JOINT BASE SAN ANTONIO

MIDAIR COLLISION AVOIDANCE HANDBOOK

MIDAIR COLLISION AVOIDANCE (MACA) HANDBOOK

WRITTEN AND COMPILED BY

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and
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Additional information and the MACA Handbook
(in PDF format) can be viewed at:
http://www.jbsa.mil/Resources/Safety.aspx

INFORMATION CONTAINED IN THIS HANDBOOK IS SUBJECT TO CHANGE, AND IS NOT TO BE USED FOR NAVIGATIONAL PURPOSES. CONSULT ONLY CURRENT FLIGHT PLANNING DOCUMENTS.

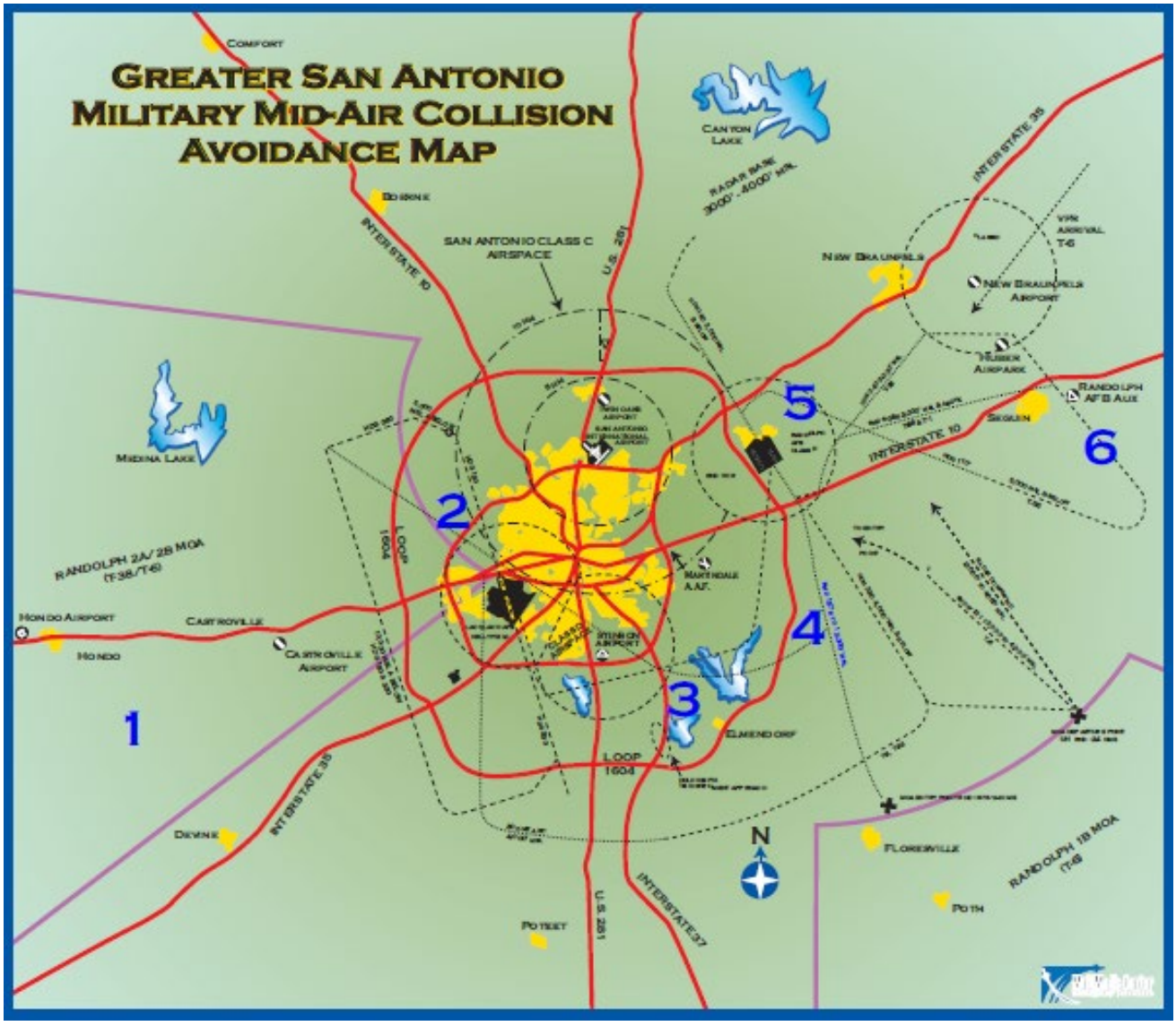
A thorough preflight plan should include a review of potential conflicts and hot spots associated with air traffic control procedures and aircraft flight path proximity. Military aircraft conduct operations and training in the same airspace as civil traffic, but in many cases using vastly different flight parameters such as speed, altitude, aerobatics, combat maneuvering and multi-ship formations.

You should never assume the military aircraft has you in sight. Never assume the military aircraft has you on RADAR (in fact, most JBSA aircraft do not have airborne RADAR). In addition, many military aircraft are using a UHF radio to speak with controllers and other aircraft, which hampers communication and situational awareness. Last, almost all JBSA-based aircraft are conducting student training, adding to the complexity and workload of a mission. The best practice for mitigating MACA hazards is to stay proactive, informed and situationally aware.

Please use this document as part of your preflight planning, along with these helpful resources online:

https://sua.faa.gov/sua/siteFrame.app
https://www.1800wxbrief.com/
https://www.faa.gov/uas/b4ufly/
http://www.modelaircraft.org/

9 May 17



T-1 T-6 T-38 F-16 C-5

SAN ANTONIO MILITARY AIR TRAFFIC OPERATIONS

1. Hondo Municipal Airport
Location: 2NM west of Hondo
Altitude: Surface to 4000' AGL
Aircraft Type: General Aviation (GA), Crop Dusters
Flights per day: Up to 50 flights

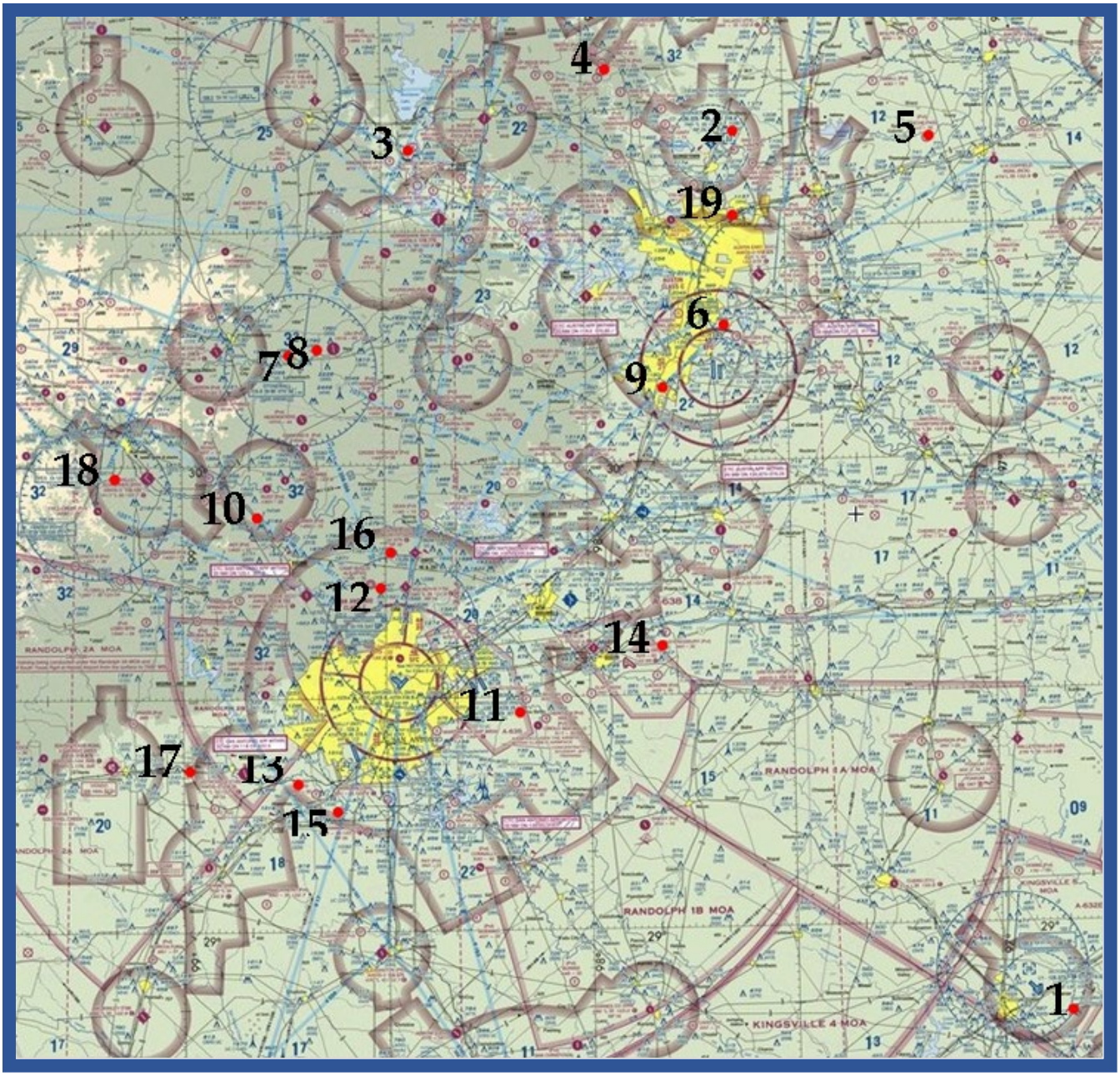
2. JBSA-Kelly Field
Rwy 16/34, Patterns East & West
Altitude: 2200-2700' MSL Traffic Pattern
Aircraft Types: F-15, F-16, F/A-18, C-5, KC-10, KC-135, C-17, C-12, C-21, C-130, T-1, T-6, T-38
Flights per day: up to 40
Operating hours: 24 hrs
Remarks: Heavy flight training day and night, Class D, fighters & heavy aircraft

3. Stinson Airport
Rwy 14/32, 9/27, Patterns to East
Altitude: 1600' MSL Traffic Pattern
Aircraft Type(s): GA
Flights per day: 150-200
Operating hours: Tower 0600-2200 L
Remarks: Class D, USAF T-6 aircraft use airport for instrument approach training.

4. Martindale AAF
Location: 8NM SW of JBSA-Randolph, Intersection of I-10 & I-410
Altitude: 1500' MSL
Aircraft Type: UH-60
Flights per day: 10
Op Hours: 0700-1730 L, ocsnl night ops
Remarks: Heavy weekend activity

5. JBSA-Randolph
Rwy 15/33 (L and R)
Altitude: 1800'-3800' MSL TP
Aircraft Type(s): T-1, T-6, T-38, C-21
Flights per day: 300+
Operating hours: 0700-2200 L
Remarks: Heavy Flight Training, Class D

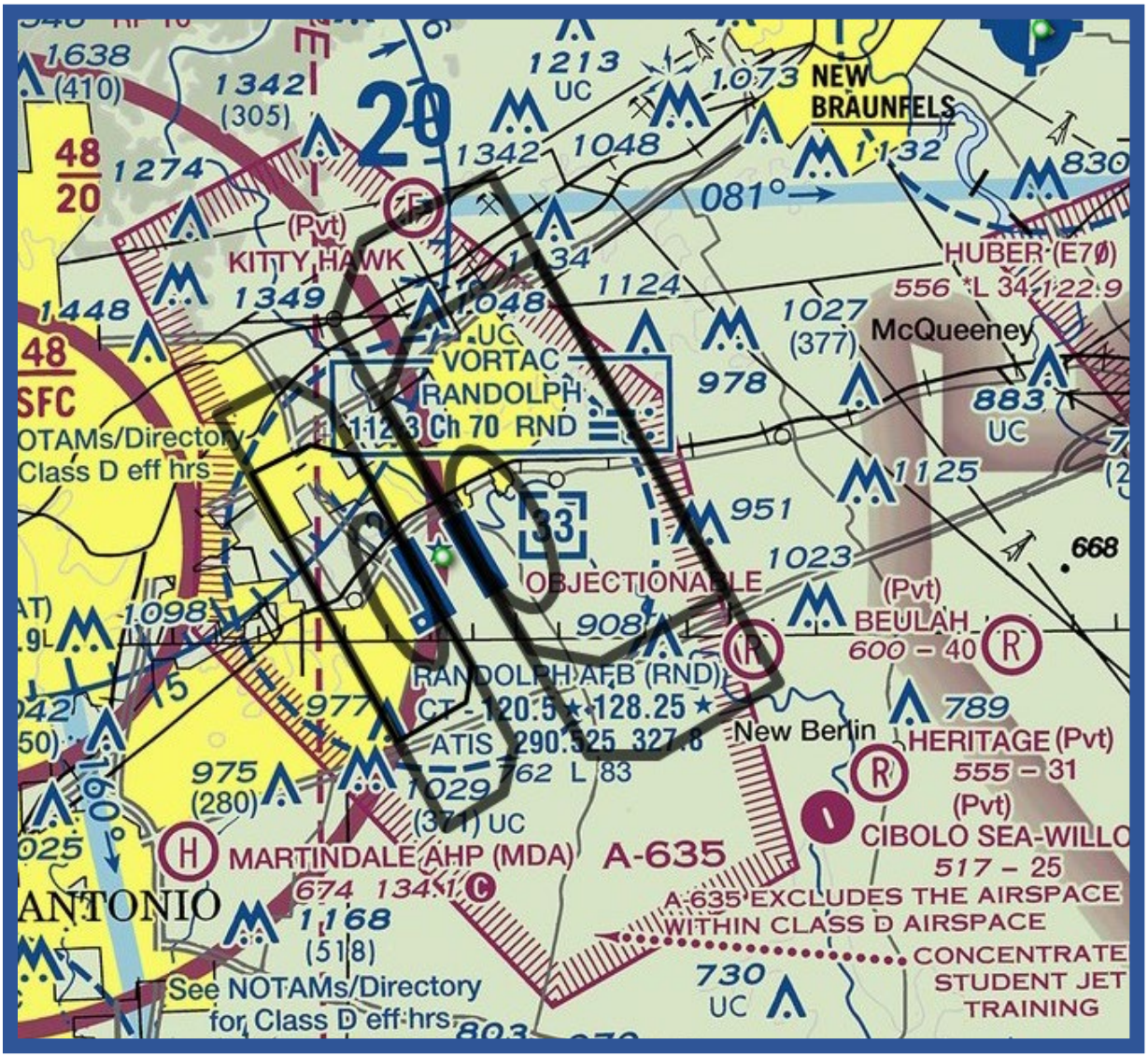
6. Seguin Aux Field
Rwy 13/31
Altitude: Surface to 3500' MSL
Aircraft Type(s): T-6 & T-38
Flights per day: 30
Operating hours: 0800-1700
Remarks: Heavy Flight Training, Runway Supervisory Unit "Charlie Brown" monitors 122.95



SUAS AWARENESS CHART

Source: Academy of Model Aeronautics

1. Victoria Radio Control Flyers, Inex TX
2. Georgetown Aero Modelers Assn, Georgetown TX
3. Highland Lakes Flyers, Kingsland TX
4. Briggs Radio Control Flyers, Bertram TX
5. Fly Apache Pass RC, Thorndale TX
6. Austin RC Assn, Austin TX
7. Fredericksburg Wingdingers Aero- Modelers, Fredericksburg TX
8. Hill Country Aeromodelers, Austin TX
9. Boerne Area Model Society, Comfort TX
10. Heart of Texas Soaring Society, St Hedwig, TX
11. Bulverde Aero Modelers, San Antonio TX
12. Alamo Radio Control Society, Atoscosa, TX
13. Sandhills RC Flyers, La Vernia TX
14. Tri City Flyers, Seguin TX
15. San Antonio Prop Busters, Somerset TX
16. River City Radio Control, Bulverde TX
17. Medina Valley Flyers, Hondo TX
18. Kerrville RC Flyers Kerrville TX
19. Lone Star Aeronuts, Round Rock TX

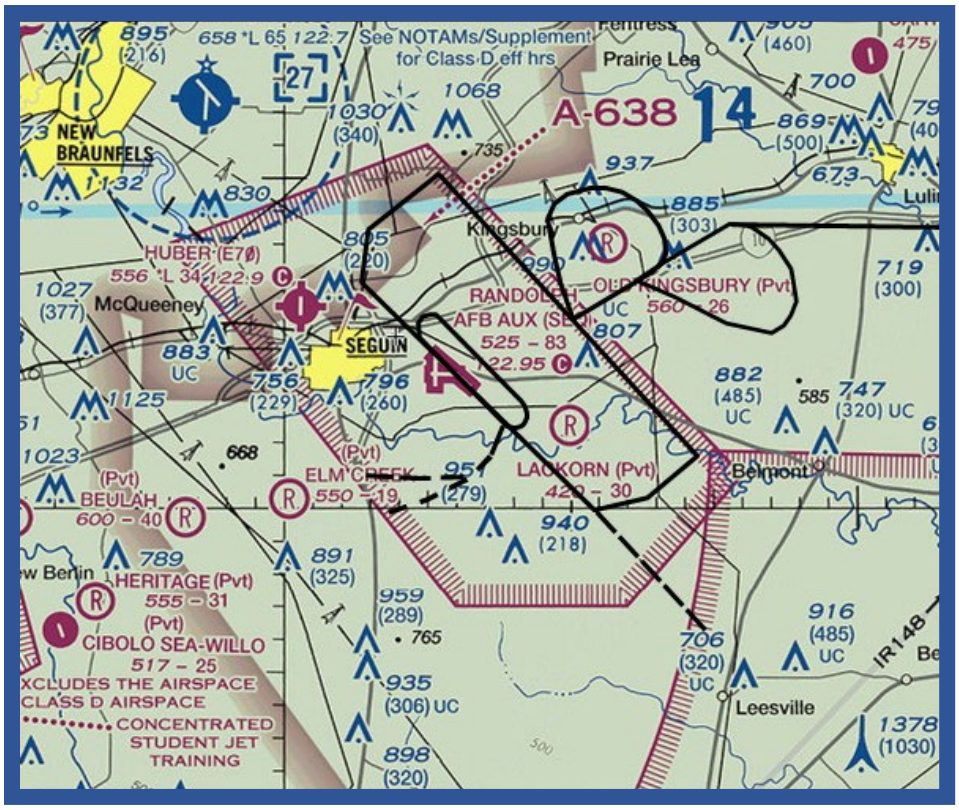


West Runway (15R/33L)
VFR Traffic Pattern
T-6s at 100-200 KIAS
SFC-3800’ MSL

East Runway (15L/33R)
VFR Traffic Pattern
T-1s/T-38s at 100-300 KIAS
SFC-3100’ MSL

JBSA-Randolph is home to the 12th Flying Training Wing, which conducts extensive flight training in numerous aircraft, including the T-1, T-6 and T-38C. In addition, an average of 60 military transient aircraft fly in and out of JBSA-Randolph monthly. Randolph is the Air Force's busiest airfield with 27,000 flights annually. Much of this traffic is high speed--further reducing the ability to see and avoid. Instrument approaches and VFR traffic patterns are conducted simultaneously on both runways, weather permitting. The T-6s operate a VFR traffic pattern on the west runway (15R/33L), and the T-38Cs and T-1s operate a VFR traffic pattern on the east runway (15L/33R). These VFR traffic patterns are as depicted on the chart above.

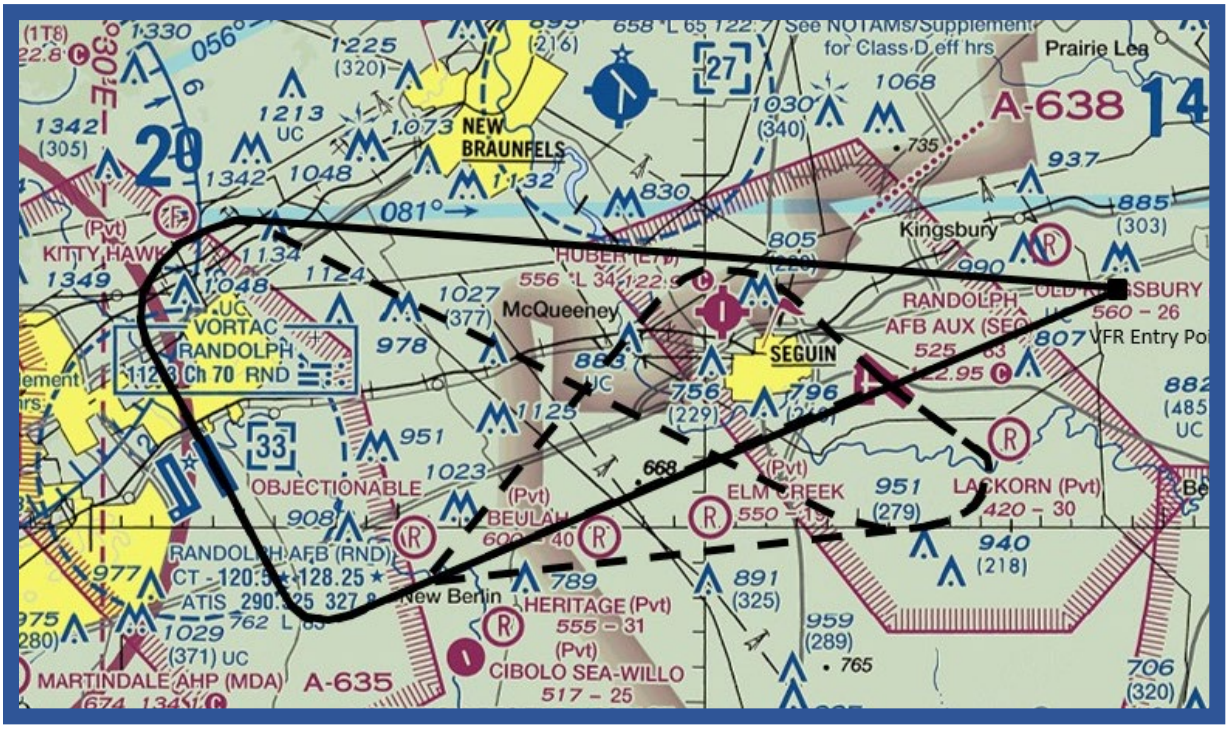
Patterns: Randolph T-38s fly VFR patterns at Seguin Auxiliary Airfield. The T-38 VFR traffic pattern and transition routes are depicted below.



VFR Pattern Seguin Aux Field (13/31)
T-38s at 155-300 KIAS; SFC-3000' MSL

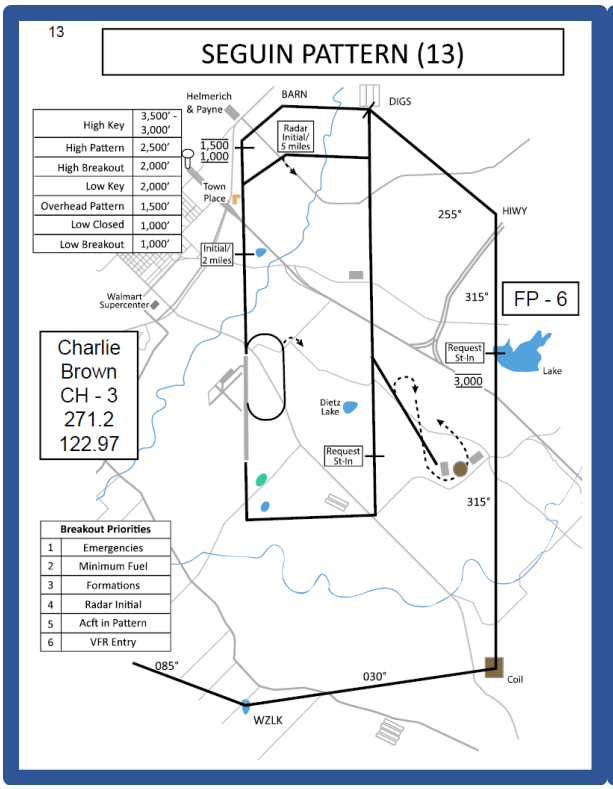
Seguin Advisory "Charlie Brown"
VHF 122.975; UHF 271.20

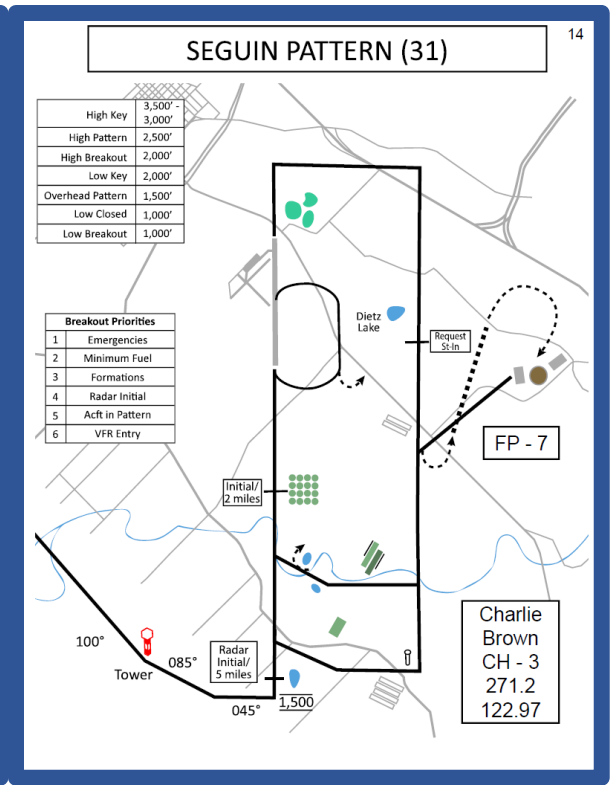
Transition: Randolph T-38s operate between Randolph and Seguin at 300 KIAS between 1500-3000' MSL with a ground track similar to the chart above.



Randolph to Seguin **Seguin to Randolph**

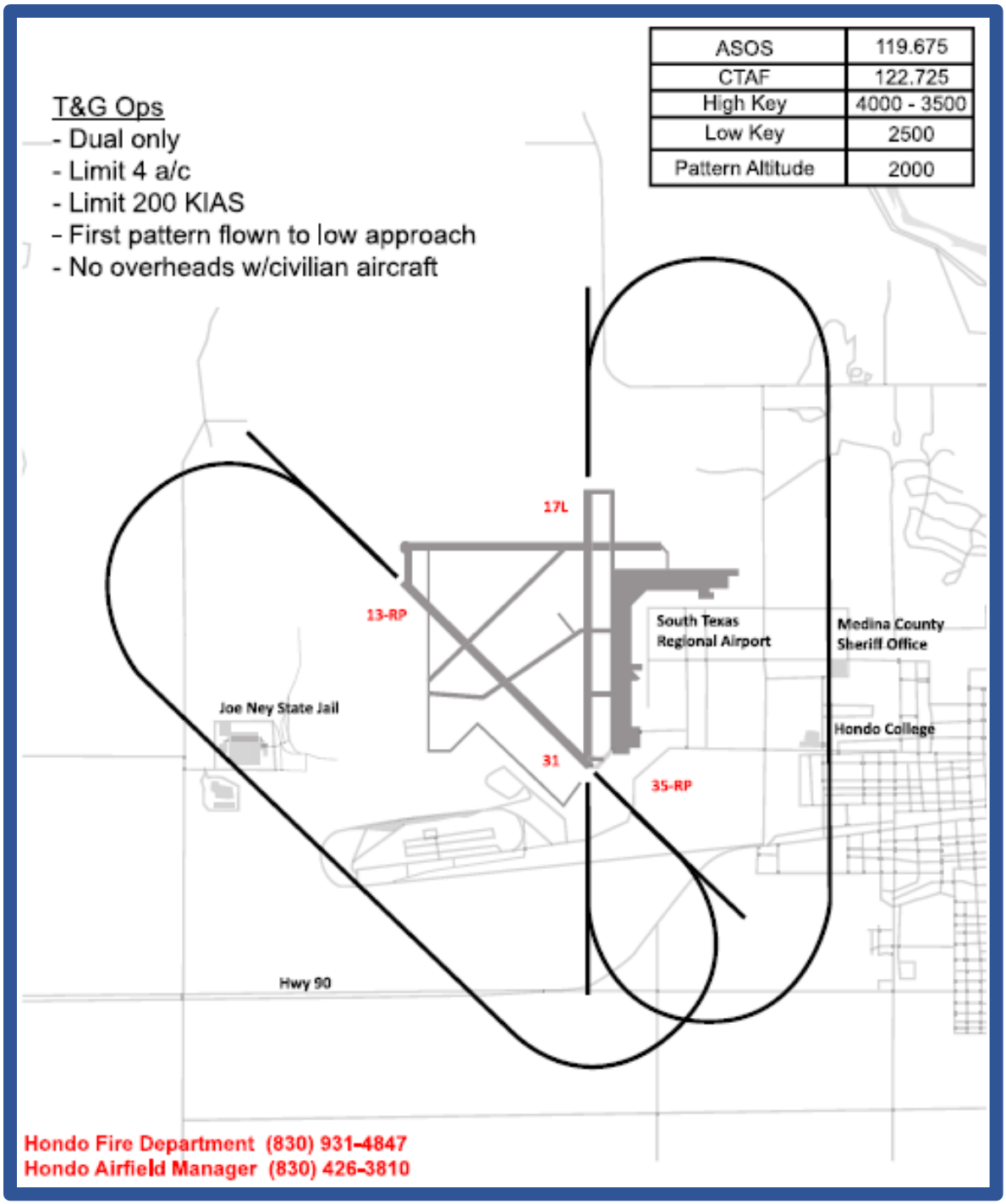
Randolph T-6s also fly VFR patterns at Seguin Auxiliary Airfield. Depicted below is the T-6 VFR traffic pattern and transition routes flown at Seguin.

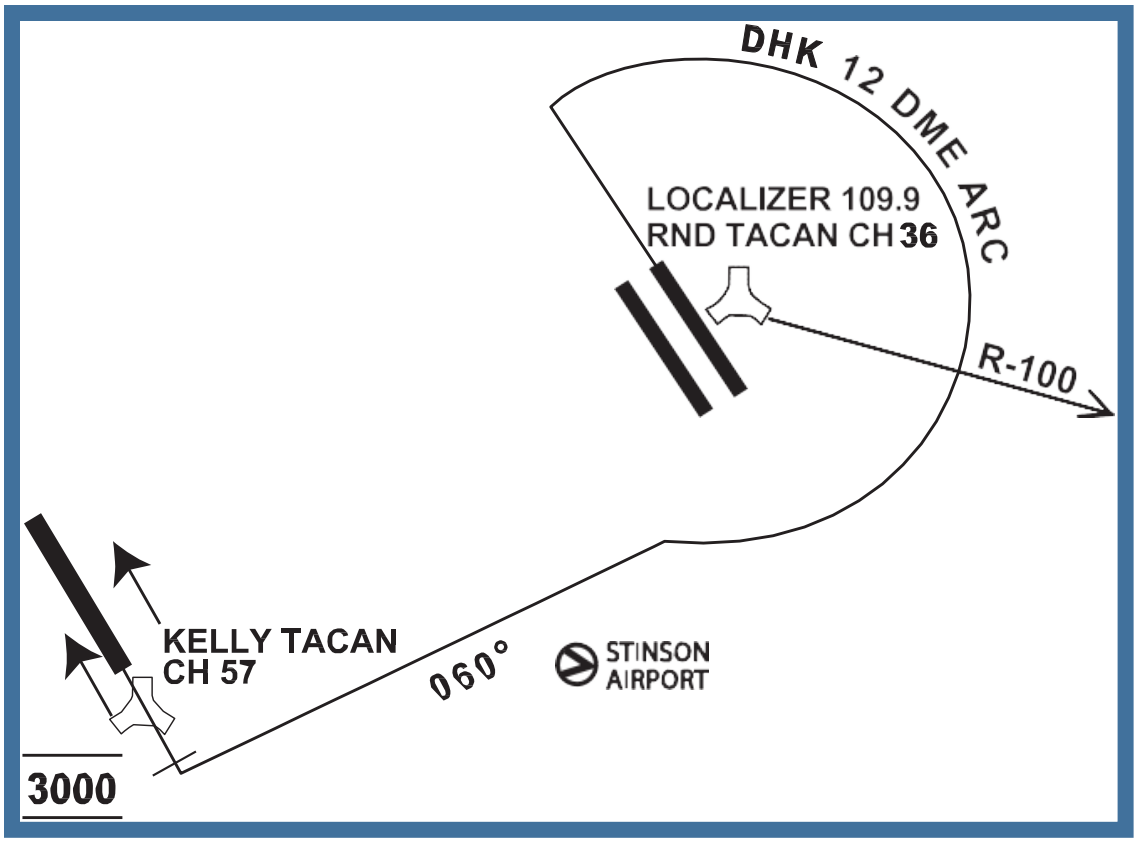




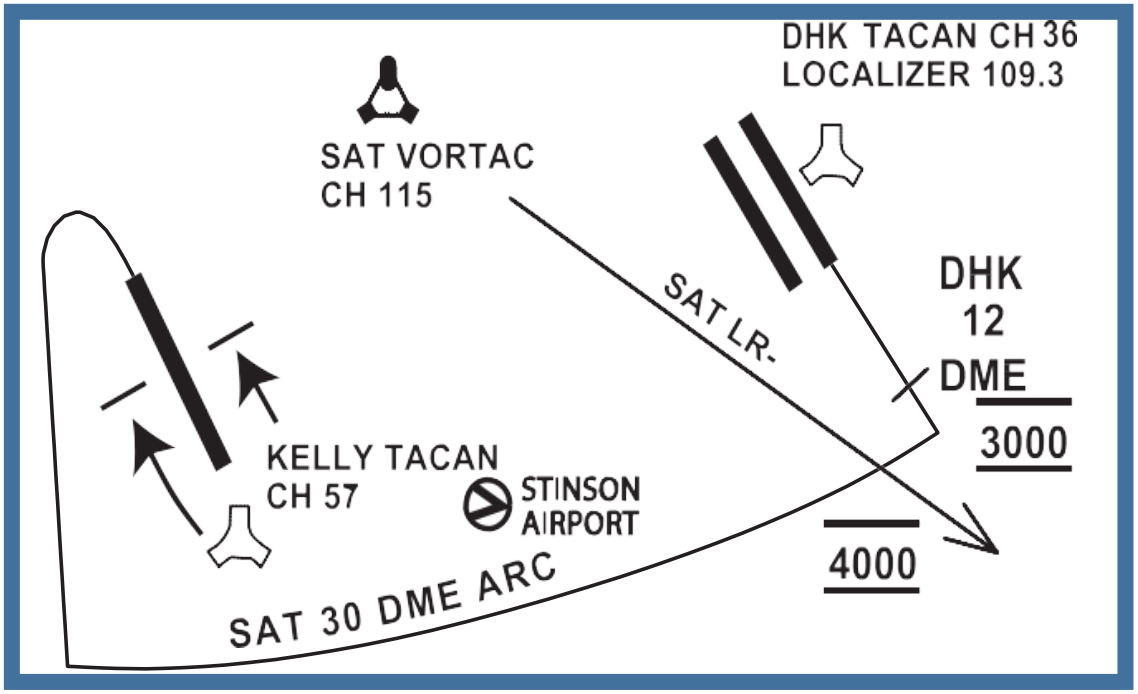
T-6 Hondo Airfield Operations

Randolph T-6s fly VFR patterns at Hondo Airfield. The T-6 VFR traffic patterns are depicted below.





SEENO RECOVERY (Above): (SKF RWY 16 to RND RWY 15): Fly runway heading until reaching 4000', then turn left heading 060, intercept the RND 12 DME arc, arc east, and expect vectors to Randolph. If radar vectors are not received by the RND R-100, maintain last assigned altitude and execute the remainder of the HI-ILS 1 RWY 15L.



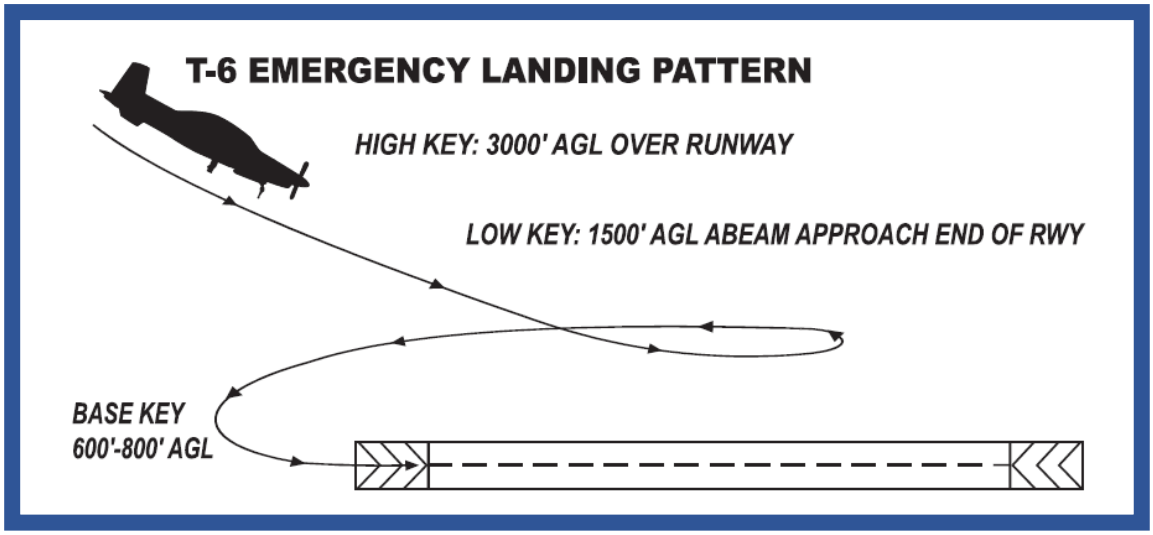
SUTHERLAND RECOVERY (Above): (SKF RWY 34 to RND RWY 33): Turn left heading 180, maintain 2500', intercept the SAT 30 DME arc, then climb and maintain 4000', and arc east. Intercept the RND 323 course inbound. Descend to cross RND 12 DME at 3000'. Execute the remainder of the HI-ILS Rwy 33R

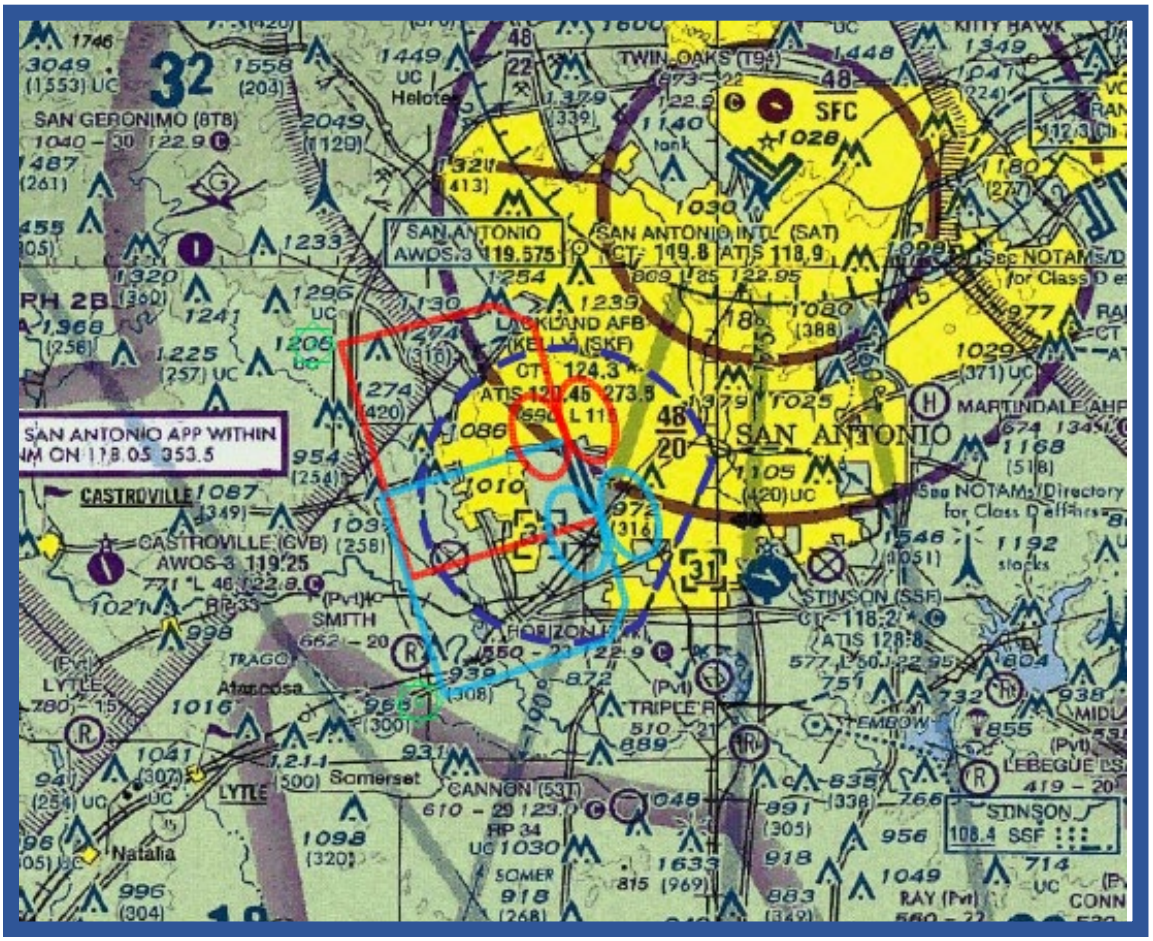
T-6 Non-Towered Airfield Operations

Randolph-based T-6 aircraft routinely conduct Emergency Landing Pattern (ELP) and normal pattern practice at the following airfields:

Garner Field
Giddings-Lee County Airport
Pleasanton Municipal Airport
Smithville Crawford Municipal Airport
Karnes County Municipal Airport
Castroville Municipal
Hondo Municipal
McKinley Field

Note: T-6's will not conduct pattern practice if there are more than two aircraft (military and civilian combined) in the pattern. T-6's conducting ELP's at these airfields will fly the ELP pattern described below. T-6 crews will monitor the appropriate CTAF and make appropriate position reports. T-6s will fly low approaches when practicing at non-towered airfields.





Runway (16/34) VFR Traffic Pattern
C-5s and F-16s at 100-300 KIAS; SFC-2700' MSL

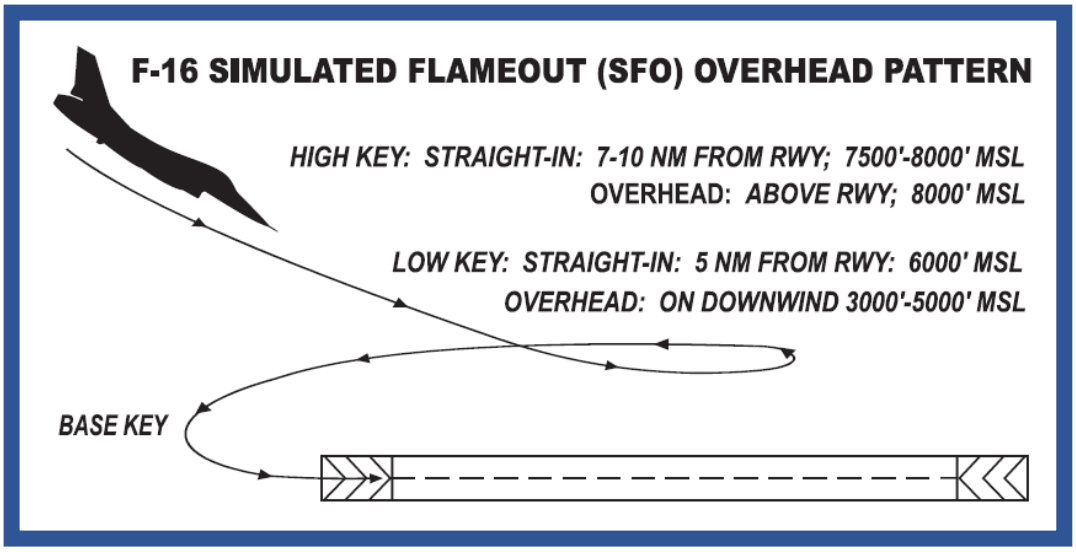
JBSA-Kelly Field is home to the 149th Fighter Wing (Texas Air National Guard F-16 unit) and the 433rd Airlift Wing (Air Force Reserve C-5 unit). In addition, Kelly Field has many other military aircraft transiting the airport and is home to a Boeing Depot Repair Facility for C-17 and other aircraft. Kelly is a joint-use field, and several civilian aviation assets operate from Port San Antonio. As a result, this area has the potential for a large amount of diverse flying activities. As with many other military bases, Kelly Field operates instrument approaches and VFR traffic patterns simultaneously, weather permitting, day and night.

The VFR pattern flown by the C-5 is a visual box pattern flown between 2200-2700 feet MSL. In addition, the C-5 practices steep visual approaches beginning ~10 miles from the landing RWY at 5500 feet MSL or from a high overhead pattern from 5500 feet MSL.

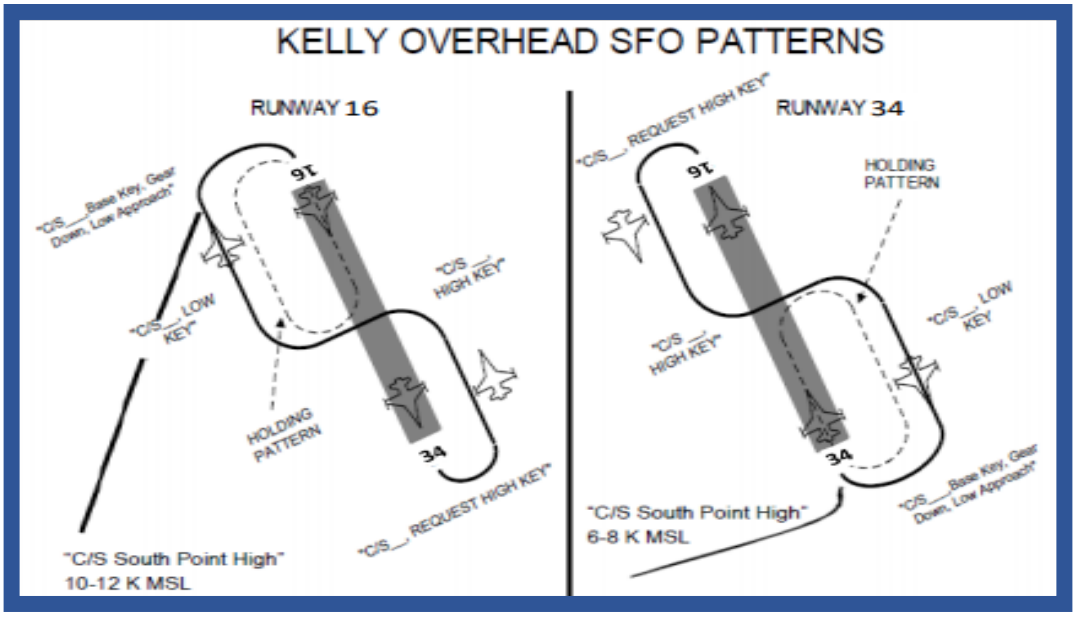
The F-16s operate a military overhead pattern (ground track shown above) flown at 2700 feet MSL. In addition, the F-16s practice simulated flameout (SFO) patterns at Kelly, either by means of a visual straight-in or an overhead pattern. This pattern simulates the failure of the aircraft's one (and only) engine, starts at a high altitude, and requires a high rate of descent to the runway.

F-16 Simulated Flameout Operations

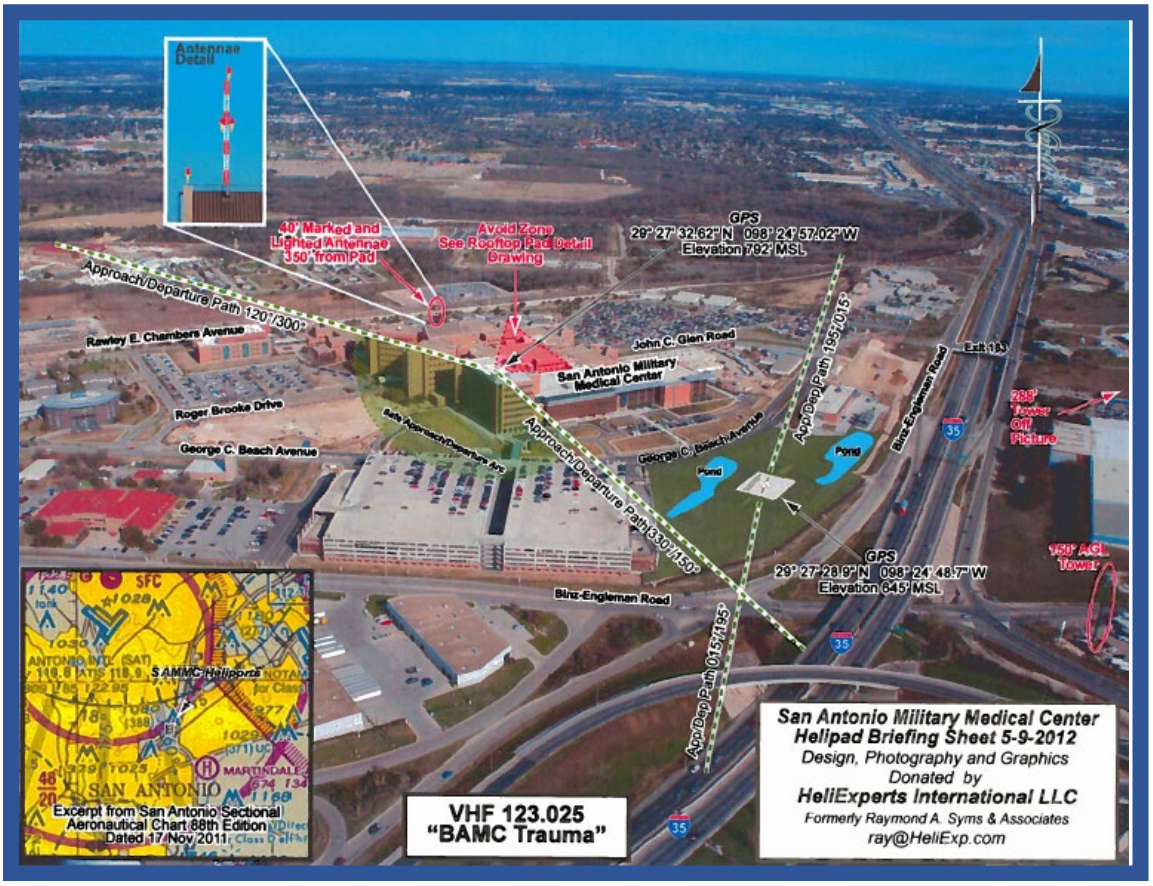
Kelly-based F-16 aircraft routinely conduct Simulated Flameout (SFO) patterns, using extremely high rates of climb and descent near the runway. VFR aircraft should avoid the pattern by 3-4 NM and up to 8000' AGL. The graphic below depicts the descent profiles. Note: For use by 149 FW only during daylight hours.



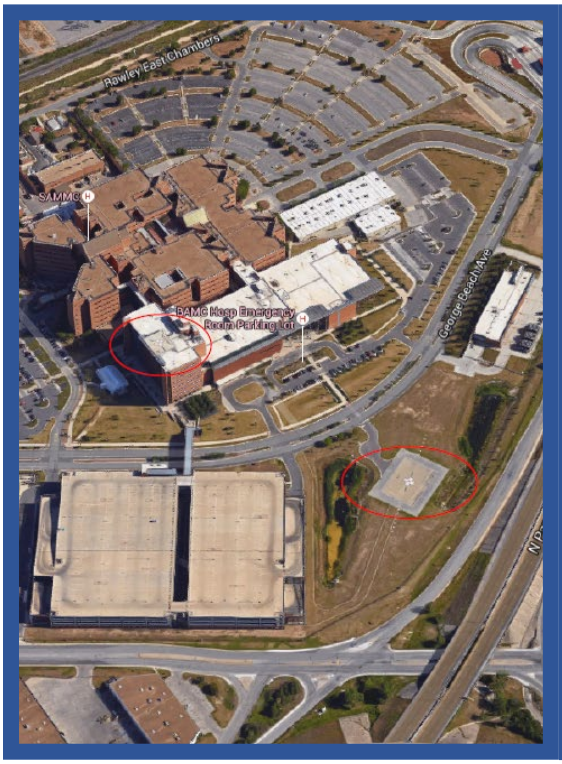
Depicted below are SFO entry procedures at JBSA-Kelly Field.



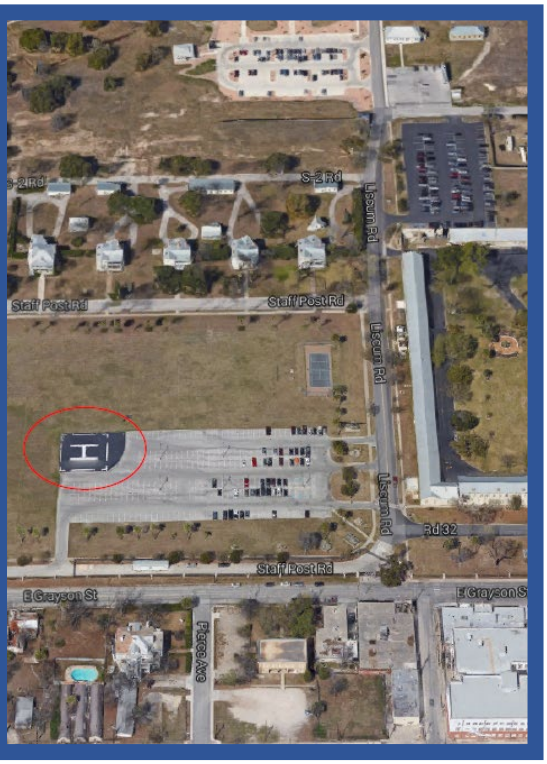
SAMMC ROOFTOP AND GROUND HELIPADS (RESTRICTED)



SAMMC

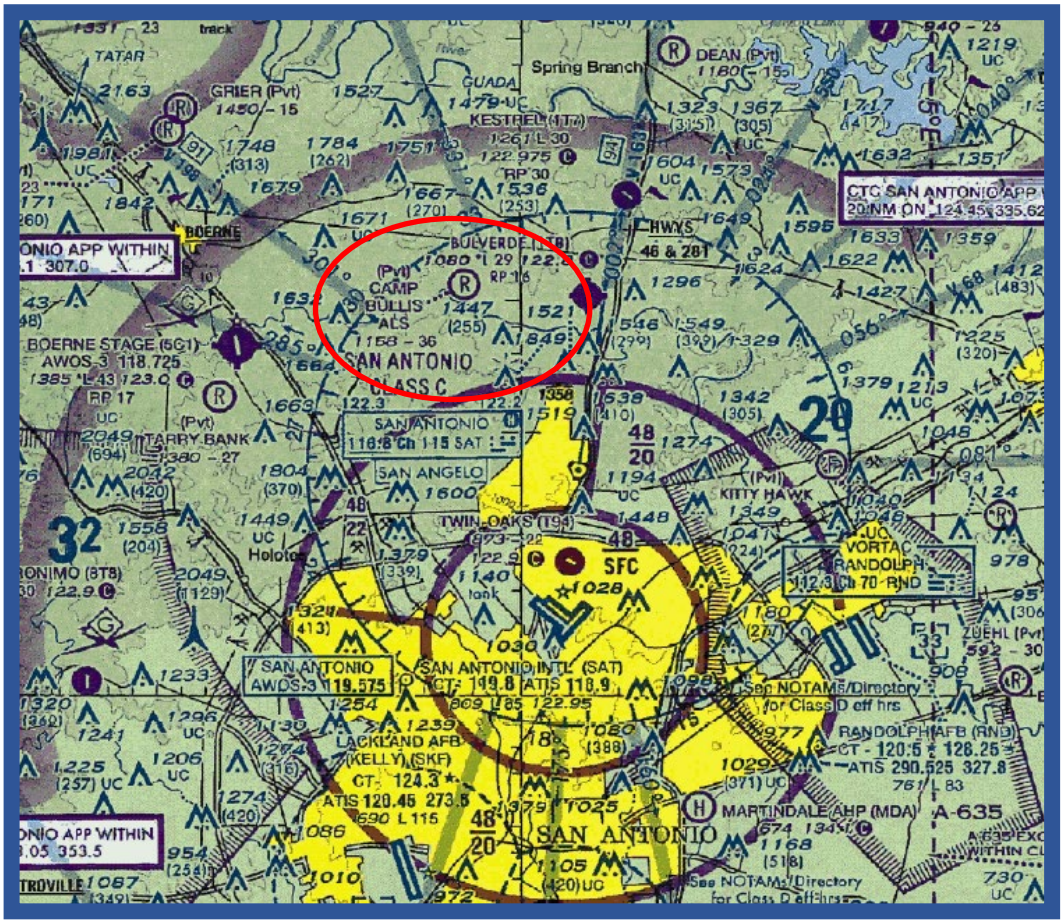


Ft Sam Houston



JBSA-CAMP BULLIS OPERATIONS

Camp Bullis (RESTRICTED)



Helipad

Combat Assault Landing Strip

Military Training and Operations

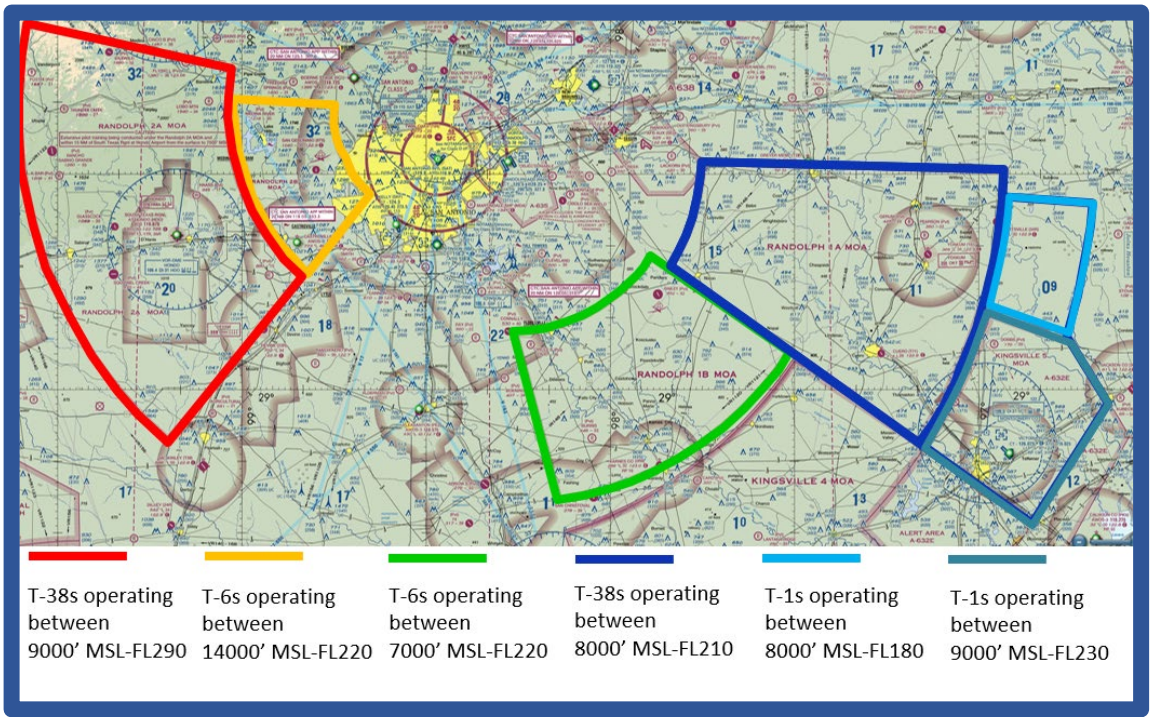
A Military Operations Area (MOA) is an airspace of defined vertical and lateral limits used for military flight training. Its purpose is to separate these flight training activities from IFR traffic. Numerous types of flight training occur within a MOA, to include acrobatic maneuvers, spins, formation flying, air combat training (ACT), basic fighter maneuvers (BFM), traffic pattern stalls and instrument training maneuvers.

IFR traffic can be cleared through a MOA when traffic conditions permit and standard IFR traffic separation criteria can be met by the controlling agency. VFR traffic can legally transit a MOA at any time. However, please consider the following before doing so: Consider a simple loop performed by a T-38. Lowering the nose, the pilot accelerates to 500 knots indicated airspeed (approximately 0.9 Mach - almost supersonic!). When reaching this airspeed, a 5-6 G pull-up is performed, topping out 10,000 feet (almost 2 vertical miles!) above the point at which the loop was begun. This occurs in a matter of seconds. This is followed by an inverted pull-through back down, losing the 10,000 feet that was gained and re-accelerating back to 500 knots as the loop is completed.

If you elect to transit a MOA VFR, military aircraft could potentially approach your aircraft at extremely high rates of closure from virtually any angle. As a result, the ability to "see and avoid" such traffic is almost impossible. The military aircraft being flown in the Randolph MOAs do not have radar. Also, the MOAs are not just occupied by one or two aircraft. Many MOAs are subdivided into multiple sectors both horizontally and vertically. The RANDOLPH 1B MOA is a smaller MOA and can hold up to 12 T-6 aircraft. At peak operating periods you will be a conflict.

Information regarding the Randolph and other MOAs should be consulted during your preflight mission planning. This can be obtained from sectional charts, enroute low altitude charts and VFR terminal area charts. The operating times and altitudes will be as reflected in these publications, unless changed by NOTAM. If you need information concerning a MOA during your flight, contact the agency that controls the MOA, usually the Air Route Traffic Control Center (ARTCC) or the nearest Flight Service Station (FSS).

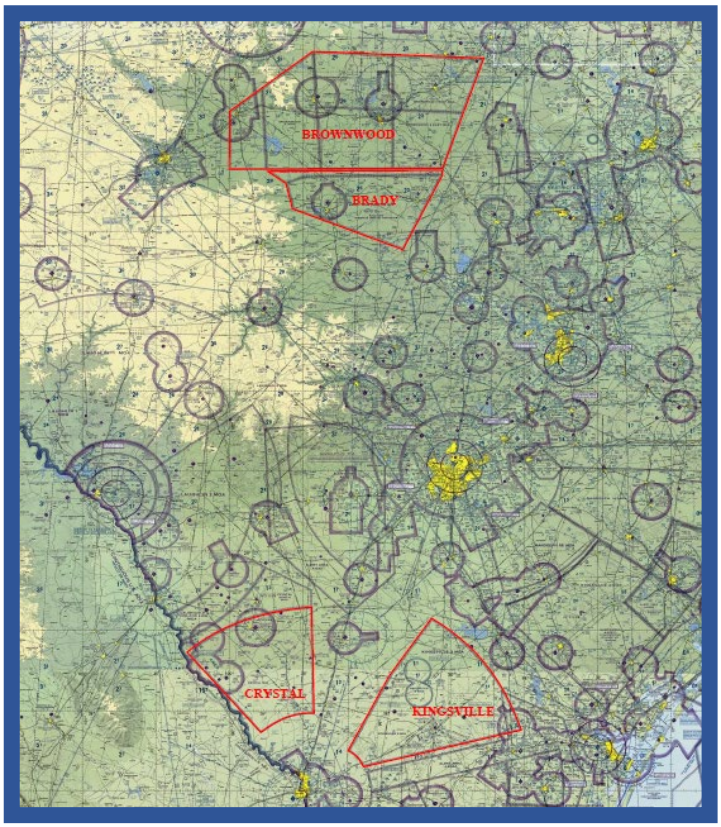
12 FTW MOAs

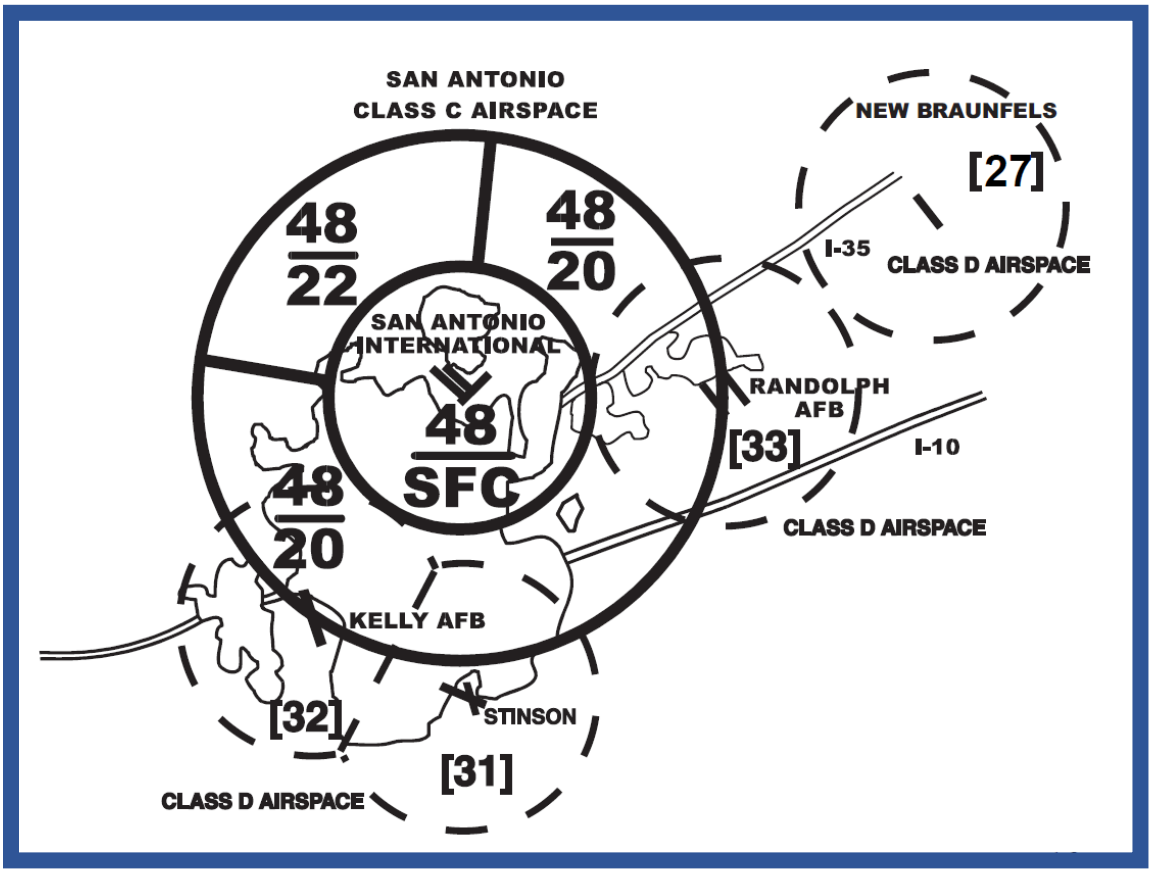


In the San Antonio area, Houston Center controls Military Operations Areas (MOAs), except for Randolph 1B MOA (Green), which is controlled by San Antonio Approach. When flying on an IFR flight plan, the controlling agency will only allow you to transit a MOA if traffic conditions permit and IFR separation can be provided between you and the aircraft in the MOA.

When flying on a VFR flight plan, it is strongly recommended that you not transit an active MOA due to the maneuvers, high speeds, and high closure rates of the military aircraft operating in these areas. It is possible for spins, aerobatics, stalls, and formation flying to be performed in these areas, making it highly unlikely to "see and avoid" such traffic. However, should you decide to transit an active MOA while flying on a VFR flight plan, please contact the controlling agency for traffic advisories.

149 FW MOAs





The San Antonio area contains Class C airspace and is centered on San Antonio International Airport. The inner ring of this airspace extends 5 nautical miles from the airport and the outer ring extends10 nautical miles. In addition to the Class C airspace, there exists an outer area with a radius of 20 nautical miles. Pilots must establish radio contact with approach control before entering the charted Class C airspace (5/10 nautical mile rings).

The San Antonio approach controllers are invaluable to assist you with traffic separation and traffic advisories. If you are transponder equipped, make sure it is on, to include altitude-encoding (Mode C). In VFR conditions, keep your head out of the cockpit, clear all the airspace around you, remain situationally aware, squawk the appropriate transponder code and use these radar services to the max extent possible!!!!!

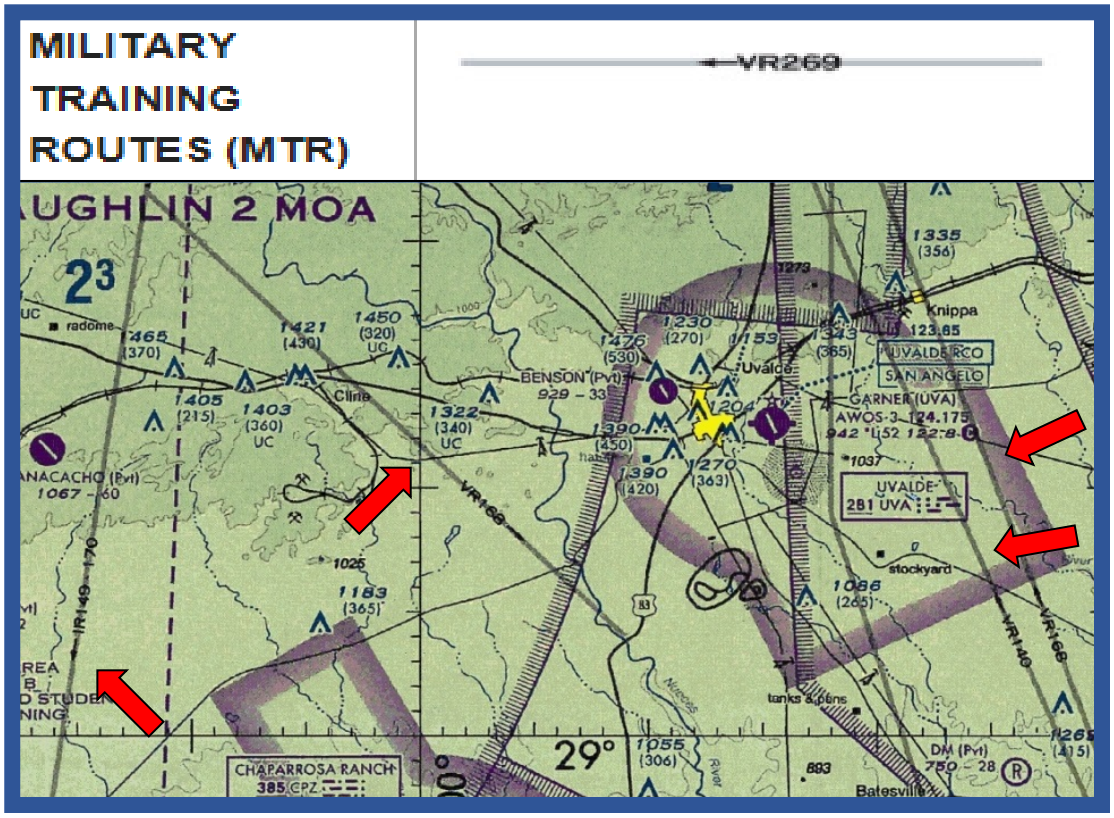
The frequencies to contact San Antonio approach will vary depending on the direction you approach the city from. These frequencies are as depicted on the VFR sectional chart and indicate that arriving aircraft should contact approach control within 20 nautical miles of the San Antonio International airport. This insures an appropriate safety margin in case of frequency congestion, allowing you time to attempt contact and stay out of the Class C airspace should difficulties be encountered and you are not able to contact the controller.

MILITARY TRAINING ROUTES

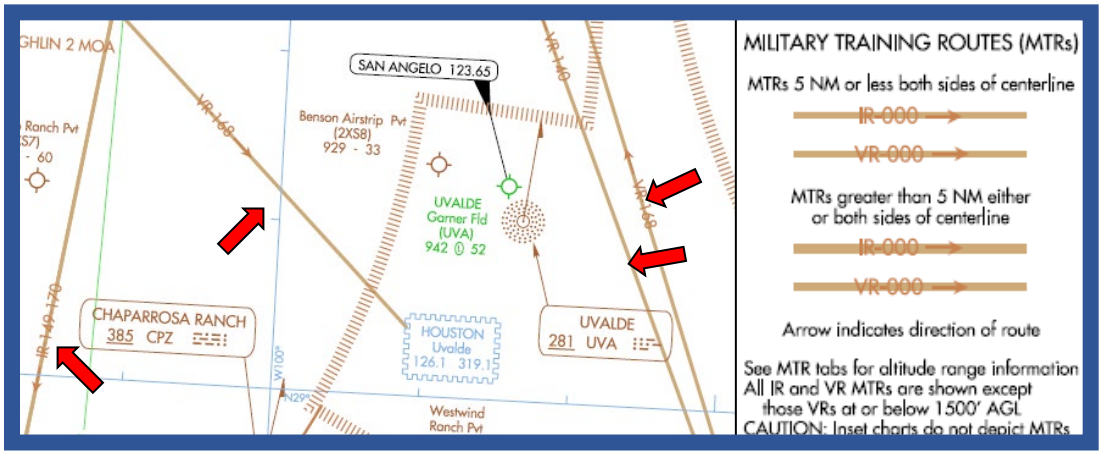
Military Training Routes (MTRs) and Slow Speed Low Altitude Training Routes (SRs)

A Military Training Route is a low altitude route of flight defined by vertical and lateral dimensions established for the conduct of military flight training in excess of 250 knots below 10,000 ft. MSL. They are depicted on Sectional Charts (light grey lines) and US IFR Enroute Low Altitude Charts (light brown lines).

SECTIONAL LEGEND AND CHART



IFR ENROUTE LOW ALTITUDE LEGEND AND CHART

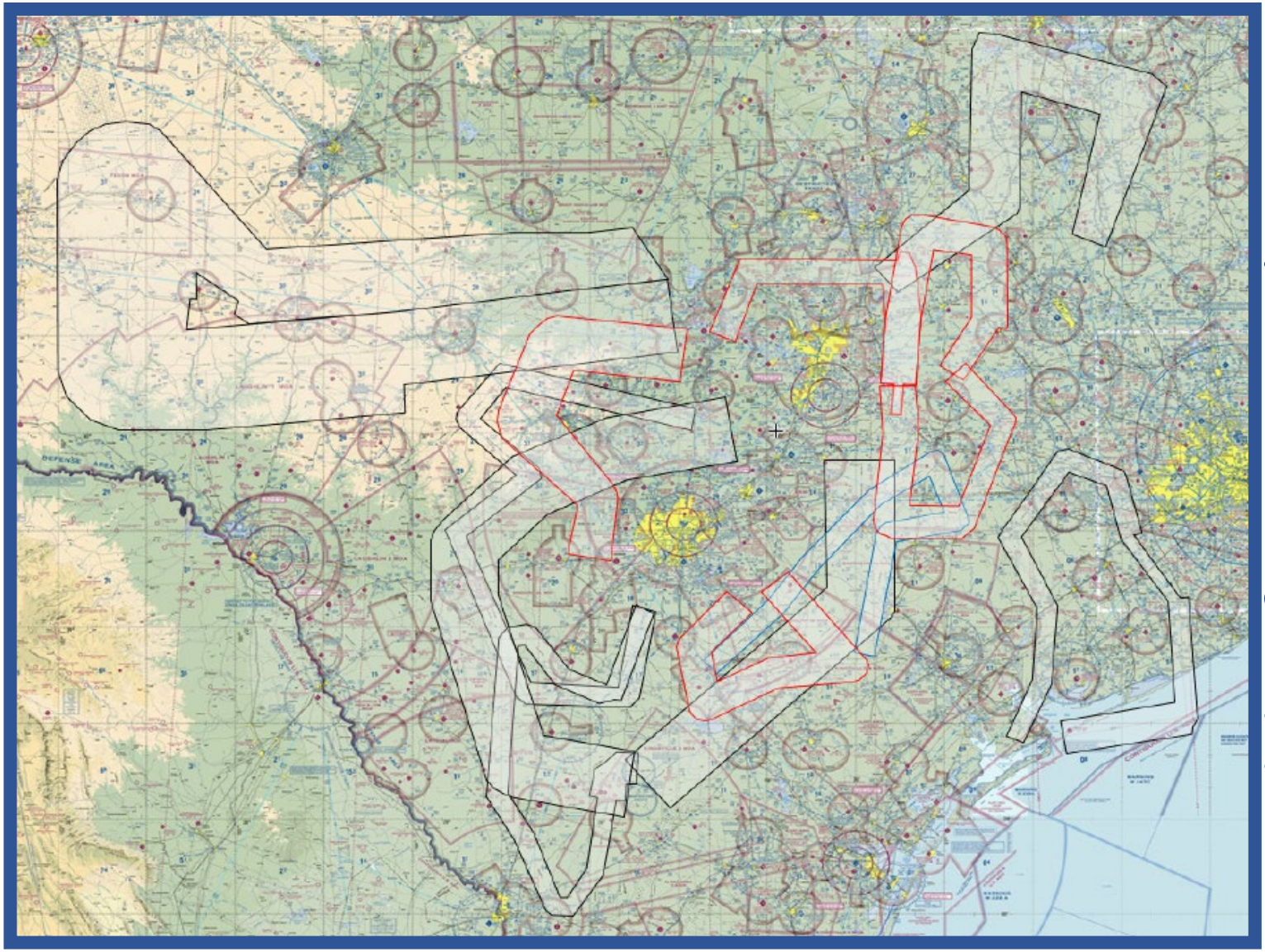


Visual Route (VR)
500-1500'AGL,
300-450 knots.

Instrument Route (IR)
Same altitude and airspeeds as VR, but require an altitude reservation (ALTRV) and may be flown in IFR.

Slow Route (SR)
Unlike IR/VR routes, FSS *will not* know if SRs are active.

** Military aircraft can choose a route anywhere within the published boundary width -- not just the route centerline depicted on the charts. Watch out for formations!

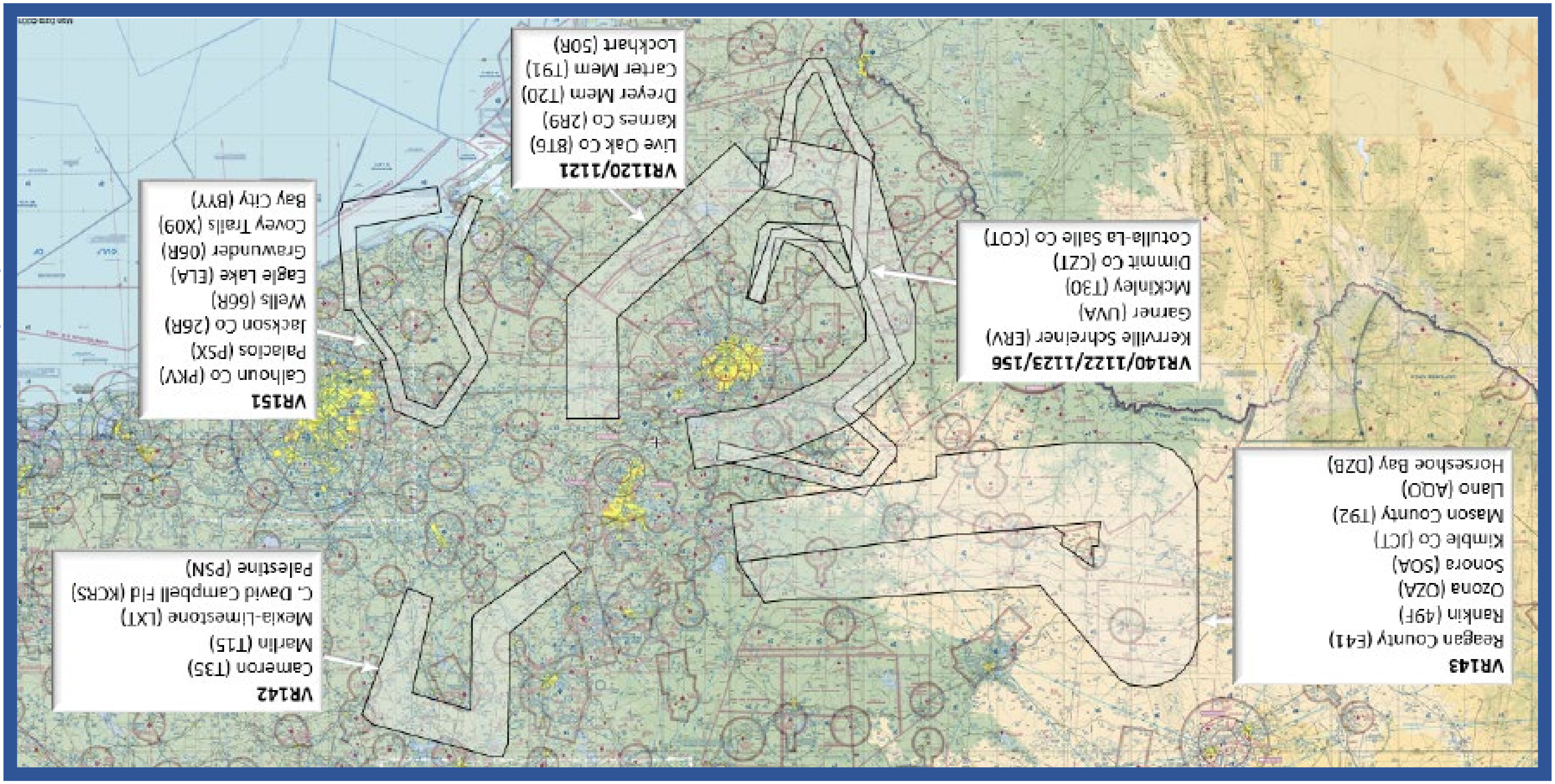


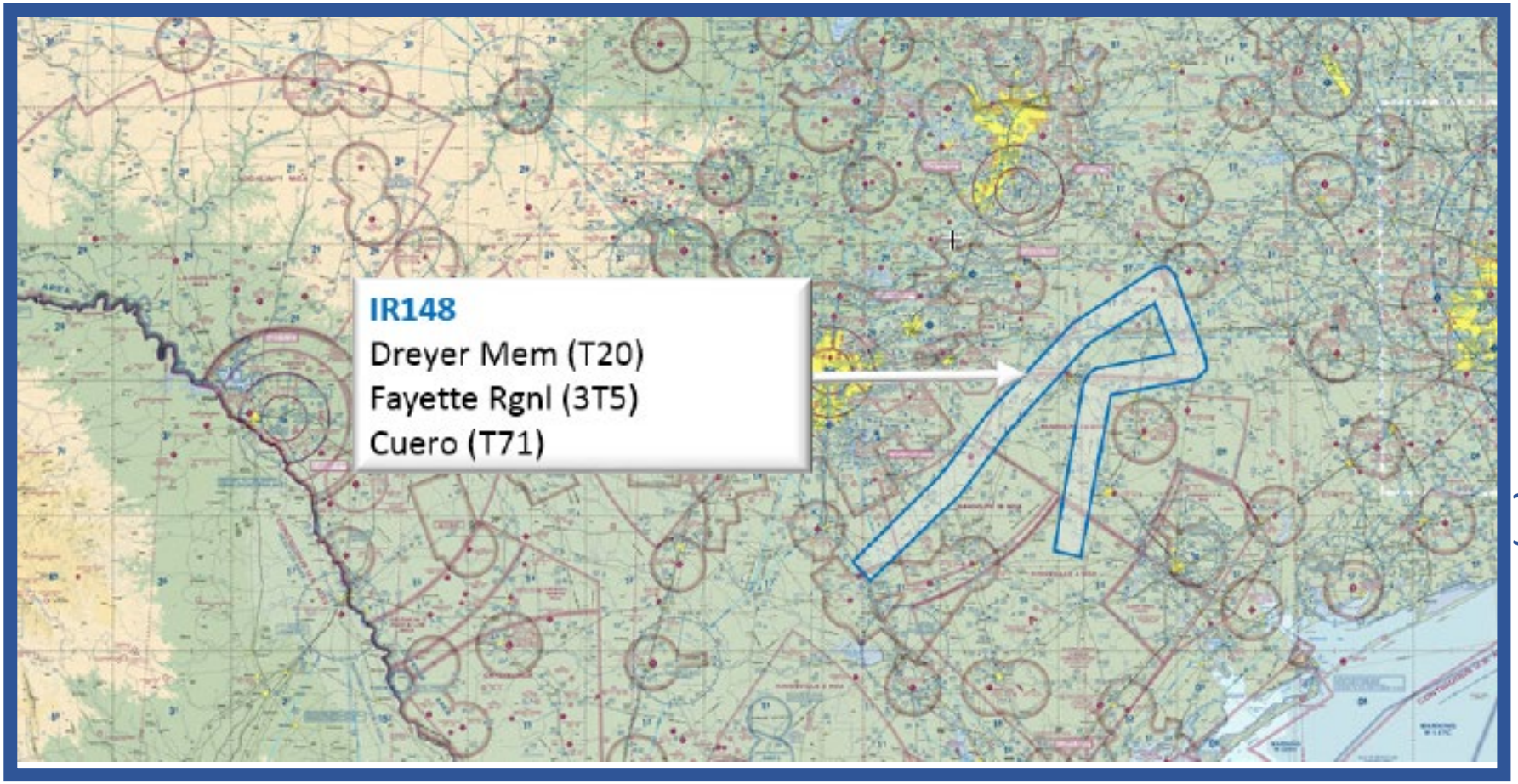
Military Training Routes (MTRs) and
Slow Speed Low Altitude Training Routes (SRs)

MILITARY TRAINING ROUTES

MTRs – Visual Routes in South TX

Visual Routes (VRs)

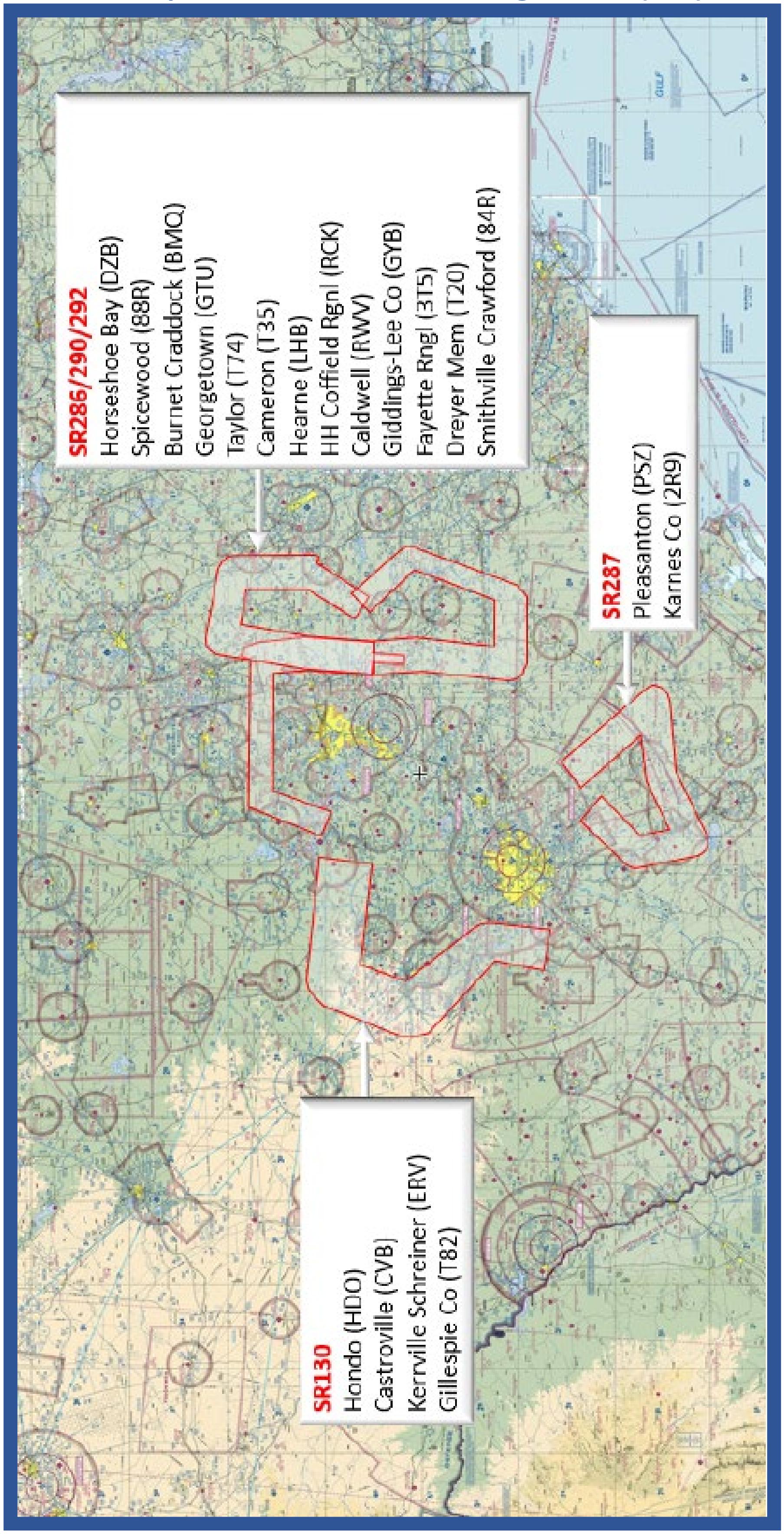




MTRs – Instrument Route in South TX

SRs – Slow Routes in South TX

Slow Speed Low Altitude Training Routes (SRs)



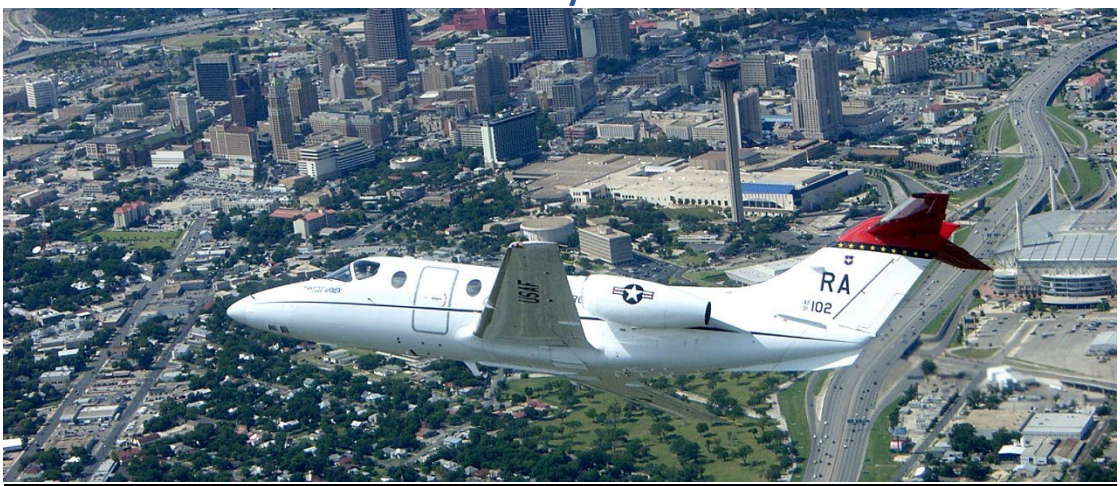
T-38C Talon

Length: 46 ft., 4.5 in. **Height:** 12 ft., 10.5 in. **Wingspan:** 25 ft., 3 in.
Speed: 812 mph (Mach 1.08 at sea level) **Ceiling:** 50,000 ft.

T-6A Texan II

Length: 33 ft., 4 in. **Height:** 10 ft., 6 in. **Wingspan:** 33 ft., 3 in.
Speed: 364 mph **Ceiling:** 31,000 feet

T-1A Jayhawk



Length: 48 ft., 5 in. **Height:** 13 ft., 11 in. **Wingspan:** 43 ft., 6 in.
Speed: 538 mph (Mach 0.73) **Ceiling:** 41,000 ft.

JBSA-KELLY FIELD AIRCRAFT

F-16C/D Fighting Falcon

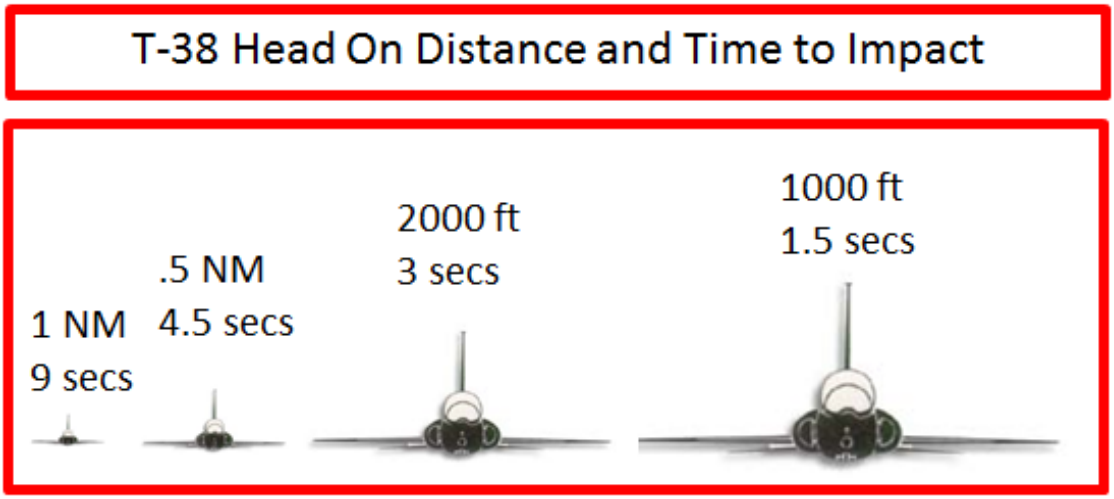
Length: 49 ft., 5 in. **Height:** 16 ft. **Wingspan:** 32 ft., 8 in.
Speed: 1,500 mph (Mach 2 at altitude) **Ceiling:** above 50,000 ft.

C-5M Super Galaxy

Length: 247 ft., 1 in. **Height:** 65 ft., 1 in. **Wingspan:** 222 ft., 9 in.
Speed: 571 mph (Mach 0.77)

Statistics indicate the majority of midair collisions occur during the day, in VFR weather conditions, in controlled airspace, at lower altitudes (5000 feet AGL or less), and close to an airport (within 5 miles). The reasons are obvious: these are the times, locations and conditions in which the heaviest flying activity occurs.

Because of the congested airspace the pilot operates in and the limitations of the human eye, it becomes readily apparent that midair collision avoidance is a concern that must be addressed before stepping in the cockpit. Here is an example of how a T-38 head to head pass would look:



Here are some additional tips on clearing:

1. HOW TO CLEAR. You've probably learned about clearing, so here's a quick refresher on how we teach military students to visually clear. Begin by breaking down the visible area through the windscreen into sectors. Allow your eyes to adjust and search each sector before moving to the next. Small head movements can sometimes help distinguish between a bug splat and traffic. If you spot traffic, take note of its movement. If the traffic is moving on your windscreen, you will not fly over the same spot on the ground. However, if the traffic is remaining stationary on your windscreen USE CAUTION. In the military we call this "zero line-of-sight". It means if you or the traffic does not change direction, you will fly over the same point on the ground. Without altitude deconfliction between your plane and the traffic, this could mean a collision!

2. MISSION PLAN WITH AN AWARENESS OF POTENTIAL CONFLICTS. Know where high-density traffic areas are. This is where your knowledge of military flight operations becomes important. Review the location of military airfields, MOAs, low level routes and alert areas. Plan your flight to avoid potential conflicts to the greatest extent possible. Insure you fly the correct altitude for direction of flight. In addition, review the airfield layout and ground references associated with your destination--this will help you when other aircraft make position reports at that airport.

3. USE ALL AVAILABLE RADAR SERVICES. When operating in controlled airspace, always maintain flight following for traffic advisories, even when not in radar contact. Transponder equipped aircraft should always set the appropriate codes. Ensure the altitude-encoding (Mode C) feature is on and operable. Though you may not be in

radar contact with the controller, some aircraft have TCAS (Traffic Collision Avoidance System) equipment and can monitor your position and avoid you, but only if your transponder is on and operable.

4. PRIORITIZE COCKPIT DUTIES AND REMAIN SITUATIONALLY AWARE. Review approach plates, enroute charts, and other inflight materials as much as possible on the ground to reduce the amount of time you are reviewing them in the cockpit during flight. When it does come time to review such materials inflight, hold them just below the glare shield, if possible, so the periphery of your vision remains outside. This will minimize the "heads down" syndrome. Always make several clearing scans during your review of inflight materials, and never keep your eyes inside the cockpit for an extended length of time. Prioritize your cockpit duties: maintain aircraft control and clear FIRST! Everything else is secondary. Stay situationally aware by monitoring your position and the position of other aircraft around you (both visually and on the radios). As instructors, don't get complacent! Many mid-air collisions occur during periods of instruction.

5. "SEE AND AVOID". These procedures are critical for VFR traffic. Air traffic controllers are not required to provide separation between VFR aircraft outside of Class C airspace. They may provide traffic advisories for VFR aircraft if time and workload allow. Remember, there is no guarantee that everyone is flying by the rules, or that anyone is where they are supposed to be.

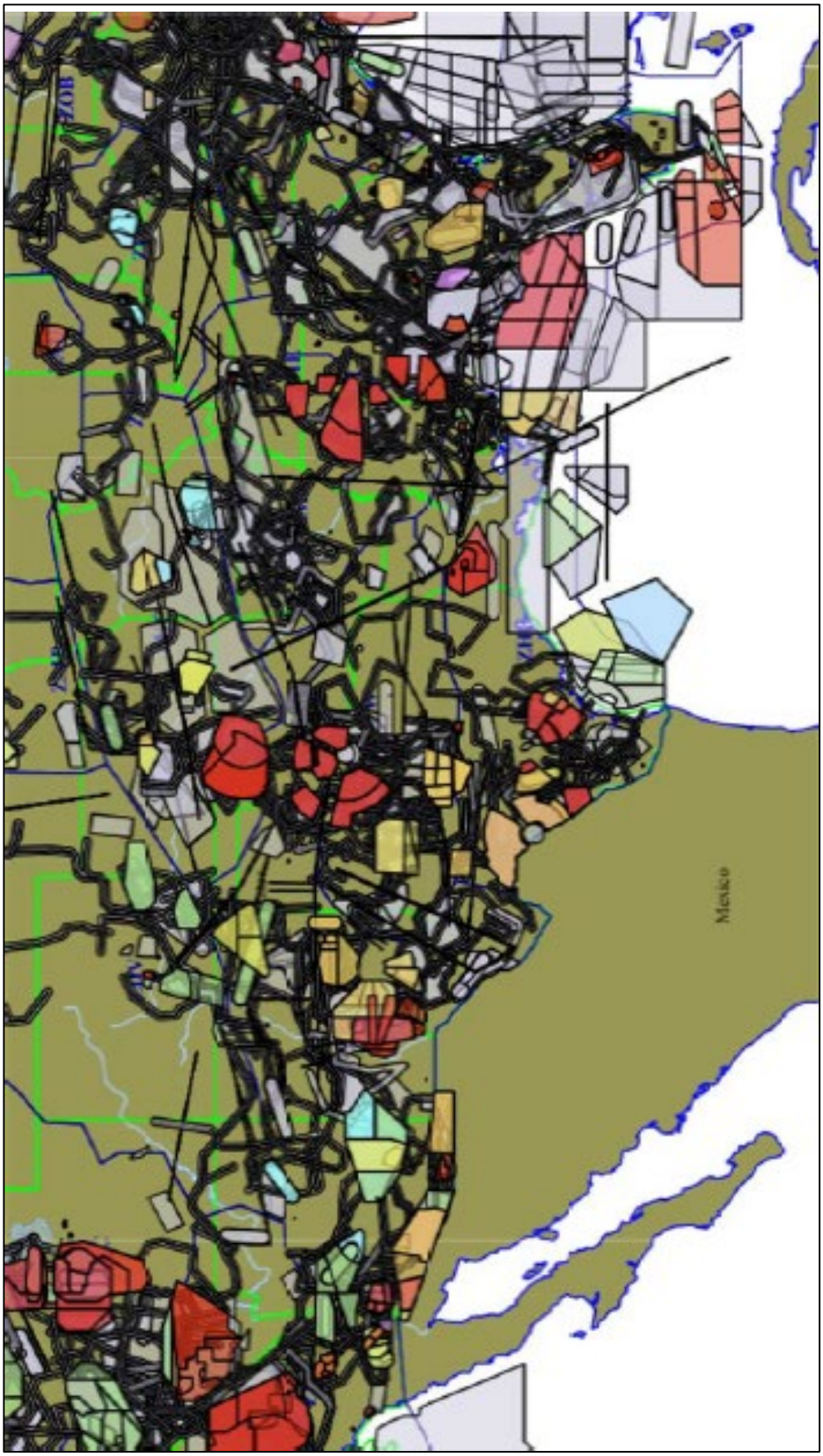
6. FACTS.
- Average 13 Mid-Air Collisions (MACs) Per Year - Most Often Fatal
- Most Occur…
  -- Daylight, VMC, 1000–1700 ft. AGL
  -- Weekends of Warmer Months
  -- Within 5 NM of an Airport
  -- 80% at or Below 3000 ft. AGL, 31% at or Below 500 ft. AGL
  -- 45% in the Pattern (76% on Final)
- Head-on MAC is Rare
  -- 5% Head-on
  -- 33% were 0-10 degrees (Straight Behind)
  -- 82% at Overtaking Converging Angles
- Flight Time NOT a Major Risk Factor
- CFIs at High Risk - 10% of Pilot Population, Involved in 35.5% of MACs

(Source: AOPA ASF Safety Advisor, Operations and Proficiency No. 4)

- In a Three-year NTSB study, most MACs:
  -- Were on Pleasure Flights
  -- No Flight Plan Filed
  -- VMC Conditions (Nearly All)
  -- Weekend Daylight Hours
  -- Faster Aircraft Overtaking/Hitting Slower Aircraft
  -- Experience Level Ranged Initial-Solo to 15,000 Hours
  -- Uncontrolled Airports Below 3,000 ft. AGL.
  -- Enroute MACs below 8,000 feet, within 25 NM of Airport
  -- CFIs Onboard One or Both aircraft 37% of time

(Source: National Transportation Safety Board)

Is it active? Contact FSS/ATC for updates.



Source: https://sua.faa.gov/sua/siteFrame.app

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