

Army eyes in the sky

The history of the US Army's multifaceted manned aerial ISR programmes can be traced back to Southeast Asia in the late 1960s, when iconic Grumman OV-1 Mohawks and first-generation Beechcraft RU-8 and RU-21 Guardrail I aircraft operated throughout southern Vietnam and Laos to satisfy critical battlefield intelligence requirements. **Jim Dorschner** tracks the lineage of these aerial ISR platforms

Following the end of the Vietnam War in 1975, US Army manned aerial intelligence, surveillance, and reconnaissance (ISR) capabilities grew and matured through many years of sensitive, around-the-clock Cold War Peacetime Airborne Reconnaissance Program (PARPRO) collection operations along the West German border with East Germany and Czechoslovakia, and along the demilitarised zone (DMZ) in Korea. At the same time, the army continued to provide tactical intelligence support at corps and division level.

Then, as the army transitioned back to a more conventional heavy mechanised force posture to counter the Warsaw Pact in Europe in the 1980s, dedicated pioneers in the army special electronic mission aircraft

(SEMA) community gained sufficient influence to introduce groundbreaking 'aerial exploitation battalions' (AEBs) in four corps-level military intelligence (MI) brigades. Two were based in West Germany and two in the continental United States, along with a fifth in the separate MI brigade in South Korea.

Each AEB featured an imagery intelligence (IMINT) company equipped with OV-1D Mohawk ISR aircraft, and a signals intelligence (SIGINT) company with the RC-12 SIGINT platform. The latter employed advanced Guardrail V systems with a line-of-sight (LOS) tether to a ground-based integrated processing facility (IPF) at the AEB base. The IPF was manned with linguists and analysts capable of real-time exploitation and dissemination. The OV-1Ds, meanwhile,

were equipped with conventional aerial cameras and either a long-range side-looking airborne radar (SLAR) system with moving-target indicator (MTI) capability, or a vertical infrared linescan system. Specialised RV-1D Quicklook electronic intelligence (ELINT) versions of the Mohawk were also rolled into AEBs.

After the 1990–91 Gulf War, during which two AEBs deployed to the Middle East, the US Army embarked on a massive post-Cold War downsizing that ultimately eliminated the two Germany-based corps and their AEBs, leaving just the battalions in the United States that supported XVIII Airborne Corps and the heavy III Corps, plus the US Army Intelligence and Security Command (INSCOM) AEB in South Korea. By 1996



A US Army RO-6A ARL-E aircraft in Tucson, Arizona. The ARL-E is a multi-intelligence airborne platform with the capability to detect, locate, classify, identify, and track targets in day/night and all-weather conditions.

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all the Mohawks were retired and their capabilities had been nominally replaced by unmanned aerial vehicles (UAVs) and US Air Force (USAF) E-8 Joint Surveillance Target Attack Radar System (JSTARS) platforms.

Airborne reconnaissance low

Meanwhile, in about 1987, INSCOM established a unique AEB designated the Military Intelligence Battalion Low Intensity (MILI). Based in Central America until the late 1990s before ending up at Fort Bliss, Texas, MILI was originally intended to support regional counter-drugs and counter-insurgency (COIN) missions. In its early days MILI operated a number of ISR platforms, including three specially configured Crazy Horse RC-12G SIGINT aircraft, also known as Guardrail South. These were joined in 1993 by the unique, four-engine EO-5 SEMA (originally designated RC-7s) in quasi-civilian paint schemes, although they retained their US military tail numbers until 2002, after which they regularly operated with civilian N-number registrations and deployed crews often wore civilian clothing.

Developed and fielded under the Airborne Reconnaissance Low (ARL) programme, EO-5s were highly modified De Havilland DHC-7 aircraft originally in two configurations, ARL-I for IMINT (EO-5A), and ARL-C for SIGINT (EO-5B). By 1999 these capabilities were combined into nine multisensor ARL-M variants (EO-5C), which remained in service with MILI and the INSCOM AEB in South Korea until 2016, when phased retirement of the type began. They also deployed regularly from 2003 to Iraq and Afghanistan. ARL-M operations were notable for their light footprint at forward-operating locations (FOLs), and their ability to self-deploy and self-sustain for extended periods.

In November 2015 the army awarded an ongoing five-year contract to Leidos, reportedly valued at USD662 million, to replace its EO-5 ARL-Ms with nine ARL-E (Enhanced) variants. The new platforms featured upgraded sensors and satellite communications (SATCOM) datalinks installed on highly modified secondhand, twin-engine DHC-8-315 special mission aircraft, designated the RO-6A. Five of these have been converted to the RO-6A standard from existing Saturn Arch and Desert Owl DHC-8s, which were originally fielded for counter-improvised explosive device (C-IED) missions. Four additional airframes were procured on the civilian market for conversion



A SLAR-equipped Grumman OV-1D Mohawk ISR aircraft from the 73rd Military Intelligence Company (Aerial Surveillance) at rest in the Hawk Cage at Stuttgart Army Airfield in 1978 before another PARPRO mission along the Czech or East German border.

and all nine are expected to be delivered by 2020.

Sensors on the RO-6A include a SIGINT suite; high-definition electro-optical/infrared (EO/IR) full-motion video (HD-FMV), foliage-penetrating (FOPEN) radar, ground-moving target indication/synthetic aperture radar (GMTI/SAR), dismount moving target indicator (DMTI), and ground-penetrating (GPEN) radar, all controlled from six onboard operator work stations. Retirement of EO-5 ARL platforms began with two in 2016, followed by two every year until the final platform is retired in 2020.

Guardrail common sensor

A natural progression for the successful Guardrail programme was the Guardrail Common Sensor (GRCS), launched in the late

1980s, which combined the advanced SIGINT capability of the Improved Guardrail V with the Communication High Accuracy Airborne Location System (CHAALS), and the ELINT intercept capability of the Advanced Quicklook from the RV-1D Mohawk, in an evolving series of RC-12 platforms. The Guardrail V normally flew collection missions with two aircraft but GRCS used three to maximise geolocation accuracy and to serve as data relays back to the ground-based IPF. The first GRCS RC-12H was fielded in 1988, followed by the upgraded RC-12K (1991), RC-12N (1995), and the RC-12P (1998). Later, the RC-12Q added off-tether satellite datalink capability and other improvements.

In mid-2010 the US Army and Northrop Grumman began introducing the definitive RC-12X Guardrail variant with enhanced



The US Army is replacing nine venerable EO-5C (DHC-7) Aerial Reconnaissance Low (ARL-M) multisensor manned ISR aircraft introduced in the 1990s with nine 'new' ARL-Enhanced aircraft, designated RO-6As, remanufactured from second-hand DHC-6-315 platforms with advanced avionics and sensors.



USArmy:1731902

Guardrail SIGINT collection aircraft have served with the US Army since the late 1960s. Fourteen RC-12X advanced Guardrail Common Sensor aircraft are scheduled to remain in service through the mid-2020s.

capability to detect the most sophisticated forms of communications and electronic signals. Onboard systems collect low-to-mid- and high-band radio signals; identify and classify them; determine their source location; and provide near-real-time reporting to commanders on the ground – known as the ‘find, fix, finish, exploit, analyse, and disseminate’ (F3EAD) paradigm. The RC-12X upgrade also included a new glass cockpit and other refinements.

The army planned to upgrade 33 of its 45

Guardrail aircraft to the RC-12X configuration during 2014, while retiring the rest of its older RC-12D and H aircraft. However, the fiscal year 2012 (FY 2012) budget cut the RC-12X programme to just 14 aircraft to “assist the funding, force structure, and manning for the EMARSS programme”. Under continuing modernisation plans, all 14 platforms now in service should receive MX-15i EO/IR systems, which will possibly be controlled from the flight deck because of the lack of space in the cabin for a workstation and sensor operator.



USArmy:1731896

A US Army MC-12 EMARSS-M intelligence aircraft. These aircraft were converted from King Air B350 and B350ER aircraft by L3 Systems.

By 2015 the 14 RC-12X mission aircraft were joined by five RC-12X (T) trainers converted from older models, with the same glass cockpit and avionics. The GRCS is slated to remain in service until 2025.

ACS

Priority combat operations in Afghanistan and Iraq generated a powerful wave of new requirements for manned ISR during 2003–04 with a focus on prosecuting insurgent targets in direct support of troops on the ground, often down to the company or special forces team level, and frequently in close proximity to the enemy in demanding urban and mountainous terrain. This meant the ability to instantly downlink imagery and other data, and the necessity for secure communications between soldiers on the ground and aircrew, specifically backend sensor operators, to directly co-ordinate collection and conduct live analysis of ongoing action. In addition to requirements for EO imagery and basic SIGINT collection, including cell phones and handheld commercial radios, from 2004 the need to detect and counter IEDs also became critical.

Although the RC-12 Guardrail aircraft and UAVs that deployed with AEBs at the time, supplemented by ARL deployments, were successfully adapted and tasked against insurgent targets in both theatres, the need for numbers of platforms capable of live, co-ordinated overhead collection became increasingly urgent. The army considered various multisensor concepts as a follow on for the OV-1 Mohawk and RC-12 since the 1980s, but the Aerial Common Sensor (ACS) programme that finally emerged in 2000 after many years of internal wrangling had trouble gaining traction and the necessary support from within the army and the Department of Defense to be successful.

By 2004 the ACS concept had evolved into an expensive, technologically challenging, multisensor collection and communications suite in an Embraer ERJ-145 regional jet that would never fly. The platform was theoretically capable of long-duration, high- to medium- altitude collection against conventionally arrayed land forces, reflecting what many in the army SEMA community had long-envisioned in a multisensor platform based on the pre-2001 operational environment. However, the concept was weight and space limited, could not be rapidly fielded and was clearly not what the insurgent battlefields of Iraq and Afghanistan required. As

a result, in early 2006 the army terminated a USD879 million contract with Lockheed Martin for further ACS development.

Project Liberty to EMARSS

With the army seemingly unable to satisfy increasingly urgent needs for manned ISR as casualties mounted, particularly in Iraq, the USAF stepped up with Project Liberty. In April 2008, then secretary of defence Robert Gates established the Project Liberty taskforce to identify solutions to rapidly field additional manned ISR, which recommended modifying commercially available King Air platforms and building up the required force structure.

The USAF was directed to select 37 aircraft on the commercial market and worked with Hawker Beechcraft to obtain eight King Air B350s and 29 B350ERs for immediate modification by L3 Systems into MC-12W manned ISR platforms. The first eight MC-12Ws had an MX-15i EO system with an infrared pointer, which enabled the aircraft to highlight an object or building to a soldier on the ground wearing special goggles. Follow-on upgrades provided a state-of-the-art laser designator.

The first MC-12W combat mission was on 10 June 2009 by an aircraft from the 362nd Expeditionary Reconnaissance Squadron operating from Joint Base Balad in Iraq. Essentially the task force and the USAF accomplished in about a year, with a strong remit from Gates, what the US Army had been unable to do since urgent requirements for manned ISR first surfaced about six years earlier.

MC-12W crews comprised two pilots and two sensor operators. Crew training began in April 2009 at Key Field in Meridian, Mississippi at the Mississippi Air National Guard (ANG) 186th Air Refuelling Wing, which hosted a temporary qualification training detachment. Aircrews were drawn from active duty USAF and ANG personnel. Pilots came from various backgrounds, while sensor operators were a mix of experienced aircrew and intelligence personnel with little or no flying background. Sensor operators trained first with the ANG 152nd Airlift Wing in Reno, Nevada, which had extensive aerial reconnaissance experience with specially configured C-130 Hercules aircraft, before moving on to the MC-12W at Key Field.

With the demise of ACS and the success of Project Liberty, the army shifted to the similar Enhanced Medium Altitude



L3 Systems in Greenville, Texas, has converted eight former USAF Project Liberty MC-12W manned ISR platforms into MC-12S-2 EMARSS-M multi-intelligence variants for the US Army.

Reconnaissance and Surveillance System (EMARSS) concept, also based on the B350ER platform, but with a more extensive sensor suite featuring greater digital processing and dissemination capability. The concept called for a “manned multi-intelligence airborne ISR system to provide persistent capability to detect, locate, classify/identify, and track surface targets in day/night and near-all-weather conditions with a high degree of timeliness and accuracy”.

Sensors included an MX-15 EO/IR system, a SIGINT collection system, an aerial precision geolocation system, LOS tactical and beyond LOS communications suites, two Distributed Common Ground System-Army (DCGS-A) workstations, and a self-protection suite. Unlike Guardrail, with a crew of just two pilots, EMARSS followed the MC-12W model with two sensor operators in the cabin.

As mentioned previously, the FY 2012 budget request called for a cut to Guardrail modernisation to help pay for a USD540 million request for 18 ‘new’ EMARSS aircraft. At the time it was thought EMARSS would complement USAF MC-12W Project Liberty operations. A December 2010 USD88 million contract award to Boeing called for the supply of four EMARSS aircraft for a two-year engineering, manufacturing, and development (EMD) phase, but the contract was subsequently contested by L3, Lockheed Martin/Sierra Nevada, and Northrop Grumman and, as a result, Boeing dropped out of EMARSS after delivering the four aircraft.

Then came the 2014 decision by USAF Air Combat Command to divest the Project Liberty manned ISR mission and the MC-12W

aircraft. Of the 41 aircraft in service when the type was officially withdrawn on 1 October 2015, 13 were transferred to Air Force Special Operations Command (AFSOC) to equip the newly formed 137th Special Operations Wing of the Oklahoma ANG.

A further eight aircraft were transferred to the army for immediate operational use and eventual conversion into MC-12S EMARSS-M multisystem variants by L3 Systems. The first flight of L3’s M-1 prototype took place on 14 March 2016 from Majors Field in Greenville, Texas. Meanwhile, the first deliveries of converted EMARSS-M aircraft from L3 to the army followed in early 2017, with officials revealing in March of that year that the type had made its operational debut in Africa and Latin America.

Overall, the army’s 24-aircraft EMARSS programme involves individual aircraft converted from different sources into four different capability models. These include the four original EMARSS-S variants delivered under the 2010 Boeing contract, which have broad spectrum SIGINT systems and high-definition, full-motion video (HD FMV); four formerly contractor-operated EMARSS-V variants with the Northrop Grumman Vehicle and Dismount Exploitation Radar (Vader), dubbed MC-12S-3; and eight Constant Hawk conversions to EMARSS-G/S-1 variants with geographical intelligence, wide area surveillance, light imaging and ranging, and HD FMV; plus the eight MC-12Ws obtained from the USAF, converted to the multirole S-2 variant, with essentially the same sensors as the Boeing-produced EMARSS-S.

All 24 EMARSS aircraft are slated for

US Army aerial intelligence force structure from December 2018

Battalion	Base	Aircraft	Function
116th MI Brigade (aerial intelligence)	Fort Gordon, Georgia		Headquarters
224th MI Battalion (aerial exploitation)	Hunter Army Airfield, Georgia	MC-12S/MQ-1 UAV	EMARSS/Grey Eagle
15th MI Battalion (aerial exploitation)	Fort Hood, Texas	MC-12S/MQ-1 UAV	EMARSS/Grey Eagle
204th MI Battalion (aerial exploitation)	Fort Bliss, Texas	EO-5C/RO6A/RC-12X	ARL/GRCS
3rd MI Battalion (aerial exploitation)	Pyeongtaek, South Korea	EO-5C/RO-6ARC-12X	ARL/GRCS
138th MI Company	Robins Air Force Base, Georgia		JSTARS army element

Note 1: Nine RO-6A ARL-E aircraft to fully replace EO-5C ARL-Ms by 2020

Note 2: Delivery of 24 MC-12S EMARSS conversions complete

Note 3: RC-12X to 14 + 5 trainers

Source: IHS Markit

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delivery to the army by the end of this year. Additional MC-12W conversions are an option as required.

Aerial intelligence brigade

A watershed moment in the development of army manned aerial ISR came on 15 October 2015 when the 116th Military Intelligence Brigade (aerial intelligence) was formally established under INSCOM, with Administrative Control (ADCON) of four subordinate AEBs (see table). Whether intentional or not, the move mimics the relationship of army special forces groups, which are under the ADCON of the army special forces command until deployment, when the gaining command assumes operational control (OPCON).

The aerial intelligence brigade concept introduces profound implications for the training, standardisation, and employment of aerial ISR in the future. Having all of the army's operational AEBs under a single force-providing headquarters should significantly improve effectiveness and flexibility in satisfying the ISR requirements of combatant commands. Other than the 3rd MI Battalion (AE), which remains focused on supporting US Forces Korea, the other three AEBs are now essentially force pools from which the brigade staff can assign appropriately trained and equipped elements to specific missions under the OPCON of forces in theatre.

At the same time, similar to established special forces doctrine, individual AEBs can continue to maintain long-standing regional or task-specific currency. For example, the 204th MI Battalion, formerly MILI, will remain the brigade focal point for expertise on ARL operations and support to Southern Command (SOUTHCOM) in Latin America.

Since the 116th MI Brigade (AI) formed in 2015, individual AEBs have regularly deployed elements to support multiple combatant commanders. Examples include

commitments in northern Iraq and Syria as part of the anti-Islamic State (IS) campaign, continuing commitments in Afghanistan, Africa, the Mediterranean littoral, and the Pacific. In 2016 and 2017 EO-5 ARL aircraft, presumably from the 204th MI Battalion (AE), were noted conducting collection operations over Libya.

In March 2016 an army-operated MC-12W made an emergency crash landing near Irbil in Iraqi Kurdistan because of a technical fault. All four crewmembers were recovered safely, but the aircraft was written off. In a civilian paint scheme with civilian registration N6351V, this MC-12W was based at Hunter Army Airfield in 2015, home of the 224th MI Battalion (AE), and was slated for conversion to MC-12S

EMARSS standard. At the time of the crash the aircraft was supporting anti-IS operations.

An interesting sidebar with the 116th MI Brigade (AI) is inclusion of the JSTARS army element in the form of the 138th MI Company at the home base of the USAF 116th Air Control Wing at Robins Air Force Base (AFB) in Georgia. The 138th includes army aircrew that integrate with USAF counterparts aboard the E-8C JSTARS aircraft, as well as specialist staff and analysts in the wing charged with co-ordinating army collection requirements and dissemination.

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Outlook

In terms of force structure AEB organisation has evolved since 2015. Two battalions are now equipped with ARL and GRCS, while the other two have EMARSS and MQ-1 Grey Eagle UAVs. Looking to the future, a potential issue is how the AI brigade addresses collection requirements in more conventional, high-threat environments, such as along NATO's volatile eastern frontier with Russia, as opposed to the relatively more permissive environments found in Afghanistan, Iraq, and elsewhere since 2004. An obvious, if somewhat ironic option is to revisit the ACS concept for a multisystem, broad area collection suite in a long-range business jet such as a Gulfstream or, mimicking the RAF Sentinel R1 programme, a Bombardier Global platform. Ultimately, this could drive a requirement for a fifth AEB, possibly with USAF participation, particularly if JSTARS modernisation funding is not forthcoming as expected.

In December 2017 Northrop Grumman Corporation was awarded a USD750 million contract by the US Army to provide contractor lifecycle services for the approximately 50 aircraft in the army's objec-

tive manned ISR fleet, covering RC-12X GRCS, the EMARSS, and ARL variants. If all options are taken up, the total could reach about 75 aircraft by 2027. Activities covered by the contract include programme management, systems engineering and modification, supply chain management, aircraft modifications, and upgrades. All army fixed-wing aircraft are maintained by contractors, including the SEMA fleet.

After decades of challenging operations and growth, building on the dedicated efforts of so many determined advocates and SEMA personnel along the way, the community is now the most robust and capable manned ISR effort in the world. One tribute to the accomplishments of the army SEMA community, and the extraordinary USAF Project Liberty effort, is the number of other air arms, including the UK Royal Air Force, the Mexican Air Force, Colombian Air Force, and the Saudi Air Force that now operate similar manned ISR capabilities, often also employing Hawker Beechcraft 350 platforms. Undoubtedly this trend will continue, as will further refinements of US Army capability, at least into the 2030s if not beyond.