Safety Analysis
Helicopter / Drone Collision
July 7, 2025 - Ingram, Texas

Executive Summary –

On July 7, 2025, at approximately 3:58 PM CDT, a UH-60 Helicopter collided with a Small Unmanned Aircraft System (sUAS/Drone), causing minor damage to the tail rotor of the helicopter and destroying the Drone. There were no injuries, fatalities or property damage beyond the two aircraft involved.

Based on the available information, it is determined that the UH-60 Helicopter operated well below the established control altitude for the purpose of conducting a visual search for victims of the flood along the northern banks of the Guadalupe River. Simultaneously, the Drone was operating slightly above the established control ceiling to perform an aerial mapping mission. The Drone operator was monitoring the video display feed from the Drone at the time of the collision. The combined operation of the Drone at a far distance, approximately ½ statute mile, and above the established Drone ceiling, combined with the helicopter low altitude, which acted to mask it from visual or audible early detection, resulted in the Mid-Air Collision.

Summary of Events –

On July 4, 2025, there was a major rain event over western Kerr County and the watershed area of the Upper Guadalupe River. The accumulation of rain resulted in flash floods to the smaller waterways converging at Hunt, Texas and subsequently downstream to the Guadalupe River eastward to Canyon Lake. Fortunately, Canyon Lake had the available capacity to capture the flood waters. This flood event resulted in a major disaster rescue operation from western Kerr County, eastward across Comal County. Rescue operations transitioned to recovery operations several days later.

Airspace Control - The Texas Division of Emergency Management (TDEM) established control of the Disaster Rescue operations and the transition to recovery operations. As a function of the emergency management, the Air Operations Center (AOC) and subordinate Joint Air and

Ground Coordination Team (JAGCT) assumed control over the aviation assets participating in the rescue/recovery operations. A Temporary Flight Restriction (TFR) to the airspace was established early in the process and a larger Notice-to-Airmen (NOTAM) block was created to further aid in the exclusion of non-participating aircraft.

The airspace deconfliction parameters were established as follows –

- Manned aircraft operate above 400 FT AGL
- Drones operate below 200 FT AGL
- Manned aircraft operations below 400 FT AGL were allowed for takeoff, landing and mission-dictated situations, such as hoist or search tasks

For the first four days of the emergency operations (4 to 7 July), the established airspace control altitudes were distributed verbally and on multiple messaging Apps but were not published in a written format.

Drone Operation - On Monday, July 7th the Drone, a DJI Mavic 3 Thermal (Figure 1), operated by Texas Department of Public Safety (TX-DPS), was performing an Aerial Mapping mission, at approximately 200-FT Above Ground Level (AGL), just west of Ingram, Texas. This mapping mission was coordinated with the JAGCT.

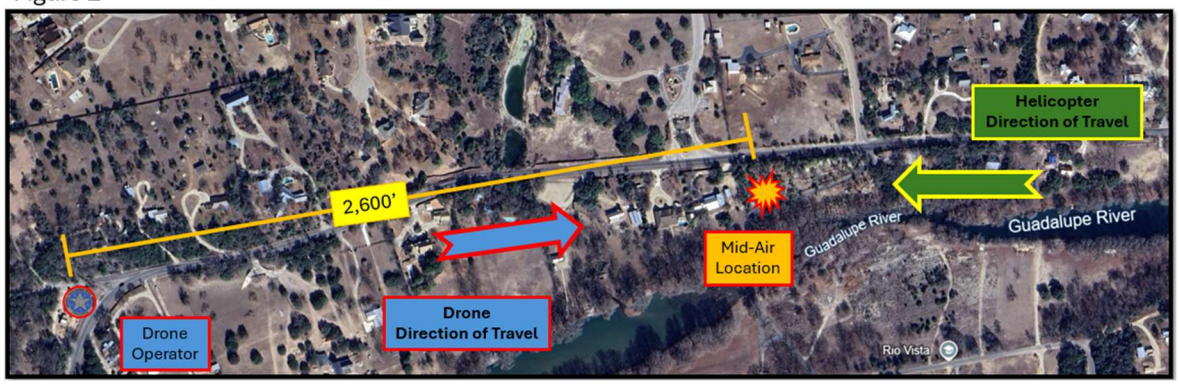
Figure 1



DJI Mavic 3 Thermal

The Drone was at approximately 3:56 PM and was in the process of positioning to the starting point of the mapping mission. Approximately two minutes into the flight, the Drone was traveling from west-to-east, parallel to the road (TX-39) and had decelerated to approximately 16 MPH, when a Blackhawk helicopter traveling the opposite direction, from east-to-west collided with the Drone. Data from the Drone indicates that the collision occurred at approximately 224 feet AGL, and 210 feet above the launch location elevation. (Figure 2) The Drone was totally destroyed by the impact and the parts were scattered over the surrounding area.

Figure 2



Helicopter Operation - A Texas Army National Guard (TX-ARNG), UH-60 Blackhawk Helicopter was performing an authorized search mission along the northern shore (high water mark) of the Guadalupe River. Traveling from east to west at approximately 250 FT AGL and 40 to 60 Knots Indicated Airspeed (KIAS), the encounter with the Drone occurred. The pilot saw the Drone at the last moment, estimated 50 to 100 feet distant, and reduced power to descend with a left bank to avoid the collision. Despite the evasive maneuver, the helicopter contacted the Drone with the tail rotor. The collision was followed by an emergency landing to determine the extent of the damage to the helicopter.

Findings –

- A Temporary Flight Restriction (TFR) was in effect for the Rescue/Recovery Operations
- AOC-JAGCT was established as the airspace controlling agency
- Both aircraft were authorized to operate within the TFR Airspace
- Deconfliction altitude controls were in effect
- Deconfliction control altitudes were not published but were disseminated verbally and via messaging apps
- Drone was operated below 400 feet AGL, but Visual Line of Sight was intermittent, thus should have been operated in compliance with FAA Certificate of Waiver or Authorization - 2023-CSA-12881-COA-A (FR BVLOS), Exp 04-22-2027

- The Drone maintained a constant Mean Sea Level (MSL) altitude over slightly descending terrain, resulting in an AGL altitude above the control altitude of <200' AGL, approximately 25' high
- The helicopter operated well below the control altitude of >400' AGL; approximately 175' low, due to the active search for flood victims, necessitating flight below the control altitude
- Helicopter was transmitting ADS-B OUT data, however ADS-B data will likely be intermittent at low altitudes, particularly in hilly terrain, where line-of-sight with ADS-B antennas cannot be maintained.
- Following the mid-air collision, all Drone operations were discontinued and written deconfliction controls were published for the following days (See attachment – UAS and Crewed Aircraft Deconfliction Directive)

Recommendations (General) –

In the course of gathering information from all parties concerned, the material received covered the scope of the event and often included additional information that serves to provide a more complete understanding of the totality of operations at the time. Much of this additional information lends itself to illuminating areas of improvement that may not be directly related to the collision analysis. Not all recommendations listed are directly related to the Helicopter-Drone collision but may serve to improve the safety of similar operations in the future.

In the very early stages of any disaster event there invariably materializes a Wild-Wild-West environment. Individual agencies at the lowest levels (local fire, police, rural volunteer departments, etc.), will take unilateral actions to save lives. There will be little regard for coordination of simultaneous similar operations taking place nearby. Coordination will be limited to requesting additional assets when a rescue cannot be carried out with the personnel and equipment readily available. This will likely be the point of highest risk, with very little control and/or coordination.

No amount of planning will change this; first responders will become the heroes needed in the moment. Establishment of the central control and coordination elements needs to happen as early in the process as possible to reduce these initial risks to all participants.

It should also be understood that there is no "Cookie-Cutter" plan that will be the right fit for every situation. Although a well-organized checklist will no doubt be useful, there are factors beyond control that will dictate innovation, deviation and flexibility from all participants. Characteristics, such as –

- Rural -vs- Urban
- Coastal -vs- Hill Country -vs- West Texas Oil Fields
- Continuation of Adverse Weather, well beyond the initial disaster
- Multiple Disaster Locations, etc.

Even with substantial changes required by many of these variables, the need for a comprehensive base plan will always be necessary.

Some of the recommended practices included here are currently being used by participating pilots / controlling agencies. Listing them below serves to reinforce the continued use of these best practices.

Recommendations JAGCT –

While there are no findings of the JAGCT directly contributing to this collision, this team can implement procedures to improve the safety of operations for all aviation elements. The JAGCT, as the direct airspace control/coordination element, has the greatest ability to influence safety, and to firmly establish the "*Safety Culture*" of operations across the aviation spectrum. Consider the following -

<u>Vertical Separation</u> –

The greater the terrain elevation variation, the greater the probability that the terrain will mask aircraft from ground observation, thus reducing the time/distance available for Drone operators to take avoidance actions. Consider variations of terrain elevation in establishing deconfliction altitudes; the greater the terrain elevation variation, the greater the deconfliction separation, and the higher that manned-aircraft need to operate AGL.

<u>Lateral Separation –</u>

Aviation relies heavily on Vertical Separation to deconflict aircraft. Most aviators would consider 500' vertical separation as good as 2-miles lateral separation. Much of this conventional wisdom is derived from the fact that aircraft travel faster laterally than vertically. Wherever practical, the total disaster operations area can be divided into sectors, generally along easily

identifiable linear features on the ground, such as roads, rivers, railroads, etc. Within these sectors, Drone and Manned-Aircraft operations can be segregated from one another.

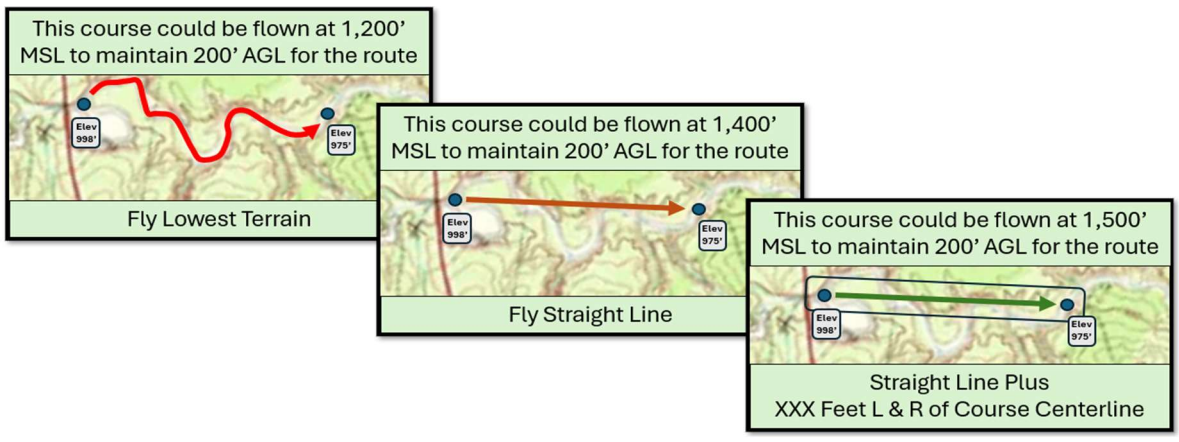
Tracking of Real-Time Flights –

To the extent possible, expand the use of the Team Awareness Kit (TAK) App to track aircraft operating in the disaster area. This App can mitigate many of the low-level weaknesses of the ADS-B system and provide real-time situational awareness to pilots and the AOC-JAGCT.

Expanded the Definition of "Route-of-Flight" –

When an aircraft flies on a flat trajectory over terrain that varies, the AGL altitude continually changes. A flight that begins at 200' AGL could vary significantly over a distance of less than a mile. Because of these variations, it may be appropriate to further define the route of flight, not as a pencil-line, but more as a swath. This could be accurately described as follows – "Route-of-Flight is defined as a corridor 500' laterally left and right of the course centerline." AGL altitude would be above the maximum terrain/obstruction elevation within the "Route-of-Flight."

Figure 3



Any time the route of flight follows a linear feature (road, river, railroad, etc.), the rules of the road should always be followed. That is, all flights will be to the right-side of the linear feature, thus creating a natural lateral separation, much like driving your car to the right of the roadway centerline. This rule should be followed by both manned and unmanned aircraft to the extent possible.

Essential Operations Determination –

With the introduction of Unmanned Aviation (Drones) there has been a rapid advancement of technology and capabilities. Every Drone manufacturer and service provider is eager to participate in disaster operations to test and to prove, in a real-world environment, the viability of these advanced capabilities. While this is a necessary step in advancing future capabilities, there must be an effort to evaluate the Risk -vs- Benefit of the proposed operation. This will require the AOC and JAGCT, or other designated office to gain a clear understanding of the services being offered, the potential benefit, and the potential risk impact to current operations, both in the air and on the ground.

An example of this may be to NOT conduct any Drone mapping, or similar missions until rescue operations have been concluded and the Recovery phase has begun

Crew Briefing –

- *Safety Culture* is Top-Down within any organization. It is imperative that the JAGCT places significant emphasis on the imperative that Safety is first and foremost in all operations.
- Require an initial, in-person, in-brief for all participating aircrews (manned and unmanned), conducted by the JAGCT. Larger aviation organizations, such as the National Guard, may be briefed to an experienced team lead for dissemination to the individual crews.
- Update briefs should be provided daily, or more frequently, to inform all participants of the known activities and to emphasize the *Safety Culture*, to reiterate the deconfliction altitudes, right-of-way rules and rules-of-the-road operations. Verification that updates are received by all participants will reduce the possibility of uninformed pilot errors.
- Military Aviation operates on a “Mission Accomplishment” mentality. Military aviation operations are inherently dangerous and include risks that are not common in civil aviation. A "Mission Creep" mentality can easily consume a crew’s "Mission Accomplishment" mentality. To ensure that the military Aviators enter the rescue/recovery operations with the proper mindset, the briefer must emphasize to all pilots, and particularly to military aviators that this IS NOT a military tactical

operation that requires stealth or risk-taking. This is a Rescue/Recovery operation that is to be conducted with the greatest emphasis on Safety and coordination of effort. Emphasis on this may be advisable through update briefs at the discretion of the JAGCT.

- Identify the nearest airfield that has Crash-Rescue capability, as well as frequencies and phone numbers to alert them to in-flight emergencies. If airfield Crash-Rescue is not available, consideration may be given to allocating assets for this purpose. Brief this airfield location to all aircrews as the emergency recovery location.
- Entry / Exit Procedures - If appropriate, establish inbound/outbound routes for entry/exit of the TFR Airspace, with lateral and vertical separation parameters.

Recommendations TX-ARNG –

- Except in life-saving and urgent operations, make contact with the JAGCT before descending below the deconfliction altitude and every 15-minutes for the duration of the flight below the deconfliction altitude
- If unable to make contact with the JAGCT, make calls In-the-Blind as well as on messaging Apps or any other means available, advising intentions and every 15-minutes operating below the deconfliction altitude
- Notify the JAGCT when concluding low-level operations and climbing above the deconfliction altitude

Recommendations TX-DPS –

- Ensure all DPS Drone Operators have a copy of the appropriate FAA Certificate(s) of Waiver / Authorization in their possession and review this document prior to Drone Operation under the provisions of the Waiver / Authorization and the listed Special Provisions
- To the maximum extent possible, have a Drone Assistant/Observer included in the operation of the Drone, even when not operated under the provisions of an FAA Certificate of Waiver / Authorization
- Ensure that all Drone missions are coordinated through the AOC/JAGCT.

- When ready to begin any Drone mission, make contact with the JAGCT to advise them prior to launch. This notification should include, at a minimum –
    - Launch location
    - Altitude of operations
    - Geographic area of operations
    - Duration of operations
- Notify the JAGCT when concluding the mission
- When practical, choose a launch location that is as close to the Drone operation as possible to reduce the distance, to improve visual line-of-sight and provide timely manned aircraft detection
- When the Drone Operator is accompanied by an Assistant/Observer, to the extent possible, locate this extra set of eyes at the most advantageous location possible, such as within the Drone operation area or at the highest terrain with the greatest unobstructed view
- Prior to operation of any Drone mission, determine the changes in terrain elevation in the operational area, so as to conduct the entire flight below any established altitude limits

POC for comments – Ryan Newman
FAASTeam Program Manager
San Antonio - Flight Standards District Office
Ryan.B.Newman@faa.gov

Attachment –

UAS and Crewed Aircraft Deconfliction Directive

After a UAS and UH60 collision on 7 July 2025, all UAS in the AO were grounded. An open discussion in the Air Operations Center occurred and requires the following for reinforcement of UAV and Crewed aircraft deconfliction:

Overarching Strategies:

- All UAS and crewed aircraft operations in an Area of Operation (A/O) need to be coordinated through the JAGCT. (Local area aircraft not associated with the mission need to have their aircraft checked into the JAGCT).
- UAS operations will stay BELOW 200-foot Above Ground Level (AGL). (Note: Civilian UAS have the capability of flying well above the civilian allowable limit of 400-foot AGL)
- Crewed Aircraft will generally stay ABOVE 500-foot AGL
- JAGCT will more critically check the UAS deconfliction step of the mission flow process
- In the A/O the use of "Drone Detection" technology will be put into place when possible
- "Rules of the Road" apply: Fly on the "right side" of roads, waterways, terrain features, etc…
- Radio Deconfliction between UAS and Crewed aircraft will be:
    - Primary - VFIRE21
    - Secondary - 123.025

Crewed Aircraft Tactics:

- Fly ABOVE 500-foot AGL while moving though the A/O except when mission requires lower flight altitudes
- If BELOW 500-foot AGL the aircraft movement intent should be announced on both the primary and secondary frequencies (if equipped) and time permits
- If BELOW 500-foot AGL do not exceed 50-knots unless the mission or aircraft limitations will not allow it
- Only fly missions coordinated by the JAGCT, so deconfliction tactics can be implemented
- Pilots must announce intentions of departure point, direction of flight, route, and altitude

Un-crewed Aircraft Tactics:

- UAS Ceiling of 200-foot AGL (Height Above Terrain)
- Reduce UAS operations only to those needed to support the current mission requirements
- Ensure radio with either the primary or secondary frequency is available and monitored during flight.
- All operations will be conducted under "Visual Line of Sight" flight rules
- To the extent possible, UAS will use anti-collision lights both day and night
- Configure aircraft to ensure the "lost connection" actions include a "Return to Home" no higher than 200-foot AGL
- In the event of losing UAS control, the pilot shall:
    - Immediately announce on the primary and/or secondary radio channel "**UAS Flyaway-UAS Flyaway-UAS Flyaway**" to notify any aircraft in the area.
    - Immediately notify the JAGCT to allow aircraft owners to receive communications about the "UAS Flyaway"

Current 7/8/2025