

Many people don't realise the crew of a US Air Force unmanned aircraft is larger than the crew of most of its jet fighters. For an unmanned aircraft, or better-called remotely piloted aircraft (RPA), there is a crew comprising of at least a pilot and a sensor operator.

Flying an RPA requires just as much airmanship and situational awareness as piloting a manned aircraft. Real-world missions can be hectic and stressful. To train and prepare crews, the 558th Flying Training Squadron (FTS) provides the fundamental flying education on flying an RPA and operating its sensors. The most important thing to learn to fly is summed up by three keywords: aviate, navigate, communicate.

Operating RPAs

An RPA is flown through remote means using a data link. The traditional way multi-

role RPAs operate is to send launch and recovery-qualified crews downrange to a Launch and Recovery Element (LRE). LREs are mostly overseas and closer to the area of operation. The LRE transmits via line-of-sight communications and takes off and lands the aircraft, because there is no inherent delay to the signals in the transmissions.

The LRE puts the RPA on a pre-programmed mission and hands it off to the continental United States-based Mission Control Element (MCE), which will do all the flying anywhere beyond the line of sight. Ku-band satellite communications data links used to fly an RPA from the other side of the world have an inherent delay in the control input of 1.3 to 1.5 seconds, unacceptable when landing the aircraft. Therefore, when the RPA returns to base, the MCE flies it to a designated location and hands it back to the LRE, which lands it and gets the next one airborne.

The Block 5 MQ-9 Reaper variant is equipped with improved electrical and communications systems to provide better software and hardware upgrades for future operations. *Senior Airman Christian Clausen/US Air Force*

Phantom

The returned RPA will receive maintenance and be refuelled for its next mission. Mission sets range from high-altitude intelligence, surveillance and reconnaissance (ISR) for disaster relief, to counter-narcotics and precision strike operations. Designations of RPAs are MQ and RQ, such as MQ-9 and RQ-4. The M stands for multimission and the R for reconnaissance and the letter Q signifies an unmanned aircraft system.

RPA pilot training

The 558th FTS 'Phantom Knights' trains US Air Force RPA pilots, sensor operators and their US Marine Corps counterparts, at Randolph Air Force Base near San Antonio, Texas.

The path to learn the job of an RPA pilot is called Undergraduate Remotely Piloted Aircraft Pilot Training and starts off with flying a manned aircraft, the Diamond DA20, for two months at Pueblo, Colorado,

where all US Air Force pilots start to fly. This basic training is called RPA initial flight training. Students get to fly 22 dual sorties and five solos and they clock 39.3 flying hours. Next stop is Randolph for the remainder of the education to earn their wings. In two-and-a-half months, the students will do RPA Instrument Qualification (RIQ) that consists of 140 academic hours and 36 flights in a Texan T-6 simulator.

In the simulators, students learn to trust their instruments and to cross-check altitude, speed, heading and emergency procedures.

Major Jerry, an instructor pilot, said: "To alleviate the pressures of war is to put a little pressure on during training. For example, we give the student a scenario and they have to recite the critical action procedures and then maintain aircraft control, analyse the situation and take appropriate action."

The 558th Flying Training Squadron trains the crews of US Air Force unmanned aircraft. Dick Wels visited Randolph Air Force Base in Texas to learn about the unit's work

Knights

"They call this a morning 'stand-up' and then they will go off and do the simulator. There they have a real-world environment, where all the different aircraft are simulated together. The students actually get to hear other radio traffic and communication, so they learn to be attentive for their own callsign in actual airspace."

Once the students complete the RIQ, they go to the RPA Fundamentals Course (RFC). This, roughly month-long course, contains 78 academic hours and 31 simulator hours. Maj Jerry said: "We take it to the next level with regards to flying, aviating, navigating and communicating, but now with an RPA flavour, and this is where the transition from manned to unmanned aspects start. The students will enter the simulator where the left seat is the pilot and the right seat is the sensor operator."

"This is called PRIME: Predator Reaper Integrated Mission Environment. It is an RPA-type environment where we have a tracker, head-up display, head-down display and some situational awareness tools. It is not as robust as what the students will see later on operationally for the RQ-4 and MQ-9, but it is to start getting them to develop that crosscheck with an RPA because there is a lack of senses."

"They have to analyse the data and make wise decisions, and at the end of the course they practise some munitions delivery. Special training at Camp Bullis, Texas, is also part of the process. They do a Humvee convoy support, but as the ground troops. We practise scenarios where they have RPA support and no RPA support. Just to show them the perspective of not just the fog and friction of war, but also making split-second decisions on enemy combatants and everything in accordance with the law of armed conflict."

Sensor operator training

The enlisted sensor operators go to specific training for six days at Lackland Air Force Base, Texas, where they go through the Aircrew Fundamentals Course (AFC) that teaches aircrew responsibilities, basic aircraft functionalities, safety procedures and safety equipment, and different types of missions.

Maj Jerry said: "They get a sense of crew resource management to start getting them ready because for some people it might be a trial based off rank structures, like a young senior

airman speaking to a Lieutenant Colonel. We try to break the barriers towards crew position as far as pilot versus sensor operator, because a crew save is a good save. We want them to communicate what they see. The sensor operator may see something that the pilot doesn't see and talks about it to the pilot."

After AFC the sensor student goes through the Basic Sensor Operator Course (BSOC) in 1.5 months at Randolph. Maj Jerry: "It comprises academic and simulator environments to train them on their major weapons system, which specifically is the payload, the Multi-Spectral Targeting System Ball as we call it. They have to keep the crosshairs on the target and be able to maintain situational awareness."

"You have to make sure you are in clear conscience of doing your job, defending the rules of the constitution, that you are on the correct target, that you are getting to be ready to kinetically engage this munition, and they are going to be terminally guiding the munition with the laser spot. So, once the missile or the weapon – in the MQ community – is released off the rails, the pilot is basically hands-off, because he has no control over it. It is rather the sensor operator through laser-guided precision munitions who is in effect steering that munition to the target."

Crew resource management

On the last four days, the RFC and the BSOC courses come together. Maj Jerry said: "The essence is crew resource management and putting it all together. The RPAs we train for are all-crew concept aircraft. On the left seat of the cockpit is the pilot and on the right seat the sensor operator. A very unique situation for the RPA community is that the pilots are directly placed in the left seat, which is the responsibility of the aircraft commander as far as leading the crew. We normally say that there is no rank in the cockpit, unless there needs to be. It is more [a matter] of a role than of a rank."

This is different than becoming an aircraft commander in the manned aircraft environment, which usually takes some years. Maj Jerry, a former KC-10 pilot, explained: "They say the biggest move you can make



in your Air Force career is that three feet move to the left becoming an aircraft commander, like I did when flying the KC-10; but here, 2nd Lieutenants are in the fight very soon after they have finished their training, well before 2nd Lieutenants who will go to manned fighters. Normally only commissioned officers are pilots of aircraft, but we have just started training enlisted members to being pilots of at least ISR aircraft. ISR systems support those troops manoeuvring on the ground, and they are just as kinetic, just as lethal and just as important in the fight as those fighter pilots that are flying in and knocking out different targets on the ground."

Learning responsibility

Crews have different operating altitudes, from low and slow all the way up to 18,000ft-plus. Flying RPAs brings a big responsibility, but not every student realises that during training according to Maj Jerry: "We have received feedback from former students that they wish they would have



THIS IMAGE: An MQ-9 armed with four GBU-38 Joint Direct Attack Munitions parked before a February 2018 mission from Kandahar Airfield, Afghanistan. A key aspect of the training at the 558th Flying Training Squadron involves not just learning to fly, but also foundational knowledge about the principles of employing remotely piloted aircraft for strike missions.

TSgt Paul Labbe/US Air Force

BOTTOM LEFT: Remotely piloted aircraft pilots during a training sortie in support of a Red Flag exercise. The 558th Flying Training Squadron provides training to both RPA pilots and sensor operators. TSgt Nadine Barclay/US Air Force



taken the training more seriously when the instructors said, 'take it more seriously.' That is because within a few short hours after finishing training, they received engagement authority to take it to that next level kinetically, so the responsibility was literally there."

He said taking responsibility is what instructors try to instill in their students, "to stay in your circle of aviate, navigate, communicate. That's your primary role because you are flying in manned asset airspace, as well. Several former students that have gone operational come back here and share all the valued lessons they learned, like maintaining certain terms of radiuses so they don't cross borders unintentionally and maintain clearances.

"There is a misconception about flying RPAs. A lot of people think, 'Hey, all you do is press go and it goes,' but it is not that way. The MQ-9 Reaper is more like a manned than unmanned aircraft in the aspect of flying it. The pilots have stick and rudder skills. The way the RQ-4 operates is more computer controlled, but it still requires the same level of information and pilotage to aviate, navigate,

communicate. That is why you need the skills of an aviator."

Formal training unit

After completing these courses, the students graduate and get their wings. Maj Jerry said: "The sensor operators will earn their set of wings just as well as the pilots, but on their specific major weapon system. With another four months they will finish their training at their formal training unit, where they learn to fly their major weapons system, like the MQ-9 or RQ-4."

Next, they will report to their operational squadron. The RPA enterprise is continually growing. Bases are spread throughout the United States, not just because housing all the RPAs at one place would ask for a base as wide as Los Angeles, but also because strategically it is wiser to spread them. Students can go through a list and state which airframe and location would be their preference. Maj Jerry said: "You might not get it, but at least you asked for it. We will try to keep them happy, because a happy worker is a productive worker."

On average there are 16 classes in one year on the pilot training side, but this varies. Maj Jerry said: "We had a mass production last year. Our mandate is 384 pilots. That has changed, because we used to have only 12 students per class. We increased by 100% for the last one-and-a-half to two years. Each class is now designed on being 24 students. The number of trained sensor operators is 384 in a year. The number of instructors also grows accordingly. The squadron now has 100 instructors working at Randolph."

The real thing

Once working in an operational squadron, the RPA crew operates from a ground control station (GCS), inside which are all the up and down links to the satellite to maintain control of the aircraft. There are a lot of screens inside the GCS to handle situational awareness.

Maj Jerry said: "There is a lot of information thrown at you during a mission and the crews are trained to deal with that, so they constantly keep situational awareness [SA]."

MILITARY 558TH FLIGHT TRAINING SQUADRON

Lack of 'SA' causes complications. We train pilots to keep it simple as things are starting to get too peripheral. Crosscheck altitude, airspeed, heading and know your role, do your job, and just keep flying the plane.

"The sensor operators have a specific role and function in their job. That is all in support of the combat commander they are operating with that day. A crew of two is the minimum. Depending on certain squadrons, there might be a third or fourth crew member, like a mission intelligence coordinator who helps to procure the information, identify it and provides a liaison for us within the GCS and our supporting unit to keep to communication flowing."

Shift work

In the RPA community there is a relentless need for information, so operations are done

on shift work. Maj Jerry said: "It's a 24/7/365 operation and so crews are constantly changing. That's why it is even more essential every crew knows its role so [there is] a seamless continuity between crews and supporting units. You may have four to seven crews that control the aircraft during one flight. It is quite different than in a manned aircraft. There you would take off, fly and land that same aircraft but here you take off and may only touch it for two to four hours and then someone else recovers it."

Normally, an MQ-9 can stay up in the air for 14 to 15 hours, but there are constant technical changes that extend range. Maj Jerry commented: "It is a matter of efficiency. The more they are in the air, the more they are gathering intelligence for individuals to make decisions on the ground. When I was at Creech Air Force Base flying the MQ-1, we

would fly an average of eight hours a day. We would have a four-hour block of flight, a two-hour lunch break and four hours in another area of responsibility, and, of course, all the time crews have to maintain responsibility.

"We utilise autopilot and pre-programmed missions to help alleviate that control. Our responsible level has to maintain the heightened sense of alertness and awareness. We are persistent reconnaissance; we show up, we start watching, and it is all controlled by the MCE. There are radios on the aircraft, so we talk to the forces on the ground. You must always be ready and alert, because you never know what happens in a war situation. As we share real-life missions [with] our students, we stress to them to keep focus on details, because otherwise it will cause complications. Know who it is, don't assume that that's the right person. Get clarification, communicate, get on the radio and ask for some signal. We can use tactical chat, as well as the radio, or even just pick up the phone, if possible."

"No Wild West out there"

The MQ RPAs carry bombs and missiles. Maj Jerry said: "Based on what squadron you are part of, [you] might change or vary your primary roles, whether you are strictly reconnaissance that day or if you are going into a strike role – and things can change in a moment. With the proper intel and chain of command and authorisation given, a reconnaissance mission can change to a strike mission to strike an unexpected target.

"Of course, it is not the Wild West out there; we are there to help and that is what we teach our students. You have to follow the rules: the law of armed conflict, special instructions and the Geneva convention. Students are highly trained to make those wise decisions, and then there is a clearance authority that actually gives the authorisation to shoot a missile."



A student trains on a T-6 simulator and an instructor operates the instrument computer panel. Students undertake an RPA instrument qualification consisting of 140 academic hours and 36 flights in a T-6 simulator as part of their training programme. *Joel Martinez/US Air Force*

After the 558th Flying Training Squadron, students will learn to fly their major weapons system, such as the RQ-4 pictured here, before reporting to their operational squadron. *Airman 1st Class Tristan Viglianco/US Air Force*





Members of an enlisted pilot class at the 558th Flying Training Squadron operating the controls of a simulator. Students learn the responsibilities of using remotely-piloted aircraft as weapons systems as well as learning to fly the aircraft. *TSgt Ave Young/US Air Force*

The RPAs have video datalink capabilities and, if there is another airborne asset that is ROVER-capable (Remotely Operated Video Enhanced Receiver) or has a video datalink, the RPA crew can send them the images. Maj Jerry said: "A picture is worth more than 1,000 words. We can show people on the ground what we are looking at, so they can say, 'Hey, move your crosshairs a little to the left to get it on the right target.' As part of that crew resource management we have screeners trained in intel. We may see something that looks like a shovel to us, but the screener can identify it as a weapon. We can help the screeners and show them different view angles, so they can make wise decisions. We definitely want to provide the most clarity and actionable intelligence as possible."

"Finish it, if required"

During a raid the RPAs may operate in a restricted operating zone stack. Maj Jerry explained: "There might be fixed-wing assets at a certain altitude, helo support at another altitude and we might be at the top of the stack under ISR. It is all down to how the

commander or the Joint Terminal Attack Controller wants to run the show.

"I like to share with our students that we show up and we provide customer service, like, 'How can I help you?' The crews have to know the system to the best of its abilities. This also means that they know what its limits are and that they let the troops know if they can't do it, but if we have to we will find the target and we finish it off, if required."

During a strike, crews are watching live the impact of their weapons and they directly can assess the results of their attack. It is inevitable that, during some missions, people will lose their life. Although crews know this will happen, it can cause a lot of stress on them, and both during training and operations there is much attention paid to this aspect.

Maj Jerry said: "We will continue to develop all of our airmen while ensuring graduates have foundational knowledge of both aviation principles and employment of remotely piloted aircraft. During training, we give our students a reality check: what do you do here? We want to make sure they understand that the Air Force is a profession of arms, and we want them to realise that war is not a pretty thing. One of the priorities is how people cope with these attacks, because human life is precious. The Air Force has recognised that, and they put in place a support structure, as well as briefings to show the graphic nature of war, to say, 'This is what you are pulling the trigger on.' They have a clear understanding of what they are going into.

"When you are in ISR, afterwards you may be sent to the wing psychologist to prove that you are ok before going home. There are different mental health programmes to help people cope with their job and keep moving forward and being able to be resilient. We don't want people to just throw in the towel, and when you are mentally not at 100%, we let them know it is okay to bow out from a strike or two.



One of the first enlisted pilot initial class students in an Undergraduate Remotely Piloted Training Class at the 558th Flying Training Squadron operating the controls of a simulator during the Remotely Piloted Aircraft Fundamentals Course. *TSgt Ave Young/US Air Force*

They are allowed to say, 'I am not right-minded right now. Let me refocus on this.'"

No manned aircraft anymore?

With the numbers of RPAs increasing and the systems developing, the thought comes to mind that someday there may not be any manned aircraft at all.

Maj Jerry doesn't think that will happen: "RPAs are not necessarily weather friendly. We have to steer clear from a thunderstorm, because of Air Force regulations. Icing conditions and turbulence: that obviously affects it, but we have learned to adjust strategically to operate in certain conditions and maintain coverage.

"The greatest benefit of an RPA is that it can stay on station much longer than a manned aircraft, but I think there will always be the need for manned aircraft. We speak of unmanned aircraft, but in fact there is a man operating it. I welcome technology to advance and to help us make wiser and efficient decisions, but I believe the human process of thought and reasoning, compiling the data and exercising aircraft commander judgment, is something that really can't be replaced." **AI**

