore, on 20 February 2008, an imagery radar spacecraft (NROL-21/USA-193) owned by the National Reconnaissance Office (NRO) launched in December 2006 was destroyed, as there was a risk that it would survive re-entry and strike the Earth. This was done in order to prevent the satellite's hydrazine fuel tank from dispersing highly toxic fumes on the ground. A Standard Missile (SM-3) and the ship-based Aegis targeting system developed for the sea-based component of the U.S. missile defence architecture were used. While the controversial anti-satellite test conducted by China in January 2007 occurred at an altitude of about 850 kilometres, the U.S. intercept occurred at an altitude of about 240 kilometres. Moreover, unlike the Chinese ASAT-test, the United States informed the international community well in advance of the attempted shot-down.

The U.S. Air Force Space Command and the NRO joined together on 31 March 2008 to create a new programme to advise the military and intelligence community on how to protect space assets.[292] The so-called "Space Protection Program" is intended to help identify a wide range of possible options to safeguard space capabilities such as the development of new hardware, change in tactics and procedure. It is also involved in the development of the congressionally-mandated space protection strategy due in summer 2008.[293]

While the United States is the country investing the most in space, it is also the most conceptually advanced in military space affairs. In 2007/2008, a series of high level documents were released underlining the strategic nature of space activities in security-related activities for the United States. In particular, in May 2008, the first Defense Intelligence Strategy (DIS) was published. The DIS highlights the following four strategic goals for the Defense Intelligence Enterprise (DoD intelligence, counterintelligence and security communities)[294]:

- "Extend the full advantage of the U.S. intelligence enterprise to all defense users to ensure timely and accurate decisions, as well as ensure defense intelligence is available to the broader U.S. intelligence enterprise;
- Enhance all services and capabilities provided by the U.S. intelligence enterprise to satisfy the changing needs of defense intelligence users;
- Explore concepts, technologies, and strategies to address customer requirements and emerging threats;
- Enable us to counter and deny adversary capabilities to acquire and exploit our technologies or knowledge of the battle space."[295]

[290] Brinton, Turner. "NPOESS Costs Soar Again, Pentagon Threatens to Withhold Funding." Space News 19 June 2008.
[291] For more information see Neuneck, Götz. "China's ASAT Test- A Warning Shot or the beginning of an Arms Race in Space?" Yearbook on Space policy 2006/2007: New Impetus for Europe. Eds. European Space Policy Institute: Kai-Uwe Schrogl, Charlotte Mathieu and Nicolas Peter. Wien: Springer, 2008: 211-224.
[292] Singer, Jeremy. "U.S. Air Force, NRO create Team Focused on Space Protection." Space News 8 Apr. 2008.
[293] Ibid.
[294] The mission of the Defense Intelligence Enterprise is identified as to "support our national, defense and international partners with "knowledge rich" all-source defense intelligence, counterintelligence, and security".
[295] U.S. Department of Defense. "Defense Intelligence Strategy." May 2008.

Defence intelligence in space is identified in the fourth strategic goal. It aims to "eliminate any advantage held by our adversaries to operate from and within the space and cyber domains". [296] Referring to the 2006 U.S. National Space Policy, it underlines that the focus of defence intelligence in space will be to "ensure full situational awareness for military and civilian decision-makers, support military planning initiatives, and satisfy operational requirements". [297] Among the three priorities identified for defence intelligence in space, two touch upon space specifically. The Priority IV.4.A calls to "pursue and support enhanced space situational awareness to include the protection of U.S. and partners' space assets and interests in all domains" and the Priority IV.4.B stresses the importance to "expand our ability to operate from and within the space domain by designing and operating a seamless, fully integrated next generation space enterprise."[298]

Finally, on 12 May 2008, The North American Aerospace Defense Command (NORAD), a bi-national U.S. and Canadian organisation charged with the missions of aerospace warning and aerospace control for North America, celebrated its 50th year anniversary.

6.5 Russia

In 2007, Russia launched 35% of all military spacecraft upgrading its navigation capabilities (seven satellites), its reconnaissance (one satellite), early warning (one satellite), electronic surveillance (one satellite) and communications capabilities (one satellite) (Figure 55). This increased activity is part of an overall effort to upgrade and modernise Russia's military in-orbit infrastructure.

Following Russia's economic recovery (Cf. Chapter 1), Russian military space programmes are recovering from the under-investment that characterised the immediate post-Cold War period (Cf. Chapter 3). Russia maintains activities in military space programmes in six areas: reconnaissance, communications, navigation, early warning, signal intelligence as well as access to space. Russia's involvement in military space programmes is channelled through the 2007-2012 State Armaments Programme and the two Federal Target Programmes on Glonass (2002-2011) and the Development of Russia's Cosmodromes (2006-2015). The major investments are, however, in the field of access to space (new launch sites and launch vehicle) and its GNSS constellation, Glonass (Cf. Chapter 3).

6.6 Japan

In 2007, Japan, launched two dedicated security satellites: the Information Gathering Satellites (IGS) (Figure 55). These two additions provide Japan with an Earth observation constellation dedicated to security issues (five satellites in orbit).

In May 2008, the Diet finally approved the "Basic Law for Space Activities". This new law commits Japan to a series of major administrative and conceptual changes (Cf. Chapter 3). These include: shifting emphasis from R&D to utilisation and defence, and placing space development planning in a new planning and administrative authority in the Prime Minister's Cabinet (so-called "Strategic Space Development Headquarters") under a new minister for space appointed by and reporting directly to the Prime Minister. The switch of space planning from the Ministry of Education, Culture, Sports, Science and Technology (MEXT) to the Prime Minister's Cabinet underscores the shift in attitude about the strategic importance of space for national security and public welfare. In particular, the new law replaces the 1969 Resolution which restricted Japan to use space only for "exclusively peaceful purpose" with a commitment that military uses of space will be for defensive purposes only in accordance with the 1967 Outer Space Treaty and with the pacifist spirit of Japan's Constitution. This policy change thus does not aim to promote an aggressive use of space, but, among other things, it aims to allow Japan to use space assets for crisis management and disaster monitoring in the Asian region and in peacekeeping missions.

6.7 China

In 2007, China launched 13% of all military spacecraft. It launched two reconnaissance satellites and two navigation satellites (Figure 55).

China's long-term, comprehensive trans-formation of its military forces is on-going at a high pace following its investments in the military sector (Table 12). However, it is difficult to precisely evaluate Chinese military

[296] Ibid.
[297] Ibid.
[298] Ibid.

capabilities, as China is very secretive about its military activities and military space is no exception. Nonetheless, in an August 2007 speech celebrating the 80th anniversary of the founding of the People's Liberation Army (PLA), President Hu called for accelerating the modernisation of weapons and equipment, enhancing personnel training, and strengthening combat skills through "coordinated development between national defence building and economic construction."[299] This is thought to also cover space activities. Furthermore, while China's leaders are communicating widely about the achievements of its civilian space programme they remain silent about the military applications of China's space programme. Space-based command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) are considered key to enable and coordinate joint operations and win modern wars by Chinese theorists (Cf. Office of the Secretary of Defense "Annual Report to Congress on Military Power of the People's Republic of China). China further views the development of space and counter-space capabilities as bolstering national prestige and, like nuclear weapons, demonstrating the attributes of a world power.

6.8 India

While India continues to emphasise the peaceful uses of space, following the 2006 Chinese ASAT-test, the country is considering developing a military space programme and optimising space applications for military purposes. No formal decision has been made yet on the creation of an Indian Aerospace Command as part of a wide process considering an increase of the role of military applications and defence forces in India's space activities. Military space activities are still officially being separated from ISRO's civilian activities and until now India has not been focusing on space technology solely for military purposes. However, it is widely speculated that an ISRO spacecraft Cartosat-2A launched on 28 April 2008 is the first satellite of a constellation dedicated to reconnaissance, as it has a sub-metric resolution.

[299] United States of America. Office of the Secretary of Defense "Annual Report to Congress: Military Power of the People's Republic of China 2008." 3 Mar. 2008.

6.9 Other space actors

Non-traditional space powers and actors have also been acquiring dedicated military satellites or creating new structures demonstrating the increasing trend of "inter-nationalisation of the militarisation of space".

While the North Atlantic Treaty Organization (NATO) is relying on space activities to support its operations and tasks, it has not yet defined a clear and comprehensive approach to space operations. However, this is evolving. In May 2008, NATO released an unclassified document entitled "NATO Space Operations Assessment". This project was undertaken by the Joint Air Power Competence Centre (JAPCC) at the request of Allied Command Transformation. This document presents an overview of current standing of NATO Space Power and provides recommendations for NATO to better enable an effect-based approach to operations. The NATO Space Operations Assessment focuses on the importance of space for current operations and transformational ambitions. In the process of drafting this document, 33 stakeholder organisations participated in a Space Workshop hosted by the JAPCC on 22 April 2008. In order for NATO to better ensure and use the space domain, the document identifies 20 gaps, and short and long-term recommendations such as space governance, force development, training, concept development and experimentation, standards and interoperability. A paper entitled "Considerations for a NATO Space Policy" is also provided as annex to the document (it comprises 16 guiding principles, 13 foundational guidelines and three guidelines on international cooperation). Finally the tenets of a NATO Military Space strategy are also provided in an annex.[300]

While Australia is considering increasing its involvement in space activities (Cf. Chapter 3), in November 2007, the Australian government agreed to a 822.7 million U.S. dollars investment in the U.S. Wideband Global Satcom (WGS) system to fund the sixth WGS satellite.[301] This will provide access to high communication bandwidth in the X and Ka-bands to support bandwidth-intensive applications.[302]

[300] Joint Air Power Competence Centre "NATO Space Operations Assessment." May 2008.
[301] "Australia to Fund Sixth WGS Satellite." Satellite Today 3 Oct. 2007. <http://www.satellitetoday.com/military/headlines/19168.html>.
[302] The WGS system is scheduled to be achieve full operational capability in 2013 following the launch of the

In February 2008, Israel received the first images from its new reconnaissance satellite which was successfully launched by the Indian space agency, ISRO, onboard a PSLV on 21 January 2008. As opposed to the Ofeq series, TechSAR is a radar (SAR) satellite providing Israel 24-hour, all-weather capability. This addition completes the launch of Ofeq-7 in June 2007.[303] Additionally, the Israeli government invested about 265 million U.S. dollars in Amos-4 communications satellite planned for launch in the third quarter of 2012,[304] illustrating the high national priority accorded to the programme.

Following the successful launch of Turksat 3A on 12 June 2008 onboard an Ariane 5, Turkey is about to acquire the long-delayed military reconnaissance satellite, Göktürk. In July 2006, Turkey's Under Secretariat of Defence Industry received tenders from EADS Astrium, Israel Aerospace Industries (IAI), OHB-System and Telespazio (now Thales Alenia Space) to manufacture this reconnaissance satellite. In January 2007, Turkish Defence Industry Implementation Committee (SSIK) decided to continue its discussions for the construction of Göktürk with Telepazio, OHB and EADS Astrium. A final decision on the prime contractor for the high-resolution reconnaissance satellite is expected to be taken soon.

sixth satellite. The first satellite was launched in 11 October 2007.

[303] For more information see Peter, Nicolas. "Space Policy, Issues and Trends in 2006/2007." ESPI Report 6 Sept. 2007.

[304] Opall-Rome, Barbara. "Israeli Government Invests Big in High-Powered Amos-4 Telecom Sat." Space News 25 July 2007< http://www.space.com/spacenews/archive07/amos4_0716.html >.

Chapter 7 - The specific roles of institutions

Various institutions are playing a growing role in space affairs, particularly at regional and international level, thus completing existing national activities. This chapter specifically looks at the most influential institutions of European space affairs in 2007/2008.

7.1 European institutions

In Europe, the main European institutions (the Presidency of the Council of the European Union, the Council of the European Union, the European Commission, the European Parliament and Agencies of the European Union) are increasingly involved in European space affairs, along with other institutions such as parliamentary and regional structures, therefore complementing national structures such as space agencies, ministerial and inter-ministerial entities.

7.1.1 Council of the European Union and its Presidencies

The Presidency of the Council of the European Union, which is sometimes informally called the "European Presidency", refers to the responsibility of presiding over all aspects of the Council of the European Union. It rotates every six months among European Union (EU) member States. The Council is a major actor in European space affairs, as it is the driving force in the political decision-making process of the EU.

During the second half of 2007, and the first half of 2008, the second and third Presidencies of the first "triple-shared Presidency" were held by Portugal and Slovenia respectively (following Germany in the first half of 2007).[305] The joint 18-month programme was elaborated for the period running from January 2007 to June 2008. The main themes of the programme were the continuation of the EU reform and constitutional process, the implementation of the Lisbon Strategy for Growth and Jobs, and the further completion of common areas of freedom, security and justice. Space was identified in this work programme as one of the elements of priority linked to the Lisbon Strategy. In particular, the elaboration of a European Space Policy to promote cutting-edge technology in the EU was underlined. The necessity to continue to develop Galileo and the Global Monitoring for Environment and Security (GMES) programmes was also stressed.

Under the Portuguese Presidency, in the second half of 2007, besides solving Galileo, Euro-African cooperation in space development was also an important agenda topic.[306] In December 2007, a "GMES for Africa" event was organised in Lisbon (Portugal) as a first attempt to bring together actors from both continents to address the issue of GMES and Africa. Two technical seminars were organised on 6 December 2007; the first one being on environment and agriculture and the second one on crisis response and monitoring for security. The event "Space for Development: The case of GMES and Africa" was then held on 7 December 2007. The overall Lisbon exercise, attended by about 350 participants, led to the adoption of two documents: the Lisbon Declaration on "GMES and Africa" and the Lisbon Process on "GMES and Africa" supporting the joint Africa-EU strategy and first Action Plan (2008-2010). The Portuguese Presidency also launched a two-year process leading to the drafting and consolidation of an Action Plan for the "GMES and Africa" partnership for approval at the third EU-Africa Summit scheduled for the end of 2009. This initiative follows the Maputo Declaration signed on 15 October 2006 by the Commission of the African Union (AU), the Secretariat of the African, Caribbean and Pacific Group of States (ACP) and five regional Economic Communities of Sub-Saharan Africa (Economic and Monetary Community of Central Africa (CEMAC), Economic Community Of West African States (ECOWAS), the Indian Ocean Commission (IOC), Intergovernmental Authority on Development (IGAD), Southern African Development Community (SADC)) explicitly asking for an extension of the GMES initiative

[305] The next triplet will consist of France, the Czech Republic and Sweden.

[306] For more information on Galileo see the section devoted to the Council of the European Union.

to Africa and other ACP countries (the so-called "GMES – Africa").[307]

Completing the aforementioned documents (Declaration on "GMES and Africa" and the Lisbon Process on "GMES and Africa"), space activities were also specifically mentioned within the Joint Africa-EU Strategy and the accompanying first Action Plan (2008-2010) adopted at the EU-Africa Summit by Heads of States and Governments on 9 December 2007 (Cf. Chapter 1). In the Joint Africa-EU Strategy, aiming to foster enhanced cooperation, space is mentioned in the context of one of the four main objectives of the long-term strategic partnership, and particularly to support key development issues in order to address progress towards the Millennium Development Goals (MDGs) such as human and social development, but also environmental sustainability and climate change.[308] It is stated that Africa and the EU shall strengthen their existing cooperation mechanisms and programmes in space-based technology, applications, sciences and systems. In the first Africa-EU Action Plan (2008-2010) eight partnerships areas and priority activities have been singled out with one tackling space issues explicitly. The eighth Africa-EU partnership on Science, Information Society and Space aims to enhance cooperation in space application and technology as a priority action to support Africa's sustainable development objectives by developing concrete joint cooperation initiatives in selected areas.

In the first half of 2008, under the Slovenian Presidency, the main activities linked to space affairs concerned the re-profiling of the Galileo programme and the development of the legislation concerning Mobile Satellite Services (MSS) in Europe. The GMES programme was also an element of attention. In particular, during the fourth "Bridging the Gap" environmental conference held in Portoroz (Slovenia) several points were stressed, including the need to take environmental impacts into account in economic decisions and the need for increased interstate cooperation regarding data collection and exchange. It has been underlined that efforts such as GMES, the Shared Environmental Information System (SEIS), the infrastructure for Spatial Information in Europe (INSPIRE) or the directive on Public Sector Information (PSI) are very positive, but call for greater cooperation in order to efficiently use the data collected.[309]

Another major element of the Slovenian Presidency was the end of the public consultation period for the EU budget reform of the post 2013 period, as many in Europe would like to see a dedicated budget line (and specific financing tools and mechanisms) for space affairs in the next EU budget, so that the EU can fully assume its role in space policy.[310] A conference entitled "Reforming the Budget, Changing Europe" will be held on 12 November 2008 to represent these contributions.

The regular decision-making of the various councils are described in the following sections.

The Council of the EU is made up of the 27 national ministers of member States meeting in nine different configurations depending on the subject under discussion, with each "council" dealing with functional areas. Two "formations" are primarily in charge of space activities: the Competitiveness Council and the Transport, Telecommunications and Energy (TTE) Council, with other councils like the Economic and Financial Affairs Council being involved on a more irregular basis in space affairs. [311] In 2007/2008, the Competitiveness Council was principally involved in overseeing space policy and the development of the GMES programme, while the TTE Council has been mainly involved in monitoring Galileo issues, as well as regulatory development in the domain of MSS.

The Competitiveness Council under the Portuguese Presidency, on 28 September 2007, discussed the proposal for establishing Joint Technology Initiatives (JTIs) in the fields of innovative medicines, embedded computing systems, nano-electronics technologies, aeronautics and air transport. It also invited the Commission to present the remaining two JTIs on hydrogen and fuel cells, as well as GMES, as soon as possible.

[307] This extension should make available to African decision makers all the data and tools needed for an operational implementation of policies targeting the sustainable management of the African environment.
[308] Pisani, Pierre-Henri. ""GMES and Africa" A Hopeful Case for Euro-African Cooperation in Space Development" ESPI Perspectives 6 Apr. 2008.
[309] Conclusions of the fourth "Bridging the Gap" environmental conference. 14-16 May 2008. Portoroz, Slovenia <http://www.bridgingthegap.si/content.php?idm=9>.
[310] A Communication by the European Commission was released on 12 September 2007 and was followed by a public consultation.
[311] For instance following the TTE Council request in June 2007 of detailed alternative proposals for the financing of Galileo, on 10 July 2007, the Economic and Financial Affairs Council held an exchange of views on the possible additional public financing of Galileo.

Then, on 22-23 November 2007, the Council adopted the conclusions on competitiveness (under an integrated approach). In the Council's conclusions concerning industrial policy, while underlying the need to continue addressing sector-specific issues, the stepping up of on-going work on the space industry was noted with interest.

Under the Slovenian Presidency in the first half of 2008, space was not an issue dealt with in the Competitiveness Council. More involvement is therefore expected under the French Presidency during the second half of 2008, with, among others, the informal meeting of European ministers responsible for space in Kourou (French Guiana) on 21-22 July 2008 and the fifth Space council on 26 September 2008.

For the Transport and Telecommunications and Energy Council, in the second half of 2007 and the first half of 2008, Galileo was a major agenda item, as well as the selection and authorisation of systems providing MSS. On 1-2 October 2007, the TTE Council adopted conclusions on Galileo and the European Geostationary Navigation Overlay Service (EGNOS) satellite navigation programmes, which, among others, reaffirmed the value of an effective Galileo as a key project for the EU, and reiterated the need to continue with the implementation of a certifiable EGNOS to ensure the initial service's availability by 2008. The Conclusions also looked forward to a balanced participation in Galileo of all member States during the different phases of the project. The Council also took note of the Commission's information on its proposal for a decision on the selection and authorisation of systems providing MSS, adopted in August 2007.

During the TTE Council on 29-30 November 2007, conclusions on launching the European Global Navigation Satellite System (GNSS) programmes, defining the general principles of public sector governance and public procurement of the programmes, were adopted. In particular:

- Budgetary and political decision-making bodies will be the Council and the European Parliament;
- The Commission and the European GNSS Supervisory Authority (GSA) remain fully responsible for the management of the programmes;
- ESA was designated as the procurement agent for Galileo and maître d'oeuvre of the programme;
- The European Community will be the full owner of Galileo and EGNOS.

This Council also took note of a progress report on a proposal for a decision on the selection and authorisation of systems providing MSS.

On 7 April 2008 under the Slovenian Presidency, the TTE Council reached a general agreement on a proposal for further implementation of the Galileo and EGNOS programmes. The proposal put forth lays down the rules for the implementation of the aforementioned two programmes, including those on governance and the financial contribution of the European Community. The draft regulation reflects the principles defined in the Council conclusion adopted on 30 November 2007. However, significant amendments to the Commission's initial proposal were made. In particular, the European Community will assume responsibility for the deployment of the system, and the budgetary resources needed to finance both programmes for the period of 1 January 2007 to 31 December 2013 are set at 3.4 billion euros. Finally, regarding MSS issues, the TTE Council took note of the information provided by the Slovenian Presidency on 12-13 June 2008 and reached a first reading agreement on a draft decision for the section and authorisation of systems providing those services.

7.1.2 European Commission

In 2007/2008, the executive body of the EU, the European Commission, was particularly involved in three areas pertaining to space affairs: space-based navigation (Galileo and EGNOS), space-based Earth observation (GMES) and space-based communications services (specifically MSS).

In the second half of 2007 and the first half of 2008, the Commission pushed to find a solution to solve the Galileo crisis by shifting the project from a public-private-partnership (PPP) scheme to a structure fully funded with public money. On 6 September 2007, the Commission adopted a cancellation of its call for tenders for a concession of the deployment and operation phases of the Galileo programme. The Commission then put forth communication aiming to ensure that the Galileo and EGNOS deployment phases would be funded by the European Community. The publication released on 19 September 2007 entitled "Progressing Galileo: Re-Profiling the European GNSS Programmes" sets out the main details regarding Galileo and EGNOS programmes. It covers, among other things:

- Infrastructure costs;
- Risks in terms of completing the programmes and their management;
- Benefits and revenues expected;
- Funding of the European GNSS programmes;
- Public-sector governance.

In particular, unspent public funds were proposed as an additional source of funding for the procurement of the Full Operational Capability (FOC) of the Galileo programme with 1.7 billion euros coming form the Agriculture budget in 2007 (500 million euros in 2008), and 120 million euros from the Administration budget in 2007 (100 million euros in 2008) for a total of 2.72 billion euros (300 million euros of which should be used for the European Institute of Technology). The Commission also proposed that the Council and the European Parliament agree on a modification of the public governance of the European GNSS programmes. In particular to:

- Create a European GNSS programme committee;
- Define the role of the Commission as the European GNSS programme manager and maître d'oeuvre;
- Strengthen the role for the GSA in market preparation and as advisor to the Commission and assistance in programme management;
- Define ESA as the maître d'oeuvre acting on the basis on an ESA-EC GNSS agreement.

On 19 September 2007, another Communication from the Commission to the European Parliament and to the Council was issued. It assessed a proposal for a decision by the European Parliament and the Council amending the "Decision of the European Parliament and of the Council, amending the Inter-institutional Agreement of 17 May 2006 on budgetary discipline and sound financial management as regards to the multiannual financial framework". Another amended proposal was submitted on the further implementation of the European satellite radio-navigation programmes (EGNOS and Galileo). The proposed regulation provides the responsibility for the deployment phase of Galileo to be fully assumed by the European Community acting on its own. The proposal also aimed to improve the public governance of the programmes. In the first half of 2008, most of the EC's efforts were therefore focused on developing the regulation on the further implementation of the European satellite radio-navigation programmes (Galileo and EGNOS) and to prepare for the procurement phase.

On 23 June 2008, the Commission sent a letter to ESA authorising the start of the Galileo contractor selection. This one-year process started on 25 June 2008 with the Commission issuing an Invitation to Tender entitled "Advisors Contract to the European Commission on the European GNSS Programme" (TREN/G/3/318-2008) for the six work packages of the Galileo satellite navigation system.[312] On 1 July 2008, the Commission and ESA launched the procurement of the programme. It complements the In-Orbit-Validation contract placed by ESA for the first satellites and associated ground control infrastructure. For the deployment phase, the Commission and ESA have opted for the procurement procedure of "Competitive Dialogue".[313]

The Commission continued in 2007/2008 to work on its second flagship, the GMES programme, and particularly, on the three Fast Track Services: the Emergency Response Core Service (ERCS), the Land Monitoring Core Service (LMCS), the Marine Core Service (MCS), as well as the GMES atmosphere and security core services. A document entitled "Preliminary User Requirements for GMES-like services (for Emergency Response FTS)" was also released in July 2007. In February 2008 the EC approved funding for the recurrent satellites needed for GMES (Cf. Chapter 3). A publication entitled "Window on GMES" was issued in May 2008, identifying and presenting GMES's services and usefulness.

The Commission was also involved in the development of a new mechanism for the selection and authorisation of systems providing MSS. It issued a communication on 22 August 2007 entitled "Proposal for a Decision of the European Parliament and of the Council on the selection and authorisation of systems providing mobile satellite services (MSS)". The general objective of this proposal was to develop the internal market of European consumers and businesses by overcoming the national selection and authorisation to foster EU-wide MSS. The proposal complements the Commission's

[312] The six work packages are system support, ground mission segment, ground control segment, space segment (satellites), launch services and operations.

[313] In the first phase of the procedure, interested entities may submit to ESA a "Request to Participate" and will be short-listed on the basis of pre-defined selection and exclusion criteria. The selected candidates will then be invited to the dialogue phase, representing the formal kick off of the second phase of the tendering process. The Competitive Dialogue procedure will be organised and managed by ESA as delegated procurement agent, in close coordination with the Commission as contracting authority.

decision adopted by comitology[314] in February 2007, which obliged member States to reserve the Gigahertz spectrum by 1 July 2007 (1980 to 2010 MHz and 2170 to 2200 MHz) for systems providing MSS. This initiative aims to simplify the licensing process and reduce the risk of market fragmentation as well as ensure that the transnational services work at their best potential (Cf. Chapter 3).

The Commission has also been involved in the management of the first calls for proposals under the seventh Framework Programme as well as dialogues with other space powers: the United States and Russia (Cf. Chapter 3).

7.1.3 European Union Agencies

Following the expansion of the Commission's tasks, a number of specialised and decentralised EU agencies have been established to support EU member States and their citizens in tackling very specific tasks. Three EU agencies have direct and explicit activities in space: the European GNSS Supervisory Authority (GSA), the European Union Satellite Centre (EUSC) and the European Defence Agency (EDA), the latter increasingly being involved into space activities. Other EU agencies like the European Maritime Safety Agency (EMSA) are also relying more and more on space technologies to perform their mandated activities.

The GSA, an EU regulatory authority, is in charge of managing specific activities such as security aspects and the development of marketing activities linked to European GNSS programmes: Galileo and EGNOS (see above). In particular, on 8 April 2008, the GSA released the second version of the Galileo Service Signal-In-Space Interface Control Document, in order to enable the development of products and applications which will be used with Galileo's system and signals.[315]

The EUSC aims to support the decision-making of the EU in the field of Common Foreign and Security Policy (CFSP) and especially European Security and Defence Policy (ESDP). For this purpose it provides geospatial intelligence products and services to the Council of the EU, member States, the Commission and third States and international organisations if deemed relevant to the CFSP and in particular the ESDP (Cf. Chapter 6). The EUSC released a 2008 annual work programme stating the following tasks:

- Support to EU operations in the framework of ESDP, including the EU battle-groups
- Contingency planning
- Control of proliferation of weapons of mass destruction
- Support to EU counter-terrorism policy
- Support to humanitarian aid missions
- Support to EU counter-organised crime policy

One of the latest EU agencies created, the EDA has an overall mission to improve Europe's defence performance by promoting coherence among its member States. In particular, its core functions are to develop defence capabilities, promote Defence R&T, promote armament cooperation, create a competitive European Defence Equipment Market and strengthen the European Defence, Technological and Industrial Base including space activities (Cf. Chapter 6). Following the adoption of the first European Space Policy in May 2007, the EDA is getting more and more involved in space activities, particularly in activities linked to Earth observation, communications and space surveillance (Cf. Chapter 6).

Several EU agencies are increasingly relying on space technologies to perform their mandated tasks. For instance, following a European Directive (2005/35/EC) of the European Parliament and Council, the EMSA developed the CleanSeaNet service. The EMSA ClearSeaNet satellite services offer all EU coastal member States (as well as Iceland and Norway) a near-real-time marine oil spill detection service by using radar satellite imagery (SAR) to enhance the overall maritime safety system within the EU. The services aim at strengthening operational response for accidental and deliberate discharges from ships as well as to locate and identify polluters.

7.1.4 European Parliament

The role of the European Parliament in space affairs has expanded considerably over the years in passing legislation as well as through its say over EU budget, and 2007/2008 was no exception. In particular, the Parliament has co-decision powers (along with the Council) over the regulation on the deployment and commercial phases of Galileo. In the conciliation meeting of 23 November 2007, it reached an agreement with the Council and the Commission to

[314] This is a committee system which oversees the activities implemented by the Commission.
[315] "GSA Releases New Galileo Open Service Signal-In-Space Interface Control Document." GSA Press Release 8 Apr. 2008.

revise the EU's financial framework for 2007-2013 with the purpose to preserve Galileo with public funding taken mainly from unused farm-support funds (see the Council of the European Union section). Furthermore, following the modification of the "Decision of the European Parliament and of the Council, amending the Inter-institutional Agreement of 17 May 2006 on budgetary discipline and sound financial management as regards the multiannual financial framework", and the creation of the Galileo Inter-institutional Panel (GIP) composed of seven representatives with three from the European Parliament (Cf. Chapter 3), it now has more say regarding the political control of the project.

Standing committees of the European Parliament, designed to aid the Commission in initiating legislation, were also active elements in tackling space issues over the last months. Three specialised standing committees (the Committee on Industry, Research and Energy (ITRE), the Committee on Transport and Tourism (TRAN) and the Committee on Foreign Affairs (AFET) and its subcommittee on Security and Defence (SEDE)) adopted reports on legislative proposals and "own-initiative" reports and conducted hearings on particular space topics.

The ITRE Committee had space-related issues on its agenda items on seven of its 25 meetings over the July 2007-June 2008 period, with Galileo being the major space topic agenda followed by MSS. Hearings were also conducted on space policy. However, the report led by Rapporteur Etelka Barsi-Pataky on the amended proposal for a "regulation of the European Parliament and of the Council on the further implementation of the European radio-navigation programmes (Galileo and EGNOS)" was the major space issue being discussed by the Committee. The other main topic was the report led by Rapporteur Fiona Hall on the selection and authorisation of systems providing MSS.[316]

Space affairs were also tackled by the TRAN Committee, however mainly in response to the aforementioned GNSS report while in its draft phases.

The SEDE held a series of activities linked to space affairs, and particularly space security issues (Cf. Chapter 6). A series of hearings and exchange of views occurred during the period, and a study on "The Cost of non-Europe in the field of satellite based systems" was also released. Furthermore, an "own-initiative" report was drafted by the Subcommittee chairperson on "Space and Security".[317]

Finally, other ad hoc structures of the European Parliament were also involved in space affairs. For instance, on 25 June 2008, at the second meeting of the European Parliament Platform on Civil Protection, geo-information was the main issue presented, and among other things, the importance of Earth observation services for civil protection was stressed.[318]

7.2 Other institutions

Besides the aforementioned institutions, other bodies and organs, particularly linked to parliamentary and regional structures, are active and influential for European space activities.

7.2.1 Assembly of the Western European Union (WEU)

The WEU released a report on space issues through one of its permanent committees, the Technological and Aerospace Committee. The report submitted by Edward O'Hara and Giannicola Sinisi entitled "Space Systems for Europe's Security: GMES and Galileo – reply to the annual report of the Council", was released on 4 June 2008. A recommendation was subsequently adopted during the third sitting of the 54th Plenary Session on 4 June 2008.[319]

7.2.2 European Inter-parliamentary Space Conference (EISC)

The EISC [320] held its ninth Conference in 2007. In 2007, Italy had the chair of the EISC for the second time after 2000. The VAST Committee (Committee for the Evaluation of Scientific and Technological Options) of the Chamber of Deputies, which is responsible for technological and space issues at parliamentary level took care of the organisation of this chairmanship. In the

[316] The GNSS related proposal was voted by the European Parliament on 23 April 2008 (607-36-8) and the MSS related proposal on 21 May 2008 (652-16-10). The vote on GNSS gave the approval for the reprofiled flagship project.

[317] This document was adopted on 10 July 2008 by the European Parliament (483-99-20).

[318] The Platform was launched on 13 February 2008 to promote the European Parliament with an in-house resource for better inform member of the European Parliament (MEPs) on currents status on Civil Protection.

[319] Recommendation 821

[320] The EISC is a permanent forum to foster cooperation on space policy issues between European national parliaments.

second half of the year, a seminar on "Space exploration: the role of Europe" was held on 24 July 2007, as well as the ninth Plenary Conference. The topic of the two-day Plenary Conference held on 8-9 October 2007 was the relation between the European space policy and its impact on the life of citizens and on enterprises, as well as on public administration. Nineteen parliamentary delegations with 63 members of parliaments (MPs) took part in the Conference; for the ESIC: Belgium, the Czech Republic, France, Germany, Italy, Spain, the United Kingdom and Russian MPs attended and as observers: Poland, Romania, Estonia, Lithuania, Norway, Portugal, Slovenia, Sweden, Switzerland, China and Japan MPs attended. A final resolution was approved at the end of the Conference stressing among other things, the need to strengthen interrelations between the EU, ESA, national agencies, national programmes and national parliaments. Finally, Poland and Romania joined as new permanent members of the EISC.

In 2008, the Czech Republic held the chairmanship of the EISC for the first time. It was the first time that a country from Central and Eastern Europe played this role.[321] In the first half of the year, two events were held. In February 2008, a workshop as part of the three-day Conference "NavAge 08" took place. In a concise statement, the EISC stressed the need to have a strong participation of the new EU member States in GMES and Galileo, and highlighted the Czech initiative for a Galileo User Forum (GUF). A second workshop, also taking place in Prague, on space applications was held on 28 June 2008 on small and medium enterprises (SMEs) with a particular view on the new EU member States. A meeting of the preparatory committee for the GUF also took place. The 10th Plenary Meeting will be held on 13 October 2008.

7.2.3 Network of European Regions Using Space Technologies (NEREUS)

Recognising that European regions are increasingly being involved in space activities ranging from infrastructures to applications, a new actor in the European space context is emerging with the coordination of activities at a regional level.

The NEREUS was formally established on 18 December 2007 with an inaugural assembly in Toulouse (France) with the aim to promote cooperation between European regions. Twenty-three European regions from nine member States were represented and signed the NEREUS Charter, a formal document developing the scope and aims of the network. Created at the instigation of the French Midi-Pyrenees Region, this network is intended to create a forum for dialogue exchanges and discussions between the regions and European space stakeholders. NEREUS follows the April 2007 Graz Conference entitled "A Market for GMES in Europe and its regions – The Graz Dialogue" organised by the Austrian Presidency of the EU that acknowledged the role of regions in space-related activities and particularly Earth observation. The role of regions in GMES was mentioned as essential to the definition and use of GMES services. [322] A total of 35 European regions representing ten EU member States have since December 2007 expressed their interests in NEREUS.[323]

NEREUS and its member regions aim, among other things, to influence both Europe and national policy debates and programmes in the development and exploitation of space technologies and applications; to bring closer coordination and cooperation between member regions in their policy, strategy and dialogue with European institutions, Europe and national programme exploitation activities. The NEREUS Association will include two groups:

- The group of Regional Authorities in charge of the governance and of relations with the EU institutions, member States, space agencies and the EISC.
- The group of associate members will regroup industries, training institutions, private and public research laboratories and other public and private actors.

[321] Up to 2007, the following countries held the Presidency of the EISC Belgium (twice), France (twice), Germany (once), Italy (twice), Spain (once) and the United Kingdom (once).

[322] For more information see Peter, Nicolas. "Space Policy, Issues and Trends in 2006/2007." ESPI Report 6 Sept. 2007: 94.

[323] Regions that have shown their interest are Wien-VBA (Austria) Région Bruxelles Capitale, Région Wallonne (Belgium) Alsace, Aquitaine, Bretagne, Midi-Pyrénées, Nord Pas-de- Calais, Provence-Alpes-Côte d'Azur (France) Baden-Württemberg, Bayern, Brandenburg, Bremen, Hessen, Mecklenburg-Vorpommern (Germany) Abruzzo, Basilicata, Campania, Emilia Romagna, Lazio, Lombardia, Molise, Piemonte, Puglia, Toscana, Veneto (Italy) Mazovieckie Viovodeship (Poland) Açores, Madeira (Portugal) Kosice, Presov (Slovakia) Aragon, Catalunya, Madrid (Spain) East Midlands (United Kingdom).

7.3 International institutions

The main international institutions involved in space affairs are the United Nations (UN) with their main bodies such as the United Nations General Assembly (UNGA) and other committees and specialised agencies being involved in space activities primarily at policy and application levels.

7.3.1 United Nations General Assembly (UNGA)

The UNGA was particularly active in tackling space-related issues in 2007/2008.

At the 62nd plenary session of the UNGA, three resolutions pertaining to space affairs were passed, as well as one recommendation.

- The resolution on the annual Prevention of an Arms Race in Outer Space (PAROS) (A/RES/62/20);
- The resolution on the Transparency and confidence-building in outer space activities (A/RES/62/43);
- The resolution on the International cooperation in the peaceful uses of outer space (A/RES/62/217);
- The recommendation on enhancing the practise of States and international intergovernmental organisations in registering space objects (A/RES/62/101).

The PAROS draft resolution dealing with space security issues was adopted on 5 December 2007 (A/RES/62/20) with 178 votes for, the United States voting against and Israel abstaining. In this resolution, the UNGA calls all States (in particular space powers) to contribute actively to the objective of peaceful uses of outer space and to the prevention of an arms race in space and to refrain from actions contrary to that objective. It also calls on all States to enforce the relevant existing treaties in the interest of maintaining international peace and security, and particularly, international cooperation. The resolution reiterates as well that the Conference on Disarmament (CD) has the primary role in the negotiation of agreements on PAROS in all its aspects.

The draft resolution entitled "Transparency and confidence-building in outer space activities" was also adopted on 5 December 2007 (A/RES/62/43) with an overwhelming majority of 179 votes for, with again the vote against it by the United States and the abstention of Israel, signifying therefore the strong international support for this resolution. The resolution recognises the threat of militarisation of outer space for international peace and stability. It requests that member States continue submitting concrete proposals to tackle this issue, and that "transparency and confidence-building measures in outer space activities" be addressed during the 63rd plenary session.

The draft resolution "International cooperation in the peaceful uses of outer space" was adopted on 22 December 2007 (A/RES/62/217) without a vote. This resolution calls all States, in particular those with major space capabilities, to contribute actively to the goal of preventing an arms race in outer space. A separate vote was recorded on operative paragraph 42 which concerned the "United Nations Platform for Space-based Information for Disaster Management and Emergency Response" (SPIDER) programme's funding along with its platform form the biennium 2007-2009 and work plan for the period 2008-2009.[324] One hundred and twenty-nine States voted in favour, six voted against and 13 abstained.

Finally, recommendations to enhance the practise of states and international intergovernmental organisations in registering space objects were adopted on 17 December 2007 (A/RES/62/101) without a vote. This resolution recommends that countries and international intergovernmental organisations register launched space objects. This is intended as a monitoring action, which requires harmonisation in the recorded data, as well as further measures in case of the non-declaration of space activities. Furthermore, precisions are given in cases of joint launches or changes of space asset supervision while in orbit. This recommendation aims to promote transparency and security through increased information-sharing and the monitoring of space activities.

7.3.2 UNGA Committees

In 2007/2008, three UNGA committees were particularly involved in space affairs:

- The First Committee for Disarmament and International Security (DISEC), concerned with disarmament and related international security questions;
- The Fourth Committee on Special Political

[324] SPIDER aims to ensure access to and use of such solutions during all phases of the disaster, including the risk reduction phase, which will significantly contribute to an increasing reduction in loss of lives and property.

and Decolonisation (SPECPOL), dealing with a variety of political subjects not dealt with by the First Committee;
- The Committee on the Peaceful Uses of Outer Space (COPUOS) that aims to review the scope of international cooperation in peaceful uses of outer space to devise programmes in this field to be undertaken under UN auspices, to encourage continued research and the dissemination of information on outer space matters, and to study legal problems arising from the exploration of outer space.[325]

Disarmament and International Security Committee

During the First Committee's session in October 2007, there was a complete consensus on the need to preserve outer space for peaceful and cooperative uses.[326] The majority of States recognised that the key threat to preserving outer space is the likelihood of its weaponisation and a subsequent arms race. Several States consequently called for further substantive debates and negotiations on a comprehensive legally-binding PAROS treaty in the CD and for the reestablishment of a PAROS Ad Hoc Committee. Two draft resolutions regarding space security issues were presented and adopted.

The annual draft resolution on PAROS (A/C.1/62/ L.34) was introduced by Sri Lanka. This annual resolution was identical to last year's proposal and noted that an international agreement to prevent an arms race in outer space "remains a priority task" of the Ad Hoc Committee in the CD. The resolution placed emphasis on:

- The need for greater transparency and for confidence building measures which could form the heart of any agreement;
- The urgency of preventing an arms race in outer space;
- The inadequacy of the existing legal regime;
- The necessity to examine further measures with effective and appropriate verification provisions, including the issue of weaponisation.

The resolution also called for the CD to establish an Ad Hoc Committee as soon as possible to tackle this issue. It was voted in the First Committee by 170 for, one against (the United States) and one abstention (Israel).

Russia introduced a draft resolution entitled "Transparency and Confidence-Building Measures (CBMs) in Outer Space Activities" (A/C.1/62/L.41). This proposal followed the same resolution as last year. The new resolution directed the Secretary-General to submit a similar report to the next session of the UNGA and further invited States to continue submitting proposals on international outer space transparency and confidence-building measures. The resolution also continued to assert that measures are needed to prevent an arms race in outer space, including weaponisation. It was voted by 168 States for, one against (the United States) and one abstention (Israel).

Special Political and Decolonisation Committee

The Fourth Committee adopted two texts proposed by France. A text on "International cooperation in the peaceful uses of outer space" (A/C.4 /62/L.9) setting the work programme for UN-SPIDER for the coming year was put forward. The aforementioned operative paragraph 42 of the text was approved by a vote of 148 States in favour, six votes against and three abstentions. The draft resolution (document A/C.4 /62/L.9) was approved without a vote. The text on "recommendations on enhancing the practise of States and international intergovernmental organisations in registering space objects" (A/C.4/62/L.8), which would give direction to the reduction of space debris, was also considered. The latter guidelines were the result of five years of work in the Legal Subcommittee of the COPUOS. They were approved without a vote.

Committee on the Peaceful Uses of Outer Space

At the 45th session of the Scientific and Technical (S&T) Subcommittee (11-22 February 2008) the newly established space-system-based disaster management programme (UN-SPIDER) was a main focus. Possible dangers from Near-Earth Objects (NEOs), space debris mitigation and a safety framework for nuclear power sources in outer

[325] The COPUOS has two standing Subcommittees: the Scientific and Technical Subcommittee and the Legal Subcommittee. The Committee and its two Subcommittees meet annually to consider questions put before them by the UNGA, reports submitted to them and issues raised by the member States.

[326] This Committee meets every year in October for a 4-5 week session, after the UNGA General Debate. At each meeting Disarmament Counsellors and Ambassadors read statements on general or thematic issues, propose draft resolutions, and vote on the resolutions. There is generally an annual PAROS resolution up for vote; and additional resolutions related to outer space are also often proposed and voted on.

space were also key agenda items. Other topics of discussion included a review of the implementation of the recommendations of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), recent developments in Global Navigation Satellite System (GNSS), the use of the geostationary orbit, the International Heliophysical Year (IHY) and matters related to space-based remote sensing, particularly to monitor the environment and develop applications for developing countries. Space debris mitigation measures and solutions were discussed as well.

The following month, during the 47th session of the Legal Subcommittee (31 March - 11 April 2008), capacity-building in space law and exchange of information on national legislation relevant to the peaceful exploration and use of outer space were two new items on the agenda. Other topics included:

- The status and application of the five UN treaties on outer space;
- The definition and delimitation of outer space;
- The draft Protocol on Matters Specific to Space Assets to the Convention on International Interests in Mobile Equipment;
- Review and possible revision of the principles relevant to the use of nuclear power sources in outer space;
- Matters relating to the character and use of the geostationary orbit.

Like in previous years, international organisations reported on their activities related to space law.

At the 51st plenary session of the COPUOS (11-20 June 2008) disaster management, climate change and food security, space and water, space and society, as well as space and education were among the main topics of discussions.

7.3.3 Other UN bodies and organs monitoring outer space activities

Besides the UNGA and related specialised committees, there are other UN programmes, specialised UN agencies and other organs having activities relevant to space.

The UN Space Applications Programme (SAP) is primarily in charge of cooperation in space science and technology. The activities of the SAP encompass four main categories: the identification of areas where space applications could be useful; education and training; the dissemination of the information on the status of space technology; and the promotion of pilot projects supporting economic and social development. In the second half of 2007 a series of workshop and conferences were held in Austria, India, Russia, Vietnam and Argentina, and in the first half of 2008 in Saudi Arabia, Burkina Faso, Bulgaria and Columbia. Conferences were held on diverse themes, ranging from space applications for sustainable development, micro-satellites and environment monitoring, space law education, water management, to cooperation among national agencies on tele-health for Africa.

The International Committee on Global Navigation Satellite Systems (ICG) [327] has been gaining momentum in recent months. The second meeting of the ICG organised by the Indian Space Research Organisation (ISRO) took place in Bangalore (India) on 5-7 September 2007. In particular, a Providers Forum was established at the occasion of this meeting with the aim to promote greater compatibility and interoperability among current and future providers of GNSS. The current members of the Providers Forum include China, the European Community, India, Japan, Nigeria, Russia and the United States.[328] The ICG will hold its next meeting in 2008 in Pasadena (USA).

The United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) [329] organised a series of workshops in 2007/2008.

- The First United Nations International UN-SPIDER Bonn Workshop on “Space-based Information and Solutions for Disaster Management and Emergency Response" took place on 29-31 October 2007.
- The "fourth UN-wide Meeting on the Use of Space Technologies for Emergency Response and Humanitarian Assistance" was held in Bangkok (Thailand) on 27

[327] The ICG was established on a voluntary basis on December 2005 as an informal body to promote cooperation, as appropriate, on matters of mutual interest related to civil satellite-based positioning, navigation, timing, and value-added services, as well as compatibility and interoperability among GNSS.
[328] The first meeting of the Providers Forum was held in Bangalore (India) on 4 September 2008. The second meeting was held on 18 February 2008 in Vienna (Austria).
[329] UN-SPIDER was created by the UNGA Resolution 61/110 adopted on 14 December 2006 with the mission to "ensure that all countries and international and regional organizations have access to and develop the capacity to use all types of space-based information to support the full disaster management cycle".

November 2007.

- A "United Nations/China Regional UN-SPIDER Workshop: Building Upon Regional Space-based Solutions for Disaster Management and Emergency Response" took place in Shenzhen (China) on 3-5 December 2007.
- A "United Nations International UN-SPIDER Expert Meeting: Building Upon the Network of Regional Support Offices" was also held in Salzburg (Austria) on 7-9 February 2008.

Finally, the Bonn Office was inaugurated on 29 October 2007 and the next offices are foreseen to open in Beijing (China) and in Switzerland in 2008.

Several specialised agencies of the UN are also active in space. The two most important are the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Telecommunication Union (ITU).[330]

In 2007/08, UNESCO[331] was involved in a series of space-related events. UNESCO is very active in using space-related technologies to pursue its international Conventions and Charter goals. Earth observation and other imagery and scientific satellites are being used, as they allow UNESCO to monitor, assess and spread data to tackle climate change, environment and cultural heritage problems.

In January 2008, a meeting between experts was organised at the UNESCO headquarters for the Space for Science programmes developed by ESA and UNESCO. This programme promotes scientific cooperation in South-eastern Europe.[332] In April 2008, a workshop was jointly organised by CNES and UNESCO in Toulouse (France) on the theme of space and archaeology: "Archaeology and remote sensing".[333] The "Open Initiative" was also an area of major progresses in 2007/2008.[334] In November 2007, the German Aerospace Centre (DLR) formally joined the "Open Initiative", bringing the possibility to use TerraSAR-X data for the preservation of UNESCO World Heritage sites.[335] In March 2008 Spot Image joined the "Open Initiative" as well. This will allow UNESCO to use Earth observation data to monitor climate change. UNESCO wishes to further strengthen its cooperation with Spot Image.[336] A Chinese proposal to establish a centre in Beijing (China) for the "Open Initiative" was approved during UNESCO's 179th Executive Board Meeting.[337] It will be located in the Centre for Earth Observation and Digital Earth (CEODE), in the Chinese Academy of Sciences.[338] This Centre will allow developing countries to have access to satellite data, in order to better understand, monitor and assess climate change, environmental impacts of human activities as well as observe World Heritage sites. Countries will thus be able to address these issues more efficiently.[339]

The ITU was particularly active 2007/08 in the adoption of new regulations. In the fall of 2007, at the World Radio-communication Conference (WRC), the revised and updated Radio Regulations to meet the growing demand for radio frequency spectrum for space services were adopted. In particular, there was a revision of the Fixed Satellite Service (FSS) plan for communications, television and internet to facilitate access to spectrum and orbit resources for FSS system, as well as the revision of the international regulations relating to maritime mobile services including distress and safety transmissions.

Regarding natural disasters, ITU has been active in 2007/2008 in providing communications support in cases of emergencies such as in the cases of Uganda and Zambia's floods respectively in October 2007 and March 2008 as well as Peru and China's earthquakes respectively in September 2007 and May 2008. Transportable terminals and satellite communication systems have been deployed,

[330] Specialized Agencies are autonomous organizations working within the UN system.
[331] The UNESCO aims to contribute to peace and security by promoting international collaboration through education, science, and culture in order to further universal respect for justice, the rule of law, and the human rights and fundamental freedoms proclaimed in the UN Charter.
[332] "L'UNESCO poursuit son projet de coopération scientifique en Europe du Sud-est." UNESCO communication et information- Service des actualités 11 Feb. 2008.
[333] "The French Space Agency (CNES) and UNESCO: Space and Archaeology." UNESCO News and Events 24 Apr. 2008.
[334] The UNESCO-ESA Open Initiative on the use of space technologies to monitor natural and cultural heritage of UNESCO sites.
[335] "The German Aerospace Center Joins the 'Open Initiative." UNESCO News and Events 14 Nov. 2007.
[336] "Spot Image Joins the 'Open Initiative': From Space to Place." UNESCO News and Events 7 Mar. 2008.
[337] This process requires the endorsement of the UNESCO General Conference that will be held in October 2009.
[338] "The ESA-UNESCO 'Open Initiative: from Space to Place' makes an Important Step Forward." UNESCO News and Events 14 Apr. 2008.
[339] "Rapport du Directeur General sur l'Examen de Faisabilité de l'Etablissement d'un Centre international: Technologies de l'Espace au Service de Patrimoines Culturel et Naturel, en tant que Centre de Catégorie 2, sous l'Egide de l'UNESCO." Conseil Exécutif UNESCO point 7 de l'ordre du jour 28 Mar. 2008.

facilitating rescue, and government and victims communication and coordination capabilities.[340] Furthermore, a conference on "Global Forum on the Effective Use of Telecommunications/ICT for Disaster Management: Saving Lives", was held in Geneva (Switzerland) on 10-12 December 2007.[341] Two important initiatives resulted from the conference: the ITU Framework for Cooperation in Emergencies and the ITU Network of Volunteers for Emergency Telecommunications. Agreements with industries were also concluded in order to provide ITU with more material capabilities and funding for these emergency operations.[342]

The United Nations Coordination of Outer Space Activities[343] met for its 28th session on 16-18 January 2008. The key issues considered during this Inter-Agency Meeting on Outer Space Activities were:

- Coordination of plans and programmes and exchange of views on current activities in the practical application of space technology and related areas;
- Space-related outcomes of the World Summit on Sustainable Development (WSSD);
- Implementation of the recommendations of UNISPACE III;
- Use by the UN of the Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters by the UN system and methods to increase operational collaboration in the use of space technology in emergency response;
- Lessons learned and good practices in the use of space technologies for relief efforts and disaster reduction;
- Participation of the entities of the UN system in the process of the Group on Earth Observation (GEO);
- Public-private partnerships and innovative funding approaches in the UN system to promote the use of space technology and its applications.

Subsequently, a report was issued on the coordinated space-related activities of the UN system.

The United Nations Institute for Disarmament Research (UNIDIR)[344] also deals with space related issues.[345] It held seminars and conferences to generate food for thought, and promoted informal, confidence-building dialogues. In 2007/2008, two main events dealing with outer space issues occurred in the context of the UNIDIR activities. A conference on "Exploring cooperative approaches to security" was held on 15 October 2007 in New York (USA). The objectives of this event were to discuss issues relating to the future of space security, peaceful and cooperative uses of outer space and the prevention of an arms race in outer space. Another conference was held on 31 March – 1 April 2008, entitled "Security in space: the next generation". The objective was to discuss issues related to the future of space security and examine confrontational versus cooperative approaches in space exploration, consider the new generation of legal regimes of outer space, and ensure peaceful uses of space for all.

UNIDIR is also home to the Conference on Disarmament (CD) which is the single multilateral disarmament negotiating forum of the international community, including space arms control. Substantive discussions on PAROS were included in the CD's proposed programme of work, and discussions on a treaty to prevent the placement of weapons in outer space gained popularity in recent CD sessions. For many years a general agreement has developed through resolutions and discussions within the UN that an arms race in outer space should be prevented. However, due to the structure of the international legal regime and to the objection of a few States (mainly the United States[346]), a treaty on PAROS has not yet been negotiated to comprehensively prevent

[340] "ITU Deploys Satellite Terminals in Quake-Hit China." ITU press release 22 May 2008; "Zambia Flood Victims Re-Connected to Aid Relief and Reconstruction." ITU press release 17 Mar. 2008; "Uganda Flood Victims Receive Telecommunication Links." ITU press release 16 Oct. 2007 ; "Vital Communication Links Restored After Peru Quake." ITU press release 27 Feb. 2008.

[341] "Zambia Flood Victims Re-Connected to Aid Relief and Reconstruction." ITU press release 17 Mar. 2008.

[342] "ITU Global Forum Adopts Action to Strengthen Response in Emergencies." ITU press release 13 Dec. 2007.

[343] The United Nations Coordination of Outer Space Activities is the formal mechanism to coordinate the activities of all related UN bodies and agencies that convene on an annual basis to discuss current and future activities, emergent technologies of interest and other related matters.

[344] UNIDIR is an autonomous entity within the UN structure which role is to inform States and the global community on questions of international security and to assist with disarmament efforts.

[345] UNIDIR, through its research projects, publications, small meetings and expert networks tries to bridge the gap between researchers, diplomats, government officials, non-governmental organizations (NGOs) and other institutions to explore both current and future security issues.

[346] The United States' delegations to multilateral disarmament fora routinely argues that there is no arms race in space and that there is no prospect of an arms race in space and that it will continue to protect its access to, and use of, space.

the deployment of weapons in space or to prevent an arms race in outer space. Furthermore, some delegations and experts have argued that PAROS is not the most relevant term or treaty to pursue. In this context, discussions in the CD have recently evolved by shifting focus on a treaty to prevent the placement of weapons in outer space. On 12 February 2008, Russia's Foreign Minister, Sergey Lavrov, addressed the CD and presented a joint Russia-China draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects (PPWT). It is the first draft treaty on this issue formally introduced to the CD, though it is based on elements proposed in a working paper to the CD in June 2002 by Russia, China, Vietnam, Indonesia, Belarus, Zimbabwe, and Syria.

7.4 Non-governmental organisations (NGOs)

A new type of actors is increasingly getting involved in space affairs at a transnational level: NGOs. In particular, in 2007/2008, the United Nations Conference of Non Governmental Organisations (UN-CONGO) in consultative relationships with the UN and other stakeholders such as international, non-profit membership association of NGOs organised a Forum on Civil Society and Outer Space in Vienna (Austria) on 8-9 October 2007. The focus of the meeting was on three domains: the use of space, the rules of the road, and the relevance and benefits of space applications and safeguarding space. A position paper calling for setting up an NGO Committee on Outer Space was adopted on the occasion of this event.

One of the most active NGOs is the Space Generation Advisory Council in Support of the United Nations Programme on Space Applications (SGAC), which is an international non-profit organisation presenting views of the youth in space issues to the UN, space agencies and other bodies.[347] In 2007/2008 SGAC finalised the second round of surveys for a project on youth vision for the next 50 years of space exploration. On behalf of its members, it addressed the UNIDIR annual conference on space security, under the theme of providing security for the Next Generation. In March 2008, SGAC announced an international youth technical paper competition to develop unique and innovative concepts to deflect an asteroid or comet that could impact the Earth (referred to as mitigation). The SGAC working group on Near Earth Objects (NEOs), which has been actively contributing to the UN COPUOS Action Team 14 on NEOs conducted a survey on "NEOs – A Youth Perspective" results of which were presented during the COPUOS S&T Subcommittee in February 2008. SGAC also concluded a study concerning the Applications of Global Satellite Navigation Systems, results of which were presented at the United Nations/Colombia/United States of America Workshop on the Applications of Global Navigation Satellite Systems which took place in Medellin (Colombia) on 23 - 27 June 2008.

[347] It has a permanent observer status at the UNCOPUOS and is a member of the International Astronautical Federation (IAF).

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Mission Statement of ESPI

The mission of the European Space Policy Institute (ESPI) is to provide decision-makers with an independent view and analysis on mid- to long-term issues relevant to the use of space.

Through its activities, ESPI contributes to facilitate the decision-making process, increases awareness of space technologies and applications with the user communities, opinion leaders and the public at large, and supports students and researchers in their space-related work.

To fulfil these objectives, the Institute supports a network of experts and centres of excellence working with ESPI in-house analysts.