



# REAPER'S REIGN

The 'Grizzlies' of the California Air National Guard's 163rd Wing previously flew the MQ-1B Predator, and became the first ANG organization to transition from the MQ-1 to the far more capable MQ-9 Reaper.

report and photos: **Ted Carlson/Fotodynamics.com**

Typical MQ-9 armament currently consists of a combination of AGM-114 Hellfire missiles and GBU-12 Paveway II guided bombs.

IN THE PAST decade, the demand for remotely piloted aircraft (RPAs) has grown exponentially. RPAs are relatively low-cost, have a long endurance, can work independently from other assets, and provide a considerable 'bang for the buck' in achieving combatant commanders' intent. The ubiquitous General Atomics MQ-1 Predator was the pioneer of the continuous, in-theater RPA presence. Growing demand resulted in the more capable MQ-9A Reaper being developed. Compared to the Predator, which has not been in production since 2009, the MQ-9 is faster, larger, can carry a much greater payload, and has superior sensors. It is an all-around improvement over the MQ-1.

Over the past few years, the 'Grizzlies' have traded in their 12 Predators for the more capable Reapers, with six MQ-9s now in their inventory. Three aircraft were transfers from other units, and the remaining three were brand-new. The 163rd Reconnaissance Wing (RW) was redesignated as the 163rd Attack Wing (ATKW) in July 2015 to reflect its current mission.

### Reaper review

To clarify, the Reaper is also known as the Predator B, reflecting the fact that it represents the second generation of the Predator after the MQ-1 Predator A. The Predator C is the jet model with swept wings, known as the Avenger, but this has not yet been widely used. The Reaper, like the Predator, is a visual flight rules (VFR)-only aircraft — three-mile visibility is required — so care must be exercised to avoid icing and foul weather.

While the Reaper offers similar endurance to the MQ-1, at around 20 hours, the MQ-9 flies much faster and farther, making it able to cover a significantly greater area during a mission. It can carry a much heavier payload including a wider variety of ordnance, has a more powerful 900shp engine (the Honeywell TPE331-10YGD turboprop), and is equipped with an improved sensor suite.

The Reaper's primary sensor is the Multi-Spectral Targeting System (MTS-B,

*'We ensure the aircraft is ready to shoot, and we read back all pertinent data to confirm the information is accurate. The JTAC then will give us clearance and we take the shot'*



formally designated as the AN/DAS-1) that includes a robust suite of visual sensors for targeting. The MTS-B integrates an array of systems, including an infra-red sensor, color/monochrome daylight TV camera, image-intensified TV camera, laser designator, and laser illuminator. The camera magnification and zoom range, plus image resolution, are superior to those offered by the MQ-1.

The MQ-1's nose landing gear looks somewhat 'spindly' in comparison to the much more robust titanium undercarriage found on the MQ-9.

Dash 12 has more robust landing gear and superior brakes.

The MQ-9 is equipped with four underwing stores pylons. It can carry either 500lb GBU-12 Paveway II laser-guided bombs or AGM-114 (P-2, P-4 and R-2 variants) Hellfire air-to-ground missiles, or a combination of these weapons up to a 2,400lb maximum stores weight. Future munitions will include the GPS-guided 500lb GBU-38 Joint Direct Attack Munition (JDAM).

The AGM-176 Griffin air-to-ground missile is in testing. It is being explored as a possible new laser-guided bomblet for

at a distance — is by the tail section.

The Reaper has V-shaped tails pointing upward, whereas on the Predator they point downward. More than 100 Reapers have been procured by the US Air Force to date.

## Reaper ranch

Headquartered at March Air Reserve Base in Riverside County, California, the 163rd ATKW is broken down into groups and squadrons that have different roles. Under the 163rd ATKW, the flying group is the 163rd Attack Group (ATKG), comprised of the 196th Attack Squadron



The MQ-1 nose gear was susceptible to collapse in the event of excessive bouncing or a hard landing, a problem especially with a \$4-million sensor located directly below on the chin. The sensor alone is worth more than the airframe, so the Reaper was designed with stronger landing gear from the outset.

The MQ-9 can climb much faster than the MQ-1 and fly at higher operating altitudes. It turns quicker, and is generally more agile than its predecessor. There are also differences between MQ-9As. Technically they are designated as the Block 1-10, and Block 1-12, in which the

**Above: Crews typically fly four-hour stints in the mission control element, before being replaced with other RPA operators.**

**Left: On July 9, 2015, the 163rd Reconnaissance Wing officially became the 163rd Attack Wing, reflecting its transition to the new Reaper RPA.**

the Reaper, as well as the 500lb GBU-49 Enhanced Paveway II GPS/laser-guided bomb and the 500lb GBU-54 Laser JDAM. Carriage of the AIM-9X Sidewinder air-to-air missile has been eyed as well. Some of these weapons are budget-dependent, however, and the reality of using them in real-world scenarios has yet to be determined.

A single Predator costs \$4.9 million, while Reapers come in at \$12.7 million, which is still relatively inexpensive for an aircraft of this caliber and capability. The easiest way to tell an MQ-1 from an MQ-9, aside from the MQ-9 being larger — which can be hard to discern

(ATKS), the 160th ATKS, and the 163rd Operational Support Squadron (OSS). There are three other additional groups under the wing, these being medical, mission support, and maintenance. The Formal Training Unit (FTU) is designated as the 160th ATKS and is responsible for training new ANG Reaper pilots, sensor operators, and mission intelligence coordinators.

The 196th ATKS is the tactical squadron that flies in-theater, real-world missions, and is known as the mission control element (MCE). The squadron flies missions in theaters including Iraq and Afghanistan. Crews will typically

four-hour stints, and then be replaced with other RPA operators. When flying missions, the aircraft takes off and lands in the hands of a pilot and sensor operator who fly it from the host base in theater. For a single sortie, there may be up to five or six different crews that have completed several hours of flight time each for a portion of the total Reaper mission.

The FTU has a ground control station (GCS) at March ARB, and in the Southern California desert is what is called the launch and recovery element (LRE). The LRE is technically a detachment of the 160th ATKS. The six aircraft owned by the 163rd ATKW are used solely by the FTU for local training and never in an operational theater. The 196th ATKS only flies aircraft owned by other units in theater. The 163rd OSS is another squadron under the 163rd ATKG. It handles airfield management, standardization evaluations, and has advisory officers that report to the 163rd ATKG commander. Then there are the 163rd Maintenance Group (MXG) and Maintenance Squadron (MXS), and the 163rd Security Forces Squadron (SFS) that reports to the 163rd Mission Support Group.

## Reaper realm

Current Federal Aviation Administration guidelines dictate that, within the United States, unmanned aircraft systems (UAS) must be accompanied by a chase aircraft between home base and 'to and from' the restricted airspace they enter and leave for training. The chase observes the UAS for safety, watches for VFR traffic, and can make air traffic control (ATC) calls. Above 18,000ft, a UAS can fly independently outside of restricted airspace via instrument flight rules (IFR) flight. Chalk 2, a private aviation contractor, provides a reliable and dependable chase service for the local 'Grizzlies' flights, typically operating Cessna 210s and taking the MQ-9s to the R-2502 complex airspace.

If an MQ-9 is involved in a 'lost link' situation, meaning there is a problem with data exchange, some kind of signal hiccup, or a break in communications with the aircraft, it will go to a pre-set altitude and orbit safely over a remote, unpopulated area, while crews initiate troubleshooting. There are redundant receiving systems, so rarely is an aircraft lost after a lost-link scenario. Should attempts to regain the link fail, the aircraft will remain in a 'death orbit' until

it runs out of fuel and crashes within the uninhabited region.

For landing, pilots use GPS co-ordinates and are backed up by the sensor operator, giving a picture of what the sensor sees, such as en route landmarks and then the base. Once on final approach, pilots use a separate camera built into the nose of the Reaper for a visual line-up on the runway.

Reaper shipping containers, called 'coffins', are used to accommodate the disassembled aircraft, allowing for compact and expedient worldwide shipping.

## Reaper remarks

'In the FTU we train both experienced and inexperienced pilots and sensor operators, and teach them how to fly and operate the aircraft', commented a senior pilot and LRE detachment commander who shared his experiences with *Combat Aircraft*. He first flew H-60 Black Hawks with the Oklahoma Army National Guard, was an air traffic controller, and later flew C-130Hs with the USAF, gaining some 1,500 hours in the Hercules. In 2006, he switched to the Predator and has 2,000 Predator flight hours. He joined the 'Grizzlies' in 2011, and transitioned to the Reaper in 2014, with about 100 hours in the MQ-9 to date. He continued: 'Instructors in the 160th ATKS may go to the 196th ATKS and help them fly the combat missions, and then come back and teach. On different days we may be individually tasked for the needs of the wing and Air Force.

'Basically we use a 'crawl, walk, run' system until students are proficient. Academics are first, then basic flight functions, followed by skill development near the end. We focus on the missions, such as shooting and reconnaissance, plus joint operations and working with friendly forces. Close air support is essentially graduation-level training, and they are combat mission-certified by their final unit in the end after receiving a bit more advanced training.

'The role of the Reaper pilot is to facilitate whatever the sensor operator needs, such as positioning the aircraft for the best view of the target, maintaining a good stand-off distance to avoid detection, pre-positioning the aircraft for an engagement, etc... We receive permission to launch from the theater JTAC [Joint Terminal Attack Controller] that is in charge of the area, and he has been given authority from the ground

commander who is often present anyway. Then they will start giving us the nine-line [a preparation checklist for firing], we ensure the aircraft is ready to shoot, and we read back all pertinent data to confirm the information is accurate. The JTAC then will give us clearance and we take the shot.

'For us pilots, it can be boring when in transit to targets because it may take a few hours to get there. When we first get to the target area, it can be exciting, figuring out the lay of the land, ins and outs, and environment. If it is night-time in theater and everyone is asleep, it can be slow. During the day, it usually is much busier and more exciting.

'For a typical mission, we will arrive at a target area, watch for patterns of life, hopefully find whatever the target of interest is, ID them, stay on them, and observe. It could be they go to a village, drive around on a motorcycle. We may look for bad guys planting bombs such as IEDs [improvised explosive devices] alongside roads, or other terrorist-related activities. We do the nine-line and are prepared to fire, keeping the aircraft orbit in position. We may not have a need to fire, but we are always ready. If the nine-line is followed by a permission to shoot, we will then engage.

'While a mission can last up to 20 hours, we may only man the flight station for three to four hours, and then swap out with a different crew. As the aircraft becomes low on fuel, another Reaper may arrive and relieve the aircraft to provide a continuous presence.

'Of interest, we are also flying some domestic operation missions now, such as a recent search and rescue looking for a lost hiker near Lake Tahoe, and supporting fire operations, working with the US Forest Service and fire jumpers. We give the firefighters a direct feed to their command post and it helps them decide where to make the drops, including areas to work. For that kind of scenario, we are in Class A airspace and above 18,000ft.'

Another Reaper pilot flew C-21As, C-5A/B/Cs, T-3s, and Predators (at Creech Air Force Base, Nevada) with the USAF, accumulating over 2,000 flight hours. They moved on to pilot Boeing 727s and 737s for United Airlines, and later served as a contractor for the 163rd FTU, instructing student pilots on Predators, before transitioning to the Reaper over two years ago. They added: 'Landing is still the most challenging part of the

**Powered by a Honeywell TPE331-10 turboprop engine, the MQ-9A is capable of reaching speeds up to 230mph and an altitude of 50,000ft, while providing 20-plus hours of flying capability.**



*'Recently we participated in an exercise with the US Navy and the USS Ronald Reagan Carrier Battle Group. We gave them a direct feed from our aircraft and we flew a variety of profiles'*



58

flight for pilots. When landing the MQ-9, you can still bounce the nose some, but it is not near as prone to that was the Predator. Normally brakes are not an issue because we use reverse thrust to slow and stop, but should we lose an engine, that is when heavy-duty brakes become quite important.

'As an FTU instructor, we do initial qualifications for any Guard members that need the training, and then they get more tactical expertise with their operational units. We specialize in training all four Air National Guard units that operate the MQ-9. There are two separate types of MQ-9 crews: those that take off and land the aircraft [LRE], and those that fly them

in the combat zones [MCE]. Only 10 per cent of MQ-9 crews are LREs. Every LRE crew member has been an MCE before becoming an LRE, but not every MCE individual has been an LRE.

'When flying the Reaper, you have to watch for having too low an airspeed in the turns. It is equipped with a variable-pitch propeller and there is essentially a thrust delay. If you are close to the ground, the power usage must be anticipated, similar to how a jet engine needs spool-up time. It is minor, but it does need to be watched. As with the Predator, it is hard not being in the Reaper when flying it from our ground station. You have a limited field of view, cannot

Above: **The full weapons load of the MQ-9 is roughly equivalent to the weight of an entire MQ-1 Predator.**

Far right: **The AN/DAS-1 Multi-Spectral Targeting System (MTS-B) combines an infra-red sensor, daylight TV camera, image-intensified TV camera, laser designator, and laser illuminator.**

feel vibrations, smell smoke, cannot hear it, and there is a slight delay for the data exchange and thus for things to respond. They are great little airplanes, and we rarely have any maintenance issues.'

A 160th ATKs sensor operator who spoke to CA originally started with the Oregon ANG working on F-15s, and joined the 'Grizzlies' in 1999. He was a KC-135R crew chief and became a Predator sensor operator when the 'Grizzlies' converted to that type. He has more than 3,000 UAS flight hours, and pitched in: 'In theater, we basically support ground commanders; whatever their needs are, we do. The needs are different depending on which theater



we work. The tasking is different in Afghanistan where we may just be flying reconnaissance, than it is fighting ISIS [Islamic State of Iraq and Syria] in Iraq, where it is more ISR [intelligence, surveillance and reconnaissance] and CAS [close air support]-related missions. In theater, we work with all different US branches of services and in joint operations.

‘Our job entails controlling the various sensors on board, providing terminal guidance to the weapons during delivery, and we serve as co-pilots helping our pilots. There is a third crew member, the MIC [mission intelligence co-ordinator]. They are quite important, and although

Above top to bottom:  
**Despite its beefed-up nose gear, landing the MQ-9 remains one of the biggest challenges for the crew.**

**The Reaper currently carries the AGM-114P-2 and P-4, optimized for employment from RPAs at high altitude, and the AGM-114R-2 that offers increased engagement envelope and lethality, and a new warhead.**





they are in a different room than us, they work with the JTAC telling us where to go and what to do. They are the conduit between the sensor operator and the supporting unit down-range. Sensor operators are usually quite busy during the entire flight.'

The director of operations with the 160th ATKS is a senior pilot who started as a civil engineer and later served as a KC-135 navigator with 2,500 hours. Becoming a KC-135 pilot he gained an additional 2,400 flight hours, and transitioned to the Predator in 2006. He amassed 2,700 combat support hours in the MQ-1 and converted to the MQ-9 some 18 months ago, now having 250 hours of Reaper time. He commented: 'There are still four ANG Predator units, and we were the first ANG unit to convert from the MQ-1 to the MQ-9. The Reaper is larger and more complex, so transporting one and setting it up in the field is a bit more labor-intensive than the Predator. But the Reaper has a significantly greater capability also. The sensor nadir [field of view when looking straight down] is superior on the

Reaper compared to the Predator sensor, another benefit.

'Recently we participated in an exercise with the US Navy and the USS *Ronald Reagan* Carrier Battle Group. We gave them a direct feed from our aircraft and we flew a variety of profiles. We are very flexible and fully exploit the MQ-9's capabilities.

'Within our FTU, we are expanding from processing a total student throughput of 30 crewmen per year to eventually 45 per year. [In 2017] alone, we will have a 40 per cent increase in trainee tasking. We train them in groups of two, being a pilot/sensor combo. We try to pair individuals where they can learn from each other, but on rare occasions we may change the crew mix to custom-tailor efficiency. Over the next four years, we will have trained four different ANG units in the Reaper, all slated to transition from the Predator to the Reaper.

'The Reaper brings great performance to the table. Before, when flying a Predator in theater, it would take us 23 minutes to go from 7,000ft up to 16,000ft, which was a bit embarrassing to tell ATC when we were

Right top to bottom: **Among its performance advantages over the Predator, the Reaper is quicker in the turn, and possesses greater agility.**

**While the USAF has purchased more than 100 MQ-9s to date, the 163rd Attack Wing was the first ANG unit to trade its Predators for Reapers.**

This image: **As well as being larger than the MQ-1 overall, the MQ-9's V-shaped tails point upward, rather than downward as on the Predator.**

directed to climb. In the Reaper, we will climb at 1,000ft a minute, so it would only take us nine minutes to make that same climb. That helps us better integrate into national airspace as well.

'We use a different mindset when flying the MQ-9 over the MQ-1. We cover more ground faster, and we have more weapon load-out options. Our weapons load-out weight is about equal to the entire MQ-1 aircraft weight! We are less ISR-oriented than the Predator, and better at CAS with the additional weapons. In UASs we find, fix, track, target, engage, and assess. We can do the whole circle and then move on to the next one. We don't rely on someone else to find things for us. We hunt for our own targets, we eliminate our own targets, and can assess on our own. We can code the missiles in flight for anyone we want to work with, allowing for co-operative targeting with any of our allies and troops. In summary, it is a more aggressive mindset.'

### Reaper refinement

The Reaper's existing sensor software is in need of updating. When lasing, the





*'We don't rely on someone else to find things for us. We hunt for our own targets, we eliminate our own targets, and can assess on our own'*



Predator has a toggle on/off switch, whereas for the Reaper it must be depressed and held the entire time. Since it is a newer aircraft, the Reaper has not undergone as much refinement as the Predator, and it remains a work in progress at the time of writing. The 163rd ATKW will likely explore upgrading its Reapers with an 'extended range' modification. This would include a four-bladed propeller, additional fuel capacity, and a second radio.

One significant upcoming change is the integration of the desert-located LRE once it moves to March ARB. When this

occurs in 2017, all 163rd ATKW aircraft and personnel will be in one place, greatly enhancing the logistical efforts and streamlining the system. March ARB may also be acquiring its own chase aircraft, minimizing dependence on outside resources. Looking further ahead, the wing can look forward to a planned Block 30 Reaper cockpit upgrade.

Although the mission of the 'Grizzlies' has changed numerous times throughout the years, the 163rd remains one of the top flying units in the USAF and the ANG, playing an integral role in state and global security. 