



## A New Era:

### Aerial combat in the age of unmanned aircraft

BY ANN TILLERY

Somewhere in Iraq, an unmanned aircraft orbits patiently above a war zone, unnoticed as it monitors a person of interest, transmitting live video halfway around the world to its operators. Elsewhere, a drone breaks from its holding pattern to launch a missile that wipes out an enemy tank, protecting ground troops. The person behind its controls, operating with decisiveness amidst a chaos of monitors and phones and information feeds, is a completely new breed of pilot—one who might very well get his or her start as a cadet training at the United States Air Force Academy.



Dr. Daniel Pack and Lt. Col. Dean Bushey are passionate about the fledgling Unmanned Aircraft Systems (UAS) program at USAFA. Pack, the center director for research, and Bushey, the program director in charge of training and education, have a balanced collaboration that unites the program. They provide a solid foundation for cadets in a field that is widely misunderstood, even as it experiences rapid growth due to an immediate demand for trained pilots.

In the coming year, the Air Force will, for the first time, order more unmanned aircraft than traditional manned aircraft. According to a recent article in *Stars and Stripes*, "Predators and Reapers are the most requested air asset by ground commanders in Iraq and Afghanistan." When asked why UAS are in such demand, Bushey explains, "UAS do the dull, the dangerous and the dirty missions." The "dull" missions include intelligence gathering, which involves UAS loitering in the air and performing surveillance missions for up to 40 hours at a time. Performing the "dangerous" and the "dirty" missions involves being able to navigate unsecured areas and to fly through chemical, biological, radioactive, and nuclear environments with no risk to pilots' lives, by virtue of being unmanned.

UAS capabilities are expanding every day. "There is really no limit to the missions a UAS can perform," says Bushey. "Beyond intelligence missions, they can do unmanned airlift, unmanned tanker, unmanned fighter, and unmanned bomber tasks." He paraphrases Gen. James Cartwright, the vice chairman of the Joint Chiefs of Staff, from his briefing to USAFA cadets, "UAS are ten times more capable at a tenth of the cost while removing the risk to a pilot's life, which speaks for itself."

USAFA is the only service academy that has its own unmanned aircraft systems program. The Academy's approach to training cadets in UAS is threefold. The first component involves learning to actually operate the UAS from the ground. This can be an intensive process, as operating an unmanned aircraft is vastly different from flying a traditional aircraft. For starters, a UAS operator guides up to four unmanned aircraft *simultaneously* by coordinating the use of seven active monitors, a satellite phone, a cell phone, radios, cameras and other equipment, as well as collaborating with other crew members. "It's a different mindset to teach unmanned aircraft because your attention is not on the three-dimensional world outside," says Bushey. "You're looking at

Above: USAFA's aerial drone makes a low-level pass during an early morning test flight

Left: Research teams prepare their aircraft for launch  
Right: Dr. Pack helps cadets set up their aircraft's on-board video recording unit.



multiple two-dimensional worlds. Teaching someone who has flown manned aircraft to do this is very difficult; that pilot is relying on motion, sound and other environmental indicators. But if I take a cadet who has grown up in a world where they multitask and are used to monitors, flatscreens and flight simulators, they are already able to assimilate a lot of information at once. It's a new skill set."

The second component of the USAFA approach is specialized education. The cadets learn about the multifaceted aspects of unmanned aircraft systems in class: the emerging technologies involved, the various types of aircraft used, and the different ways of thinking required to operate UAS. "UAS operators have more information at their disposal compared to manned aircraft," says Dr. Pack. "The decision-making process in training has to be different. They have to make higher level decisions, so critical thinking skills are crucial."

The educational aspect of UAS training is supported by research, the third component of the program. The USAF and the Academy rely heavily on research because UAS technologies change very rapidly and the only guarantee of success is to stay at

the front of the pack. The research side of the program exposes cadets to the innovations and challenges that are constantly coming over the horizon and introduces them to the required future capabilities of the field. "By exposing them to the research side of things, the cadets become aware of the issues they are going to face and the questions that they need to ask," explains Bushey.

The opportunities for cadet training in the UAS program are growing rapidly. The initial phase of the program involved a small group of 21 cadets training on two Viking 300 unmanned aircraft at Fort Carson last summer, under the supervision of four specially-trained cadets serving as the cadre. The next phase of training involves 90 cadets working with a different model of UAS next spring and summer. The program will grow to consistently accommodate 300 to 400 cadets, based on the idea that all cadets, regardless of their choice of study or career, will have to deal with UAS in the future and should have a chance to experience it firsthand.

This past August, the program's first class received their UAS wings. They have become the ambassadors for a first-of-its-kind program that is not widely under-

stood. Bushey relates one UAS program graduate's experience at the Academy: "He found a downed airplane, supported an insurgent attack and saved a downed airman. That was his mission. That's what gets our cadets excited. They are actually doing missions instead of flight exercises."

Dr. Pack describes UAS as being the culmination of multiple technological specialties. "We're talking about separate disciplines—such as aircraft control, communications, sensing—coming together as artificial intelligence, working together to exponentially expand capabilities," he says. "Right now, we are making multiple unmanned aircraft work cooperatively together, autonomously." Pilots can fly multiple unmanned aircraft simultaneously in different areas of the world. The pilot selects an aircraft to actively control while the others fly autonomously. These drones then relinquish control to the pilot when his or her attention is needed. In addition to increased autonomy, UAS are being designed for increasingly specialized purposes. The Army currently uses three-pound UAS called Ravens for reconnaissance. Other UAS are being developed that will be small enough to fly indoors



and conduct surveillance. The program collaborates with other USAFA programs, like Mechanical Engineering, Electrical and Computer Engineering, and Systems Engineering, to advance UAS research and development.

Given the sheer variety of functions UAS can perform, it may seem as if their role will overshadow traditional manned aircraft. “I don’t think anyone is going to say that unmanned aircraft are going to take over for man,” explains Lt. Col. Bushey. “But it will be an integral part as we move forward over the next 20 years.” For example, current projections for large-scale conflicts incorporate both manned and unmanned aircraft in complementary roles. “Manned aircraft will fight the first five days of World War III,” says Bushey. “When we have air dominance, the UAS will come in and handle it for the next five years.”

The Academy continues to push the limits with its burgeoning UAS program. The opportunities for UAS pilots to actively play a role in national security and defense continue to expand, bridging independent technologies and fields to revolutionize modern warfare and homeland. In the midst of this rapid change and



Above: Cadet Bradley Sapper assembles his UAS.

explosive growth, USAFA’s UAS program stays true to its ultimate purpose. “The only reason the Air Force Academy exists is for the cadets,” says Lt. Col. Bushey. “It’s not to train unmanned aircraft pilots, and it’s not to develop the next generation of UAS. We’re here to make the cadets better leaders when they step out the door in four years. If we’re not doing it for the cadets, then we’re not doing it.”