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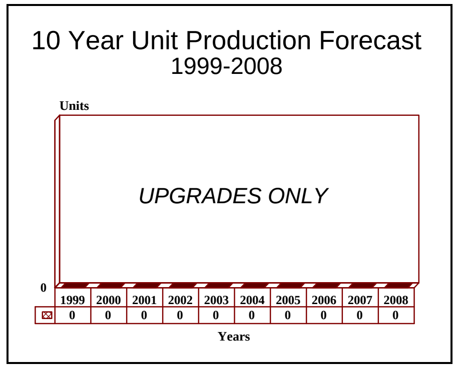
ASARS-2 - Archived 12/2000

Outlook

- Ground mapping SAR for the U-2
- A major upgrade has begun
- Variant selected for the UK ASTOR program



Orientation

Description. Advanced synthetic aperture radar surveillance system.

Sponsor
US Air Force
AF Systems Command
Aeronautical Systems Center
Wright Patterson AFB, Ohio (OH) 45433
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Contractors
Raytheon Systems Company
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USA
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(Prime)

Lockheed Martin Corp
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USA
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(Ground station)

Mercury Computer Systems Inc
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(Upgrade computers)

Status. In service, ongoing logistics support, upgrades pending.

Total Produced. An estimated 35 ASARS systems have been produced. There are 36 U-2R (including four trainers) in the active Air Force inventory.

Application. U-2R (TR-1A). E-2R NASA research aircraft, can carry ASARS.

Price Range. Estimated unit cost is US$4.2 million.

Technical Data

	Metric	**US**
Dimensions		
CBSP Processor (ground)		
Weight:	68 kg	150 lb
Volume:	0.18 m^3	6.5 ft^3
Size:	43 x 58 x 69 cm	17 x 22.75 x 27.2 in
Replacement Airborne Processor (proposed)		
Weight:	43.1 kg	95 lb
Characteristics		
Range (est):	165 km	102 mi
Frequency:	8 to 12 Ghz	
Resolution:	Better than 18.3 m	Better than 60 ft
Units:	Electronically Scanned Antenna Transmitter Receiver/Exciter Control Display Unit Processor (CBSP) Power Supply	
Operational Modes:	Moving-Target Search Moving-Target Spot Stationary-Target Search Stationary-Target Spot	
U-2R/S		
Range:	2,609+ nm (6,400 km)	
Ceiling:	+ 70,000 ft (21,212 m)	
Speed:	475+ mph (Mach 0.58)	

Design Features. The Advanced Synthetic Aperture Radar System-2 (ASARS-2) was designed to provide high-resolution, long-range radar ground maps in all weather conditions, day or night. It originated in the Side-Looking Airborne Radar (SLAR) Program, which funded development of high-resolution radar components to be used in airborne imagery collection.

Radar data are collected and transmitted in near real time to ground stations for tactical analysis. The ASARS-2 is one of the modular sensor packages carried by the U-2R in a special forward Q-Bay in the nose of the aircraft. It is characterized by a special cooling intake on top of the nose.

ASARS-2 is a synthetic aperture radar (SAR) with side-pointing antennas that is used to detect and locate stationary or moving targets on either side of the aircraft. The U-2R/S can gather detailed information on selected portions of the coverage area. The radar uses a dual planar array antenna oriented perpendicular to the U-2's flight path. It can map the area on either side of the flight path without changing aircraft or radar antenna orientation. The radar produces constant-scale imagery in plan view, even at long range, with ground resolution independent of range. Increased resolution can be achieved with the "spot mode" by changing the look angle of the antenna to repeatedly map a small area of interest. The radar has several classified search modes.

Near-real-time imagery exploitation is carried out in a transportable ground processing station, the Multi-Sensor Exploitation System (MSES), which processes the received data into exploitable tactical information. The units use a flexible imaging and data-processing system to accomplish the necessary intelligence reporting and imagery dissemination. The ground station is air transportable and can be mounted on selected ground vehicles.

Operational Characteristics. The U-2R/S is a primary USAF airborne reconnaissance platform and the only high-altitude, air-breathing reconnaissance aircraft of its type in the inventory. It can operate day or night and in adverse weather. As a battlefield surveillance sensor, ASARS-2 can locate and monitor fixed or semi-fixed surface targets using the radar's broad area search or spotlight modes to develop photo-like radar maps of a target area, downlinking the imagery to a ground station for viewing in real time.

Imagery-derived target location reports are sent to users, including battlefield command centers, intelligence centers, and strike systems such as the Combat Operations Intelligence Center and the Joint Surveillance and Target Attack Radar System (JSTARS). The ground station can direct the aircraft to obtain additional coverage of the target area. During the Persian Gulf War, typical deployment was to fly a photo reconnaissance mission during the day, followed by an ASARS mission at night.

The ASARS-2 radar has four basic operational modes, two for moving and two for stationary targets. They are:

Moving Target Indicator Modes

Search: A wide-area MTI mode provides selectable cartographic or synthetic aperture radar background information highlighted by moving-target activity.

Spot: Improved detection and location capabilities characterize this MTI mode. It can detect both slow- and fast-moving targets, group and count individual targets, and overlay these targets on a synthetic aperture radar background.

Stationary Target Modes

Search: This mode provides large area coverage with the ability to detect and locate targets. It provides large target discrimination.

Spot: This mode provides greater target detail and small-target discrimination.

Besides military missions, the U-2 has been used by the Army Corps of Engineers, state governments, and the Federal Emergency Management Agency (FEMA) to cope with natural disasters. The U-2 supplied radar images during the floods in the Midwest in 1993 and Northern California in 1995, as well as the Northridge (California) earthquake in 1994. The aircraft was used for surveillance during the Malibu (California) fires and to evaluate damage after Hurricane Andrew.

The U-2R can be configured for a variety of specialized missions by changing modular sensor packages. Plans are for upgrades to keep the U-2 effective until at least 2020. There are proposals to begin developing a replacement aircraft around 2010, which would become available to operating units in 2025.

Mission upgrades from the ASARS-2 Improvement Program (AIP) will result in a significant improvement to the sensor capabilities. GMTI, onboard processing, and datalink improvements will make it possible for ground commanders to get U-2R imagery in near-real time, a major improvement over past operations. It will also expand the number of target types that can be seen. The resulting system will feature a four-fold increase in coverage in the search mode, a spot mode nine times larger than the current system, and a new very-high-resolution search mode.

Variants/Upgrades

In August 1994, the Air Force contracted for the new CBSP (signal processor). The new processor will feature newer technology, flexibility, and software portability and based on the latest commercial off-the-shelf (COTS) hardware and software available.

An airborne version was successfully flight tested in late 1995. Commonality will make it possible to use a common software baseline for both the ground and airborne computers. It has been proposed as the basis for the Air Force radar improvement plan. The new processor will increase resolution and coverage and enable the of addition of MTI capability. It will make it possible to provide ASARS-2-derived digital maps to ground commanders for better assessment of force composition and location.

By the beginning of 1996, one aircraft flying out of Korea had received a prototype Enhanced MTI upgrade. A second modification was in progress. A US$220 million contract was awarded in June 1996 to begin the full upgrade effort. The effort involves integrating legacy ASARS equipment with a new COTS Receiver/Exciter/Controller and a new onboard Processor.

Aircraft upgrades include new engines and an improved power system which will allow the aircraft to carry more sensors at one time, as well as added defense avionics.

The **ASARS-2 Improvement Program (AIP)** is taking advantage of advances in state-of-the-art hardware and software to improve operational capabilities. Enhancements include real-time, precision targeting; broad area synoptic coverage; onboard processing; complex imagery for measurement intelligence applications; and Ground Moving Target Indicator (GMTI).

Mercury Computer Systems i860-based RACE® processors will make the major planned airborne performance possible.

The Air Force is upgrading ASARS ground stations with new processors. The COTS Signal Processor (CBSP) features scaleability, extensibility, software portability, and low cost. The Image Information Processor is made up of 38 Intel i860XR processors on three modules. The Host Computer is a SUN 600 Series Dual SPARC CPU module. Both have a 9U VME factor.

The processor is small and light, and a ruggedized version is being developed for airborne applications. CBSP will interface with the TAC 3/4, CARS, and JSIPS systems. The architecture was designed to be upgradeable, and could be software-modified to process MTI and F/A-18 RECCE data.

IFSAR. An interferometric synthetic aperture radar is to be developed for the U-2 and high-altitude endurance UAVs. The Senate Select Committee on Intelligence added US$6 million to the FY98 intelligence authorization to begin the development. An IFSAR is scheduled to fly on the Space Shuttle around 2000. The upgraded radar will be designed to provide improved targeting and terrain information for better targeting of precision-guided munitions.

The **Multi-Sensor Agile Reconnaissance System (MARS)** will reduce or eliminate many of the time-delay problems experienced in the past and support rapid precision targeting and other reconnaissance missions using an integrated intelligence suite. The suite will require integration of current and/or planned Synthetic Aperture Radar/Moving Target Indication (SAR/MTI), signals intelligence (SIGINT) payloads, and a new electro-optical/infrared (EO/IR) multi-spectral imaging/hyper-spectral imaging (MSI/HSI) payload which is to be developed under the Multi-Sensor Agile Reconnaissance System (MARS).

The modularized, integrated system will be used to provide cross sensor cueing and a more usable data output to image analysts. The program is initially targeted to go on the U-2 aircraft; however, capabilities for growth of the Global Hawk High Altitude Endurance Unmanned Airborne Vehicle (HAE UAV) will be an inherent part of the basic system design.

Advanced Tactical Air Command and Control System (ATACCS) is a subset of MARS. MARS was originally composed of two main components. The first component was the integration of existing EO, SAR and SIGINT sensors to perform dynamic sensor/platform cross cueing, data fusion, and Automatic Target Recognition/Correlation (ATR/ATC) algorithms. The second component of MARS was the development and incorporation of an advanced hyperspectral cueing sensor to aid in the detection of difficult targets, such as camouflaged targets. The MARS program has been restructured to separate the sensor integration and cross cueing work from the higher risk advanced hyperspectral sensor work. The sensor integration and cross cueing work under the MARS program will be executed under ATACCS. The advanced hyperspectral sensor work will be executed by the Air Force Research Laboratory (AFRL) to mature the technology.

ATACCS will support rapid precision targeting and other reconnaissance missions using an integrated intelligence suite. The suite will require integration of current and/or planned SAR/MTI, SIGINT, and EO/IR payloads. The modularized integrated ATACCS system will be used to provide sensor cross cueing and a more usable data output to image analysts and other system users.

The Initial Operation Capability platform for ATACCS is still the U-2 aircraft, but the program must be designed to be platform independent. We anticipate ATACCS migration to the Global Hawk and eventual incorporation of other sensors and platforms.

Program Review

Background. The U-2 first flew in 1955, carrying cameras and radioactivity sensors. One of the U-2's most famous missions was photographing the Soviet military in the act of installing offensive missile sites in Cuba. The high-flying reconnaissance aircraft have been a backbone of Cold War intelligence gathering since the '50s and used extensively in operations around the world.

Development of ASARS began in 1972. Development grew out of the need of NATO forces in Europe to observe second-echelon areas of the (then) Warsaw Pact forces. A wide-band datalink transmits radar data to a ground station for processing and analysis. Operators can select the mode, resolution, and search area for the radar. Joint funding began in 1977 with a contract awarded to (then) Hughes to develop the system. Contractor integration and testing of the original radar took place in 1979, with ground processing equipment testing following in 1983.

The SLAR program was conducted in three phases: Phase I, analysis and digital demonstration; Phase II, competitive prototyping; and Phase III, preproduction prototyping. In FY76, the program was held at the advanced development level because of the need for a substantial amount of additional R&D. Phase II was completed and Phase III was initiated in FY81.

In FY83, elements of a demonstration prototype were integrated into the ground processing system as part of the initial production ground processing and exploitation system specification preparation.

In FY87, the first ASARS-2 production radar was flight-tested and accepted. The Tactical Reconnaissance Exploitation Demonstration System (TREDS) achieved limited operational capability and the TR-1 Ground Station preliminary design review was completed in May. Software development for the ASARS-2 Processing Segment (APS) continued.

The TR-1 Ground Station critical design review was conducted in FY88. Development of APS software and a variety of capability and technical improvements for the system continued. In 1992, the aircraft was redesigned the U-2R.

APS training and integration support was to be completed in FY91, along with design modifications for ASARS technology. Plans included tailoring SLAR exploitation techniques for ASARS-capable systems. The SLAR tailoring effort continued until FY93. Design specifications for classified capabilities are yet to be published.

In 1990, TR-1 aircraft were deployed to Cyprus to support Operation Desert Storm. The aircraft were used for a variety of missions, including the search for SCUD missile launch sites and location of Iraqi forces. TR-1s were involved in battlefield surveillance from early on, flying over 300 missions through the end of the effort. Missions changed from several sorties daily in the beginning to 24-hour operations in the latter stages of the operations. Reports indicate that some of the TR-1s flown had not been updated to the full ASARS-2 configuration.

TR-1s reportedly provided 90 percent of the target information received by the Army. ASARS-2 played a major role in planning and conducting breaching operations during the ground war. The radar could map barriers and report on Iraqi positioning, making it possible for the Coalition forces to go around instead of through many of Saddam Hussein's forces. The fixed-target detection capabilities of the ASARS radar complemented the moving-target performance of JSTARS. Operations frequently involved using the TR-1's radar to check and verify suspected targets, mapping battlefield obstacles and tracking Iraqi force deployment/movement.

The data were very useful for targeting. Evaluators claim 11 to 15 SCUD launcher kills could be credited to JSTARS/ASARS/F-15E hunter/killer teams. Air Force controllers operating from Army ground stations passed search requests to the TR-1 and target information to attack aircraft which locked on to the targets with their own radars. An estimated 80 percent of the targets were found at the exact coordinates indicated.

After-action reports indicated that intelligence information from a variety of sources was plentiful. The major bottleneck was getting the information distributed around the battlefield to commanders who needed it. General Norman Schwarzkopf, testifying before Congress, was especially critical of this. He pointed out that Coalition forces had very good information, but were not able get it to the commanders who needed it. This prompted the development of new communications and processing systems and techniques to connect field commanders with intelligence sources in a more direct, timely way.

Production of the a COTS processor upgrade for all ASARS-2 ground stations was contracted in August 1994. Factory acceptance testing was conducted in May 1995. Environmental testing of a ruggedized airborne version was completed successfully in January 1995.

A prototype airborne version of the new processor was delivered to the Air Force for testing in 1995. The 95 pound system uses software that is common with the ground processor. The advanced capabilities would make it possible to have an MTI capability on board the aircraft instead of having to transmit radar to the ground station for MTI processing. The ASARS-2 Improvement Program was formally begun in June 1996. The first phase consisted of integrating the legacy ASARS-2 electronic scanning antenna, transmitter, and low-voltage power supply with a new, COTS-based receiver/exciter/controller (REC) and new onboard processor.

In 1996, the high-altitude aircraft were considered for deployment to support the Operation Joint Endeavor mission in Bosnia. Aircraft were deployed from the Royal Air Force Base at Fairford, England, to Istres le Tube, France to facilitate mission operations. Deploying up to five aircraft was planned. The idea was to deploy aircraft with the new MTI capability to help JSTARS monitor ground movements among the opposing forces. The high altitude of the U-2R would make it possible to see into some of the valleys that were shielded from the JSTARS radar. The end of hostilities limited the tactical usefulness of the move.

During the Roving Sands exercise in April 1997, an upgraded version of the U-2 SAR was considered an unqualified success. According to reports, radar imagery was credited with three kills and one re-tasking against Scud-type targets in just over four minutes. The radar worked with F-15E attack aircraft in the exercise.

Flight tests of the improved ASARS-2 sensor began in June 1999. The first phase of the AIP was successfully completed in early 1999. Flight tests of the improvements were declared successful after five of seven planned tests. All objectives were accomplished and reports indicated that contract ratio, impulse response width, and peak sidelobes met or bettered the requirements. Testers were extremely pleased with the imagery collected. This cleared the way for a possible delivery of the first two production units in early 2000, with the upgraded aircraft flying operationally by the end of the year. A replacement transmitter is programmed for fielding in FY03, and the advanced image processing equipment is funded through FY05.

During Operation Allied Force in Kosovo in late 1999, U-2s were credited as being the only 24-hour, all-weather, multi-intelligence capability available to commanders and planners. The U-2s flew 189 combat missions and provided 1,300 hours of collection time. The overall mission-capable rate was 90 percent and the system collected 80 percent of the imagery needed to plan the Kosovo air strikes.

ASARS-2 data were sent via tactical datalink to the Common Imagery Processor (CIP) and Enhanced Tactical Radar Correlator (ETRAC) in the U-2 ground station. CIP is the US DoD/National Imagery and Mapping Agency standard for all tactical imagery processing systems. This high-power, compact system provided commanders with intelligence data directly from aircraft.

The CIP can receive data from other sources as well. A mission command imagery specialist would view incoming data and forward it to battlefield commanders for mission planning. ETRAC features include day/night imaging, SAR, IR, and EO processing, as well as having a remote workstation capability. The ground station can process data from the U-2 and UAV sensors, increasing the ability to develop a comprehensive picture of the battlefield for commanders.

Engineers have tested the CIP with SAR imagery from the F/A-18 APG-73. There are plans to retrofit the CIP into major ground stations for the Army, Navy, Air Force, and Marines to process Global Hawk and, eventually, Predator video data.

<u>United Kingdom ASTOR Program</u>. This effort began as CASTOR, the Corps Airborne Standoff Radar. It was an army requirement to cover the 70 kilometer British front planned for the Cold War. It was basically an MTI requirement because the army knew its area very well and knew what would be coming. It felt that all it needed to know is when the enemy force was moving and where it was located. That requirement was never developed because in the '80s the technology was not there. Competition mounted between the Army and Air Force over who should own the platform (the army assumed if the AF owned it the Army would never see any product – something not uncommon worldwide) and the Air Force felt that the aircraft was too small and would not survive. This further delayed the effort.

Eventually, the Parliament forced the Army and Air Force had to get together and write a requirement that satisfied both users. It included factors like the ability to look at vehicles and tell if they were tracked or wheeled, helicopters, and so on. A Concept Paper was written in 1986/87, "The point at which the two services got their heads knocked together by the Ministers," an official told *Forecast International*.

As a result, there was a technical demonstrator program run in the UK to prove the dual-mode radar concept, to estimate the program risk, and to formulate a reasonable budget. In 1991, the Ministry of Defence (MoD) Operational Requirements branch took over the project and created a project definition.

The UK decided that most of the ASTOR system processing would take place on the ground instead in the aircraft, as with JSTARS. Engineers began to look at the U-2 and ASARS. The MoD gave the imaging radar highest priority, so the imagery provided by a radar like ASARS was considered paramount. There had to be MTI, but it did not have the same importance. Since 1995, the importance of MTI has grown, and planners now balance MTI, SAR, and Spot SAR. They want the ability to change depending on the mission and environment.

The Defence Research Agency conducted analyses and came up with a balance. In peacetime, there is not much need for MTI; Spot SAR is more useful because it enables operators to look at a relatively static situation, and Spot SAR is effective in updating specific items of interest. In a crisis, wide-area SAR becomes more important and MTI starts to take on a greater importance as well. In a conflict, use will tend to be a balance of 40 percent MTI, 40 percent Swath SAR, and 20 percent Spot SAR. In the Gulf War, after there had been movement on the ground, Swath SAR assumed greater importance, letting commanders know where the hostile forces were located.

The MoD decided it wanted a good imaging radar that could give wide-area coverage as well as Spot SAR and then MTI. The quality and detail, as well as superior MTI, is a result of the enormous JSTARS APY-3 antenna. Planners decided to compromise on airplane size and require higher altitude operation than with

JSTARS but less than with ASARS. As established, ASTOR will still maintain about a 2° grazing angle at the range required, and an acceptable MTI is still possible. The airplane would carry extensive datalinks capability.

The U-2 can fly at high altitudes, but has limited processing on board, so Raytheon designers decided to base their bid on installing a version of ASARS-2 in a business jet that would fly at 50,000 feet, a compromise between the 70,000 foot U-2 and 35,000 foot JSTARS. This platform would also make it possible to have some analysts on board, but not to the extent of JSTARS with extensive exploitation, and allow some command decisions to be made in the aircraft. In addition, the system would be able to operate on its own in peacetime when there were limited ground stations on the scene. So the development focus was on the ability to do some exploitation on board and adding extensive communications to transfer the information to ground operators. There would also be ample recording capability both in the air and on the ground.

In June 1999, the UK selected the Raytheon ASARS-2 bid for ASTOR. A Bombardier Global Express aircraft will have three airborne workstations, with growth capability for a fourth. The new antenna will be three times longer than the one carried by the U-2R, and the Dual-Mode Radar will incorporate ASARS Improvement Program enhancements as well as features from the Raytheon Global Hawk radar. The JSTARS Common Ground Station will be used for the battlefield segment. The design will also include significant potential for hardware upgrades that could increase transmitter power, processing capability, speed and memory growth.

Raytheon will support ASTOR through Raytheon Systems Limited, its UK subsidiary. The development includes significant participation by UK companies. Other bidders were a Northrop Grumman team with a down-sized JSTARS in a business jet, and Lockheed Martin, featuring a Racal Defence Systems sensor.

Funding

Most recent funding is from platform and O&M accounts or classified lines. Congress added US$15 million to the FY95 budget for the Enhanced MTI development. In FY97, Congress added US$57 million to the US$28.3 million request for U-2R sensor upgrades. In the FY98 Appropriation, the Senate added some funding for various U-2-related lines, but these were dropped in conference. In FY00, the Defense Appropriations Subcommittee adopted amendments provide funding for U-2 aircraft defensive system modernization and cockpit modifications.

Recent Contracts

(Contracts over US$ 5 million.)

Contractor	Award ($ millions)	Date/Description
Westinghouse	4.7	Feb 1996 – Increment as part of a US$6,585,008 CPFF letter contract to support ARPA Advanced Concept Technology Demonstration (ACTD) activity and satisfy a critical DoD need. The Semi-Automated Image Intelligence (IMINT) processing system is a DoD initiative to develop and field a set of integrated exploitation tools for the U-2R aircraft. Completed November 1997. (MDA972-96-3-0005)
Raytheon Systems Co	43.9	Jul 1999 – FFP cost-reimbursable contract to provide for FY00 contractor field service representatives in support of ground stations, sensors, and datalinks supporting the U-2 aircraft. Performance period Oct 1, 1999 through Sep 30, 2000. (F09604-99-C-0050)

Timetable

Month	Year	Major Development
Aug	1955	First U-2 flight

Month	Year	Major Development
	1972	Development of ASARS initiated
	1977	Contract awarded to Hughes for SLAR development
Aug	1981	First TR-1 flight
Sep	1981	First TR-1 delivered
	1984	ASARS deployed
Jul	1985	First ASARS-2 operational sortie
Jun	1986	ASARS-2 enters flight testing
	1988	Ground station CDR
Oct	1989	Last U-2R delivered
	1992	TR-1 redesignated U-2R
Mar	1994	CBSP IOC
Aug	1994	CBSP contract awarded
Jan	1995	CBSP airborne environmental tests complete
Mar	1995	Enhanced MTI software development award
Jun	1996	AIP upgrade effort begun
Jan	1999	AIP flight tests completed
Jun	1999	UK decision on ASTOR; AIP flight tests begin
Fall	2000	Delivery of first AIP production versions
	2003	ASTOR in-service date
	2020	Development of U-2R replacement begun
	2018	U-2R replacement delivery planned
	2035	U-2R retirement

Worldwide Distribution

US Air Force only.

Forecast Rationale

During Operation Desert Storm, the Air Force used the TR-1 (became the U-2R) to provide theater coverage and intelligence-gathering. Operating from beyond the reach of most threats, the ASARS-2 radar provided target location information under conditions in which non-radar and other sensors were ineffective. Aircraft equipped with ASARS-2 can look approximately 55 kilometers (35 miles) into hostile territory.

The advanced synthetic aperture radar performed well and featured some of the most recent technology and software available at the time it was built. Operation Desert Storm, Bosnia, and Kosovo proved this in actual combat. By combining with JSTARS, the U-2R proved its value as part of an overall battlefield surveillance system that combines high- and low-altitude surveillance with reconnaissance capabilities. Contingency operations and disaster support are the main missions for the U-2R.

The ASARS-2 capabilities were recognized in the DoD's desire to deploy EMTI-equipped U-2Rs to Operation Joint Endeavor to aid JSTARS. The high operational altitude of the aircraft makes it possible to see deep into some of the terrain. The weakness of the plan was the lack of available modified aircraft.

Currently, software and radar upgrades are being continually improved. The ground station is expanding its ability to process and distribute the data provided by the aircraft. The major efforts are developing the ASARS processing segment software and increasing the imagery yield at extended ranges. Technology developed under this program is being carried into other Raytheon airborne radars, such as the APG-73(V).

The new airborne processor will be an important asset for the aircraft. It is lighter and more capable, and reduces the need to datalink everything to the ground for processing. This will make MTI operations possible on the aircraft, as well as transmitting processed target data direct to ground commanders. The improved capabilities will result in significant enhancements to the radar's performance.

Further production of the airborne radar for U-2Rs has been considered unlikely, although the airborne processors are being replaced and the radars enhanced. New, more powerful and fuel efficient engines are being installed in the U-2. Logistics support will continue, along with software and hardware upgrades.

Kosovo operations have generated increased interest in improving reconnaissance to include new, long-endurance aircraft. This may start an unexpected competition between the unmanned Global Hawk and manned U-2. Pentagon Acquisition Chief Jacques Gansler requested the addition of US$500 million to the 2001 budget to bridge a gap in production for Northrop Grumman's Global Hawk unmanned reconnaissance aircraft, but is providing an opportunity for officials to rejuvenate the idea of new production of the U-2.

Both the U-2 and Global Hawk can carry synthetic aperture radar, electro-optical and infrared cameras and SIGINT payloads, but each offers different advantages. The U-2 has a 2 ton payload, but only about a 12 hour endurance, while the Global Hawk can carry only a ton, but can stay aloft for almost two days. This overlap has prompted consideration of specializing the aircraft, leading the Air Force to ascertain what each aircraft does best. The studies seem to be gravitating toward Global Hawk as a long-endurance SIGINT, capitalizing on an ability to spot short, irregular electronic transmissions (such as the calibration signals for mobile missile radars) that a conventional aircraft or low-orbit SIGINT satellite might miss because of their shorter observation times.

Ten-Year Outlook

No further radar production planned, although a version of the ASARS-2 will be produced for the UK ASTOR surveillance system program.

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