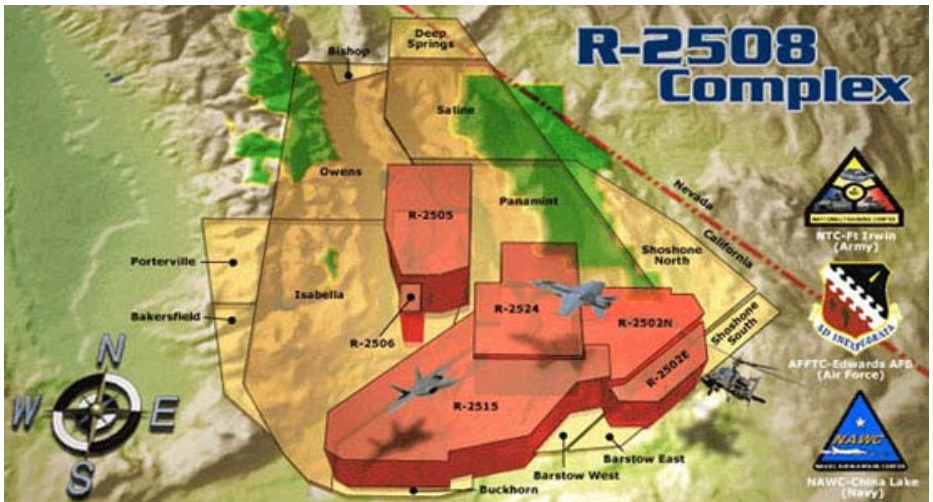


MIDAIR COLLISION AVOIDANCE



- ▶ A Civilian Pilot's Guide to Navigating the R-2508 Complex, surrounding Edwards AFB, China Lake NAS and Ft. Irwin

This publication Includes:

- A description of the R-2508 Complex and resident missions
- Hazards to civilian pilots while flying in the Complex
- Procedures and techniques to safely fly through the Complex
- Techniques to identify and avoid midair collisions

**Written By: The Air Force Flight Test Center,
Flight Safety Office, Edwards AFB, CA**

Fellow Aviators,

This pamphlet is designed to increase your awareness of military operations in the R-2508 Complex , supporting the mission of Edwards AFB, China Lake NAS and Ft. Irwin. It includes information on restricted areas, military operating areas (MOAs), and low-level training routes. Additionally, it describes how to avoid the hazards in the R-2508 Complex and transit to your destinations safely. I hope this information will help you better understand our local military operations and will facilitate an enjoyable, safe flying environment for all concerned.

I solicit your comments and recommendations for improvement. If you have a group of 10 or more aviators and are interested in having my Flight Safety Officers visit your organization and provide a Midair Collision Avoidance (MACA) seminar, call us at (661) 277-2623 (DSN: 527-2623) or write us at:

AFFTC/SEF
35 North Wolfe Ave.
Edwards AFB CA 93524-6755

MICHAEL A. MCKENNA, Colonel, USAF
Chief of Safety

SUMMARY OF REVISIONS

Complete revision was made to airspace descriptions, techniques, and figures to clarify this pamphlet for the general aviation audience.

OPR: AFFTC/SEF (Mr. Bill Koukourikos, DSN 527-2623)

Approved by: AFFTC/SE (Col McKenna)
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Table of Contents

Missions of the R-2508 Complex	4
Edwards AFB and the Air Force Flight Test Center	
NASA Dryden Flight Research Center	
China Lake NAS and the Naval Air Weapons Division	
Fort Irwin and the National Training Center	
Mojave Spaceport	
Outside Users of the Complex	
The R-2508 Complex	10
Restricted Areas	
Military Operating Areas	
Military Training Routes (Low Levels below 1,500' AGL)	
Controlled Firing Area (The Trona Gap)	
Navigating the Complex	17
Civilian Routing	
Five Steps to Safely Transit the R-2508 Complex	
Military Formation Flying Procedures	
Avoiding a Midair Collision	21
Pilot Reaction Time	
Your Reaction Time (or lack of it)	
Scanning Techniques	
Techniques to Finding the Traffic	
Some Common Avoidance Tips	
Detachable Card for In-Flight Navigating of the R-2508 Complex	25
Local Frequencies	

Edwards AFB

The Air Force Flight Test Center is the world's premier flight test facility. Every day, aircraft of all types take to the skies around the famed Rogers Dry Lakebed to expand the capabilities of controlled flight. These hallowed skies have seen the conquering of the supersonic flight, the expansion of jet speeds never imagined, the recovery of spaceships and the development of robot aircraft. Nearly every piece of technology used in your civilian aircraft was at one time flight tested at the Center.

Today, the Center is testing the new F-35 Joint Strike Fighter, developing the Airborne Laser, expanding the capabilities of robot aircraft like the Global Hawk and Predator, and even testing a new jet fuel made from US coal, instead of imported oil. The expansion of current capabilities continue alongside these major programs, from envelope expansion of current jets, to avionics upgrades, and expanded weapons capabilities.

The Center is also home to the USAF Test Pilot School. The school teaches experienced pilots and engineers from across the USAF and allied air forces the procedures for safe and effective flight testing, graduating two classes of flight test professionals each year.

At Edwards AFB, we are Testing the Future—Today!



NASA Dryden

The Dryden Flight Research Center is co-located with Edwards AFB and is NASA's center for aeronautical flight research and atmospheric flight operations. NASA Dryden is chartered to research, develop, and transfer advanced aeronautics, space and related technologies. Recently, the SOFIA, an airborne world-class observatory has joined the Dryden team and will complement space and major ground based telescopes. The X-48 blended wing transport has entered research alongside autonomous formation flight and warping wing research. Another recent endeavor is the reduction of sonic boom noise by altering the shape of aircraft nose sections. All these programs are tailored to expand our aeronautical knowledge and discovery of our universe.

Dryden is also a backup landing site for the Space Shuttle and has seen multiple recoveries in recent years. The Shuttle is prepared for ferry back to the Kennedy Space Center after it arrives here and is loaded on NASA's specially modified 747.

NASA Dryden also operates an educational facility in the city of Palmdale, where adults and youngsters can learn about the world of space and aviation. The facility is next to the Palmdale City Hall on Palmdale Blvd.



SOFIA



X-48



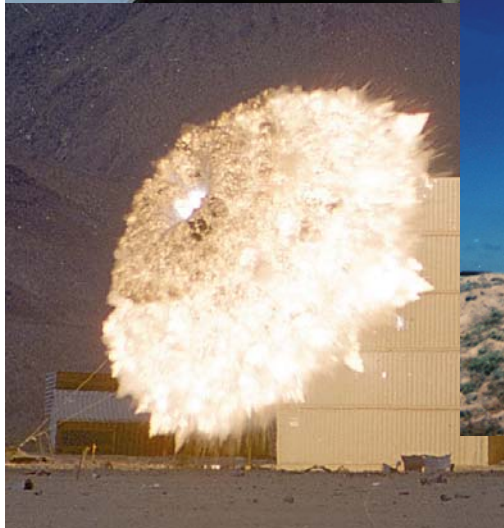
Autonomous Refueling



China Lake Naval Air Station

The Naval Air Weapons Station China Lake is located within a day's travel of both the highest (Mt. Whitney) and the lowest points (Badwater in Death Valley) in the contiguous 48 states. China Lake is located in the California Mojave Desert and is considered High Desert.

The Station was established in 1943 when the Navy was looking for a sparsely populated area with near perfect flying weather and practically unlimited visibility that could handle the mission of serving as a research, development and testing area for weapons. An early partnership established a pattern of cooperation and interaction between civilian scientists and engineers, the military, and defense contractors that continues to this day.



Fort Irwin

The Army's National Training Center (NTC) prepares soldiers for the rigors of combat in a desert environment. Located north of the Barstow area, Ft. Irwin is a wide expanse of land used for full scale combat training operations, including air support from the US Air Force's Weapons School at Nellis AFB, NV. Thousands of soldiers have rotated through the NTC and then deployed to areas throughout the world in support of national defense objectives.



THE NATIONAL TRAINING CENTER AND FORT IRWIN

The world's premiere training center for the world's finest Army!



A collage of images at the bottom of the page. On the left is a soldier in a helmet. Next to him is a soldier in a beret with a child. In the center is a tank. On the right is a soldier in a helmet. The background is a yellow and red gradient.

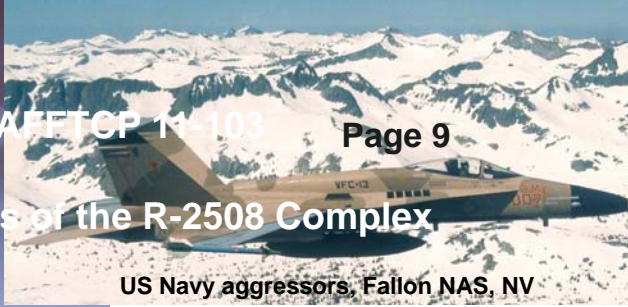
Mojave Spaceport

Mojave Air and Space Port emerged as the leading aerospace test center supporting commercial operations in North America. No longer a sleepy north desert general aviation destination, Mojave Air and Space Port amassed more first flights and significant newsworthy flight activity than any other airport in the world over the past 5 years. It is currently home to over 40 companies engaged in flight development of highly advanced aerospace designs, flight test and research and even heavy rail industrial manufacturing. Mojave Air and Space Port is the home of SpaceShipOne and Burt Rutan's Scaled Composites; the premier civilian flight test school, the National Test Pilot School; rocket companies like XCor and even a storage facility for unused airliners. What Edwards AFB is to the military, Mojave Air and Space Port is to civilian flight research.



SOURCE: Scaled Composites

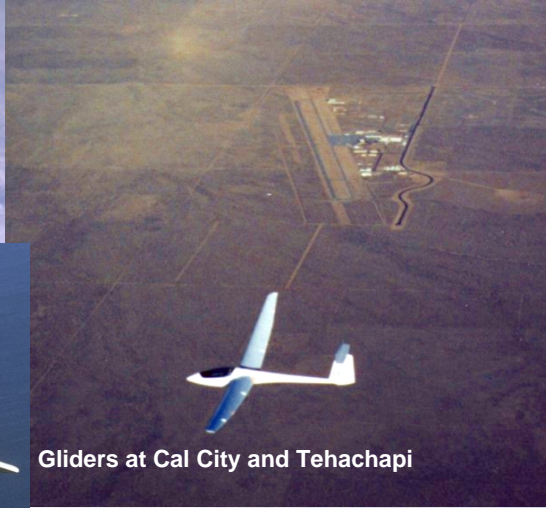
Outside Users of the R-2508 Complex



US Navy aggressors, Fallon NAS, NV



US Navy combat training from Lemoore NAS, CA and various aircraft carriers off the coast as part of fleet certification



Gliders at Cal City and Tehachapi



And YOU!

Commercial Jet Flight Test



Maintenance Check Flight

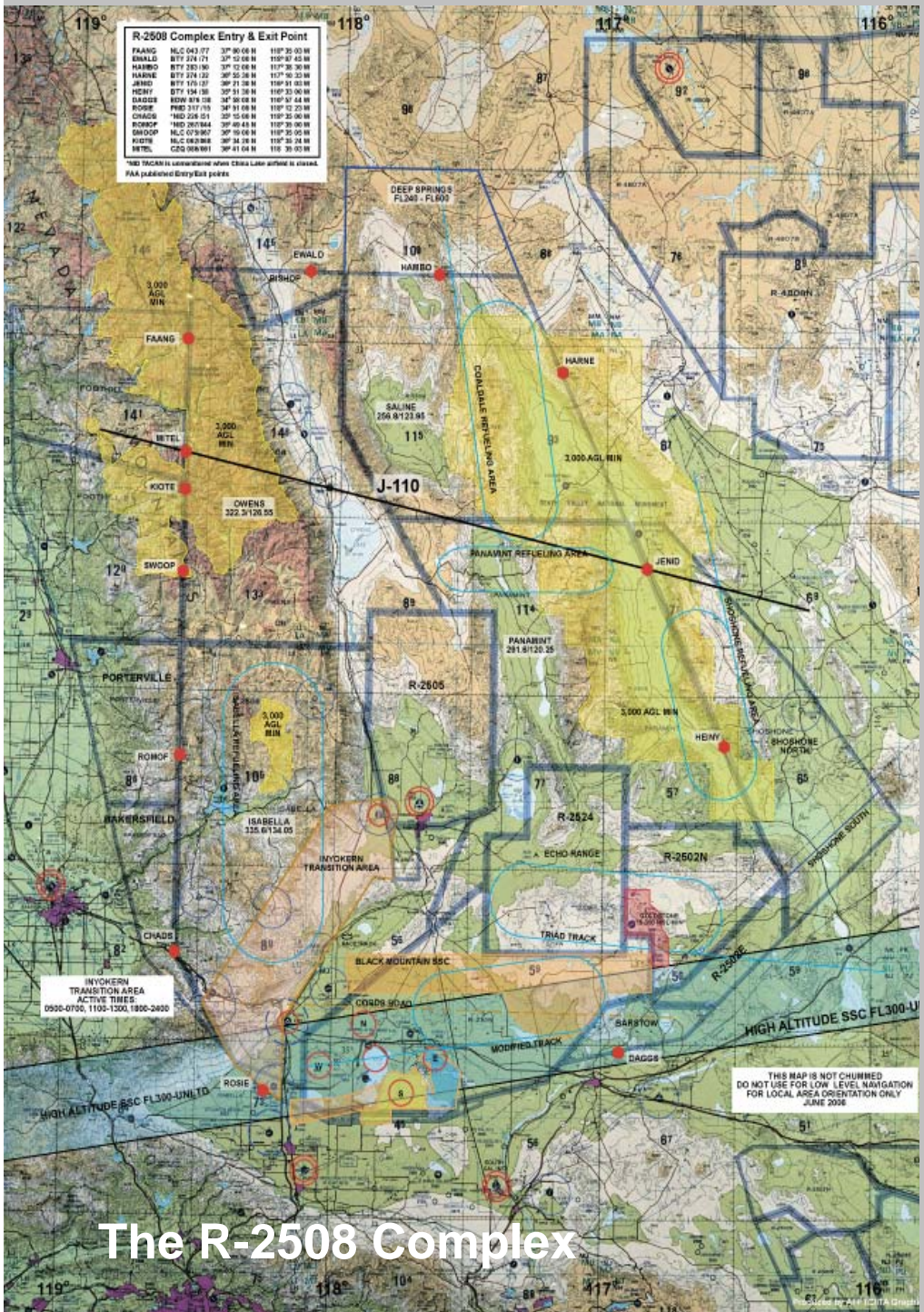


USAF Weapons School, Nellis AFB, NV

R-2508 Complex Entry & Exit Point

FAANG	MLC 043 07	37° 30' 00" N	110° 35' 00" W
EWALD	DTY 274 01	37° 32' 00" N	110° 37' 45" W
HARBO	RTY 283 00	37° 42' 00" N	110° 36' 30" W
HARNE	DTY 274 02	36° 55' 30" N	110° 30' 30" W
JENID	RTY 116 02	36° 21' 30" N	110° 31' 45" W
HENRY	DTY 154 06	37° 31' 30" N	110° 33' 00" W
ROSE	RTY 176 02	37° 30' 00" N	110° 37' 45" W
CHADS	MLC 268 08	37° 15' 00" N	110° 35' 00" W
ROSCOP	FRSD 217 03	34° 31' 00" N	110° 42' 30" W
SWOOP	MLC 268 09	37° 15' 00" N	110° 35' 00" W
ROSCOP	MLC 267 04	37° 40' 45" N	110° 39' 00" W
SWOOP	MLC 073 00	37° 15' 00" N	110° 35' 00" W
KIOTE	MLC 062 08	38° 34' 30" N	110° 30' 34" W
INTEL	CDG 006 01	39° 41' 00" N	110° 36' 00" W

110° TRICHINA is uncorroborated from China Lake and/or is suspect.
FAA published Entry/Exit points



The R-2508 Complex

The R-2508 Complex

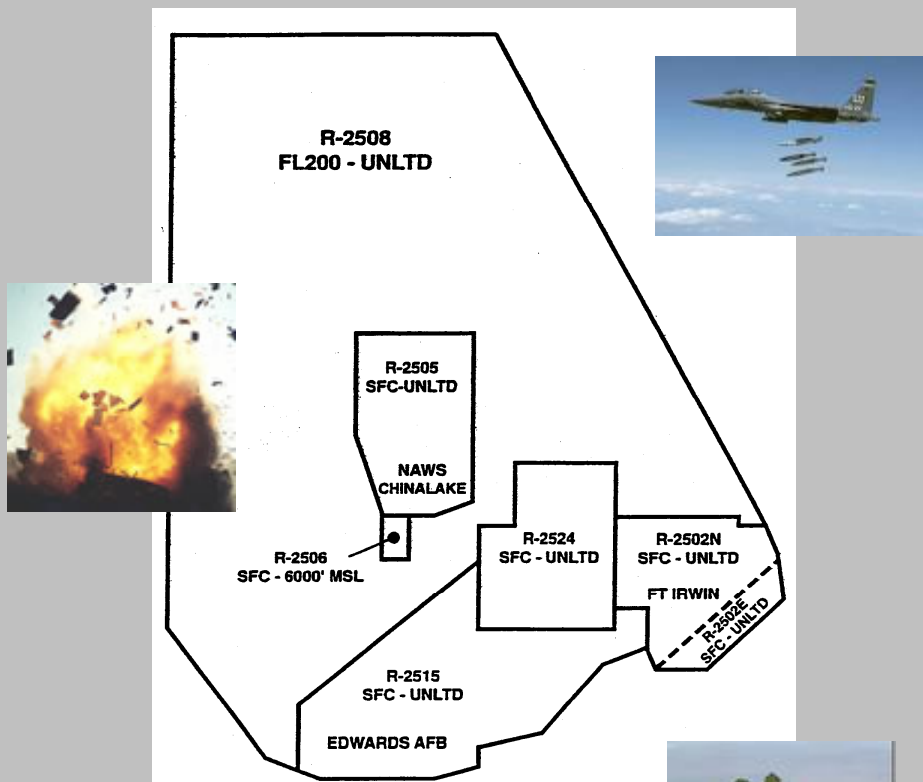
The R-2508 Complex is one of the largest military “special use” areas in the United States. Located around the Mojave Desert, it covers almost 16,000 square miles. Since this airspace is used extensively by all the military services, you need to be aware of the potential conflicts you might encounter when transitioning the area. This knowledge will help reduce the risk of a midair collision. A number of civilian communities, airports, and recreational parks underlie the confines of the R-2508 Complex increasing the potential for a midair conflict.

For flights inside the complex, realize that borders between restricted areas and military operating areas (MOAs) are normally hard boundaries for general aviation aircraft. However, these borders may be soft boundaries for *military aircraft*. You may find fast moving aircraft coming from directions you don't anticipate.

For flights just outside the complex, avoid the airspace boundaries by at least 3 nautical miles as a rule of thumb. This provides you with some buffer airspace since military traffic may fly right up to the complex boundary.



Restricted Areas



Restricted areas are areas where extreme hazards exist in the form of unusual (and often "invisible") threats to aircraft, such as artillery firing, aerial gunnery, laser firing, guided missiles, unmanned aircraft and flight test. These areas are active ("hot") on a continuous basis unless released. During such "released periods," the FAA controlling agency may permit aircraft to operate in certain restricted areas. When active, you must obtain approval from the military controlling agency prior to entering a restricted area. During most late nights, weekends and federal holidays, the Complex may be cold. Get a clearance from Joshua BEFORE entering the airspace.

Restricted areas are assigned a number. For example, R-2515 is the restricted area surrounding Edwards AFB. Further, some restricted areas are contained within larger restricted areas. For example, R-2515 (Edwards area) sits inside of the lateral boundaries of R-2508. The difference usually involves the specific altitude blocks you are to avoid.

Military Operating Areas (MOAs)

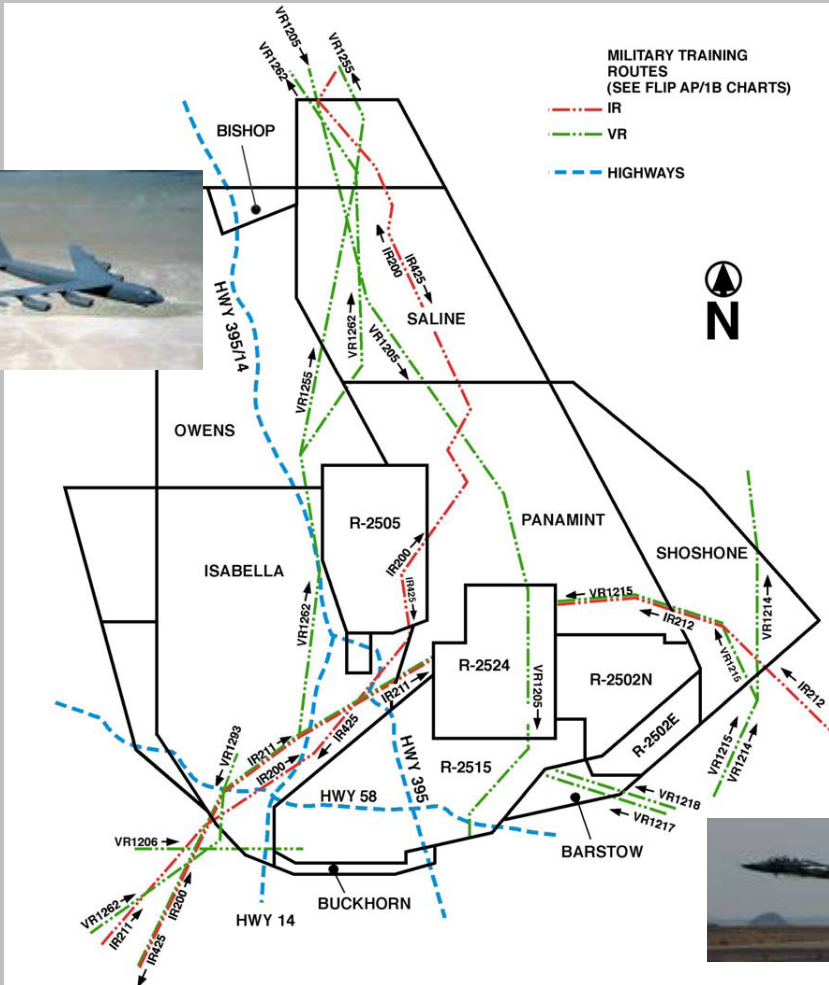


81380.05

MOA airspace is established to separate/segregate certain military activities from IFR traffic and to identify for VFR traffic where these activities are conducted. These activities include air combat maneuvers, air intercepts, aerobatics, low altitude flight, etc. MOAs are depicted on your sectional. The vertical dimensions of the MOAs in the R-2508 Complex range from 200 feet AGL up to, but not including FL 180.

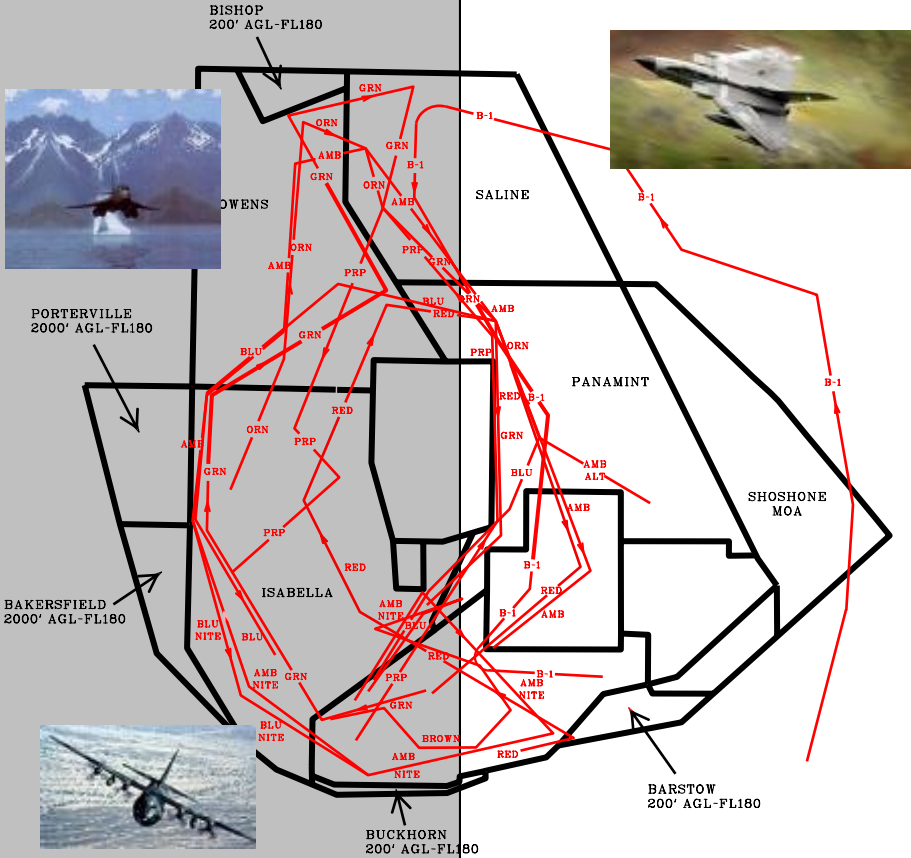
You may fly through a MOA any time you like, and you do not need to coordinate with anyone prior to or during your flight. However, considering the potential conflicts with military users, it is highly advisable to contact Joshua for traffic advisories; as well as squawk Mode 3/C and use landing/taxi lights for better visibility. (see page 18)

Military Training Routes (MTRs)



These routes, further classified as IR Routes and VR Routes, are low-level navigation routes running through and around the R-2508 Complex. On these routes, aircraft can travel in excess of 500 knots as low as 200 feet AGL. In fact, many of the military training routes have a base altitude designated as "surface," and military aircraft may operate right on the deck! Many of the turn points along the military training routes are road intersections or other well-defined geographic points YOU might use yourself for a cross-country flight.

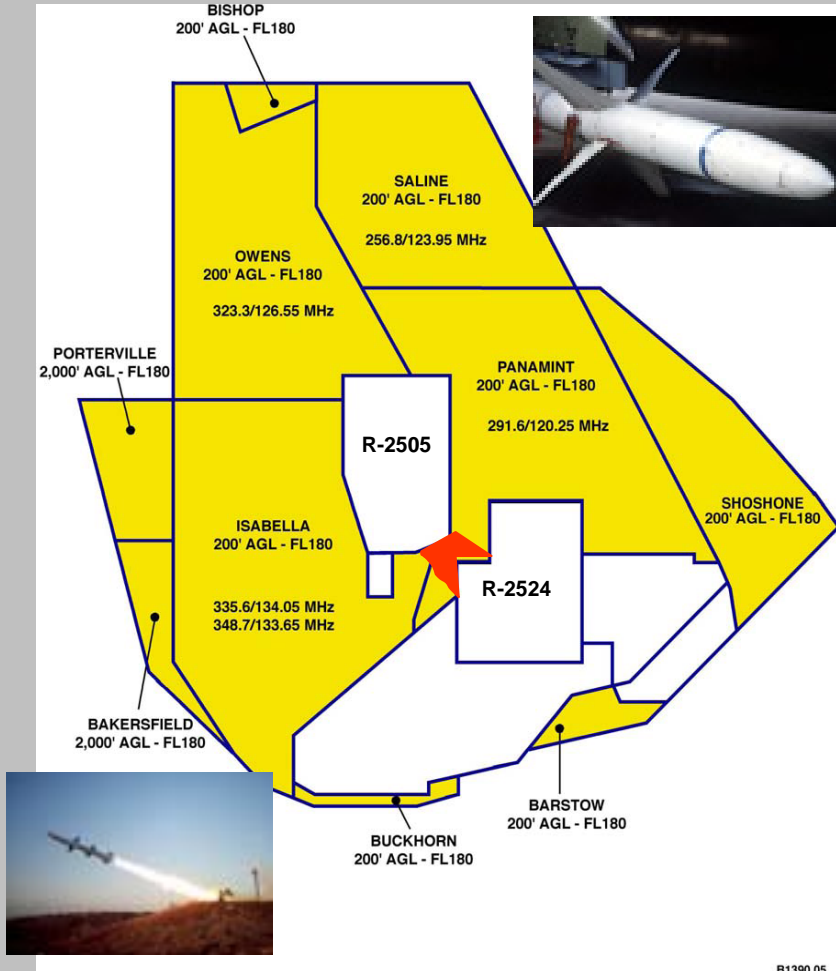
Military Training Routes (MTRs)



Additionally, each military user may also establish low-level routes that are contained entirely within the R-2508 complex. These routes are not published on sectionals. The figure above shows low-level routes used by Edwards Air Force Base aircraft only. The US Navy uses a similar route structure, but their routes are not used by USAF aircraft..

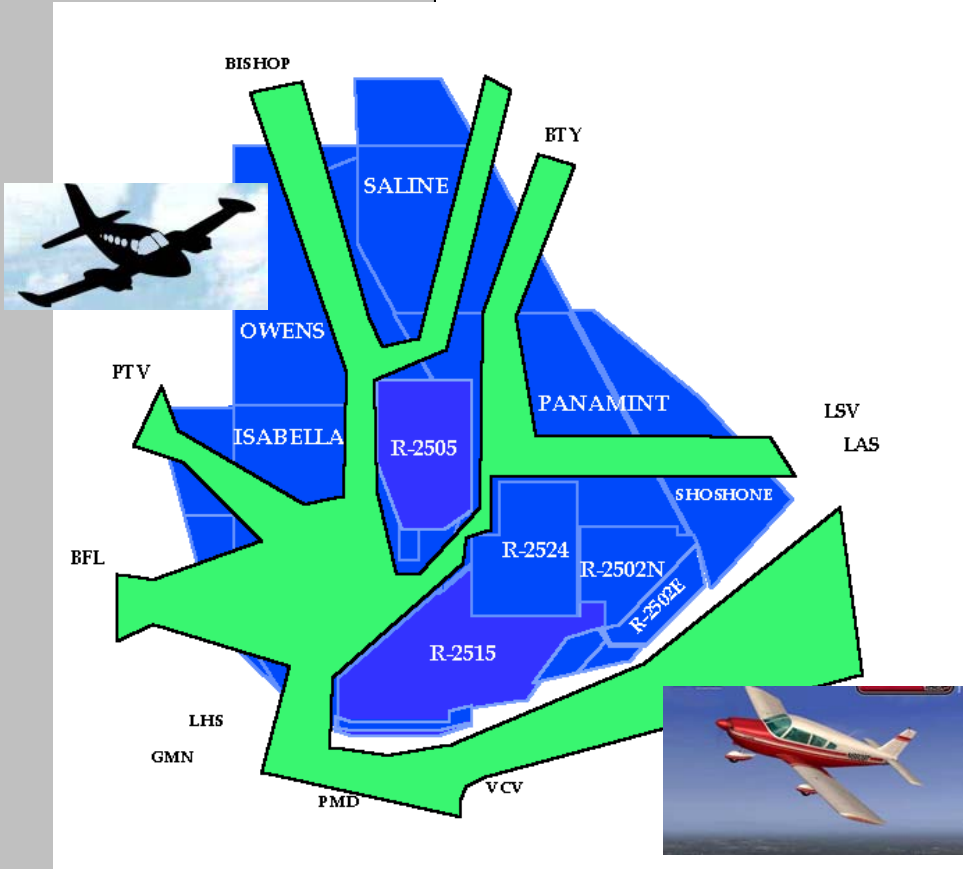
As you can see, multiple routes cross the Owens Valley, over Owens Lake and north toward Bishop. Additionally, Panamint Valley is very busy with low level activity, as well as the “Trona Gap”, connecting Panamint and Isabella MOAs.

Controlled Firing Area (Trona Gap)



Between the R-2505 (China Lake) and R-2524 (Echo Range) exists a special piece of airspace called a Controlled Firing Area (CFA). The CFA is only activated by NOTAM and is normally part of the MOA. When activated, this section of airspace effectively becomes a restricted area, due to high risk activities between R-2505 and R-2524. The type of activities may include a missile firing or long range bombing. This is why checking the NOTAMs is very important. If the CFA is active, you will not be able to transit the Trona Gap. Even if you plan on transiting outside the NOTAMed times, ask Joshua Control real time if the CFA is active, in case the firing times have changed after your takeoff time.

Recommended VFR Flyways



Civilian VFR traffic often transits the R-2508 Complex MOAs below 18,000' MSL. Although the depicted flyways are not mandatory for transit, staying on them will make you predictable to the military missions and increase your chances of an event free trip. As you can see, the area west of R-2515 is a major VFR transit area, and military fliers usually avoid the lower altitudes since they expect high density VFR traffic. Military jets can still use these areas, but do so at a reduced frequency.

Transiting The R-2508 Complex

Five Steps to a Safe VFR Flight in the R-2508 Complex (or any other MOA)

STEP 1	SQUAWK If you are invisible to radar, you are invisible to the military high speed jets. Turn on your transponder so that Joshua can see where you are and give the military aircraft the proper traffic calls to avoid you. Without a transponder, you can disappear easily off ATC radar in the local mountainous terrain.
STEP 2	TALK Look at the outside back cover of this book and call Joshua on the appropriate frequency before entering the MOAs. Request radar service while transiting the MOAs. Communicating your intentions helps Joshua warn you of possible problems and of traffic conflicts. You may even be able to listen to the military traffic.
STEP 3	BE VISIBLE Turn all your lights on. Notice how you can see the landing lights of an aircraft on final approach well before you can actually see the aircraft? Your lights make you infinitely more visible to us, especially the landing and taxi lights. We can see a landing light at least 10 miles away. An unlit aircraft may not be visible until 2 miles.

STEP**4****BE PREDICTABLE**

Fly VFR hemispheric altitudes. The military fliers usually avoid flying at those altitudes to avoid GA traffic. Also, use the Recommended VFR Flyways (page 17) to remain in areas the military fliers expect to see you. The more predictable you are, the more the military pilots can predict where to look for you and how to avoid you.

STEP**5****PLAN BEFORE YOU GO**

Get the NOTAMs for R-2508, Edwards AFB and China Lake NAS. Most will not apply to you, but some, like the activation of the CFA (page 16) will drastically affect your flight planning. Study this booklet and attend an R-2508 MACA seminar. Either look for an FAA safety notice of a seminar, or call **661-277-2623** to schedule.

Transiting the Restricted Areas

Transiting any of the restricted areas when they are active is forbidden and dangerous. However, during some late nights, most weekends and federal holidays, the restricted areas may be "cold". Ask Joshua (Step 2) if you can transit the areas and confirm if your altitude is appropriate. Play it safe and you can save some travel time and fuel.

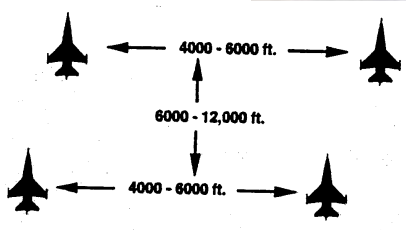
Military Flying

MILITARY FORMATIONS

Sage advice for anyone who spots a military aircraft is to look for another military aircraft near by – often the same type as the first aircraft. Military aircraft flock together. It provides mutual support and tactical efficiency, and is the way the military does business. It is safe to assume if you see one C-130 flying down Panamint Valley at 500 feet, there may be another C-130 nearby. Some of the various military formations are shown below:

TACTICAL FORMATIONS:

Wartime formations are called “tactical formations.” This usually means the aircraft are flying a mile or so apart horizontally and may be split vertically by as much as 6000 feet. You could see as few as two aircraft in tactical formation or as many as eight or more. Here is an example:

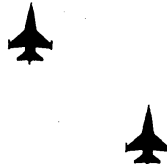


(NON-TACTICAL) FORMATIONS:

Military aircraft in a non-tactical formation (non-hostile) environment usually fly in a “standard” formation. By regulation, this means they must be within 1 mile horizontally and 100 feet vertically of each other. Usually the aircraft will be close enough together to spot them easily. Here are a few examples:



"FINGERTIP"
3' - 6' SEPARATION



ROUTE FORMATION
100' - 800' SEPARATION

Pilot Reaction Time

HUMAN LIMITATIONS

Although you may think that you can react quickly to a traffic conflict, the truth is that most of us take about 4 seconds to recognize another aircraft as a threat to our flight path. Then, it takes another 2-3 seconds to actually move the flight controls and get the aircraft to do something. If you are flying a small GA aircraft, it may take another 10 seconds just to climb or descend 50 feet. That means it will take about 16 seconds from spotting a threat to moving your aircraft only 50 feet off altitude to avoid a midair. In those 16 seconds, a military jet can travel a long way at 500 KIAS.

HOW CLOSE IS TOO CLOSE?

Studies have shown that if two aircraft are closing at 600 KIAS, on a collision course (you at 100 KIAS and the jet fighter at 500 KIAS), there is no way to avoid a midair if they see each other at closer than 1.5 miles. This even assumes the jet fighter pulls 7 Gs to try and avoid the impact. Assuming both pilots see each other at 1.5 miles, and by the time they take the 6 seconds to move their aircraft, the impact will occur. No way out, none!

High speed jets keep their landing and taxi light retracted to avoid drag, therefore they cannot turn them on in flight. BUT, you can turn yours on! Step 3 on page 18 tells you to turn your lights on when transiting the airspace so we can see you at over 10 miles and easily maneuver. At 10 miles, a jet pilot has plenty of time to move out of your way.

MANEUVERING

It's no secret that a small GA aircraft can't perform like a jet fighter. But every airplane has its strengths. When a modern jet fighter goes into a 6 G turn, it has a turn radius of about 3,000 ft. However, most small GA aircraft can make the same turn in less than a 500 ft turn radius. That means you can out-turn a fighter!

How do you use this to your advantage? If you find you are on a collision course with a fast mover, big jet or small, you cannot out-climb or out-descend the higher performance jets, but you sure can turn tight and change your flight path quickly. Making a steep turn also exposes your entire wing, making you more visible. A tight turn may be your best option! Realize, if you turn to put a fast mover behind you, they will catch up quickly, and you'll lose sight too. Normally, turn to get the fast mover in front so they can cross your flight path as soon as possible. Just watch for wake turbulence after they have flown past.

Scanning Techniques

EMPTY FIELD MYOPIA

When flying in clear cloudless skies, like we mostly have here in the high desert regions of California, your eyes will focus on the instrument panel or the propeller, only 3'-6' in front of you. That means you will have to refocus your eyes to find traffic. Add that to the reaction time described on page 21 and now it will take you even longer to move out of danger.

DISTRACTIONS

That cool new GPS you have may be nice, the conversation with your friends may be engaging, the cool stuff on the ground may grab your interest, but all that may be diverting attention away from the traffic outside your airplane. Being a pilot means prioritizing. Keep most of your attention outside, especially when flying in a MOA.

BUGS

Clean that windshield. A traffic conflict will look like a bug when about 1 mile or more away from you. By the time a fast moving (fighter) traffic conflict is larger than the bugs on your windshield, it's already too late.

STANDARD SCANNING TECHNIQUE

Moving your eyes around the sky produces nothing but a blur for your brain to decipher. In order to see correctly, you must steady your eyes and focus on something other than the blue sky (Empty Field Myopia). Select about a 15 degree portion of the sky, focus your eyes on the ground at about 5 miles away, then move up and scan a few inches above and below the horizon. Move to the next 15 degree segment. Repeat often. This will keep your attention outside, and you can do this while talking to your friends. If you teach this to your passengers, they'll help out, and think you are cool...well, maybe not cool.

WHAT AFFECTS YOUR ABILITY TO SPOT TRAFFIC

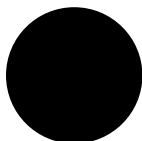
1. **Image Size:** The bigger the jet, the easier it is to find.
2. **Luminance and Contrast:** Darkness, sunlight flare, haze and fog will affect contrast and reduce visibility.
3. **Darkness Adaptation:** It takes 30 minutes to adapt to darkness.
4. **Motion:** An object must move to interest the eye and the brain. A stationary object in the windshield is on a collision course.
5. **Exposure Time:** The more time to see, the better the odds of finding the traffic. Keep your attention outside in high traffic areas.

Finding the Traffic

THE BLIND SPOT

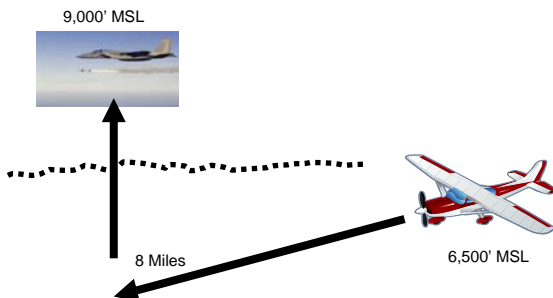
We all have a “blind spot.” Potential for a midair collision lies within this blind spot. At one mile this area could be 800 feet by 500 feet, and at 5 miles, this area could be almost a mile wide. One way you can compensate for the blind spot is to move your head around while doing your scanning and look more than once in a given direction.

Here is a demonstration on locating your blind spot. With your right eye closed, look at the cross on the right. Move the paper back and forth about a foot away from your eye; the circle on the left will disappear. When that happens, the circle is in your blind spot.



FINDING THE TRAFFIC

Let's say you are navigating the R-2508 Complex at 6,500' MSL and Joshua gives you the following traffic call: “N1234AB, you have military traffic at your 2 o'clock, 8 miles 9,000 feet”. The easiest way to find it is to first look at the 2 o'clock position, then focus your eyes to something on the ground at the approximate distance (8 miles in this case), then move your eyes up to the altitude (slightly above the horizon in this case). Works like a charm! Joshua may also tell you the traffic is “maneuvering” which means the position is changing rapidly. Keep asking for position reports if initially unable to acquire the traffic.

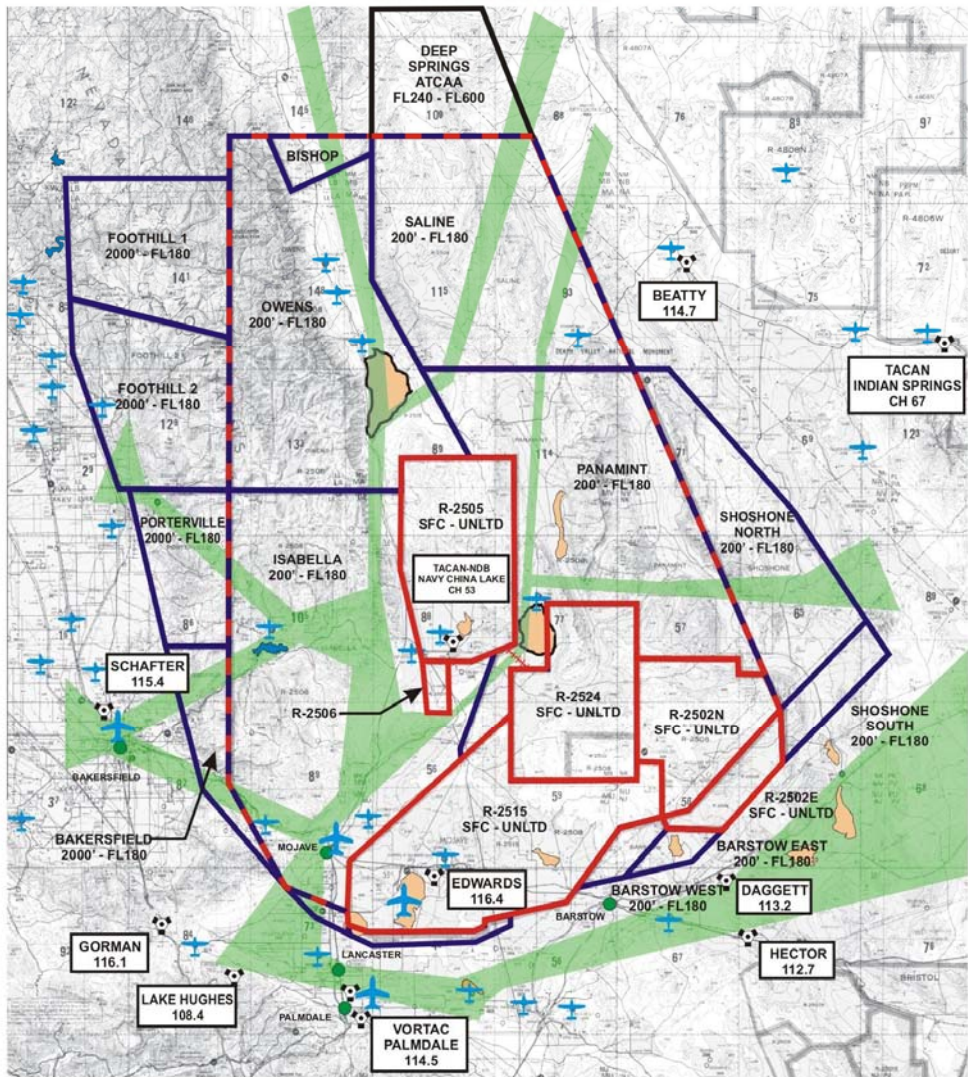


Some Common Avoidance Tips

Studies on midair collisions show most accidents occur below 8000 feet MSL and near airports, nav aids, and other high density traffic areas. Here are some ways to help reduce your midair collision potential:

1. Know where the high-density traffic is (Tehachapi, Mojave, Cal City area; Palmdale traffic pattern; Hwy 395 along the Owens Valley; Lake Isabella; Trona gap, among others)
2. Fly as high as practical.
3. Obtain an IFR clearance or participate in radar flight following whenever possible, and continue to practice "see and avoid" at all times.
4. Turn on all lights at lower altitudes, especially when near airports.
5. Announce your intentions on unicom and use standard traffic pattern procedures at uncontrolled fields. Try to present a "predictable target."
6. Always use your transponder with altitude reporting on (if available). Crosscheck accuracy with ATC whenever possible.
7. Use the appropriate hemispheric altitudes.
8. Constantly watch for other aircraft. Remember to "manage" your visual lookout as mentioned earlier in this pamphlet and understand the limitations of your eyes. Clear over the radio in addition to clearing visually.
9. Keep your windshield and windows clean and clear. A bug on the windshield can obstruct and disrupt your visual lookout.
10. Learn proper task management in the air. Learn the proper methods to help you reduce your workload demands.
11. Do not get complacent during instruction. Instructors make mistakes too. Many midair collisions have occurred during periods of instruction or supervision.
12. When flying at night, do not use white light inside the aircraft. White light disrupts your night vision, even if used momentarily. Use a red light at night.
13. Beware of wake turbulence.
14. If another aircraft appears to have no relative motion in your windshield but is increasing in size, it is on a direct collision course with you.
15. Execute appropriate clearing procedures before and during all climbs, descents, turns, abnormal maneuvers, or aerobatics.
16. Above all: AVOID COMPLACENCY!

NOT FOR NAVIGATIONAL USE



LEGEND

- RESTRICTED AREA
- MILITARY OPERATIONS AREA (MOA)
- MOA, 200' - FL180
ATC ASSIGNED AREA (ATCAA),
FL180 - FL200
RESTRICTED AREA,
FL200 - UNLTD
- VFR FLYWAY
- CITY
- XXXXXXXXXXXX TRONA CFA
- LAKE
- DRY LAKE BED

MILITARY OPERATIONS AREA (MOA)
A MOA is airspace established outside of Class A airspace area to separate or segregate certain non-hazardous military activities from IFR traffic and to identify for VFR traffic where these activities are conducted.

RESTRICTED AREA (MOA)
Airspace subject to restriction. Most restricted areas are designated joint use and IFR / VFR operations in the area may be authorized by the controlling ATC facility when it is not being utilized by the using agency. Restricted areas are depicted on en route charts.

CONTROLLED FIRING AREA
Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to non-participating aircraft and to ensure the safety of persons and property on the ground.

TRONA CORRIDOR CONTROLLED FIRING AREA (CFA)
The CFA lies between R-2505 and R-2524 from 3000' AGL up to but not including FL200. The CFA will be activated by Notice to Airmen (NOTAM).

www.edwards.af.mil, click on "Flight Safety"

LOCAL FACILITY FREQUENCIES

JOSHUA APPROACH: R-2508

ISABELLA 133.65
PALMDALE 124.55
PANAMINT 120.25
OWENS 126.55
SALINE 123.95

SPORT (R-2515) 132.75
CHINA LAKE CONTROL
(R-2505/R-2506) 128.25

FLIGHT SERVICE STATION:

RIVERSIDE (NORTH) 122.15
RIVERSIDE (SOUTH) 122.2/122.4

ATC COMMON FREQUENCIES:

BEATTY 124.62
BFL 118.8
BISHOP 125.75
DAG-PMD 132.5
FOOTHILL 123.8
O02-LAS 125.6
PORTERVILLE 127.1
VCV-WJF 124.55 (SFC-130)

LOCAL UNICOM/TOWER:

BAKERSFIELD 118.1
BISHOP 123.0
CALIFORNIA CITY 122.7
DAGGETT 123.0
FOX FIELD 120.3
FRESNO 118.2
INDEPENDENCE 122.9
INYOKERN 122.8
KERN VALLEY 122.8
LONE PINE 122.8
MOJAVE 127.6
TEHACHAPI 123.0
TRONA 122.8

WE REQUEST YOU FOLLOW THESE
PROCEDURES PRIOR TO ENTERING
THE EDWARDS AFB SPECIAL USE
AIRSPACE:

- CONTACT FSS FOR ANY NOTAMS
- SQUAWK 1200 OR AS ASSIGNED BY ATC
- TALK TO JOSHUA APPROACH
- TURN ON ALL EXTERNAL LIGHTS
TO AID IN MID-AIR COLLISION
AVOIDANCE
- CLEAR !