

ISTAR firmament: the future of the RAF's combat air reconnaissance assets

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The UK's airborne intelligence, surveillance, targeting, acquisition, and reconnaissance (ISTAR) platforms constitute an increasingly important capability. *Tim Ripley* examines the status of the country's ISTAR assets and charts their future evolution

In April the US Air Force (USAF) despatched two of its latest fifth-generation combat aircraft, a pair of Lockheed Martin F-35A Lightning II Joint Strike Fighters, on a flag-waving tour to Estonia. As well as showing the resolve of the NATO alliance in the face of Russian threats, the foray of the F-35As into the Baltic region also provided an opportunity for the British and Americans to test the reactions and capabilities of Russian air defences in the region.

As the F-35s transited up the Baltic Sea, flying some distance behind were three Boeing RC-135 Rivet Joint signals and electronic intelligence (SIGINT/ELINT) aircraft: two from the USAF and one from the Royal Air Force's (RAF's) 51 Squadron.



The second of three Boeing RC-135W Airseeker/Rivet Joint SIGINT/ELINT aircraft for the RAF arrives at Mildenhall on 3 September 2015. (Crown Copyright)

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A Royal Air Force Boeing E-3D Sentry AWACS aircraft arrives at RAF Akrotiri on Cyprus on 28 January 2015 to support operations against the Islamic State. (Crown Copyright)

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The ISTAR Force

The RAF has a long history of airborne ISTAR operations, stretching back to the First World War when observers in bi-planes photographed German trenches. In the Second World War RAF photographic reconnaissance was expanded into strategic surveillance and the service became a pioneer in the new skill of electronic intelligence-gathering to counter German radar defences. The RAF's involvement in Cold War surveillance operations further expanded the service's ISTAR capabilities, with spy flights over and around the Soviet Union leading to the establishment of a deep and long-lasting partnership with the USAF's ISTAR units and personnel.



The Boeing Sentry AEW1 is the RAF's primary airborne early warning system. Six E-3D Sentry aircraft are in service with 8 Squadron. (Paul Jackson)

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From his headquarters at RAF Waddington in Lincolnshire, Air Commodore Dean Andrew controls force elements involving flying squadrons, ground-based analysts, and mission planners. The bulk of the 3,000-strong ISTAR Force is based at RAF Waddington, but several important units are home-based at three other smaller sites in the UK. Significant detachments supporting current operations are also based at Creech Air Force Base (AFB) in the United States, RAF Akrotiri in Cyprus, and Al Udeid Airbase in Qatar.

The RAF ISTAR Force is currently built around half a dozen core airborne platforms:

- **Boeing Sentry AEW1** . This is the RAF's primary airborne early warning platform. Seven Boeing E-3D Sentry Airborne Warning and Control System (AWACS) aircraft were ordered in 1987, but one has since been withdrawn from service and is regularly harvested for spare parts. Operated by 8 Squadron, the RAF's E-3D fleet was grounded for several weeks in late 2016 and early 2017 when electrical wiring was found to pose a potential fire risk, requiring full inspections and replacements of several components.
- **Raytheon Sentinel R1** . Five Airborne Stand-Off Radar (ASTOR) platforms were ordered in 1999 and brought together an electronically scanned radar, which can operate in wide-area ground moving-target indicator and spot synthetic aperture radar modes, and a Bombardier Global Express airframe. The RAF's 5 (Army Co-operation) Squadron is the only operator of the system.
- **Boeing RC-135W Rivet Joint (Project Airseeker)** . This SIGINT/ELINT platform was ordered after the retirement of the old Hawker Siddeley/BAE Systems Nimrod R1 aircraft in 2011. Two have been delivered to 51 Squadron by prime contractor L3 Technologies and the final airframe is due to be delivered later this year.
- **Beechcraft Shadow R1** . This modified King Air has a manned tactical aerial surveillance role in support of UK special forces and intelligence agencies. The mission systems on the Shadow R1 are highly classified, but they are thought to be similar to those on the US MC-12W Liberty surveillance and reconnaissance aircraft, which include electro-optical cameras and a signals intelligence package. Five fully missionised aircraft and a trainer airframe are currently used by 14 Squadron.
- **General Atomics Aeronautical Systems Inc (GA-ASI) MQ-9 Reaper** . This is the RAF's only operational armed unmanned aerial vehicle (UAV). The RAF is fully integrated into the US global distributed operational network that allows MQ-9 missions over the Middle East to be controlled from command centres at Creech AFB and RAF Waddington by personnel of 13 and 39 Squadrons. A small US-UK launch-and-recovery element (LRE) is deployed to theatre to run air vehicle operations. Once airborne, the missions are handed over to aircrews based in the UK and the United States. Some 10 MQ-9 UAVs are currently in use.
- **Tornado GR4** . This multirole combat aircraft, featuring a Raptor surveillance pod, does not come under the direct command of the ISTAR Force headquarters, but the UTC Aerospace Systems electro-optical camera system in the Raptor pod is one of the RAF's most powerful ISTAR tools, allowing high-definition still imagery to be collected at stand-off ranges. The Raptor pod is expected to go out of service in 2019 when the last RAF Tornado GR4 retires.



A Tornado GR4 multirole combat aircraft. In RAF service the aircraft is fitted with a Raptor pod containing a UTC Aerospace Systems electro-optical camera system, which is considered one of the force's most powerful ISTAR tools. (Benoit Denet)

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Supporting the ISTAR Force's flying squadrons are a number of specialist units, including:

- **No 1 Intelligence Surveillance Wing** . This unit groups together imagery analysts of the old Tactical Imagery Intelligence Wing (TIW) at RAF Marham in Norfolk and 5 (AC) Squadron, as well as SIGINT/ELINT specialists of 54 Signals Unit at RAF Digby in Lincolnshire.
- **54 and 56 (Reserve) Squadrons** . The former provides training for the crews of all RAF ISTAR aircraft, while the latter is the ISTAR Force's dedicated operational test and evaluation organisation.
- **ISTAR Plans** . This small cadre of personnel is based at RAF Waddington to plan future operations and training exercises.

Current operations

RAF ISTAR assets have been involved in continuous operations since 1992, when the first E-3D AWACS aircraft were committed to provide airborne surveillance over the former Yugoslavia. Since then UK ISTAR platforms have played important roles in operations over Afghanistan, Iraq, Kosovo, Libya, Mali, Nigeria, Somalia, and Syria.

International coalition operations against the Islamic State and other radical Jihadi groups in Syria, Iraq, and elsewhere are currently the main focus of the ISTAR Force, with all of its platform types being regularly committed to operations across the Middle East.



An RAF Reaper UAV pictured airborne over Afghanistan during Operation 'Herrick' and armed with a full complement of two GBU-12 laser-guided bombs and four AGM-114P Hellfire air-to-surface missiles. (RAF/Tam McDonald)

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The head of the RAF, Air Chief Marshal Sir Stephen Hillier, recently told the Royal United Services Institute think-tank that "every day, the [RAF] ISTAR Force is providing 30-40% of the Coalition's total ISTAR output".

The most high-profile force element committed by the RAF is its MQ-9 Reaper UAVs, which fly daily surveillance, close air support, and precision strike missions over Iraq and Syria. In August 2015 the RAF Reapers achieved the distinction of carrying out the first strike against UK-born Islamic State fighters in the capital of their so-called Caliphate in the Syrian city of Raqqa.

The Sentinel R1s have also had a prominent role in combating Jihadi groups and the RAF has strived to keep one of these aircraft continuously at RAF Akrotiri in Cyprus to fly wide-area surveillance missions over Iraq and Syria. Over the past four years 5 (AC) Squadron has also been deployed to support French troops in Mali and to Nigeria to help counter African Jihadi groups. Although the UK Ministry of Defence (MoD) has never publicly acknowledged the Sentinel's participation, it is believed that 5 (AC) Squadron flew missions to monitor Islamic State groups in Libya in 2016.



The Raytheon Sentinel R1 is operated by the RAF's 5 Squadron. There is uncertainty about what will replace these aircraft when they go out of service in 2021. (IHS Markit/Patrick Allen)

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Other RAF ISTAR platforms have been heavily involved in Operation 'Shader', as the war against the Islamic State is codenamed by the UK, including Shadow R1s supporting special forces, E-3Ds providing air control for UK and allied strike aircraft operating over Syria and Iraq, and RC-135s eavesdropping on Jihadi communications. The RC-135s have also played a key role in monitoring the Assad regime and Russian military activity in Syria.

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SDSR and ISTAR

The November 2015 UK Strategic Defence and Security Review (SDSR) set the RAF ISTAR Force on a new course in a number of key capability areas. First, it committed the UK to re-entering the fixed-wing maritime patrol business through the purchase of nine Boeing P-8A Poseidon aircraft. There was also a commitment to refresh the MQ-9 fleet with a longer-range, more robust platform with a better payload dubbed the Protector by the UK, with up to 26 of the new UAVs to be purchased. Meanwhile, a GBP2 billion (USD2.5 billion) upgrade to keep the E-3D fleet in service to 2035 was proposed and two additional Shadow R1s will be ordered.

This new investment, as well as other new air, land, and sea programmes, will not be paid for with new money but from an MoD drive to generate more than GBP9 billion in savings from existing programmes. While a big chunk of savings is coming from cuts in civilian personnel numbers across the ministry, pay restraint, and the sale of bases and other assets, a significant element will be gained by making efficiencies across frontline force elements, including the ISTAR Force. The main force element to take a hit was 5 (AC) Squadron, which was earmarked to lose one of its Sentinel aircraft in September 2016, although the need to sustain the Operation 'Shader' commitment eventually resulted in a stay of execution for retirement of the fifth Sentinel aircraft

until March 2017. Under the terms of the SDSR, however, the whole of the Sentinel fleet will be retired in 2021 without a replacement and there is still uncertainty about what will replace these platforms and take over their wide-area surveillance capability after the turn of the decade, which will potentially create a capability gap. There have been suggestions that the proposed P-8A fleet would take on as-yet unspecified overland surveillance roles, but the MoD and RAF senior leadership have yet to confirm whether this capability has been contracted for yet.

In April the UK formally kicked off the P-8 project via the US Navy when it placed a Foreign Military Sales (FMS) contract with Boeing for the first batch of two aircraft for delivery in 2017. The UK also made a GBP100 million investment to help GA-ASI develop the Certifiable Predator B system as part of the Protector programme. By fielding a more robust airframe fitted with sense and avoid technology, the RAF hopes to be able to home-base the Protector at RAF Waddington to allow operations over and around UK territorial waters.

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Next-generation ISTAR Force

In January 2017 ACM Hillier launched a document entitled 'The RAF Strategy' that aimed to chart a way forward for the service and, not surprisingly, ISTAR is central to the vision of a 'next-generation air force'. "Our aircraft and systems must be seamlessly integrated to allow the swift transfer and exploitation of information, rapid decision making and timely delivery of effects," said the strategy document. "Information, connectivity and command and control will be central to our success. Success will be determined by rapid understanding and swift joint action."

In the strategy 'work plan' section on expanding the RAF's capabilities it was confirmed that ISTAR would "grow" and existing capabilities would be exploited more. A major thrust of the strategy document was the need to constantly strive to do things better and more efficiently. It is very clear that major changes to the structure, working practice, and day-to-day operations of the RAF, including the ISTAR Force, are under way. The document details plans to "re-balance/re-sequence the [RAF] equipment programme to create financial headroom in the short term": an indication that the RAF is looking at re-jigging its major programmes. It is also looking to "maximise the RAF's share of Defence Innovation Funds" to bring in money to fund technological developments. A key part of this new way of doing business will be the exploitation of synthetic environments for both training and mission rehearsal.

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Air Cdre Andrew and his staff are working to embody this direction into the ISTAR Force under the banner of Project Athena, or the ISTAR Force Integration Programme. Air Cdre Andrew has described this as looking at the way his organisation operates from top to bottom. In a sign of things to come it emerged in late 2016 that the RAF and British Army were looking to combine their counter-terrorist manned aerial surveillance assets, including 14 Squadron's Shadow R1s and the Army Air Corps' Britten-Norman Defender and Islander aircraft, into a single organisation under the control of the RAF ISTAR Force.



In use by 14 Squadron, the mission systems on the Beechcraft Shadow R1 tactical surveillance aircraft are highly classified, but they are thought to be similar to those on the US MC-12W Liberty aircraft. (SAC/Lauren Pope)

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Project Athena has ambitious objectives to integrate all the work force - regular and reserve military, civilian, and contractors - into a single organisation. One of the methods being investigated to achieve efficiencies is by overhauling the way civilian contractors support the ISTAR Force. Currently, most contracts - including those for aircraft maintenance, computer software support, sensor upgrades, training and simulation, and infrastructure - are stovepiped to individual platforms. Under Project Athena, however, moves will be made to make these contracts force-wide where possible, so that expertise, efficiencies, and cost savings can be shared across multiple platforms.

A big part of the project will focus on moving to rapidly established synthetic training environments for the ISTAR Force that go beyond the current simulator systems, which at the moment mainly revolve around flight deck simulators for pilots and co-pilots. If the training of sensor operators, intelligence analysts, and ISTAR commanders can be migrated to synthetic environments, it is hoped that large savings could be achieved, particularly if these can be linked to other ground, air, and naval synthetic environments to build up skills without requiring expensive live training.

A major objective of Project Athena is to speed up the training of new ISTAR personnel to allow the RAF to grow by 300 personnel as mandated by the 2015 SDSR. Even before the SDSR set this target, the RAF was under strength by just over 2,000 personnel. According to ACM Hillier this means putting 70% more people through RAF aircrew training and operation conversion units to get them ready to serve on the new platforms, the majority of which are ISTAR aircraft, when they enter service.

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