

Space events diary, July - September, 2001
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All times given in UTC

September 28

Orbital Sciences Corporation will provide its subsidiary company, Orbimage with \$1.2 million cash, up to \$3.2 million in secured debtor-in-possession funding and the deferral of \$8.6 million provided under the OSC/Orbimage procurement agreement. Orbimage intends to file for reorganisation under Chapter 11 of the US Bankruptcy Code in October. Orbimage's Orbview 4 commercial remote sensing satellite was lost in the failure of an OSC Taurus booster on 21 September, adding to the companies' woes.

An audit by NASA's Office of Inspector General shows that the agency cannot substantiate the \$26 million savings reported to the Congress for the first two years of its much-vaunted Consolidated Space Operations Contract and cannot determine whether the contract will achieve the anticipated \$1.4 billion cost savings through to 2008.

The Southwest Research Institute and the John Hopkins Laboratory, New Horizons team has completed its NASA-funded Phase A Pluto-Kuiper Belt mission study. Two organisations were each awarded the \$450,000 Phase A contracts. A 2004 launch will enable the craft to reach Pluto in 2014 or a later January 2006 launch will extend the arrival time to 2017.

Boeing Satellite Systems International had advised customers of potential long-term issue in solar array output on the new HS-702 spacecraft bus. The arrays have exhibited a faster than expected power performance degradation during early operational life. XM Radio which operates two HS-702 satellites says it does not expect the situation to affect the quality of its services to customers across the USA – until after 2005 at the earliest – and has advised its insurers of a potential for a claim of damages. Future HS-702s will be equipped with improved solar arrays but five are already in orbit, including the XMs and PanAmSat's Galaxy II and PAS IR and Telesat Canada's Anik F1. Other HS-702s being prepared for launch in 2002 are Galaxy 3C and Hughes' Spaceway 1, due Sea Launch flights and Telesat's Anik F2, to fly an Ariane 5.

The first detailed global mapping of an asteroid – the 20 km long 433 Eros, by NASA NEAR-Shoemaker spacecraft – has suggested that most of the larger 6,760 rock larger than 15 m across, strewn across the 1,125 sq. km body were ejected from a single 7.6 km wide crater – which may be called Shoemaker – in a meteorite collision.

The delay to the shipment of the DirecTV5 communications satellite to Baikonur, Kazakhstan for its ILS International Launch Services flight aboard a Proton booster on 11 October is due to a "technical issue" says Space Systems Loral and not due to the potential action against terrorism in nearby Afghanistan.

September 27

The Common Booster Core first stage of the first flight-version of the Boeing Delta IV which will make its maiden launch in April 2002 has left the company's Decatur factory in Alabama and will arrive at Cape Canaveral's Pad 37 in about 10 days where it will undergo testing, including a static test firing of its engine.

The first orbital launch from Kodiak Island, Alaska using a Lockheed Martin Athena 1 booster carrying NASA and US Air Force payloads has been delayed yet again, this time to 28 September at the earliest so that the effects of a solar storm can abate.

The European Space Agency's Huygens spacecraft en route to arrive at Saturn and the moon Titan in 2004-05 has passed its 8th in-flight test, 1 billion km from Earth. The next test is planned for March 2002.

The Russian Pirs docking and airlock module at the International Space Station has detached its propulsion unit, clearing the way for the first EVA from the craft on October 8 to connect power and data cables between it and the Zvezda service module.

The American DirecTV satellite due to be launched by an ILS International Services Proton booster from Baikonur on 19 October has not yet arrived at the launch site and the launch is likely to be delayed.

September 26

The main oxygen generator on the International Space Station has shut down and a humidity-removal unit has also stopped working. It will take a week before the malfunctions have any significant effect and it is hoped the Russian engineers will have the problem solved in time. Meanwhile, back-up units are being used.

SpaceDev – the world's first publicly traded commercial space exploration and development company – reports that it has been awarded a proprietary research programme contract with a potential total value of \$2.2 million – but can't release details.

NASA is to resume a Spaceflight Participant Programme, that will allow members of the public to make flights aboard the Space Shuttle, as part of an Enhanced Strategy of the Development of Space Commerce which also includes the possibility of the US portion of the International Space Station being managed by a private company. Increasing parts of the Space Shuttle programme may also be turned over to private contractors. The strategy will cover five sectors: technology, research, infrastructure and facilities, media and communications, including entertainment, and space travel and exploration.

The next Ariane 5 launch will be delayed until January 2002 from November this year as the recovery plan continues after the Ariane 5 launch failure in July in which two satellites were lost. Over 60 test firings of Aestus upper stage engine of the Ariane 5 which malfunctioned during the last launch have been completed and Arianespace is aiming for a new year flight with the European Space Agency's Envisat polar platform as the payload.

Meanwhile, Arianespace successfully launched an Ariane 44P booster on mission V144 from Kourou on 25 September carrying Eutelsat's Alcatel Space-built 26 Ku-band transponder Atlantic Bird 2 communications satellite. Flight V145 will be launched on 27 November, carrying DirecTV 4S aboard an Ariane 44LP.

The first orbital launch from Alaska's Kodiak Island has been postponed again, this time due to an intense solar storm. The Lockheed Martin Athena 1 and its NASA and US Air Force satellites could fly later today.

Images of the nucleus of the comet Borrelly taken by NASA's New Millennium programme spacecraft, Deep Space 1 have been released. The 4 km by 8 km body was spewing three distinct columns of dust and the frozen dust and ice core was coated with a black material thought to be a mix of organic molecules. Deep Space 1 also returned data the gases and infrared waves in the coma around the nucleus.

XM satellite Radio launched its radio service in San Diego and Dallas-Fort-Worth on 25 September. The company plans a US-wide service, in competition with Sirius Satellite Radio, later this year offering 100 channels to homes and mainly cars at a cost of \$9.99 a month. The car stereo systems will cost between \$250 to \$400 with an additional cost of \$79 for the special antenna on car roof. Both XM Radio and Sirius are hoping for a market of four million subscribers each.

China plans to participate in the European Galileo navigation satellite system in a move to detach it from the American system and to attract commercial launches by its Long March boosters.

September 25

NASA says that the most intense meteor storm since 1966 could cause damage to at least one satellite in November. The annual Leonid meteor shower, made up from debris from the comet Tempel-Tuttle, is likely to reach a peak of 15,000 particles the size of a grain of sand per hour. NASA says the chances of a satellite-hit are as low as 1-in-1, 000.

Boeing companies Sea Launch and Boeing Space and Communications are establishing a joint sales and marketing company, Boeing Launch Services to promote commercial launches of the Delta and Zenit 3SI Sea Launch fleets under the Boeing Expandable Launch Systems subsidiary. A separate entity will be formed to market government Delta launches, while Sea Launch will remain a separate operation.

September 24

Ariane Flight V144 will be launched from Kourou on 25 September, carrying the Eutelsat Atlantic Bird 2 satellite aboard an Ariane 44P booster.

Bad weather and tracking radar problems delayed the Athena 1 launch of US Air Force and NASA small satellites from Kodiak Island, Alaska until early Tuesday morning, 25 September.

The Orbital Sciences launch of its four-stage Taurus solid propellant booster from Vandenberg AFB, California on 21 September failed. The second stage veered off course at T+83 seconds and was brought under control but the loss of energy resulted in the eventual separation of the NASA QuickTOMS and Orbimage's OrbView 4 satellites and a container, from the Celestis company, holding small samples of ashes of 50 deceased persons, was performed at too low an altitude and the payloads plunged into the atmosphere. It was the sixth launch and first failure of the Taurus which made its maiden flight in 1994 and followed the failed launch of a hybrid OSC Pegasus booster in June carrying the NASA X-43A Hyper-X scramjet test craft.

NASA's Deep Space 1 New Millennium programme spacecraft made a successful fly-by of the comet Borrelly on 22 September, passing to within 2,200 km of the nucleus at a speed of 60,000 kph and taking some black and white images, which will be transmitted back to Earth, 220,000 km away, in the next few days. The craft also transmitted spectrometer measurements, ion and electron data and measurements of the magnetic field and plasma waves.

NASA and the United Space Alliance (USA), a joint-Boeing and Lockheed Martin company, have signed a \$62 million modification to the USA Space Flight Operations Contract to provide refurbishment over a period of five years, starting in 2003. The work involves the eventual complete refurbishment of the 11 actuators on the Columbia, Discovery, Atlantis and Endeavour orbiters. The actuators operate the vehicle's rudder, speed brake and main engine gimbaling.

NASA's Kennedy Space Centre, Florida will exercise a \$47,5 million cost-plus-award-fee option under its existing agency-wide \$1,9 billion, five-year Consolidated Space Operations Contract (CSOC) with Lockheed Martin Space Operations, for work to include the communications upgrades.

September 20

The launches of Taurus and Athena boosters from Vandenberg, California and Kodiak Island, Alaska on 21 September are on schedule, weather permitting. The Taurus will launch QuickToms and OrbView 4, while the Athena 1 - making the first satellite launch from the Alaska site - will carry Foroe and NASA small satellite payloads.

NASA's planned unmanned Mars missions are being hit by budget cuts, which could result in the first sample return mission being delayed even further than 2011. Original plans two years ago had this mission scheduled for 2005 but the dual-failures of the Mars Climate Orbiter and Mars Polar Lander in 1999 resulted in a rationalisation of Mars programmes. The 2007 launch of the Smart Lander is likely to be delayed to 2009 due to "budgetary concerns". Earlier missions include the Mars Odyssey orbiter due to arrive in October, a dual Long Range Mars Rover science laboratory mission to be launched in 2003, with the possibility of being reduced to one rover only, and the 20 cm resolution Mars Reconnaissance Orbiter to be launched in 2005.

September 19

Two small satellites were deployed from the US Air Force MightySat 2 spacecraft, Sindri, on 7 September. Sindri, which was launched in September 2000, is connected to the two 0,25 kg Picosats by 30 m long tethers in an experiment that also took place using two similar craft in February 2000 from the Opal satellite.

Japan's Mitsubishi Electric is building two technology demonstration satellites to be launched in 2003 and 2005. The Space Environment Reliability Verification Integrated System (SERVIS) craft will verify low cost, commercial off-the-shelf parts and technologies in severe space condition, particularly the radiation environment, to prove they can be used for future spacecraft projects, reducing costs and providing faster component delivery.

The European Space Agency (ESA) has launched a new initiative to help small companies to enter the field of information technology and satellite communications by providing early-stage investment and support worth up to 300,000 Euros and access to ESA's experience in satellite

communications and an opportunity to forge links with industry.

Boeing Satellite Systems (BSS) has completed the design of nine unique types of custom-made integrated circuits for the two-satellite Hughes Network Systems Spaceway high-speed broadband satellite system for North-America, starting operations in 2003. The Boeing circuits will be used with IBM DSPs providing "the most powerful space-borne signal processor to orbit the Earth", says BBS, capable of 50 trillion operations per second, the equivalent of 10,000 Pentium III-based computers.

September 18

Former US Air Force Manned Spaceflight Engineer, Chuck Jones, who was scheduled to fly a Space Shuttle mission to assist in the deployment of two DoD satellites in August 1987 and whose mission was cancelled after the Challenger accident, was a victim of the terrorist attack on the north tower of the World Trade Centre aboard the American Airlines flight 11.

Roy Bridges, the director of NASA's Kennedy Space Centre (KSC), Florida has confirmed that the space agency is considering privatising the operation of the Space Shuttle launch base. He has also suggested that the US Air Force, which operates the adjacent Cape Canaveral launch site may follow suite.

NASA's Deep Space 1 Millennium programme spacecraft will plunge into the coma of the comet Borrelly on 22 September, attempting to pass to within 2,000 km of the nucleus while travelling at 16,5kps.

The launch of NASA's ozone-watching Quick Total Ozone Mapping Spectrometer (QuickTOMS) satellite, together with Orbital Imaging Corporation's OrbView 4 high resolution commercial Earth observation satellite will take place on 21 September from Vandenberg AFB, California aboard an Orbital Sciences Taurus booster.

NASA's Mars Odyssey spacecraft was given a fine-tuning of its trajectory with a thruster firing on 17 September, aiming for enter into Martian orbit on 23 October.

September 17

The EarthWatch commercial remote sensing satellite operator has been renamed, DigitalGlobe. Its second multispectral imaging QuickBird satellite is scheduled for launch onboard a Delta II booster from Vandenberg AFB, California on 18 October. The first spacecraft was lost in a Russian Cosmos 3M launch failure in November 2000.

ILS International Launch Services launched a Lockheed Martin Atlas IAS booster from launch pad 3E at Vandenberg AFB, California on 8 September carrying a National Reconnaissance Office (NRO) satellite into orbit. The satellite, at 4,725 kg, the heaviest to be launched by an Atlas booster, is thought to be an electronic intelligence satellite for a follow-on programme to the Naval Ocean Surveillance System, NOSS, called the Space Based Wide Area Surveillance System.

The Chandra X-ray Observatory has enabled astronomers to observe a burst of X-rays and the unique short-term cycling pulsing from a white dwarf star that has undergone a thermonuclear explosion in the nova binary star system, Nova Aquila 6,000 light years away.

A processed image from European Space Agency's InfraRed Space Observatory which was deactivated in 1998 reveals huge amounts of cold dust, resembling a bluish fog and with a temperature of minus 100degC that enshrouds newborn stars in the famous M16 Eagle nebula 7,000 light years away in the constellation of Serpens.

NASA's Deep Space 1 New Millennium programme spacecraft will fly to within 2000 km of the comet Borrelly at a relative speed of 60,000 km per hour on 22 September, taking 32 black and white images of the nucleus, making it the first craft to explore a comet at such close quarters since the European Space Agency's Giotto which made a fly by of the comet Halley in March 1986.

SpaceDev has started testing of the hardware and software models of the CHIPSat, being developed for NASA's first University Explorer low cost, 68 kg microsatellite mission, with the University of California to be launched on a Delta II in June 2002 from Vandenberg AFB, California. SpaceDev has designed and built most of the CHIPSat subsystems, including a miniature flight computer and S-band transceiver and transponder.

Korea Telecom and the South Korean High Gain Antenna company will co-operate in the \$194 million development of a national communications satellite providing broadband, multimedia and traditional services to the Asia Pacific region. The spacecraft to be launched in 2003, will be South Korea's first indigenously-developed communications satellite, following three Lockheed Martin-built Koreasat craft.

The Boeing-led international Sea Launch venture, which operates a Ukrainian-Russian Zenit 3SL booster, plans to launch up to six satellites in 2002, including two PanAmSat Galaxy spacecraft, IIIC and VIII/Horizons 1, joint venture with Japan's JSAT, and a Hughes Spaceway satellite.

The third series of test firings of the Aestus upper stage engine of the Ariane 5 to evaluate the nominal ignition of the power plant have been completed and work is proceeding to modelling the hydraulic and combustion conditions inside the engine. An unusually violent ignition of the engine during an Ariane 5G launch in July resulted in a loss of propellants which ended up with the insertion of two satellites, Artemis and B-SAT 2b in lower than planned orbits.

Boeing Electron Dynamic Services has received its first contract for linearized travelling wave tube amplifiers (LTWTAs). Orbital Sciences placed the \$5 million order for 32 C-band LTWTAs for a satellite being built for PanAmSat. TWTAs are the final amplifying units which transmit very low radio frequency signals to Earth. The addition of a linearizer removes amplifier distortion, resulting in clearer communications.

NASA's Kennedy Space Center in Florida was closed and put on full alert under condition "Threatcon Delta" on last Tuesday after the terrorist attacks in New York and Washington DC. Over 12,000 KSC workers were sent home from the centre which is presently accommodating all four Space Shuttle orbiters, one of which is housed in the huge Vehicle Assembly Building which dominates the skyline from miles around. The results of the attacks on the twin World Trade Centre towers in New York could be seen by the crew of the International Space Station as it passed over nearby Maine.

Diary July - September 2001

Washington-based XM Satellite Radio has cancelled its planned launch of its 100-channel digital radio service, primarily for cars, in San Diego and Dallas after the terrorism. The two-city introduction was to have been a prelude to the nationwide launch in November of the service which will cost \$10 a month. Competitor, New York-based Sirius Satellite Radio will offer its 100 channels at \$13 per month later this year. Both companies, whose investors have spent over \$1,5 billion, have two satellites each in geostationary orbit.

The five metre long Russian Pirs Docking Compartment docked to the Russian Zvezda module aboard the International Space Station on 16 September two days after its launch attached to a modified M-CO1 Progress tanker onboard a Soyuz booster from Baikonur. Pirs will provide additional accommodation and a docking port for Soyuz and Progress craft, as well as serving as the back-up EVA airlock with a 1 m diameter hatch.

Pirs was to have been replaced by the Universal Docking Module (UDM), providing three ports for Soyuz and Progress craft and life-support for up to six crew. However, the UDM, which has been scrapped due to lack of funding, will be replaced by the Functional Cargo Block (FGB 2) module for the ISS which was the reserve craft for the Zarya module launched in 1998 – the first ISS component to be launched. The FGB 2, which is 70% complete, will require several modifications.

It has also been confirmed that a modified Russian Science and Power Platform, a truss carrying solar panels, radiators and science payloads, will be launched aboard the US Space Shuttle. Called the NEP, the shorter and simpler 15 tonne payload comprises a 5,9 m long, 2,2 m diameter pressurised module and a two-segment telescopic truss.

Two Russian Proton launches carrying national payloads are scheduled for October and November, in addition to the two ILS International Launch Services Proton flights carrying DirecTV 5 and Intelsat 903 on 19 October and 26 November respectively. The national payloads will be an imaging satellite and three Glonass navigation satellites.

The European Space Agency (ESA) is expected to eventually provide almost half the funds to develop the International Space Station six-person Crew Return Vehicle (CRV) spaceplane, assisting the cash-strapped NASA which had already completed a number of glide flights of the X-38 CRV prototype. ESA's decision is to ensure that European astronauts will get regular access to the ISS to operate in the European Columbus laboratory.

Up to four Ka-band BolivarSat communication satellites built by Alcatel Space will be launched into positions at 61deg and 67deg in geostationary orbit starting in 2003 for the Andesat consortium comprising organisations in Bolivia, Columbia, Ecuador, Peru and Venezuela.

Spacehab's Astrotech Space Operations has completed the \$20 million expansion of its satellite processing building in Titusville, Florida to support launches of larger payloads aboard Atlas V and Delta IV vehicles.

AeroAstro has been awarded an \$11 million contract from the US Air Force to build the Space Test Programme Satellite 1 to be launched in 2005. It is thought to have been assigned a piggyback flight aboard a Delta IV, together with possibly five other minisatellites flying with a prime satellite payload for the US Air Force.

September 11

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September 7

Space Systems/Loral has been awarded a contract to build the DirecTV-7S high power communications satellite to be launched in 2003. The 13kW spacecraft, based on an SS/L 1300 satellite bus, will be able to provide 54 transponders for high-quality local and national digital video services 27 spot beam areas or 44 transponders for direct broadcast TV to 30 beams.

An ILS-Lockheed Martin Atlas IIAS booster will be launched from Vandenberg AFB, California on 8 September carrying a National Reconnaissance Office payload reported to weigh an Atlas-record of over 4,725kg into polar orbit. The payload is suspected to consist either of three Space-Based Wide Area Surveillance (SBWA) satellites or a single large payload as part of the SBWA network. ILS is also planning two Russian Proton launches from Baikonur this year of a DirecTV satellite on 19 October and an Intelsat 9 model on 26 November.

Lockheed Martin Commercial Space Systems has been awarded a contract from GE American Communications (GE Americom) to build three more satellites, GE-19, GE-11 and GE-18 to provide premium cable TV programmes across North America. The A2100 spacecraft bus-based spacecraft will replace previous Lockheed-built Satcom C-3 and C-4 satellites at 135degW and 131degW longitude in geostationary orbit, with GE-18 a ground spare. GE Americom will soon be joining forces with Luxembourg's SES.

China plans to launch 35 communications, meteorological and disaster monitoring satellites in the next five years to promote economic development, including six metsats between 2002 and 2008 .

The US Air Force has decided that it is not interested in taking over the cancelled \$1 billion NASA/Lockheed Martin X-33 single-stage-to-orbit suborbital demonstrator and has indicated that the Boeing X-37 precursor of a Space Manoeuvre Vehicle is also now unlikely to be required.

The Australian University of Queensland-led HyShot air-breathing supersonic combustion ramjet, scramjet will be launched aboard a Terrier Orion sounding rocket from the Woomera Rocket Range, South Australia on 23 October. The AU \$1.25 million international project, led by the University's Centre for Hypersonics will kick off with the flight to an apogee of 350km with the scramjet operating from 35km. The mission, lasting 10min with the 113kg payload, is expected to achieve Mach 7.6. A second flight is scheduled for October 30.

The barrel-shaped, 3,600kg Russian Docking Compartment 1, Pirs, will be launched aboard a hybrid Progress tanker to the International Space Station by a Soyuz booster from Baikonur on 14 September. The Energia-built Pirs will provide an extra ISS docking port for Russian Progress and Soyuz TM spacecraft and will also be used to store Russian Orlan spacesuits and tools and to act as an additional airlock from the Russian segment of the ISS.

September 6

The MirCorp company, Russia's Energia space enterprise and the Russian Aviation and Space Agency have signed an agreement to discuss the proposed launching of a commercial Mini-Station 1 orbital craft which would be able to support 20 day missions with three crew, including potential space tourists, willing to pay \$20 million. Energia, which will conduct the feasibility study, would have to raise \$40 million to develop the Mini-Station 1, which could be launched in 2004 and would be supported by Soyuz and Progress crew and logistics spacecraft respectively. The project is seen as highly speculative at this stage, with the space agency attempting to quell the hype promoted by MirCorp.

NASA's Chandra X-Ray Observatory may have found evidence of a supermassive black hole in the centre of our galaxy, by monitoring a brief X-ray outburst, 50 times brighter than the sun in the region of the constellation of Sagittarius, which may have come from a comet-sized object just as it disappeared down the suspected black hole. Meanwhile, the Chandra mission has been extended from five to 10 years by NASA. Annual operational costs are about \$60 million.

PanAmSat and Japan's JSAT Corporation have formed a joint venture, called Horizons, to launch and operate a hybrid communications satellite to be built by Boeing Satellite Systems and launched by the Boeing-led Sea Launch company in 2002. The Boeing 601HP Horizon 1 spacecraft will be located at 127degW between the Hawaiian Islands and the US west coast and will be equipped with 24 C-band and 24 Ku-band transponders.

September 4

McDonald Detwiller is planning to develop and launch a \$70 million single Ka-band Cascade store and forward communications satellite into polar orbit in 2003 to provide up to 600 Gbytes per day of data. Cascade will be based on a 250kg UK's Surrey Satellite Technology spacecraft bus launched on a Russian booster.

Orbital Sciences has confirmed that the company's \$60 million BSAT- satellite built for Japan and placed into a useless orbit during a botched Arianespace Ariane 5G launch on 13 July as been written-off as a total loss. The order to build a BSAT-2c is expected.

The Los Angeles Times reports that any plans to launch US-built satellites on Chinese boosters after possible resumption of the issue of export licences from the US Government, following a hiatus due to wrangles over China's military activities, have been wrecked by the revelation that a Chinese company has provided sensitive nuclear missile technology information to Pakistan. A continued ban on providing US satellite technology to China as part of joint-programmes is also expected.

Russian company Energomash has completed a second test of its RD-191 engine designed for the Angara satellite launch fleet. The 30% to 100% throttleable liquid oxygen-kerosene engine was fired for 10s.

September 3

Lockheed Martin and NASA's Marshall Space Flight Centre, Alabama have jointly developed and tested a sub-scale composite liquid oxygen cryogenic tank as part of the space agency's Second Generation Reusable Launch Vehicle research and technology development programme. The 2.7m long, 1.2m wide, 225kg tank will undergo further flight environment life cycle tests.

The Boeing Delta IV launch vehicle will make its maiden flight on 30 April 2001 from Cape Canaveral's refurbished pad 37 carrying a Eutelsat Atlantic Bird communications satellite built by Alenia Spazio which was originally to have flown on a Chinese Long March booster. The bargain launch agreement is expected to be confirmed soon. The second flight of the Delta IV will carry a US Air Force (USAF) Defense Space Communications Programme (DSCS) spacecraft on the first USAF flight under the Evolved Expendable Launch Vehicle programme contract and the third, the first fully commercial mission, carrying the Estrala do Sol communications satellite.

The European Space Agency reports that the landing of the Maxus sounding rocket and its payload outside the impact area after a flight from Esrange, Kiruna, Sweden on 29 April, was due to a faulty gyro in the booster's guidance and navigation control system. The destruction of the microgravity payload after the premature deployment of its parachute occurred because the design did not adequately take into account the dynamic loads that occurred during this mission.

NASA's John C. Stennis Space Centre, Mississippi has awarded a \$78 million two-year option extension of the Test and Technical Services Contract awarded to Lockheed Martin Space Operations Stennis Programs, Houston in 1994, to support propulsion test operations, systems engineering, operator maintenance and test technology development. The total value of the contract is now \$309 million.

The structural model of the European Space Agency's Mars Express spacecraft will begin a six-week system level tests at Intespace, Toulouse in preparation for the mission to be launched in 2003.

August 31

The first modified An-124-100 Ruslan aircraft for the Air Launch project was rolled out at Ulyanovsk airport on 24 August. The craft will be used to carry the Air Launch satellite booster to an altitude of 11,000km and deploy the booster and its 3,000kg payload anywhere in the world for the most cost and payload weight-effective insertion into orbit. Air Launch proposes to eventually use four Ruslan aircraft.

There will be no launches from Cape Canaveral in September so that the spaceport's range safety system, designed in the 1960s can be upgraded to allow less time between launches and a reduction in launch delays.

Aerogjet has successfully test fired a full-scale 20m long demonstration solid rocket motor (SRM) for 95secs in thrust ranges from 64kN to 88kN as part of the Atlas V development programme. Two more hot fire tests are planned in preparation of the first Atlas V flight in 2002.

The first cell culture experiments have been operated aboard the International Space Station (ISS). Thirty two kidney, ovarian and colon cells have been grown and placed into a Biotechnology Specimen Temperature Controller. Four separate investigations are being conducted on the ISS as part of the Cellular Biotechnology Operations Support System in which different types of normal and abnormal cells are studied to see if microgravity results in the cells that form tissues are more like those found in the human body.

August 30

Arianespace launched Ariane flight V143, using an Ariane 44L booster carrying the Intelsat 902 communications satellite from Kourou, French Guyana on 30 August. The delay of six days from August 24 was ordered to allow spacecraft contractor Space Systems/Loral to check the solar arrays after a set on another satellite malfunctioned. It is not clear whether the errant satellite is in orbit or under testing.

The Russian RSC Energia corporation, prime contractor for the country's participation in the International Space Station (ISS) says that a specialised Progress M-CO1 spacecraft will be launched with a docking compartment, Pirs, to the International Space Station on 15 September aboard a Soyuz booster from Baikonur. This will be followed by another Soyuz launch of the crewed Soyuz TM32 spacecraft on 21 October on a crew return craft changeover mission, with the return of the older Soyuz TM31. The crew will include French astronaut Claudie Haignere. The Progress M1-7 logistics vehicle will be launched on a Soyuz in mid-November.

Prospective space tourist Mark Shuttleworth has passed his medical examinations at the Yuri Gagarin Space Centre at Star City, with two European astronauts, Italian Roberto Vittori and Belgian Frank de Winne, the prime and back-up respectively of a Soyuz TM changeover mission at the International Space Station in April 2002. No specific contract has yet been signed with Shuttleworth, who continues cosmonaut training but Star City officials say that a flight in spring 2002 is possible, in which case he could be flying on the Soyuz TM mission with Vittori.

The European Union is planning to provide \$495,000 to help restructure six space companies in the Ukraine.

August 29

Japan's \$71 million H2-A completed a successful maiden flight after launch from Tanegashima on 29 August boosting the nation's space morale after a series of technological mishaps, including two consecutive H2 failures and a financial crisis. A 3,000kg spherical Vehicle Evaluation Payload (VEP) was successfully placed into orbit. "We want to let the world know that Japan's rocket program is back on track," Shuichiro Yamanouchi, director of Japan's National Space Development Agency said. "But this was just the first launch. It's important now that we move ahead with preparations for the rocket's second and third launch."

Japan's Institute of Space and Astronautical Science plans to launch a spacecraft to Venus in February 2007. Described as a Venus "weather satellite", the spacecraft will enter orbit around the planet in September 2009, using an Earth swing-by in June 2008. It will study the movement and extreme rotation and flow of the carbon dioxide clouds of the planet, which reach 100m per sec.

Arianespace has sacked its chief operating officer, Jacques Rossignol and replaced him with former Starsem chairman and CEO, This is the result of a behind the scenes battle of wills. An agreement has been reached to launch the Starsem Soyuz from Arianespace's home base of Kourou, French Guyana, offering flights to geostationary transfer orbit which match the capability of the lower end of the Ariane 4 fleet models. The move had been resisted by Rossignol.

Eutelsat's Atlantic Bird 2 satellite will be launched aboard an Ariane 4 booster from Kourou on 27 September, says the European satellite communications organisation. The 3,060kg, 7.4kW, 26 Ku-band transponder satellite will be located at 8deg in geostationary orbit.

In preparation for the potential launch of a replacement Iridium mobile communications satellite by Eurockot's Rokot booster from Plesetsk, a mock-up of a Lockheed Martin Iridium spacecraft has been shipped to Plesetsk in a US MD-10 cargo craft for transportation by train to Russian cosmodrome to demonstrate procedures.

August 28

Japan's critical maiden launch of the new HIIA booster from Tanegashima is scheduled for 29 August. The launcher has been fitted with a new pressure control valve on the second stage oxygen tank.

The upgrade of the Space Shuttle orbiter Discovery has been deferred due to "budget limitations", says the Johnson Space Centre. When the programme does begin, Discovery will be fitted with new avionics and a glass cockpit as part of the upgrade programme.

Boeing Phantom Works is to begin final assembly of the NASA/US Air Force X-37 flight demonstrator at Palmdale in preparation for drop tests from a Boeing built NASA NB-52 carrier aircraft in 2002.

Taiwan is considering the use of the Orbital Sciences converted Minuteman missile, the Minotaur for the launch of its Rocsat 3 eight-microsatellite fleet in 2005.

Russia's NPO Mashinostroeniya plans to launch the first Strela small satellite launcher from a silo at the Baikonur Cosmodrome in 2002 in preparation for operational flights from the Svobodny.

NASA has raised the orbit of the joint US/Japanese Tropical Rainfall Measuring Mission (TRMM) satellite to extend its operational lifetime to 2007. The satellite was launched in 1997 and its orbit has been raised from 350km to 402km counter the effects of atmospheric drag.

Arianespace says that the launch of Ariane flight V143, using an Ariane 44L booster carrying the Intelsat 902 communications satellite will be made from Kourou, French Guyana on 30 August. The delay of six days from August 24 was ordered to allow spacecraft contractor Space Systems/Loral to check the solar arrays after a set on another satellite malfunctioned. It is not clear whether the errant satellite is in orbit or under testing.

August 27

The maiden flight from Tanegashima of the updated Japanese HIIA satellite launcher has been delayed to 29 August as an investigation continues into the discovery of silicon powder in the liquid oxygen tank system caused by a faulty filter in a valve.

The Ukraine's Yuzhnoye State Design Office will be awarded a three-year contract next month to build two remote sensing satellites for Egypt. The first 100kg craft will be launched in 2004 aboard a Russian Dnepr booster.

The European Space Agency's Wide Field and Planetary camera No 2 aboard NASA's Hubble Space Telescope has returned an image of the formation of a planetary nebula, the 1.4 light years long Calabash nebula - sometimes called the Rotten Egg nebula - in an open star cluster 5,000 light years away in the constellation of Puppis.

The European Space Agency's Astrium-built Advanced Protein Crystallisation Facility is now operating aboard the International Space Station Destiny laboratory module after its delivery aboard STS 105 Discovery. The first European experiment to operate on the ISS will be returned to Earth in December aboard the next Space Shuttle mission to the orbiting base.

The successful operation of the XM Satellite Radio and Sirius Satellite Radio providing uninterrupted services to users, especially car drivers, across the USA will depend of the installation of a network of repeaters which has not yet been approved by the Federal Communications Commission.

The orbital module of the Chinese Shen Zhou 2 spacecraft re-entered the Earth's atmosphere on 24 August after 260 days in orbit. The spacecraft's re-entry capsule had landed on January 16, six days after the launch of the second test flight of the manned spacecraft aboard a Long March 2F booster from Jiuquan. The orbital, equipped with radiation detectors, made several orbital manoeuvres in preparation for a manned flight by two Chinese astronauts, called taikonauts, which is expected in 2003, after at least one more unmanned test flight, in 2002.

The launch of the US-French Jason 1 oceanographic satellite scheduled to be launched on a Boeing Delta II from Vandenberg AFB, California in September has been delayed until at least December, so that the spacecraft can be returned to Alcatel Space for an inspection of its solar array deployment system.

A Russian Proton booster was launched from Baikonur on 25 August carrying classified military satellite into geostationary orbit.

Lockheed Martin has been awarded a \$21 million contract from the US Air Force Research Laboratory to collaborate with the laboratory's Space Vehicles Directorate's Integrated Space Experiments Division to design, build and demonstrate in flight, the Experimental Satellite System, XSS-11, a 100kg microsatellite. XS-11 will demonstrate autonomous on-orbit technologies.

The 47m (154ft) tall Boeing Common Core Booster of the Delta IV launch vehicle was erected on Pad 37 at Cape Canaveral, Florida after an 800m journey from the former Saturn 1 pad's adjacent Horizontal Integration Facility. The CCB, equipped with the Boeing cryogenic RS-68 engine, which has been test fired four times at NASA's Stennis Space Centre, Mississippi, will serve as a pathfinder test unit in preparation for the first Delta IV mission in mid-2002.

August 24

In order to save \$10 million a year, NASA will shut down the \$1 billion Upper Atmosphere Research Satellite (UARS) by 30 September, with seven of its ten instruments still working. UARS, which was launched in 1991, was designed to operate for three years but will remain in orbit until at least 2016 before making an uncontrolled re-entry.

Astronomers have discovered a 1,200km diameter-class object in the Kuiper Belt beyond the orbit of Pluto which makes it larger than the asteroid Ceres, credited as the largest minor planet in the solar system.

Brazil's courting of the USA to use its Alcantara base for US satellites launches is being thwarted by US fears that funds raised through the agreement will be spent on the development of a Brazilian satellite launcher. Brazil is hoping that its equatorial-based launch site could be used

by US, Chinese, Russian and Ukrainian operators. The site could support the launches of 14 rockets a year, generating \$2 billion in business.

The Russian Progress M45 tanker has docked with the International Space Station, delivering 2,750kg of fuel, water, equipment and space parts as well as 8,000 greetings from Japanese families chosen in a contest sponsored by the Houston-based company, Encounter 2001 which is planning an unmanned spacecraft to send beyond the solar system with DNA and 4.5 million messages from people of the Earth.

Indonesia is planning to launch a new \$120 million Palapa communications satellite, to augment and eventually replace its operational C2 spacecraft which is already operating at 90% capacity. Bids for the manufacture and launch of the satellite in 2003 will be issued soon said Indonesia's Satelindo company.

August 23

Close up images of the Mercury-sized Jovian moon, Callisto taken by the Galileo orbiter from a distance of 138km in May and released by NASA, show active surface erosion and craters as small as 3m in diameter. The most heavily-cratered body in the solar system, Callisto's ice and rock surface may be considered to be geologically dead but there is evidence of erosion in the form of vaporising ice which leaves behind dust that was bound in the ice.

The orbital flight test of the eight-bladed Cosmos 1 solar sail will go ahead in 2002 aboard a Russian Volna rocket said the US Planetary Society and Cosmos Studios team leading the venture. There will be no repeat sub-orbital flight following the failure of a similar flight in July when the payload did not separate from the upper stage of the submarine-launched Volna booster due to a computer glitch in the launcher.

A Lockheed Martin Athena 1 solid propellant booster will be launched from Alaska's Kodiak Launch Complex on 17 September, carrying a four-payload cargo called Kodiak Star. It will be the first orbital flight from the Alaska site. The four satellites include the 90kg, 1m diameter NASA-sponsored Starshine, a student project to study orbital decay by tracking reflections off the satellite's 1,500 mirrors and 312 retroreflectors. The other payloads are part of the Dept of Defence Space Test Programme.

The Space Shuttle Discovery ended its 12 day International Space Station (ISS) mission with a landing at the Kennedy Space Centre on 22 August, bringing home the Expedition Crew 2, Yuri Usachev, Jim Voss and Susan Helms, after spending 167 days in space. Mir-veteren Usachev now has 531 space days experience, making him 7th in the world rankings dominated by Russia, while Helms' space experience rises to 210 days and Voss's, 202 days. Shannon Lucid, with 223 days, with 188 days on Mir is still the longest and most experienced US space traveller.

The maiden flight of Japan's uprated HII-A satellite launcher is scheduled for next week. The launch fails, Japan's space programme will "suffer a fatal wound", said a Japanese space spokesman. Meanwhile, it has been confirmed that Japan's National Space Development Agency, Institute of Space and Astronautical Science and National Aerospace Laboratory will be integrated into one space development organisation in 2003.

The delay to the launch of a National Reconnaissance Office (NRO) satellite aboard a Lockheed Martin-International Launch Services Atlas IAS booster from Vandenberg AFB, California was caused by a concern that the booster was not scheduled to carry enough propellants for the largest payload to be carried on the model. Engineers needed to be sure that the vehicle would not run out of propellant short of reaching orbit and as an extra precaution, will choose a launch window that maximises the vehicle's performance. Another NRO launch by an Atlas IAS planned for 26 September from Cape Canaveral has been delayed until October.

Greek and Cypriot plans to join forces to develop a joint 36-transponder regional communications satellite announced in 1999 are moving a step further with the planned formation of the Hellas-Sat organisation, which will also include small funding from Canada's Telesat. Hellas-Sat is expected to announce an order for the satellite from Boeing Satellite Systems, aiming for a launch in September 2002, placing the craft into a geostationary orbit slot at 39deg E.

Malaysia has invited African countries to share the cost and use of the country's 24 C-band and 12 Ku-band transponder Measat 3 communications satellite to be launched in 2002.

August 22

SpaceDev has joined the Boeing team working on the Mars Ascent Vehicle Concept Study for NASA's JPL which awarded three \$300,000 contracts, the others going to Lockheed Martin and TRW, for work on this aspect of a Mars sample return mission. The Boeing concept of the ascent vehicle may include SpaceDev's hybrid rocket motor which uses a liquid oxidiser and solid propellant.

The UK's Particle Physics and Astronomy Council (PPARC) has awarded a \$2.88 million contract to the UK company SEA Group Ltd to develop the 4K cooler drive electronics package for the high frequency instrument on the European Space Agency's Planck cosmic microwave background mapping satellite, to be launched by an Ariane 5 booster in 2007. The flight model of the cooler, the first spaceflight hardware designed and built by SEA, will be delivered in May 2003.

Teledesic, which plans to deploy an orbiting Ka-band Internet-in-the-Sky broadband satellite network, will selected either Italy's Alenia Spazio or Lockheed Martin as prime contractor for the system. The contract will be awarded later this year. As suppliers of the spacecraft buses for the Globalstar and Iridium mobile phone satellites respectively, Alenia and Lockheed were considered to have the necessary experience to support Teledesic's plans to deploy a constellation of an as yet undesignated number of satellites.

As the Space Shuttle Discovery prepares to land back at the Kennedy Space Centre today after its mission to the International Space Station (ISS), a Russian Progress M unmanned tanker was en route to the orbital space base after its launch on a Soyuz booster from Baikonur on 21 August. It is the fifth Progress flight to the ISS.

August 21

The US General Accounting Office has criticised NASA of gross mismanagement over its attempts to develop a propulsion module for the International Space Station (ISS). The propulsion module was deemed necessary in 1997 as a contingency plan in case Russia failed to meet its delivery deadlines. Boeing was assigned the task of designing the module only to be told to stop work in 2000 at which point, NASA decided to develop another design, cancelled a year later.

The launch of an ILS International Launch Services Atlas IAS booster from Vandenberg AFB, California with a National Reconnaissance Office

payload on 25 August may be delayed to allow more time for pre-launch technical reviews.

The Mars radiation environment instrument aboard the Mars Odyssey spacecraft, 18.5 million km from Earth and heading at a speed of 24km/ps for an orbital insertion around the Red Planet on 23 October, has failed but engineers hope that it can be restored.

Astrium has sold its spacecraft momentum reaction wheel business to the Netherlands' Stork Aerospace Group.

NASA is exercising a contract option with Boeing for the \$60 million Delta II launch of the ESSP 3/CloudSat satellite in April 2004. The firm-fixed price option is covered under the NASA Med-Lite contract awarded to Boeing in 1996. The satellite, formerly known as Picasso-CENA, is the third mission of the NASA Earth System Science Pathfinder programme.

The first launch Japan's new updated 53m tall H-IIA satellite launcher from Tanegashima on 25 August could be delayed after the discovery of a faulty valve and an approaching typhoon.

Boeing Satellite Systems (BSS) will make a 30% expansion to its satellite manufacturing factory in El Segundo, California which is already the largest of its kind in the world. BSS has a backlog valued at \$4.8 billion with more than 38 satellites to which will be added 12 new Block IIF Global Positioning Satellites.

The Boeing Satellite System (BSS)-led industry team building the Wideband Gapfiller Satellite (WGS), high capacity military satellite communications system says it has successfully completed preliminary design reviews. The WGS contract is valued at a potential \$1.3 billion. Initial work involves the production of three spacecraft- based on the BSS 702 spacecraft bus, with a value of \$160.3 million.

August 20

China Aerospace Science and Technology Corp and China Research Institute of Space Technology have formed a joint venture to design and develop small satellites weighing under 1,000kg for a number of varied commercial applications for customers worldwide.

The Space Shuttle Discovery is set to return to Earth on 22 August, returning with the second Expedition Crew from the International Space Station (ISS) and 3,700kg of trash, including empty food containers and dirty clothes, aboard the Leonardo multi-purpose logistics module which delivered an equal weight of new cargo. A second EVA lasting about 5hrs has been completed to fix equipment and experiments to the outside of the ISS. This included cables fixed to the exterior of the Destiny which will provide back-up power for the central truss segment that will be launched in 2002.

The Florida Today newspaper has revealed that NASA ordered almost \$2 billion worth of costly, last minute changes to the International Space Station which contributed to the \$4.8 billion overrun that forced President Bush to cut costs with the result of the cancellation of a crew return vehicle and the habitation module and a reduction of the crew from six to three, with the effect of reducing the science that can be conducted on the station. After the \$5.6 billion ISS contract was finalised with Boeing in 1994, NASA made hardware, software and design changes resulting in a 71% increase in the estimated price of the completed station to \$96 billion.

NASA has named the crews of three more International Space Station Space Shuttle missions, STS 112, 113 and 114 in July, August and September 2002. STS 112, to deliver a truss segment, will be commanded by Jeff Ashby. STS 113, carrying another truss segment and EVA aids, is commanded by James Wetherbee. STS 113 will also return the Expedition 5 crew and deliver Crew 6. STS 114, a utilisation and logistics flight, will be commanded by Eileen Collins and will return the Expedition Crew 6 and will deliver the Expedition Crew 7.

The planned \$1 billion 24-satellite US Space Based Infrared System Low (SBIRS Low) missile early warning satellite network is almost 100% over budget in its study contract phase with TRW and Spectrum Astro being awarded an extra \$230 million each over the original \$275 million original contract. However, managers say that the five year deployment of the system will begin on target in 2006.

Russia's Khrunichev State Research and Production Space Centre announced at the Moscow Air Show that it plans to introduce a series of 1m resolution commercial remote sensing satellites, called Monitor, which will be able to be accessed directly by small VSAT personal ground stations.

The planned August launch of NASA's Quick-TOMS spacecraft to replace the Total Ozone Mapping Spectrometer Satellite has been delayed until September 15 at the earliest because the owners of the second satellite to be carried on the Taurus launch from Vandenberg are close to bankruptcy. Orbital Sciences subsidiary, Orbimage planned to launch its Orbview satellite with Quick-TOMS but OSC is not willing to invest another \$10 million into the ailing commercial remote sensing company.

China plans to launch six more Fengyun meteorological satellites between 2001 to 2008, including three sun-synchronous and three geostationary orbiting spacecraft. The craft will ensure a comprehensive weather service to support the 2008 Olympic Games.

NASA will offer ancillary related instruments of opportunities to customers aboard the new series of NOAA Geostationary Operational Environmental satellites, GOES-R to begin launches in 2010.

Russia says it will launch the first Russian-made earthquake forecasting satellite in November-December. The 80kg sub-satellite will be deployed during the launch of a major payload aboard a Zenit booster from Baikonur.

August 17

Israel's first astronaut, Ilan Ramon will be launched into orbit aboard Space Shuttle STS 107 Columbia on 23 May 2002 on a non-ISS science research mission, with a six- person crew commanded by Rick Husband. It will be the fourth Shuttle mission of 2002.

The Hubble Space Telescope has taken an image of a lumpy bubble of hot gas rising from a cauldron of glowing matter in the centre of the disc of galaxy NGC 3079, 50 million light years away. The bubble is 3,000 light years wide and rises 3,500 light years above the disc, probably blown by high speed streams of particles released during star formation. Gaseous filaments 75 light years wide and dispersed at a speed of 6 million km per hour to a height of 2,000 light years at the top of the bubble whirl around in a vortex.

The Russian Vosdushny Start, Air Launch company says it is negotiating funding with Aarb investors to allow a first launch at the end of 2003. A Ruslan carrier aircraft will deploy a two-stage Polyot booster, built by Energia, at an altitude of 11 km. The venture has been trying to raise capital since 1997 and it is by no means certain that the situation has changed.

Taiwan is using images from the Israeli-led ImageSat commercial remote sensing satellite company to monitor activities in China. It can access 2m resolution images direct from the Eros 1A satellite launched in December 2000. Earlier, Taiwan relied on images purchased from the US-based Space Imaging company's Ikonos satellite.

STS 105 Discovery astronauts completed a 6hr EVA at the International Space Station on 16 August to attach a 635kg ammonia coolant canister and experiment trays holding 750 science experiments to the exterior of the orbiting space base. Another EVA is planned for 18 August. The ISS also celebrated 1,000 days in space on 16 August. The ISS control glitch that occurred on 15 August was caused by a "planned and routine software programme update" at the Russian Kaliningrad control centre, said flight director, former cosmonaut Vladimir Solovyov. NASA has concurred with this explanation, saying that it was anticipated and planned for.

Space Systems/Loral has received final authorisation to build the MBSAT digital multimedia information service satellite for Japan's Mobile Broadcasting Corporation (MBC). The three-axis stabilised MBSAT, equipped with 16 S-band transponders and a 12m diameter antenna reflector will be launched in 2003, providing music, video and data to users with mobile receivers, including personal digital assistants (PDAs), cellular phones and home portables. Major MBC investors include Toshiba, Toyota, Nippon TV and Panasonic.

The Washington Post says that the \$2.5 billion US Advanced Extremely High Frequency (EHF) military communications satellite system is already \$1 billion over budget only 14 months after the introduction in June 2000 of a one-contractor team to build the network to save 18 months development time. The Advanced EHF is being developed by a Boeing-Lockheed-TRW team created in June 2000 to replace two competing bids from Lockheed/TRW and Hughes Space and Communications, now Boeing Satellite Systems. It is unlikely that the 2004 launch date of the system, which is designed to eventually replace some of the services provided by Milstar satellites, can be met. It is reported that 2006 seems a more likely date.

August 16

A cloud of millions of comets has been formed around the young star Beta Pictoris, say US and French scientists after studying data from NASA's Far Ultraviolet Spectroscopic Explorer (FUSE) spacecraft which indicates that the lack of a molecular hydrogen disc around the star is evidence that the hydrogen and other compounds have condensed to form a swarm of comets around the star. The finding, however, conflicts with the opposite indications from the European Space Agency's Infrared Space Observatory (ISO).

A team of astronomers has found a second Jupiter-sized planet orbiting the faint star 47 Ursa Major - the Big Dipper - bringing to 70, the number of such objects discovered so far around nearby stars. 47 Ursa Major is 51 light-years away.

A ground computer problem in the International Space Station Kaliningrad control centre in Russia stopped the operation of the station's gyros on 15 August, requiring the intervention of the Space Shuttle Discovery's thrusters. The problem which occurred during software uploading is not regarded as serious and control is expected to be achieved soon. Today's EVA by Dan Barry and rookie Patrick Forrester is unaffected.

August 15

The Globalstar satellite mobile communications company made a loss of \$145 million during the last quarter and has also lost two satellites of its constellation of 52 spacecraft due to intense solar activity. The company also made a \$145 million loss in the previous quarter and will now cut its staff by almost 50% to 175 employees. Globalstar says it has enough cash, about \$98 million, to continue operations until the end of 2001 and is making efforts to "restructure" its finances. Globalstar originally lost three satellites but one has been restored, while the other two have been replaced by two of the four in-orbit spares.

Meanwhile, Sirius Satellite Radio, which has two space on-orbit to provide US customers with mobile digital pay radio, mainly in cars, starting in late 2001, says it made a \$400 million loss in its second quarter but has enough cash to fund its business through the third quarter of 2002.

Japan has expressed interest in using Russian Soyuz boosters launched from Baikonur to launch two Urisef satellites into sun-synchronous orbit in 2003.

The US SpaceDev company has successfully test fired its new Orbital Manoeuvring and Transfer Vehicle (MTV) engine. There will be three MTV models, weighing 25kg, 50kg and 100kg designed to perform on-orbit rendezvous for inspection, repair, refuelling and with the larger version, supply missions to the International Space Station. The MTV programme is part funded by the National Reconnaissance Office and the US Air Force Office of Space launch.

The US Air Force Research Laboratory says it is studying a modular cargo aircraft pneumatic launch tube to deploy satellites into orbit, using a small two-stage reusable spaceplane. The launch tube could be carried aboard C-141B, C-5A or C-17A cargo aircraft to a maximum altitude of 12,200m (40,000ft), with a speed of 850km/ph and expel the vehicle from the back of the aircraft. The velocity and altitude head start could be enhanced with the use of a first stage vacuum nozzle and advanced variable geometry wing technology, says the lab.

ImageSat International has awarded Israel Aircraft Industries (IAI) a \$110 million contract to manufacture and launch the Eros 1B 0.82m resolution commercial remote sensing satellite. The craft's high resolution camera will be built by Israel's El-Op company. Eros 1A was launched by a Russian Start booster in December 2000. The planned ImageSat orbital constellation will number eight operating in 480km circular sun-synchronous orbits. ImageSat was established by IAI, El-Op and Core Software Technology.

The NASA Life Sciences Research Laboratories at the Johnson Space Centre, Houston reports that astronauts flying long duration missions often don't eat as much as they should and suffer from weight loss and low nutritional levels, particularly in vitamin D. Exacerbating the vitamin D problem is that the lack of ultraviolet light due to spacecraft shielding takes away the body's natural ability to produce this vitamin naturally. This makes it doubly important that the crew eats properly.

August 14

NASA's Ames Research Centre's (ARC) Kitty Hawk 3 project team have validated the aerodynamic performance of a small, 1.2m long prototype Mars airplane, called Orville. The converted NASA 731 remote controlled glider, with a wingspan of 2.4m was dropped from a helium-filled balloon 30,800m above Oregon. The Orville test followed the low-altitude flight of another vehicle, a NASA 729 glider called Wilbur, in July.

The California-based ARC has been working on a proposed Mars Airplane concept for several years.

The European Space Agency (ESA) plans to use the spacecraft bus designed for the Mars Express orbiter mission to be launched in 2003 for other interplanetary and science missions, the first of which could be launched in 2005. Three mission proposals have been selected for further study by ESA. These are a Venus orbiter, a cosmic dust explorer-observatory and a Big Bang cosmic microwave background radiation spacecraft. The winning candidate for the 2005 mission will be selected in December.

The Third Expedition Crew of the International Space Station have started work in orbit after their delivery on the STS 105 Discovery mission. Led by Frank Culbertson, a Shuttle commander who hung up his helmet for eight years to manage the US missions on the Russian space station, Mir and the co-ordination between the USA and Russian on the ISS, will remain in orbit until December with two Russian crewmembers.

Arianespace says that the launch of Ariane flight V143, using an Ariane 44L booster carrying the Intelsat 902 communications satellite will be made from Kourou, French Guyana on 30 August.

August 13

NASA and the Russian Space Agency have drafted criteria setting standards for fare-paying space tourists, called "space flight participants", to the International Space Station. An agreement is expected to be signed in September that includes a provision that the passengers undergo physical training, are able to speak Russian or English and have to pass a "personal suitability" test.

The Space Shuttle Discovery docked to the International Space Station on 12 August for an eight day stay during which the STS 105 mission crew will deliver equipment housed in the Leonardo multi-purpose logistics module - including a small personal portable private room for one ISS expedition crewmember - exchange expedition crews 2 and 3 and perform two spacewalks. The launch in bright weather at the Kennedy Space Centre on 10 August was made five minutes earlier than planned to avoid approaching thunderclouds.

Through layers of dust and gas in the plane of the Milky Way, that stretch more than 30,000 light years, astronomers using NASA's Chandra X-ray observatory have been able to take a long hard look behind this "barrier" and found that its X-ray glow comes from hot and diffuse plasma gas with temperatures of tens of millions of degrees centigrade.

Control of the Boeing-built Tracking and Data Relay Satellite, TDRS-H launched by an Atlas booster in June 2000, has finally been transferred to NASA. The transfer had been delayed due to a performance shortfall on the multiple-access phased array antenna which resulted in five of the 18 communications services provided by TDRS-H falling short of performance specifications. NASA and Boeing have tentatively agreed to a settlement, the terms of which are being finalised.

August 10

The launch of STS 105 Discovery was scrubbed last night due to bad weather and another attempt will be made today (10 August) although the chances of a launch are put at 30%.

NASA's Far Ultraviolet Spectroscopic Explorer (FUSE) satellite has given astronomers their best look yet at the "ghostly cobweb" of helium gas left over from the Big Bang. The helium is not found in galaxies or stars but is spread thinly through the vastness of space.

NASA's New Millennium Programme at the Jet Propulsion Laboratory has selected 13 advanced technologies concepts as candidates to fly in 2004-05 on the Space Technology 7 mission. Contracts will be signed in November. The concepts include aero entry capture manoeuvres, autonomous on-board processing and a solar sail.

India has designed a 25 tonne reusable horizontal take-off and landing, air-breathing orbital space plane, Avatar. Powered initially by turbofan, ramjet and scramjet engines, Avatar's cryogenic air-breathing engine, using 15 tonnes of on-board liquid hydrogen and 21 tonnes of liquid oxygen derived from oxygen in the atmosphere, would ignite at 10km altitude. India initially plans to develop a "mini-Avatar", to be built by CIM Technologies, weighing 3 tonnes to demonstrate the technologies within about five years.

The Russian Space and Aviation Agency has offered to provide a back-up cargo module and another module, plus an additional Soyuz TM ferry and other components to enable the International Space Station to increase its crew from three to six by 2004 to enable full science operations. Funds for the proposed solution would be raised by Russian commercial flights to the ISS carrying fare-paying passengers.

August 9

The second Thuraya communications satellite will be launched from the Pacific Ocean by a Zenit 3SL booster by Sea Launch in 2002, while at Plesetsk, Russia, a Rokot vehicle is being prepared for the launch this autumn of two US/German Grace research satellites.

After five launch cancellations, NASA's solar wind-collecting spacecraft, Genesis was launched by a Boeing Delta II from Cape Canaveral on 8 August. The Discovery programme spacecraft will make a three-year, 35 million km journey around the sun to return particles of solar wind to the Earth in September 2004 for analysis of what is described as primordial material from the star's formation.

Loral Space and Communications says its business will be profitable in 2005 hopefully after picking up some more satellite manufacturing orders.

As the Space Shuttle Discovery prepares for its evening lift-off from the Kennedy Space Centre today (9 August) on its mission to the International Space Station (ISS), the back-up command and control computer (CC&C) on the ISS failed. The primary CC&C is working and the third unit brought on stream. All three CC&Cs went out of action in April disrupting activities.

August 8

Galileo's camera may not have been working during the closest part of the 200km fly-by of the Jovian moon, Io due to an intermittent electronic problem.

The third and final firing of the twin Boeing Rocketdyne Linear Aerospike XRS-2200 engines originally built for the cancelled X-33 programme was made as part of NASA's Space Launch Initiative programme at the Stennis Space Centre, Mississippi on 6 August. The engine fired for 90s

at 85% thrust during a test primarily to gain data on electro-mechanical actuator technology which controls the flow of propellants.

NASA's Chandra X-ray telescope launched in 1999 has captured what has been described as a "stunning" image of Centaurus A, a massive elliptical galaxy, NGC 5126, 11 million light years away. In addition to the bright central source, a suspected supermassive black hole and X-ray jet emanating from the core and more than 200 point-like X-ray sources were identified.

The Genesis solar wind collecting spacecraft is now re-set for launch today (8 August) and the launch of STS 105 Endeavour remains scheduled for 9 August.

Taiwan is developing a US \$289,000 pico-class satellite, called Yamsat, with Stanford University, USA which will be launched on a Russian Denpr booster in May 2002.

Italian European Space Agency (ESA) astronaut Roberto Vittori will fly on a Soyuz TM mission to the International Space Station in April 2002. His back up will be Belgian-born Frank de Winne. ESA astronauts will fly on a number of TM swop missions at the ISS through to 2006 under an agreement with ESA and the Russian Space Agency.

Arianespace hopes to launch another Ariane 5 booster in November after taking corrective measures, including EPS upper stage Aestus engine qualification and flight engine tests, following the failure of an Ariane 5 to place its Artemis and B-SAT 2 satellites into the correct orbit on 12 July. The failure was due to the malfunction in the EPS upper stage of the booster. The European launch company says that there was "a combustion instability" during the Aestus engine's ignition, which reduced thrust and also led to the premature shutdown of the engine due to the early depletion of one of the propellants. The strong pressure variation, which could be described as a pressure peak or overshoot, responsible for this combustion instability was attributed to "a dynamic hydraulic coupling" or interaction between the EPS propellant feed lines and the engine's combustion chamber internal circuits. The next Arianespace mission will be an Ariane 44L launch of the Intelsat 902 communications satellite from Kourou later this month.

August 6

A U.S. Air Force Titan 4B rocket was launched this morning (6 August) carrying a Defense Support Program DSP missile early warning satellite. The IUS upper stage will be ignited later to boost the satellite to geostationary altitude.

Spacehab's Astrotech company has sold the assets of its Oriole sounding rocket programme to DTI Associates.

The launch of STS 105 Endeavour to the International Space Station remains scheduled for 9 August although a delay could be forced by the need to replace a hydraulic power unit on the left hand solid rocket booster. The reusable unit, which gimbals the nozzle for steering, is one of a manufacturing batch which includes one which has been discovered to have a cracked injector which, however, did not cause a problem during a previous launch.

The launch of the Genesis solar wind collector spacecraft was scrubbed again over the weekend and will have to give way to the STS 105 launch and go for a launch on 12 August. If STS 105 is delayed, the Genesis launch may be brought forward.

Alenia Spazio has delivered the European Space Agency's Integral gamma ray observatory to ESTEC, Netherlands in preparation for its launch in October 2002.

The US Federal Communications Commission (FCC) has authorised 11 new and established communications satellite operators to provide broadband Ku-band services in the USA from geostationary orbit (GEO). The companies are CAI Data Systems, Celesat America, DirectCom Networks, Hughes Communications, KaStarCom World Satellite, Lockheed Martin, Loral Cyberstar, Pacific Century, PanAmSat, Pegasus Development and TRW.

NASA's Galileo Jupiter orbiter flew to within 199km of the surface of the moon Io on 5 August to gather unprecedented magnetic measurements and examine the site of a dramatic volcanic eruption.

About one fifth of the world's population - more than two thirds in the USA and a half in Europe - cannot see the Milky Way in the night sky with the naked such is light pollution and other lower atmospheric factors, according the UK's Royal Astronomical Society.

Russia is ready to help North Korea to launch satellites if Korea scraps its missile programme. Russian assistance would be on a commercial basis, however.

The UK's two STRV research satellites launched piggyback during a December 2000 launch of an Ariane 5 are reported to have failed in orbit after two weeks due to a design fault which caused continuous electrical power rather than a pulsed supply to be applied to a relay which blew fuses and tripped switches in receivers.

August 3

The Hubble Space Telescope has captured an image of the ESO510G13 galaxy in the constellation of Hydra, about 150 million light years away, revealing a remarkable warped dusty disc, assumed to be the result of a collision, showing how colliding galaxies spawn the formation of new generations of stars.

The Genesis solar wind collecting spacecraft remained Earth-bound again yesterday due to bad weather but will try yet again to get spaceborne today (3 August).

Spectrum Astro has shipped the Coriolis spacecraft bus to the Naval Research Laboratory for final integration and testing of its WindSat payload in preparation for the satellite's shipment to Vandenberg AFB, California for a Titan II SLV launch in mid-2002. The 341kg WindSat is a yaw-spinning polarimetric microwave radiometer to measure ocean surface wind vector. Another instrument will monitor solar activity.

The recently-privatised Eutelsat SA European communications satellite operator will acquire a 21.15% stake in Spain's Hispasat organisation,

with the potential to increase the interest to 30%. The companies will establish a joint venture company, Amazonas, which will launch a satellite into a 61deg position in geostationary orbit to provide commercial services to the Americas, particularly in the fast-growing Latin American market.

August 2

While the Pentagon is looking at the cancelled X-33 SSTO as a potential space bomber, it also says it will need the capability to "take things out in orbit", using space-based laser weapons. US military and commercial space assets need to be protected, it says.

Dismal weather at Cape Canaveral cancelled the Delta II launch of the Genesis solar wind collector spacecraft again yesterday and although it has been re-scheduled for today, the forecasts are not much better for several days.

August 1

Boeing Satellite Systems has been awarded a \$130.8 million contract by the National Polar-orbiting Operational Environmental Satellite System (NPOESS) for two Conical Microwave Imager Sounder (CMIS) instruments, for a new series of satellites, with options for four more units, bringing to \$298 million the potential value of the work. The NPOESS will converge two separate but similar military and civilian Defense Meteorology Satellite Programme (DMSP) and National Oceanic and Atmospheric Administration (NOAA) satellites.

Russia's Energomash Glushko research and production enterprise has successfully completed the first test firing of the RD-191 engine designed for the new Angara satellite launcher fleet. The liquid oxygen-kerosene engine is based on the design of the RD-170 and 171 engines used on the Energia and Zenit booster. Unlike its Russian predecessors, which had four combustion chambers, the RD-191 has one unit and one turbopump and a newly designed gas generator for regulating the flow of propellants.

The Russian-Ukrainian Coronas-F solar observatory satellite was launched into a circular 500km, 85deg inclination orbit by a Tsyklon 3 booster from Plesetsk on 31 July. The 2,260kg spacecraft will study the sun and its structure and activity.

NASA has established an independent task force "to take a focused look at the budget and management challenges facing International Space Station (ISS)". After 14 scheduled assembly missions achieved "with unbelievable precision and execution, we must ensure that it (the ISS) is carried out in a more efficient and effective manner", said Dan Goldin, the space agency's administrator. "The financial management of the ISS needs an overhaul but we're going to do in a way that doesn't sacrifice safety", said Goldin, adding that the ISS must "maximise the scientific returns".

The delayed launch of NASA solar wind collector, Genesis aboard a Delta II from Cape Canaveral is scheduled for today, while the delayed Titan IVB launch of a DSP early warning satellite from the Cape is now scheduled for 6 August.

Boeing's Human Space Flight and Exploration unit will transfer approximately 1,100 jobs from its California HQ to Florida and Texas to complement International Space Station and Space Shuttle programmes, including the work of the Boeing-Lockheed Martin United Space Alliance, which operates the Space Shuttle for NASA.

July 31

XCOR Aerospace has inaugurated a flight test programme which it hopes will eventually lead to the development of the privately-developed reusable manned EZ-Rocket. Twin 180kg thrust engines fitted to the Long-EZ aircraft developed by Scaled Composites and piloted by the latter company's Dick Rutan, made a rocket-powered take-off from a runway at the Mojave Civilian Flight Test Centre, California.

The launch of NASA's solar wind collector, Genesis, aboard a Delta II Cape Canaveral has been delayed again, possibly for an extended period, despite still aiming for 1 August, after a power supply component - similar to the two that are fitted to the startrackers on Genesis - failed in a simulated space radiation environment test and mission managers wanted more time to assure themselves that the onboard startrackers "will be able to meet the requirements of the mission". The 1 August launch window is 2s long.

July 30

The launch of a US Air Force Defense Support Programme DSP early warning satellite aboard a Titan IVB from Cape Canaveral originally scheduled for 27 July has been postponed indefinitely due to a fault in the booster's second stage guidance unit.

The launch of NASA's Genesis spacecraft aboard a Delta II scheduled for today (30 July) from Cape Canaveral has been delayed one day to 31 July.

The US and Japan will build the Astro E2 X-ray astronomical telescope to be launched in February 2005 to replace the Astro E spacecraft lost in the Japanese M5 launch failure in February 2000.

China plans to launch two student satellites before the end of 2001, equipped with communications and remote sensing equipment respectively.

July 27

The Titan IVB launch of a DSP early warning satellite from Cape Canaveral has been delayed 24hr to 28 July.

The House of Representatives have agreed a 4% increase in NASA's budget to \$14.9 million which compares with the \$14.5 million agreed in the Senate. The House and Senate of the Congress will work out differences in the autumn before the final budget is agreed.

NASA is considering the use of two Soyuz TM Crew Return Vehicles (CRV) at the International Space Station (ISS) to enable six crew persons to work aboard, enabling more science, which is the mainstay of the ISS, to be conducted. However, six-person missions supported by two Soyuz TMs, could not be flown for long periods, since six crew would pose logistical problems, increasing the number of supporting flights of Russian Progress tankers providing equipment, food and water; requiring the addition of another toilet and the provision of more exercise equipment and sleeping space.

Meanwhile, NASA has shown a warmer outlook to the prospect of another tourist, South African Mark Shuttleworth, visiting the ISS during a Soyuz TM exchange flight. Provided Shuttleworth, who is undertaking a six-month training course at Star City, meets all the ISS familiarisation,

training and medical criteria, there will be "no problems", said NASA, which took a most unhelpful attitude towards "pioneer" Dennis Tito. Other ISS partners, especially the European Space Agency, will not be too happy and in the end Shuttleworth may end up making a week long orbital flight on a solo Soyuz TM mission.

Lockheed Martin Commercial Space Systems will realign its space business structure to reduce costs and improve its competitiveness, including the move of management, business operations, satellite engineering, design, business development and executive functions from Sunnyvale, California to Newton, Pennsylvania, where communications payloads for the company's A2100 satellite series and Government satellites are already built. Final assembly, integration and testing, however, will still be completed at the Commercial Satellite Centre in Sunnyvale. The assembly of a satellite propulsion systems plant in Stennis, Mississippi will continue.

July 26

The Viking 2 Mars lander has been named after Gerald Soffen, the project's lead scientist. Viking 2 landed on Mars on 3 September 1976 and operated until 11 April 1980. Earlier, the Viking 1 lander had been renamed the Thomas Mutch Memorial Station in honour of the leading Viking imaging team member. Viking 1 landed on 20 July 1976 and operated until 12 November 1982.

The US Air Force will launch a Titan IVB booster from Cape Canaveral on 27 July carrying a Defence Support Programme TRW-built early warning satellite into orbit.

It is estimated that there are 15,000 cubic miles of water frozen to a depth of 16 inches on the planet Mars, say planetary scientists.

ILS International Launch Services has confirmed its receipt of a contract from Inmarsat for the launch of one Inmarsat 4 satellite aboard an Atlas V booster in 2003-2004. It was announced that the contract was under negotiation at the Paris Air Show. Arianespace also announced similar negotiations which will lead to the launch of one of the three satellites being built. Both negotiations have included the bid to launch the third satellite. ILS says that six satellites are now firmly manifested for Atlas V launches.

Russia is planning to launch a Proton K booster from Baikonur on 23 August carrying a Cosmos military satellite.

July 25

Alenia Spazio has completed a mechanical model of the cargo carrier for the European Space Agency's Ariane 5-launched Automatic Transfer Vehicle (ATV) for the International Space Station (ISS). The module, similar to the Leonardo, Raffaello and Donatello logistics modules for the ISS, has been delivered to ESTEC, in the Netherlands, to be integrated with the ATV and prepared for structural and thermal tests.

The NASA Stennis Space Centre, Mississippi has completed the second firing of the Aerospike XRS-2200 engine, originally developed for the cancelled X-33 programme as part of the agency's Space Launch Initiative. The 80% thrust, 25s firing will be followed by a third and final test under the project.

The Space Shuttle Atlantis rounded off the 13 day STS 104 mission to the International Space Station (ISS) early this morning (25 July GMT) with a landing at the Kennedy Space Centre after a one-day waive-off due to bad weather. Discovery is scheduled to be launched on 9 August on the STS 105 mission to deliver equipment and new Expedition Crew to the ISS.

Astrium has been awarded a 9m Euro contract from Russia's NPO PM and Russian Satellite Communications Company to supply five central on-board computers for the Russian Express AM communications satellites.

July 24

NASA's planned Pluto Kuiper Express (PKE) mission may receive a \$25 million boost in the space agency's 2002 budget after the Senate Appropriations Committee approved the transfer of a similar amount from a Pluto mission advanced propulsion initiative. The House of Representatives' committee has not included the PKE work, however. A joint Senate-House committee will iron out the final draft budget. The Senate decision to fund the mission rather than the propulsion work is a positive step but as the PKE will cost \$500 million to fly, it is not certain where the rest of the funding will come from, other than the hope that \$50 million worth of work on PKE will kick-start further funds for 2003.

An ILS International Launch Services Atlas IIA booster was launched from Pad B of Complex 36 at Cape Canaveral on 21 July, carrying the National Oceanic and Atmospheric Administration's Geostationary Operational Environmental Satellite, GOES 12. The \$380 million spacecraft will be serve as an in-orbit back until called into service. GOES 11 is also a back-up satellite to the two primary spacecraft overlooking the east coast of the USA and the Atlantic Ocean and the second, the west coast and the Pacific. GOES 12 is the first of the series to carry an X-ray telescope which will monitor the sun's atmosphere once a minute to warn of geomagnetic and storms.

The landing of the Space Shuttle Atlantis after its STS 104 mission to the International Space Station was waived off from the Kennedy Space Centre on 21 July due to unacceptable rain clouds. The next opportunity will be early on 23 July GMT. Atlantis can stay in orbit for another three days if necessary.

Boeing Satellite Systems has invested \$7.6 million in a leased office at El Segundo, California which will house a "side-by-side collection of satellite contractors and their US government customers" to support several military communications satellite programmes, including the Ultra High Frequency Follow On satellite series, the Milstar Advanced Extremely High Frequency payload and the Wideband Gapfiller Satellite.

A Tsyklon 3 booster is being prepared for launch from the Plesetsk Cosmodrome on 25 July carrying the AUOS-SM-KF spacecraft into a 500km, 82.5deg inclination orbit. The satellite is a fourth generation Coronas F craft to study the solar activity. The Molniya launch from Plesetsk on 20 July carried a Molniya communications satellite.

July 23

The Planetary Society, A&E TV and Cosmos Studios-funded Cosmos 1 prototype solar sail mission failed on 19 July. The payload failed to separate from the third stage of the submarine-launched Volna missile and the planned test inflation of two Mylar solar sail blades on a 31 min suborbital flight was not accomplished. Mission officials hope that a full orbital demonstration flight of a pin-wheel shaped sail made of eight sail blades can still be made in October.

Diary July - September 2001

An RS-20 ICBM-based Dnepr booster will be launched from the Baikonur Cosmodrome in November carrying three small satellites for the USA, Italy and Germany.

The Space Shuttle Atlantis STS 104 is due to land at the Kennedy Space Centre on 24 July after its challenging mission to the International Space Station (ISS). Its main accomplishment has been the attachment of the Quest joint airlock and its inaugural EVA by two crewmen on 20 July, to attach the second of two nitrogen gas tanks. Two oxygen and one nitrogen tank had been attached during the second of three EVAs made in the mission, starting out from the airlock on the ISS itself. The addition of Quest makes the ISS a self-contained space station, not requiring the Shuttle to enable full operations. ISS crew can now make EVAs using either Russian or US spacesuits and have the luxury of a spacious exit from the attached Quest.

The Baykonurenergo electricity company has started to cut off power to late-paying customers in the area but so far, work at the Cosmodrome has not been affected.

The Plesetsk Cosmodrome is reported to be almost surrounded by a forest fire covering 624 hectares but work has not been affected yet. A Molniya booster was launched successfully from the cosmodrome carrying a military satellite into a highly elliptical orbit on 20 July.

The Indian Space Research Organisation says that its Insat 3C satellite could be switched to an Ariane 4 booster to ensure its launch later this year, although the planned shared ride with another satellite on an Ariane 5 in September would have been cheaper. Ariane 5 launches are likely to be delayed during investigations into the 12 July failure of a booster to place Artemis and BSAT-2B into the correct orbit.

The launch the third Shen Zhou spacecraft aboard a Long March 2F booster from Jiuquan is reported to be imminent. There will be one more unmanned test flight of the manned spacecraft before Shen Zhou 5 carries the first Chinese astronauts into orbit next year.

July 20

The Planetary Society and Cosmos Studios Cosmos 1 solar sail testbed was launched on a sub-orbital test flight by a Volna booster from the submerged Russian submarine, Ryazan in the Barents Sea on 19 July. The twin-sail was to have been inflated during the 412km apogee flight but no signals have been detected yet from the re-entry capsule which was to have landed in Kamchatka at the end of the 25min flight. A Cosmos 1 orbital mission with a full complement of eight solar sail blades is planned for later this year.

The third and final EVA of the STS 104 Space Shuttle Atlantis mission at the International Space Station was scheduled for today, with two crewmen exiting from the ISS itself, rather than the Shuttle's airlock. The new ISS Quest joint airlock module will be inaugurated as the astronauts emerge into space facing downwards towards the Earth, stepping off into a big void, seemingly dropping down towards the planet. The EVA crew will fix the second nitrogen tank to the airlock which is also equipped with two oxygen tanks. The ISS/Atlantis crews are still struggling with small leaks from parts of Quest, however.

South African business Mark Shuttleworth has begun a one-month familiarisation course at the Cosmonaut's Training Centre in preparation for a possible space tourist flight aboard a Soyuz spacecraft, following in the steps of "pioneer" Dennis Tito who paid \$20 million for the first paid trip into orbit. The terms of Shuttleworth's potential flight have not been agreed and it appears that if he does fly it will be on the basis of the fully-fledged Soyuz cosmonaut, completing a full one-year training course.

Euphon, an Italian multimedia group, has joined with Eutelsat to create a new satellite infrastructure based on Eutelsat's OpenSky system, for telecommunications services, TV/multimedia distribution and data transmission, involving investment of more than 35 million Euro over 10 years. The new service will transmit from the Eutelsat W3 communications satellite at 7degE in geostationary orbit.

Astrium plans to buy the German company, Bosch SatCom which designs and manufactures payload equipment for communications satellites, employs 630 staff in Stuttgart and posted 78 million Euro sales in 2000.

The European Space Agency's (ESA) Artemis communications and navigation technology demonstration satellite left stranded in the wrong orbit, with Japan's BSAT-B2 on 12 July after a botched Ariane 5 launch, made its first apogee booster motor orbit-raising manoeuvre on 18 July, with a view to eventually placing the spacecraft in geostationary orbit in a phased manner, finally using the craft's ion propulsion system for the first time in September and completing the transfer several months later, to ensure an operational lifetime which is unlikely to reach the planned 10 years. The craft will initially operate from a quasi-circular orbit at 31,000km which will be reached in a few days.

July 19

NASA's controversial \$50 million Triana Earth observation satellite may not be launched until 2004, if at all. Its planned delayed November 2001 launch date aboard a Space Shuttle mission has not materialised and the spacecraft will be safed and placed in storage at a cost of \$7 million. Further expenditure leading to the launch will bring the cost of the spacecraft to \$158 million. Triana, nicknamed GoreSat, was introduced by former vice president Al Gore in 1998 to simply provide continuous live images of the Earth from deep space to inspire the world's population largely through the Internet after being deployed from the Space Shuttle in 2000 but it got embroiled in NASA-Congress-White House politics.

The second spacewalk by two astronauts aboard the Space Shuttle Atlantis docked to the International Space Station as part of the STS 104 mission was completed on 18 July with the attachment of two high-pressure oxygen and one nitrogen tank to the \$164 million Quest joint airlock which was delivered to the ISS by Atlantis. The final nitrogen tank will be attached on 20 July during the last EVA. Crews aboard the ISS have overcome problems with the primary command-and-control computer and a leaky ventilation valve in the entrance to the airlock.

The US Federal Communications Commission (FCC) has granted licenses to eight mobile satellite service operators, including ICO Global Communications and Globalstar, for mobile satellite services in the USA, that will lead to high speed voice and data services for rural USA, which represents 88% of the US landmass that has no access to wired or wireless broadband services. The move is seen as "a significant step in assigning this spectrum for use by MSS providers", the FCC said.

July 18

Harris Corporation has received contracts worth \$5.2 million to supply radiation hardened RH3000 computer processors for several satellites, including classified spacecraft and also NASA's CloudSat which will be launched in 2003. Harris has supplied over 350 similar components for other programmes.

Echostar will build a Ku-band communications satellite which it will use for its direct broadcasting customers and also by the StarBand company for high speed Internet applications. Echostar has invested \$50 million in StarBand and will increase its shareholding to 60%.

One oxygen and nitrogen tank each are to be attached to the Quest joint airlock module on the International Space Station on 18 July after an EVA delayed by a glitch in the station's robot arm which was corrected. A third EVA planned for 19 July and the first to be made from Quest, is to install two more tanks. Earlier, a leaking ventilation valve in Quest delayed the logistics phase of the STS 104, extending its mission by one day.

July 17

Space Systems/Loral (SS/L) will build two satellites to provide leased transponder and network communications services to the Spanish Ministry of Defence and government users in the USA, Spain and other nations. SS/L will build SpainSat for Hisdesat, which will provide dedicated X-band and Ka-band services to the Spanish Government from a position at 30degW in geostationary orbit in 2003, while the XTAR-EUR satellite will offer leased X-band transponder services to government customers and provide a back-up service for SpainSat, starting in 2004. The XTAR-Hisdesat venture complements the Loral Global Alliance portfolio of C and Ku-band services and provides an opportunity to enter into new business for X and Ka band technologies.

July 16

An independent inquiry board investigating the cause of the failure of the Arianespace V142 Ariane 5G launch on 12 July to place its two satellites into the correct orbit, will make its first report on 1 August. Arianespace operations will continue with the Ariane 44L launch of Flight 143 carrying Intelsat 902 on 23 August but Ariane 5 flights will presumably await any corrective measures that may be required. Preliminary analysis indicates that there may have been a leak from one of the two tanks storing hypergolic propellants in the EPS stage powered by an Aestus engine at the start of the burn. This caused an 80% reduction in thrust and a shutdown 80s early, said Arianespace - presumably due to the leak, resulting in the placement of the Artemis and BSAT-B2A satellites into a 17,528km by 592km, 2.9deg inclination transfer orbit compared with the planned 35,853km by 858km, 2deg geostationary transfer orbit.

Two Orbital Sciences (OSC) spacecraft will be launched by the company's Taurus booster from Vandenberg AFB, California in August. The Orbital Imaging Corporation's (Orbimage) OrbView 4 high resolution commercial remote sensing satellite is the prime payload, with NASA's QuikTOMS, which will assist the mapping of the world's atmospheric ozone content. OrbView will return 1m resolution panchromatic and 4m multispectral images for commercial customers. QuikTOMS is based on an OSC MicroStar platform, which has been adapted for previous NASA and other customer missions.

The International Space Station's (ISS) Canadian SSRMS robot arm passed its biggest test on 14 July transferring the Joint Airlock from the payload bay of the Space Shuttle Atlantis into its berth on the ISS, completing a major phase in the assembly of the orbital space base. The airlock, called Quest, will enable spacewalks to be made from the ISS, rather than from the Shuttle when it is docked, by astronauts and cosmonauts using the US EMU and Russian Orlan spacesuits. The 6,500kg Quest was transferred by the SSRMS with the assistance of two spacewalking astronauts riding the Shuttle's RMS, in the first dual use of robot arm systems operated from different workstations. Oxygen and nitrogen tanks will be attached to the Quest later in the STS 104 mission, which was launched on 12 July.

The Boeing Rocketdyne XRS-2200 aerospike engine designed to power the cancelled X-33 single-stage-to-orbit demonstrator vehicle was tested for 5.3s at NASA's Marshall Space Flight Center, Maryland on 12 July and second 25s test is planned later, leading to a full-throttle 110s burn. NASA is funding the tests as part of its Space Launch Initiative.

July 13

Two satellites valued at \$1billion are stranded in the wrong orbit after a "defect, possibly in the propellant" of the upper stage during the launch of the Ariane 5 flight 142 from Kourou on 12 July. The European Space Agency's Artemis communications and navigation technology satellite and Japan's BSAT-2B commercial communications satellite were placed into a 17,528km by 592km, 2.9deg inclination orbit, instead of the planned 35,853km by 858km, 2deg inclination geostationary transfer orbit. There was a 1km/ps shortfall in velocity at satellite separation which should have taken place at 9km/ps.

The Space Shuttle Atlantis made a flawless lift-off from the Kennedy Space Centre on 12 July. The STS 104 crew will dock to the International Space Station later today, where the tetchy Space Station Remote Manipulator System (SSRMS) faces its stiffest test during the transfer of the \$164 million Joint Airlock from Atlantis to a port on the station, involving a Shuttle RMS-SSRMS handover. The Ben Guerir trans-Atlantic abort landing (TAL) site in Morocco was deactivated for the STS 104 launch due to concerns about possible terrorist actions. Two other TAL sites in Spain were available.

The \$2 billion Space Shuttle orbiter Columbia could be mothballed on a "ready-to-be-reactivated" mode as part of NASA's handling of a projected \$800 million budget shortfall to 2007. Other measures being considered are cancelling some planned Space Shuttle upgrades and closing test facilities. Columbia, which has flown 26 missions since inaugurating the programme with STS 1 in April 1981, is the only orbiter not equipped to dock with the International Space Station and is scheduled for just two firm flights in 2002: a Hubble Space Telescope refurbishment mission and a science research flight.

Viable space-based alternatives to land-based communications systems will be increased as a result of dramatic advances in satellite digital signal processors (DSP), says Boeing Satellite Systems. The breakthrough was made with the flight-proven DSP developed for the Thuraya communications satellite launched in October 2000. This provides the satellite with more computing power than 3,000 Pentium III computers, enabling the craft to handle tens of thousands of phone calls simultaneously. Boeing is tapping IBM's advanced customised integrated circuit technologies for further satellite applications.

July 12

The Space Shuttle and Ariane 5 launches today (12 July) are on schedule. First off will be STS 104 on its mission to deliver the Joint Airlock to the International Space Station, while Ariane 5 will loft ESA's Artemis communications and navigation technology satellite and the Japanese BSAT-B communications satellite.

The Cosmos 1 Solar Sail project is scheduled for a lift-off on 19 July aboard a submarine-launched Volna booster. The Cosmos Studios-A&N Network sponsored mission with the Planetary Society will deploy two inflatable solar sail blades on a 30min sub-orbital demonstration flight of a proposed late 2001 orbital mission which will deploy a full solar sail. The 19 July inflation will be captured on film which will be recovered with the two-blade sail in a capsule.

The NASA-launched Submillimeter Wave Astronomy Satellite launched in 1998 has returned data indicating that extra-solar planets contain water. The satellite has observed an ageing star located in the constellation of Leo, 5,000 light years away, that appears to be surrounded by a swarm of comets releasing a cloud of water vapour.

The VA-HUD subcommittee of the House of Representatives' Appropriations Committee has proposed the addition of \$415 million to NASA's 2002 budget sent to Congress by President Bush. \$275 million of the budget increase would go towards restoring the International Space Station (ISS) Crew Return Vehicle (CRV) which was one of a casualties after NASA's \$4 billion overrun on the ISS programme. The new budget request, only an early step in the overall approval process for the budget, which would rise to \$14.9 billion, is a positive sign of support for the agency and particularly for the CRV.

July 11

NASA has notified its top four Space Shuttle programme contractors, United Space Alliance, Boeing, Lockheed Martin and Thiokol to develop plans to cope with possible budget reductions of between \$200 million and \$300 million per year from 2003-2007, which could reduce Shuttle flights rate by one a year to six and lead to a smaller workforce. The current Space Shuttle programme annual budget is \$3.284 billion.

The X-38 prototype ISS Crew Return Vehicle (CRV) made its sixth free-flight over the Mojave Desert lasting 13 min on 10 July after being dropped from a B-52. It landed safely under its huge parafoil. NASA has spent \$66 million of the X-38 programme so far but plans for a fully-fledged CRV are on hold due to ISS budget overruns which have reduced the ISS crew size to three.

The launch of the GOES-M meteorological satellite aboard an Atlas IIA booster from Cape Canaveral has been scheduled for no earlier than 22 July. The Remote Control Unit in the guidance system of the Centaur upper stage is being replaced.

NASA is refusing to take delivery of the in-orbit Tracking and Data Relay satellite, TDRS-H from Boeing because of a shortfall in the performance of the Multiple Access Phased array antenna which was discovered shortly after the launch of the spacecraft aboard an Atlas IIA booster from Cape Canaveral in June 2000. "There is a performance shortfall on one antenna and Boeing and NASA are in discussions about that shortfall and until those discussions are complete, there's nothing more to say", said Boeing, adding that the launches of TDRS I and J are scheduled for 2002 and these craft "are being modified and testing will be performed to confirm that they will not experience similar performance shortfall."

July 10

The weather is likely to be problematical for the tanking of the Space Shuttle STS 104 Atlantis external tank and for the launch scheduled for 12 July, says NASA. STS 104 must launch by 18 July or the ISS orbit will become incompatible with a Shuttle rendezvous, creating high sun angles and temperatures on the attached orbiter. If STS 104 does not meet the window, it may be replaced by STS 105 flying a logistics and crew exchange missions on 5 August and be delayed to September. STS 104's primary mission is to attach a Joint Airlock to the ISS using the Shuttle's RMS and the ISS robot arm. Three EVAs will be performed, the first two from the orbiter, to install four high pressure gas tanks and to activate and checkout the airlock and third which will be the first EVA from the airlock itself. The Joint Airlock will enable astronauts and cosmonauts wearing either Shuttle EMUs and Orlan suits to make EVAs from the ISS without the attached orbiter in attendance. All previous EVAs have used the Shuttle orbiter airlock.

The European Space Agency and the Chinese National Space Administration has formally signed an agreement to fly the Double Star mission, involving two Chinese-built satellites launched by two Long March 2C boosters in December 2002 and March 2003 to study the Earth's magnetosphere, equipped with some European science instruments. Double Star will work in collaboration with ESA Cluster satellites. The Chinese DSP 1 and 2 spacecraft will be placed into an equatorial 550km by 60,000km orbit and 350km by 25,000km polar orbit respectively.

July 9

NASA Genesis spacecraft is scheduled to be launched aboard a Boeing Delta II from Cape Canaveral on a mission that will return to Earth a small sample of particles of the sun's solar wind in 2004. Scientists expect 1% of the samples will contain valuable, rare traces of oxygen, nitrogen, neon, argon and other elements which were present in larger quantities when the sun was being born inside a nebula of hot dust and gas.

The Space Shuttle mission STS 104 Atlantis is on schedule for its 12 July launch although there are concerns about tropical storms in the area. The main mission of STS 104 is to install an airlock module to the International Space Station (ISS) that will enable crews to make EVAs from the ISS using a pressurised airlock like the one carried on the Space Shuttle. The first use of the airlock for an EVA will be made during the third sortie by the STS 104 dual-spacewalkers.

The French Government says that it will support the plan to fly Russian Soyuz ST boosters operated by Arianespace affiliate company Starsem from Kourou, French Guyana. A dedicated launch pad costing \$250 million will be built at Kourou. The Soyuz ST, equipped with a Fregat upper stage, could place 2,000kg into geostationary transfer orbit. The French Government says that the Kourou Soyuz launches must not compete with Ariane. It seems likely that as Ariane 5 upgrades develop towards the 5ECB in 2005, the Soyuz will be seen as a cost-effective solution to the market. The Soyuz could also be used to launch Russian communications satellites into GTO.

North Korea has apparently test fired the first stage of its Tapeo Dong 2 satellite launcher. The test flight of the Tapao Dong 1 ballistic missile in August 1998 was a failed attempt to launch a satellite. The Tapeo Dong 2 would also extend the missile's range, which is worrying military analysts.

Space Systems/Loral is reported to have been selected as the prime contractor for the \$150 million Hisdesat communications satellite to be launched in 2003. The spacecraft will be operated by a commercial venture led by Spain's Hispasat.

Nigeria will spend \$93 million over the next three years to build a satellite and intends to establish a National Space Council.

July 6

In a sign of the times, the NASA-Spaceflight Florida Authority Reusable Launch Vehicle hanger which was built to accommodate the cancelled X-33 and X-34 craft, is to be leased to United Space Alliance to store and maintain Space Shuttle ground equipment.

Japan's ISAS has completed the second flight campaign of a small reusable launch vehicle demonstrator, resembling a scale model of the former McDonnell Douglas DC-X, completing three vertical take-off and landings using a liquid hydrogen engine.

The Hubble Space Telescope has captured a 16km resolution image of from a distance 68 million km, showing white water ice clouds and swirling dust storms. The Mars-Earth 2001 opposition, due to the elliptical solar orbit of Mars, is a prelude to the 2003 opposition when the planets will come to within 56 million km of each other, the closest since 1924.

July 5

Japan's NASDA has announced that the first launch of the HIIA satellite launch vehicle will take place from Tanegashima on 25 August. No further details of the flight of the uprated HII have been released yet but it is understood that the booster will carry a dummy payload. Four planned models will produce a 4,100kg to 7,500kg lifting capability to geostationary transfer orbit. The first vehicle is the HIIA-202, with uprated first and second stages with new LE7 and LE5 cryogenic liquid oxygen-liquid hydrogen engines and two new solid rocket boosters, with a 10% increase in thrust. Later models will incorporate either two or four additional smaller solid sub-boosters and an additional LE7A-boosted liquid piggyback stage. A further upgrade, using two liquid piggyback stages is planned.

July 4

The NASA Advisory Council has criticised the agency's decision to cut 40% of the science to be conducted aboard the International Space Station as the main measure to counteract a \$4 billion budget overrun. The decision is totally unrealistic and undermines the primary rationale for the ISS in the first place says the council. A reduction in the crew to the basic three is the main result of the lack of science time in orbit.

The full crew of the STS 111 mission to the International Space Station (ISS) in 2002 has been named as commander Ken Cockrell, pilot Paul Lockhart, mission specialists and spacewalkers, Franklin-Chang Diaz and Phillippe Perrin and Expedition Crew 5 crewmembers, commander Valeri Korzun and flight engineers Peggy Whitson and Sergei Treschev. Expedition Crew 4 members, commander Yuri Onfrienko and flight engineers Carl Walz and Dan Bursch will return with STS 111, a mission which is to install the Canadian Mobile Base System. Chang-Diaz will become the second person to make seven spaceflights, after Jerry Ross.

The intergovernmental Eutelsat communications satellite organisation has been set on the road towards full privatisation by the transfer of its assets and activities to a newly formed company Eutelsat SA.

July 3

NASA did not comply with the correct acquisition procedures to develop the originally-planned US Propulsion Module for the International Space Station (ISS), admits the agency's Office of Inspector General. Requirements were not validated before a design review and consequently, \$97 million was wasted over 19 months before it was decided that the design was unacceptable. Neither did NASA justify its selection of Boeing as sole-source contractor.

While repairs are made to one of the runways at Edwards AFB, California used by Space Shuttle orbiters which have been waived off a landing from the Kennedy Space Centre (KSC), the White Sands Space Harbour, New Mexico will be used as the prime back-up landing site from 1 September to November 29. Only one orbiter, STS 3 Columbia, has landed at White Sands, in March 1982. Meanwhile, as preparations are made to launch the Space Shuttle Atlantis STS 104 to the International Space Station (ISS) with the Airlock Module, from pad 39B at the KSC, on 12 July, Discovery STS 105 has been rolled out to pad 39A for its 5 August launch to the exchange crews and deliver cargo to the ISS. The launch may be delayed to 9 August.

The crew of the Russian Soyuz TM spacecraft to fly to the International Space Station (ISS) in October to replace another TM craft which is always on standby for an emergency return to Earth, has been named as veteran commander Viktor Afanasyev, rookie flight engineer Konstantin Koseyev and former Mir occupant, Claudie Haignere, formerly Andre-Deshays, from France.

July 2

The European Space Agency has confirmed the final details of the new mission scenario for the Cassini-Huygens mission to Saturn, to compensate for the design flaw in the Huygens communications systems. Cassini-Huygens will enter orbit around Saturn on 1 July 2004 as planned and will make two fly bys of the moon Titan on 26 October and 13 December. Huygens will be released on 25 December and will enter the atmosphere of Titan on 14 January 2005, seven weeks later than planned originally. To reduce the Doppler shift in the signal from Huygens, the Cassini orbiter will fly over Titan's cloud tops at an altitude of 65,000km instead of the planned 1,200km.

NASA has admitted to a further \$800 million increase in the International Space Station (ISS) budget overrun, which is now estimated to be \$4.8 billion, according the Florida Today newspaper. The agency admits that some foreign partners may drop out of the project and that replacement parts for the ISS may be required earlier than anticipated. This could increase the overspend to \$5.4 billion.

NASA's Microwave Anisotropy Probe (MAP) was launched successfully by a Boeing Delta II booster from Cape Canaveral on 30 June on a mission to record cosmic microwave radiation from the early Universe. MAP will execute a gravity-assist fly-by of the moon from its elliptical Earth orbit, directing it into a position in space four times further from the Earth than the moon, in the direction opposite the sun, called an L2 orbit, from where it will have an unobstructed view of the sky, free from near-Earth disturbances, such as magnetic field and microwave emission for its two year mission.