In 1794 the French Aerostatic Corps was established and charged with using balloons for reconnaissance and observation purposes during the French Revolutionary wars. Kept afloat by hydrogen supplied by portable units, this cutting edge new capability made its debut at the Battle of Fleurus on June 26, 1794 when the army of the First French Republic confronted a combined army of soldiers from Britain, Hanover, the Dutch Republic and the Hapsburg Monarchy. The French won what seemed like an unlikely victory, and what gave them the edge was their balloon “L’Entrepenant” which played an influential role spotting enemy positions. The corps became celebrities and appear on postcards from the era. Warfare had changed forever and it was clear that whoever was able to get a better view of opposition movements would have a substantial advantage.

It was this thinking which led to the establishment of an Australian military aviation capability, and when Lieutenant Eric Harrison took to the air in a Bristol Boxkite in March 1914 – becoming our first military aviator – it still underpinned military doctrine. It was envisaged that aviation was going to be used for what we now term intelligence, surveillance and reconnaissance, or ISR. In 1914, the notion of warfare spreading to the skies was still a way off. Fast forward to 2019 and ISR is still a prime motivator for military aviation. Since an aviation capability began as a formation within Army, it is perhaps fitting that they have been enthusiastic adopters of Unmanned
Aerial Systems (UAS) or “drones” as they tend to be known colloquially. Army currently has around 1,000 drones and operators and, according to Lieutenant-Colonel Keirin Joyce who is the Army Drone Sub-Program Manager, it is Australia’s biggest, most experienced and safest drone user. Described as the “messiah” of the military drone capability by a colleague, Joyce has the statistics to back up Army’s claim to be the nation’s preeminent drone operator. Currently there are three systems in service, with two in use. These cover specialised and non-specialised applications, as well as providing a recreational outlet – Army fields a drone racing team in the national competition.

Lieutenant Colonel Joyce’s passion for the technology is infectious. “It’s easy to be a huge advocate when you are inspired by this scenario at work every day.”

LTCOL KEIRIN JOYCE
to be a helicopter maintenance guy," he explains. "Blackhawk was my thing."

But then he was offered the opportunity to join the startup formation for the drone capability in 2006.

"I was the first UAS engineer and have remained in the UAS field. Why? Big bang for buck on investment, high rates of tech refresh and development, safer soldiers, better effectiveness for Army missions – It's easy to be a huge advocate when you are inspired by this scenario at work every day!"

Army's drones are a diverse bunch. The "Black Hornet" is like a tiny, hand-held helicopter that can be operated by an individual soldier who may want to know if bad guys are lurking someplace out of sight.

The "Wasp AE" is more like a remotely controlled model aircraft, while the "Shadow 200" is larger, again providing a much wider "picture" of the warfighting environment. Interestingly Army now has drones in every unit with a strong emphasis on training, "drone literacy" and even experimentation in their applications. Joyce has also presented on new and alternate uses for drones which can include logistics and "pseudo satellites" which could stay aloft for more than 40 days at altitudes as high as 70,000 feet! The possibilities seem endless.

An important issue is how such a diverse drone fleet and its operations can be kept safe. "All Army UAS operations are governed by DASA – the Defence Aviation Safety Authority", states Joyce. DASA implements regulations which govern UAS operations and align with CASA and international standards.

"These regulations describe all Fundamental Inputs to Capability to a flying capability and are distilled down to each fleet of UAS," says Joyce. "For systems like the Shadow 200 (a nine hour, 100km, 200kg air vehicle) this is a full suite of aviation systems including an established trade, a five month training regime, a UAS Operating Permit, and so forth. For systems like the Nano UAS Black Hornet (a 25min, 2km, 33g air vehicle) any soldier can undertake this five days of training, and those operators only have to know two governance documents: the operator handbook and a short Authority to Operate instruction."

Wing Commander Nick Dyce-McGowan from the Airworthiness Coordination and Policy Agency within DASA articulates the ADF's comprehensive approach to making sure drone operation is done safely: "UAS are regulated in a very similar manner to civilian Remotely Piloted Aircraft Systems.

"Indeed, the civil and military safety regulations for these systems share a number of similarities. For the larger aircraft-like systems, we manage them in a very similar way to a normal aircraft: we have engineering and maintenance standards and controls, operator training requirements, and specific operating procedures that provide assurance of safe operations. For the smaller systems, we have regulations that allow low-risk/low complexity operations under a number of Standard Operating Conditions (or Standard Scenarios) and an Open Category with strict compliance requirements for a number of different weight categories such as micro UAS (less than 100 grams); very small UAS (100 grams up to 2kg) and small UAS (2kg-25kg).

"All UAS operations are required to be specifically approved through the chain of command with the approver being responsible for ensuring that the activity is conducted in accordance with Defence's regulatory requirements. This will often include specific controls for remaining clear of the general public: buildings; critical infrastructure and may extend as far as operating only in airspace managed by Defence and over land owned or controlled by Defence. Ultimately, our aim is to make our operations as safe as possible while still enabling the ADF to achieve its operational objectives."

Army also operates helicopters and some may wonder if there is a possibility that one of these micro drones in the Open Category could be sucked into an engine during exercises or operations. Joyce points out that the downward thrust of the rotor blades would make this pretty much impossible but, supposing it did happen, engineers and regulators are well and truly across it. The engines are designed to incur no damage as they turn it into confetti.

"At the very small end of drone size is the Black Hornet Nano UAS," says Joyce. "DASA’s regulations for UAS classify this as a micro class (less than 100g), and our classification scheme is aligned to CASA and the European Aviation Safety Authority frameworks, allowing us to talk a common
language. The micro class have such a small mass, and subsequent kinetic energy, that they can essentially cause no harm to a human on the ground or other flying aircraft. As such, we have almost no operating regulation of this class of system – we can fly it pretty much anywhere, even around airports and low altitude aircraft.”

There has been much talk in the media recently of Air Force plans to acquire drones that can be “weaponised” and we will look at that shortly. But for Army this is not an issue. “Army has no weaponised UAS”, says Joyce, “nor have any approved projects to acquire them. We are closely following development of these systems by threat forces and academia and coalition partners.”

From the Army perspective drones are a force multiplier that make their soldiers’ lives safer and better. “UAS make soldiers safer, removing them from some of their dangerous situations, and make Army commanders and teams more effective,” says Joyce.

“Soldiers are safer because they can send a UAS down a street, into an intersection or over a hill to have the first look, instead of a soldier – soldiers are safer today because of our UAS projects. Army is more effective because the images and data allow better, quicker decisions to be made by our mission commanders.”

Army’s love of drones doesn’t end when soldiers clock off for the day – at least not for some. The Army has a drone racing team that competes in the national competition. “Army soldiers drone race”, says Joyce. “Just like Army supports it’s people in their afterhours pursuits, such as traditional sports like rugby and cricket, we want to support contemporary pursuits such as drone racing, cyber-sports, e-sports, war-gaming, and so on.”

“Our Army Drone Racing Team soldiers fly regularly in their local areas and clubs, and come together a few times a year to fly for Army. A direct spin-off of this is being able to have a conversation with STEM kids: drone racing involves design, coding, soldering, electronics, mechanics, aerodynamics, 3D printing, radio datalinks and multi-media creation. These kids are exactly the kind of people we want in Defence. “Like flying drones? You can do that in Army full time flying the Shadow 200, part-time in the infantry, cavalry or special operations flying the Black Hornet or Wasp AE, or just for fun in the Drone Racing Team. Air Force also have a Drone Racing Team, who we fly with, and beat, regularly.”

Air Force may need to lift its game in drone racing but they have plenty of operational experience. The IAI Heron UAS provided excellent ISR outcomes in support of coalition forces in Afghanistan, clocking up thousands of hours of flight time. It also starred at the Australian International Airshow at Avalon where it was one of the most popular exhibits, especially with younger punters who queued to gain access to its control interface which was situated in something that looked a bit like a shipping container. This mobile “cockpit” allowed the general public to see how the Heron was operated and reinforced the fact that it was piloted just like any other Air Force aircraft, and in fact the pilots chosen for this task were highly experienced and used to the sometimes complex airspace and airbase conditions it operated in. The type was retired from use in 2017.

Looking ahead, the Air Force plans to operate the Northrup Grumman MQ-4C Triton which is as large as a commercial aircraft and will be used primarily in the maritime ISR role. Described as a high altitude long endurance (HALE) aircraft, it can support missions up to an incredible 24 hours and its sensor equipment offers a 360 degree view for up to 2,000 nautical miles.

It is envisaged that at least six Tritons will operate out of RAAF Base Edinburgh near Adelaide with
the first going into service in 2023 and the full complement expected to be operational by 2025. Considering Australia’s vast ocean territories, the RAAF has its work cut out and it is envisaged that the Triton will operate alongside the Poseidon P-8A fleet which replaced the much loved AP-3C Orions. Its great benefit is its ability to stay airborne for long periods without aircrew fatigue but like the Heron, it will be flown by qualified and experienced pilots from a ground location. The information it gathers can then be analysed by relevant experts. Incursions into our maritime territory will be that much more challenging as a result.

Another purchase which has seen some elements of the mainstream media getting a little overwrought is the General Atomics MQ-9 Reaper. “The Government is also aiming to deliver 12 to 16 MQ-9s. Approval for acquisition is scheduled for 2021-2022 with a planned introduction into service by the mid-2020s,” stated a Defence spokesperson. It will be Australia’s first “armed” drone and when Christopher Pyne MP mentioned the word “firepower” words like “intelligence”, “surveillance” and even “reconnaissance” became a lot less interesting to a media that thrives on sensationalism.

However as he pointed out, “the aircraft will be operated under the same laws of armed conflict, international human rights law and rules of engagement as manned aircraft”.

From an ethical perspective there is no difference between how an armed UAS will be used and a piloted aircraft that delivers ordnance to a nominated target.

“Remotely piloted aircraft allow military commanders to make more informed decisions faster whilst providing the option to conduct strike and reconnaissance operations without risking the safety of aircrew,” said the then Minister.

Discussion of the ethics of conducting war in the first place is beyond the scope of this piece but military members are always interested in technology that gives them a better chance of going home unscathed and finishing the
an unpleasant business of war as soon as possible. It is expected that the Reaper will undertake a wide range of missions, including ISR, search and rescue and provide support to humanitarian relief operations.

Also on the horizon is the aircraft sized, jet fighter-like UAS developed by Boeing in conjunction with the Australian Department of Defence. Its official title is the Boeing Airpower Teaming System, or BATS (an amusing aviation acronym if ever there was one). It has also been referred to, unofficially, as the ‘Loyal Wingman’. It is the first time Australia has developed an aircraft that might be used in a combat role since World War II and represents Boeing’s biggest investment in such a system outside of the USA. A mockup of the aircraft was unveiled at the 2019 airshow at Avalon and it is expected to begin flight testing in Australia next year.

The aircraft is envisaged as being able to undertake a wide range of missions including ISR, but will also be able to be used to shield manned assets such as the Lockheed Martin F-35A Lightning II Joint Strike Fighters and Boeing E-7A Wedgetail early warning and control (AEW&C) aircraft.

As regulators for ADF aviation the Defence Aviation Safety Authority (DASA) is heavily involved with the UAS capability and recently held a symposium intended to bring together a diverse range of Defence UAS stakeholders to share information and experience. Major Glenn Pinnuck who works with Wing Commander Dyce-McGowan at the Airworthiness Coordination and Policy Agency within DASA was the Activity Coordinator for the symposium.

“The symposium provided an ideal forum where key stakeholders could discuss common aviation safety practices and procedures, exchange ideas, build networks, improve UAS community knowledge and to enable many ADF agencies to collectively discuss and exploit emerging UAS capabilities,” he said.

It is hoped that the symposium will become a regular feature and continue the process of cross pollination between the various UAS operators and stakeholders.

For now, UAS enthusiasts may want to ponder the words of Lieutenant Colonel Joyce when he states that “Army is Australia’s biggest, most experienced and safest operator of drones, and will be until companies like Amazon or Uber crack their commercial market concepts.”

The French Aerostatic Corps of 1794 would no doubt be delighted.