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Sharing the skies: Naval aviation training mitigates risk of bird strikes

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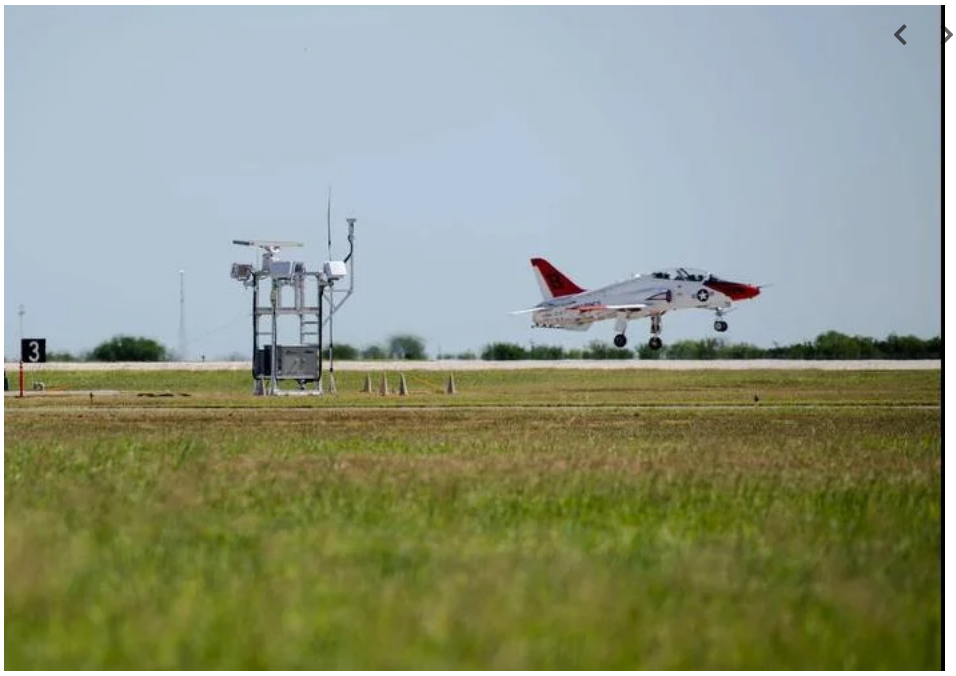

A T-45 Goshawk takes off on the NAS Kingsville runway. Training Air Wing Two utilizes a bird strike avoidance radar system with four 3D panel radars, providing essential information on all targets within a four-nautical mile radius of the airfield. (U.S. Navy photo by Anne Owens/Released)

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Naval Aviation is built on a physically and mentally rigorous syllabus that requires students and instructors to overcome many challenges. Student Naval Aviators (SNAs) are sometimes required to make split-second decisions, respond to simulated emergencies and, occasionally respond to actual inflight emergencies. Some naval air stations that support SNA training are located in major migratory corridors where hundreds of migrating bird species create an additional challenge to safe flight. To address this challenge, in June 2010, Commander, Naval Installations Command, established the Bird/Animal Aircraft Strike Hazard (BASH) program. Later that year, Chief of Naval Air Training (CNATRA) implemented the BASH program across all five of its training air wing locations. Since its inception, the BASH program has proven to be an essential tool to keep Navy SNAs and instructor pilots safe.

CNATRA has 17 squadrons that train in five different geographic locations. Each geographic area faces unique challenges in regard to bird migration patterns. As a result, each location has developed a unique BASH program made up of environmental and aviation experts. These working groups of Navy representatives partner with entities including Naval Facilities Engineering Systems Command (NAVFAC), U.S. Department of Agriculture wildlife biologists, natural resource managers, and the Smithsonian Institution Feather Identification Lab to collect and understand wildlife data that shapes daily air operations.

Training Air Wing (TW) 5 in Whiting Field, Florida, and TW-6 in Pensacola, Florida, face wildlife challenges such as Mississippi kites — low-flying birds that dive and swoop while foraging. Ryan Lynch, wildlife biologist with USDA Wildlife Services - Florida Program, says this phenomena increases the likelihood of bird strikes with Navy training aircraft operating at low altitudes.

“Mississippi kites are present locally from April through July every year, with as many as 40 on the airfield at one time,” said Lynch. “They can be managed by reducing or removing available food sources and [utilization of] non-lethal dispersal. These birds are insectivorous, and the U.S. Navy authorizes a contractor to apply approved insecticides, targeting grasshoppers and other insects. By removing a wildlife attractant (including water and food sources, as well as nesting and perching areas), we encourage kites to seek out other areas for them to fill their daily requirements.”

Farther west, for example, excessive rainfall in Corpus Christi, Texas, contributed to the growth of the cattail plant, attracting desert termites, which in turn attracted laughing gulls. These larger sea birds create hazards for pilots in the T-6B Texan II and the T-44C Pegasus that operate out of NAS Corpus Christi.

All CNATRA bases employ landscape management — managing grass height to reduce or eliminate seed production — to prevent lower-tier prey, such as mice, from establishing habitats and attracting second-tier predators to the airfield. Other passive control measures include placing physical barriers around an airfield and anti-perching devices. Direct control measures include responsible use of pyrotechnics, propane cannons, and bioacoustics to encourage species to move elsewhere. The Navy partners with USDA to trap sensitive wildlife species, such as hawks and owls, and relocate them to more appropriate habitats.

Habitat management by USDA wildlife biologists and NAVFAC natural resources managers such as Aaron Riffenbaugh attempt to decrease potentially hazardous bird activity in aircraft operations areas. He explained how direct control makes an area less suitable for invasive species.

“When it comes to wildlife, it’s about caloric balancing,” said Riffenbaugh. “If an animal comes into an area and is constantly being moved around the airfield, it’s spending more calories than it’s taking in. Fitness is reduced, reproduction is reduced, and there’s fewer animals on the landscape over time when the habitat is less suitable. The animals instinctively go somewhere else.”

The BASH program also helps mitigate interactions between Navy aircraft and wildlife on the ground. Flight lines and outlying fields (OLFs) experience complications associated with the presence of large mammals such as white-tailed deer and coyotes on the airfield. Preventative measures that have been applied in these cases include in-ground fencing and large slabs of concrete or rock applied along the perimeter fence to reduce access of large mammals and burrowing animals onto active airfields.

Working with the Smithsonian

When an aircraft experiences a bird strike, data is collected for analysis.

If a pilot is aware of the bird strike, it is immediately reported upon landing and squadron aviation safety officers write a hazard report for each individual strike. If the pilot does not notice the strike, it's typically discovered by maintenance personnel during post flight inspection. Maintenance personnel collect the remains and ship them to the Smithsonian Institution for DNA analysis to determine the species.

Jim Whatton is a research assistant with the Smithsonian Institution Feather Identification Lab in Washington, D.C., and is responsible for identifying wildlife involved in aircraft strikes. He then enters that information into a database that supports multiple partners.

"With over 90% of strikes occurring on take-off and landing, this information is key to managing habitat to prevent problematic species from being attracted to the airfield environment," said Whatton. "Not all birds on the airfield carry the same risk and knowing which species are actually getting struck allows the biologists and airfield managers to focus the resources on the problem. Having a robust strike record can also help justify changes in surrounding landscapes and allocation of resources."

After the species is identified at the lab, it is recorded into Risk Management Information (RMI), the Navy's safety mishap reporting system. USDA biologists, engineers, and safety personnel can search this data to determine long-term trends and problematic species to improve aircraft design and flight tactics to mitigate wildlife risks.

According to Whatton, the information obtained from these investigations benefits partners at many levels, not just the Navy, helping to shape future operations.

"The RMI is searchable for trend analysis, so biologists can query the data over time to detect changes in species composition, monitor for effectiveness of mitigation measures, and provide historical context for risk analysis," said Whatton. "The Smithsonian's vast research collections and expertise make it a perfect place for this type of interagency collaboration. The final goal is to make the skies safer for all who fly."

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BASH incidents can pose an elevated risk to single engine aircraft that routinely operate in migratory corridors with dense bird activity. NAS Kingsville and NAS Meridian are both located in prime migratory corridors, the Central Flyway and Mississippi Flyway, respectively, with bird populations at their highest in the spring and fall.

According to the National Wildlife Strike Database, 92% of all bird strikes occur at altitudes less than 3,000 feet above ground level (AGL), with 70% occurring below 500 feet AGL. Naval Aviators reduce their exposure to birds at low altitudes by transiting the air space quickly whenever possible. But when pilots are required to train at low altitude, such as takeoff and landing practice, they learn to apply operational risk management (ORM) in order pursue the mission safely. For instance, SNAs must perform touch-and-go's, a maneuver in which the pilot lands and immediately takes off. To mitigate the risk of bird strikes during events like these, CNATRA requires that a daily risk assessment be conducted to determine if the BASH conditions are conducive to executing daily training events.

Avian Radar

Training Air Wing (TW) Two has utilized an avian radar since 2012, building a vast collection of data that has helped them operate in an area of high bird migration. For years, the system in place was a 2D radar with rotating vertical and horizontal array radars, displaying distance to the target, direction of the target, and on the vertical radar the angle of the target, allowing for altitude calculations for targets within the

approach and departure corridors. This provided a substantial amount of data but did not provide altitude information for targets within the 360-degree, four-nautical-mile radius of the airfield. Recently, NAS Kingsville acquired a cutting-edge bird strike avoidance radar system with four 3D panel radars, providing 3D information on the targets, including altitude information for all targets within a four-nautical-mile radius of the airfield.

This system is equipped with an Electro-Optical/Infra-Red (EO/IR) camera, providing a visual and thermal image during night or day operations. When the radar operator needs to visually identify a target that has been detected, the camera pans, tilts, and zooms to the target using the 3D coordinates provided by the four radars. This system uses the existing 2D horizontal scanning radar and extends the monitored range from four-nautical-miles to eight-nautical-miles to include as much critical airspace in NAS Kingsville's initial corridor as possible with the intention of seeing large groups of large birds as far out from the airfield sooner.

"The BASH program is a vital resource to the instructors and student pilots at Training Air Wing Two," said TW-2 Commodore Capt. Aaron Rybar. "NAS Kingsville's recent implementation of a 3D avian radar will go far to mitigate future bird strikes by utilizing data-driven insights that help keep our pilots and communities safe while modernizing our approach to this problem. The technology in use here in Kingsville allows our talented team to ensure our policies and procedures minimize the avian risk during known periods of high bird migration. The coupling of technology with real time risk assessment along with data analytics of local avian levels has resulted in safer flight operations, while also increasing sortie completion rates, a true win-win for both the community and the wing."

BASH Reporting

Eddie Earwood, NAS Kingsville's resident USDA wildlife biologist, made BASH reporting an essential function in Kingsville since 2006, and the avian radar has been instrumental in fostering a safer flight environment for Naval Aviators and wildlife.

"One of my main responsibilities was to start pumping data from the radar," said Earwood. "It starts with reporting; if you don't have strike reporting you can't even begin. Prior to 2005, there was very limited BASH reporting, so there was no historical data to compare. Policies changed that leveraged maintenance [personnel] contracts to insure strikes were documented, allowing Wing Safety personnel to then report strikes. We were able to turn reporting up to a very high level."

Earwood said he was initially surprised by the radar data, which showed a vast increase in bird activity at night, when it was previously believed that bird activity was at its highest just after sunrise and just before sunset. Despite occasional bird strikes that occur throughout CNATRA units, Earwood is confident that overall populations of commonly struck species are not impacted and, for certain species, populations appear to be significantly increasing.

As fall migration approaches, lasting from early August through October, Earwood says he expects to see an even more accurate collection of data that will help determine the safest corresponding corridor for flight operations to continue.

Wildlife Detection and Dispersal Team

Earwood developed a training requirement through Commander, Navy Installations Command (CNIC) to create the Wildlife Detection and Dispersal Team (WDDT).The WDDT is a rapid response team tasked with patrolling the airfield perimeter fence during flight operations, ready to perform direct control duties to keep the airfield clear. This responsibility is carried out by field support personnel, who are trained to perform wildlife abatement on the airfield.

“If the wing duty officer (WDO) sees something concerning on the avian radar, or a pilot reports a large group of birds, they can call the WDDT to respond to that threat and report back to the tower,” said Earwood. “During periods of migration, we increase the requirement for perimeter patrol. We look for large groups of birds coming from the north moving south for the winter. We need to get our eyes on them before they enter our critical airspace.”

Earwood said birds naturally maneuver to avoid aircraft, but sometimes their instincts increase the risk of contact.

“Birds typically depend on gravity to accelerate and avoid,” said Earwood. “When they are above an aircraft and detect that threat, they tuck their wings to descend as quickly as possible, causing them to fall directly into the aircraft.”

Policy Changes

While monitoring real-time information from the avian radar, and gathering inputs from airborne pilots and the WDDT team on the ground, the WDO is responsible for setting daily BASH conditions. The Navy’s new BASH policy outlines low, moderate, high and severe levels of avian radar target counts. This allows for greater understanding of changing bird activity during training.

Cmdr. Peter Curran, from Weaverville, California, has been a pilot since 2001 and flew the EA-6B Prowler and EA-18G Growler. He currently oversees the TW-2 Safety Office in Kingsville.

“BASH is near and dear to our hearts in Kingsville since we are in this migration zone with single-engine aircraft, fighting this battle every day,” said Curran. “Our landing pattern operates at 600 feet above ground level (AGL), which is where a vast majority of strikes occur, and we have developed one of the most comprehensive BASH programs to mitigate risk.”

This new BASH policy, implemented in April 2022, was driven by the research of Scott Simpson, a former TW-2 instructor pilot who wanted to balance safety with training requirements by efficiently planning flight operations around BASH conditions.

Simpson, from Southlake, Texas, graduated from the Naval Academy with a degree in mechanical engineering and then earned his Master of Business Administration and master’s degree from Georgia Tech in aerospace engineering. During his time in the Navy, Simpson flew the F/A-18 Hornet and the T-45 as an instructor pilot at TW-2. He has since separated from the Navy and currently works for Boston Consulting Group.

“I worked in operations during my four years in Kingsville, and I knew how much bird strike mitigation affected us on the operations side,” said Simpson. “Two times a year, there are a ton of birds migrating right through Kingsville and the degree of concentration is higher in our location than in others, making our objective risk higher… I wanted to use a data-driven approach to apply a more coherent, efficient risk policy that increases safety while also increasing operational tempo, so that ended up being my goal.”

While the avian radar enables NAS Kingsville to more accurately set BASH conditions, clear, measurable and historical data needed to be captured to make policy changes. Simpson’s research into data collected by the avian radar showed that Naval Aviators face the most danger of a bird strike flying low altitude at high speeds for long periods of time. As bird count increases, pilots need to spend less time in those critical areas low to the ground.

“We introduced a new profile with a very steep climb out at a slower speed, with the intention of getting above that danger zone as quickly as possible and reducing the energy of impact should a strike occur,” said Curran. “Using simulators, we performed mitigated departures at different air speeds to determine if we have enough energy available to land safely. With this updated policy with a steeper climb, our pilots are in a better energy profile to return for an arrested landing in case of bird strike.”

Prior to Simpson’s research, BASH conditions were set by the WDO and pilots could spend three-to-four minutes waiting below 3,000 feet AGL in dangerous airspace for wingmen to take off and join them, increasing risk of bird strike with every moment.

“This theory helped us build a new departure profile that is currently being used to reduce risk when we launch airplanes,” said Simpson. “We did have a reduced risk recovery profile already in place, but the profile didn’t exist for departures. By implementing a new profile for launching aircraft, the probability of a bird strike is reduced. In the worst case scenario of a bird strike going down the engine, this new profile gives the pilot the ability to return to the airfield for a safe landing.”

Simpson hopes his research creates a safer environment for Naval Aviators at TW-2 and further benefits other units throughout the Naval Air Training Command (NATRACOM) enterprise.

“Ultimately, I hope that my research saves lives and saves aircraft,” said Simpson. “I’d love to hear someday that a pilot made it back to the field on a reduced-risk departure profile that they wouldn’t have otherwise. I also hope these policies expand beyond Kingsville throughout the NATRACOM and that all of naval aviation can benefit from the practices we’ve implemented in Kingsville.”

Personal Account

CNATRA's thorough emergency response training prepares pilots for a range of high-risk possibilities, but study and simulation can never completely duplicate all of the factors presented in an actual in-flight emergency.

Cmdr. Cody Dowd, from Bartlesville, Oklahoma, has been a pilot since 2006 and has flown with fleet squadrons operating the C-2A Greyhound. He has spent close to nine years of his Navy career flying in and around Kingsville.

In September 2022, Dowd was in a formation flight on short final approach when he saw a large bird on the right side of his plane disappear below the glareshield and impact the aircraft.

"Based on the trajectory, it had a decent chance to have gone down my right intake," said Dowd. "Upon impact, I immediately thought about where I was in time and space, what configuration the jet was in, what the health of my engine was, and how to maneuver the jet to get into a better profile to maximize my time in a more effective ejection envelope as well as ensuring that we had enough energy on the jet to land it on the runway."

He quickly took controls and nosed the plane over to intercept a steeper landing profile. On the landing, Dowd noted that engine readings were nominal, and the landing was uneventful. Blood spatter was found in the starboard wheel well between the intake and the landing gear. It was determined that no damage had occurred to the aircraft.

"BASH is something that all Kingsville pilots, IPs and students, take seriously," said Dowd. "With the use of our radar, and with the implementation of our new TW-2 BASH mitigation policies, I think we have done as much as we can to mitigate the risks of sharing these skies with our feathered avian friends."

Conclusion

Changes to the BASH mitigation policy benefit TW-2 strike students and instructor pilots, keeping them safer at their training wing airfield, and also benefit the wing as a whole, more clearly defining the accessibility and limits of operations during high migratory periods or severe BASH risk, and allowing training to continue when conditions are favorable.

The avian radar now in place at NAS Kingsville now holds the capability to report the target's size, altitude, and direction of travel that could pose a risk to Naval Aviators and flight operations. Additionally, it can track large and small mammals moving on or across a runway, day or night, and allow air traffic control to warn pilots and deploy rapid response teams to disperse animals that pose a risk to pilots and their aircraft.

Even with only a few months of data collected since updated BASH policies went into effect, the trends have been distinctly positive. From January to August 2022, TW-2 has 14 less bird strikes than in 2021 in the same time span. While the safety of CNATRA's Naval Aviators will always remain a top priority, ultimately, even when bird strike risk is low, it's never zero.

CNATRA's mission is to train, mentor, and deliver the highest quality Naval Aviators who prevail in competition, crisis, and conflict. Headquartered at NAS Corpus Christi, CNATRA comprises five training air wings in Florida, Mississippi, and Texas, which are home to 17 training squadrons. In addition, CNATRA oversees the Navy Flight Demonstration Squadron the Blue Angels and the training curriculum for all fleet replacement squadrons.