Before the Reaper and Looking Forward

An overview of the roots of Reaper Drones and future Drone Wars

India has ordered thirty American 30 SeaGuardian UAVs, ten each for the army, navy and air force. SeaGuardian is the latest version of the American MQ-9B Reaper SkyGuardian UAV and was modified to handle maritime surveillance. This process was completed and certified in late 2020. India will pay about $3 billion for the 30 Seaguardians and that includes sensors, training and tech support.

This is something new for the United States and India because since the 1990s India has obtained nearly a hundred similar large UAVs from Israel. There were two reasons for this. Israel pioneered the development and use of these larger UAVs that could carry vidcams and radar for surveillance. The Americans developed their very successful Predator based on the Israeli originals. One difference between the Israeli and American UAVs was that early on the Americans armed their UAVs with Hellfire laser guided weapons and equipped all these large UAVs with satellite communications. There were practical reasons for this as Predator was used overseas, usually to search for Islamic terrorists and, with the addition of Hellfire missiles, kill them. A decade later Predator was joined by the larger Reaper, which has now replaced the Predator. The Americans also pioneered the development of laser guided bombs and missiles, putting the first of these into service during the 1970s.

The Israeli situation was different. They are a smaller nation and have no foreign commitments that can be handled by armed or unarmed UAVs. Israeli UAVs of similar size and capability as the Predator and Reaper were optimized for reconnaissance

and surveillance and offered as export items. Most of that surveillance was along Israeli borders or in neighboring countries. If an Israeli UAV found something that needed an airstrike, they could quickly dispatch a nearby helicopter gunship or jet fighter armed with guided bombs or missiles.

The Americans considered Predator and Reaper military systems and restricted exports. The Israeli UAVs, especially the Herons, were easily obtained and optimized for the surveillance work the Indians needed done. Israel was also willing to lease their UAVs and had used this technique profitably with a number of its export customers. Finally, for most of the past two decades the American manufacturer of Predator and Reaper could barely keep up with orders from the U.S. Air Force, Army and CIA. This left Israel with most of the civilian market. Over a decade ago China began producing Predator clones, armed Chinese laser guided missiles. These were sold to anyone who could afford them and that included the many countries that did not qualify to buy weapons from the Americans.

The "*Guardian*" versions of the Reaper are selling mainly to export customers. This version was originally called MQ-9B ER (Extended Range) Reaper but after potential customers were approached, it was decided to expand the capabilities of MQ-9B ER into what is now the unarmed MQ-9 SkyGuardian and SeaGuardian. New features include compliance with NATO STANAG 4671 standards. This means Guardian UAVs can fly in commercial airspace. STANAG 4671 sets the strictest UAV commercial airspace rules in the world. If a UAV is STANAG 4671 compliant it can basically operate anywhere. SkyGuardian can operate as high as 15,000 meters (50,000 feet) and stay in the air for up to 40 hours. This means SkyGuardian can (and has in 2018) flown across the Atlantic. SkyGuardian is equipped with a deicing system and lightning strike resistance. There is more systems redundancy, which increases reliability and reduces losses to mechanical or electrical failure.

SkyGuardian is based on the MQ-9B Reaper, which has been in production since 2013. The MQ-9B cost about $12 million each and the U.S. Air Force has been replacing its older A models with the B model. In mid-2017 a MQ-9B Block 5 model, flew its first combat mission.

The latest 9B is called Block 5 and is a tremendous improvement over 2013's Block 1. The American air force was planning to halt production of Block 5 by 2019 and begin replacing Predator with the new ER/SkyGuardian version, which has passed initial flight tests in 2016 and has already broken endurance records with flights of over 40 hours. The ER is so impressive that the air force is making plans to upgrade Block 5s to the ER standard by equipping older MQ-9s with the larger (by 20 percent) ER wings, a new engine, two additional two fuel tanks (one under each wing) and new fuel management software. There are also several other electronic upgrades. These include the ability to land automatically. The new engine is more reliable and generates much more power on takeoff, enabling the MQ-9 to carry up to 1.3 tons of weapons, about twice what the 9B Block 1 could carry. Fire control electronics and software have been upgraded to enable the MQ-9 to use GPS guided bombs including the 500-pound (227 kg) Paveway smart bomb that uses laser and GPS guidance. Weapons carried now include Hellfire missiles (up to eight), two Sidewinder or two AMRAAM air-to-air missiles, two Maverick missiles, or two 227 kg (500 pound) smart bombs (laser or GPS guided). The new engine and electrical systems generate a lot more electrical power and do so much more reliably, eliminating frequent problems with inadequate or interrupted electrical supplies. With the new electrical systems Predator can handle more powerful sensors and radios.

In addition to larger (24 meters versus 21 meters) wings, the SkyGuardian is heavier (5.6 tons versus 4.6 tons) than Reaper 9B and its payload is twice that of the original Reaper. The original MQ-9 Reaper looked like the earlier 1.2-ton MQ-1

Predator but was larger. The 4.6-ton MQ-9 is an 11.6 meters (36 foot) long aircraft with a 21.3 meters (66 foot) wingspan. It has six hard points and can carry 682 kg (1,500 pounds) of weapons. Max speed is 400 kilometers an hour, and max endurance was originally 15 hours. The Reaper is considered a combat aircraft, to replace F-16s or A-10s in many situations.

Most of the over 200 Reapers built so far have been for the U.S. Air Force and, since introduced in 2007, these Reapers have flown about 2.5 million hours. Efforts to design and build a Reaper replacement have so far failed, in part because the Reaper keeps getting upgraded to match proposed specifications for a replacement UAV. This a somewhat rare, and welcome, pattern in aircraft (and weapon) design.

SaeGuardian is going to operate in areas, and from bases, already operations the Israeli Heron. This UAV was developed during the 1990s as an improvement on earlier Israeli UAVs that the Predator was based on. The first version of Heron entered service in 2005 and India was one of the first export customers. So far India has bought or leased over 70 Herons and most of them are still in service. The latest order, in early 2021, leased four Heron TPs. India was one of the first export customers for the TP, having ordered 15 of them in 2013. The Indian air force and navy both have Herons. The navy uses them for coastal patrol while the air force is moved more of its Herons, including the Heron TPs to the 4,000 kilometers long Chinese border. Heron TPs use satellite communications and can also be armed but most users prefer the unarmed version because that means the entire payload can be devoted to cameras, radars and other sensors.

India sticks with Israel as its main UAV supplier in part because Israel is always improving its equipment. In early 2014 Israel rolled out another new model of its Heron I (or “Shoval”) UAV. The new version is called the Super Heron and is a little heavier (1.45 tons) and uses a more powerful engine that burns diesel instead of aviation gas. The Heron I

is similar to the American MQ-1 Predator and has long been popular in India. The main improvements for the Super Heron are mainly the result of the more powerful (200 HP versus 115 HP) engine. This increases cruising speed to 210 kilometers an hour, provides for a faster climb rate and greater maneuverability.

The Heron 1, because it was so similar to the Predator has sold well to foreign customers who cannot obtain the MQ-1. In addition to being one of the primary UAVs for the Israeli armed forces others like India, Turkey, Russia, France, Brazil, El Salvador, the United States, Canada, and Australia have either bought, leased, or licensed manufactured the Heron.

The original Heron 1 weighs about the same (1.2 tons) as the Predator and has similar endurance (40 hours). Heron 1 has a slightly higher ceiling (10 kilometers/30,000 feet, versus 8 kilometers) than Predator and software which allows it to automatically take off, carry out a mission, and land automatically. Only some of the American large UAVs can do this. Heron 1 cost about $5 million each although the Israelis are willing to be more flexible on price. Heron 1 does have a larger wingspan (16.5 meters/51 feet) than the Predator (13.2 meters/41 feet) and a payload of about 137 kg (300 pounds). The Super Heron has a payload of 450 kg (990 pounds) and stay in the air for 45 hours.

Super Heron was designed to respond to requests from many users, especially export customers who like to use Heron for maritime patrol over long coasts (as in India) and need more payload, endurance and maneuverability to deal with the nasty weather sometimes encountered at sea. The larger payload also makes it easier to arm the Super Heron.

The Heron TP has been in service since 2009 and is similar to the 4.5-ton American Reaper. Equipped with a powerful (1,200 horsepower) turboprop engine, the 4.6-ton Heron TP can operate

at 14,500 meters (45,000 feet). That is above commercial air traffic and all the air-traffic-control regulations that discourage, and often forbid, UAVs fly at the same altitude as commercial aircraft. The Heron TP has a one-ton payload, enabling it to carry sensors that can give a detailed view of what’s on the ground, even from that high up. The endurance of 36 hours makes the Heron TP a superior surveillance UAV compared to the MQ-9 Reaper. The big difference between the two is that Reaper is designed to be a combat aircraft, operating at a lower altitude, with less endurance, and able to carry a ton of smart bombs or missiles. Heron TP is meant mainly for reconnaissance and surveillance, and Israel wants to keep a closer, and more persistent, eye on Syria and southern Lebanon. But the Heron TP has since been rigged to carry a wide variety of missiles and smart bombs because there were a few situations where Heron TPs operating far from Israel needed the weapons to deal with a distant threat.