MACA

MID-AIR COLLISION AVOIDANCE PROGRAM

January 2011

319th AIR BASE WING

GRAND FORKS AIR FORCE BASE, ND

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31 January 2011

MEMORANDUM FOR GRAND FORKS AREA AVIATORS

FROM: 319th Air Base Wing Flight Safety Office

SUBJECT: Mid-Air Collision Avoidance

1. In the high-density traffic area surrounding Grand Forks there is a greater than average risk of mid-air collision. As our airspace becomes more crowded, it's important we understand local civil and military flight operations. This brochure's purpose is to provide information about Grand Forks AFB flight operations.

2. While it may come as no surprise that mid-airs typically occur at low altitudes where airplanes congregate (close to airports), the fact they usually occur in day VFR conditions seems contrary to the notion of our ability to see and avoid other aircraft. This brochure has been prepared with that in mind and includes information on the local aircraft and where we fly, in addition to articles on the problems of "see and avoid" and pilot controller communications.

3. If you have any questions or comments, please feel free to call the 319th Air Base Wing Flight Safety Office at (701) 747-4114.

BRADLEY S. BAUGH, Lt Col, USAF
Chief, Flight Safety

ATTENTION

THE ENCLOSED MATERIAL IS FOR THE PROMOTION OF FLIGHT SAFETY AND IS FOR INFORMATIONAL PURPOSES ONLY. IT IS NOT INTENDED TO BE USED DURING FLIGHT OTHER THAN AS A SOURCE OF MID-AIR COLLISION AVOIDANCE INFORMATION. ALL INFORMATION, ROUTE DESCRIPTIONS, AND PROCEDURES ARE SUBJECT TO CHANGE. CONSULT CURRENT FLIP, SECTIONALS, AND THE AIRMAN'S INFORMATION MANUAL (AIM) FOR MORE INFORMATION REGARDING MID-AIR COLLISION AVOIDANCE.

FOR ADDITIONAL INFORMATION, OR COPIES CONTACT:
319 AIR BASE WING SAFETY OFFICE
Grand Forks AFB, ND 58205-5000
(701) 747-4114
DSN: 362-4114

MILITARY TRAINING ROUTES

IR-678 enters Grand Forks Approach's airspace near Cooperstown to the southwest and exits near Park River to the northwest. It is the only Military Training Route (MTR) in the area. Although the name IFR Military Training Route (IR) might make one think it would only be used during instrument meteorological conditions, operations on IRs are conducted in accordance with Instrument Flight Rules (IFR) regardless of weather conditions.

The approximate route centerline is depicted on the Twin Cities Sectional and the IFR L-10 Low Chart. The route may be flown in excess of 250 knots up to 8 nm right and 6 nm left of route centerline at altitudes between 200' AGL and 3000' MSL in Grand Forks Approach's airspace.

> **CONTACT FLIGHT SERVICE (1-800-WXBRIEF) BEFORE FLIGHT OR GRAND FORKS RADIO (122.6) IN-FLIGHT FOR CURRENT MTR STATUS. GRAND FORKS APPROACH (118.1) CAN ALSO TELL YOU IF THE ROUTE IS HOT. AS A LAST RESORT YOU MAY ALSO CONTACT THE 23rd BOMB SQUADRON SCHEDULING OFFICE AT (701) 723-2002/3527 FOR HOURS OF USE. More information concerning Military Training Routes is available in the Airman's Information Manual.**

GRAND FORKS AFB TRAFFIC PATTERNS

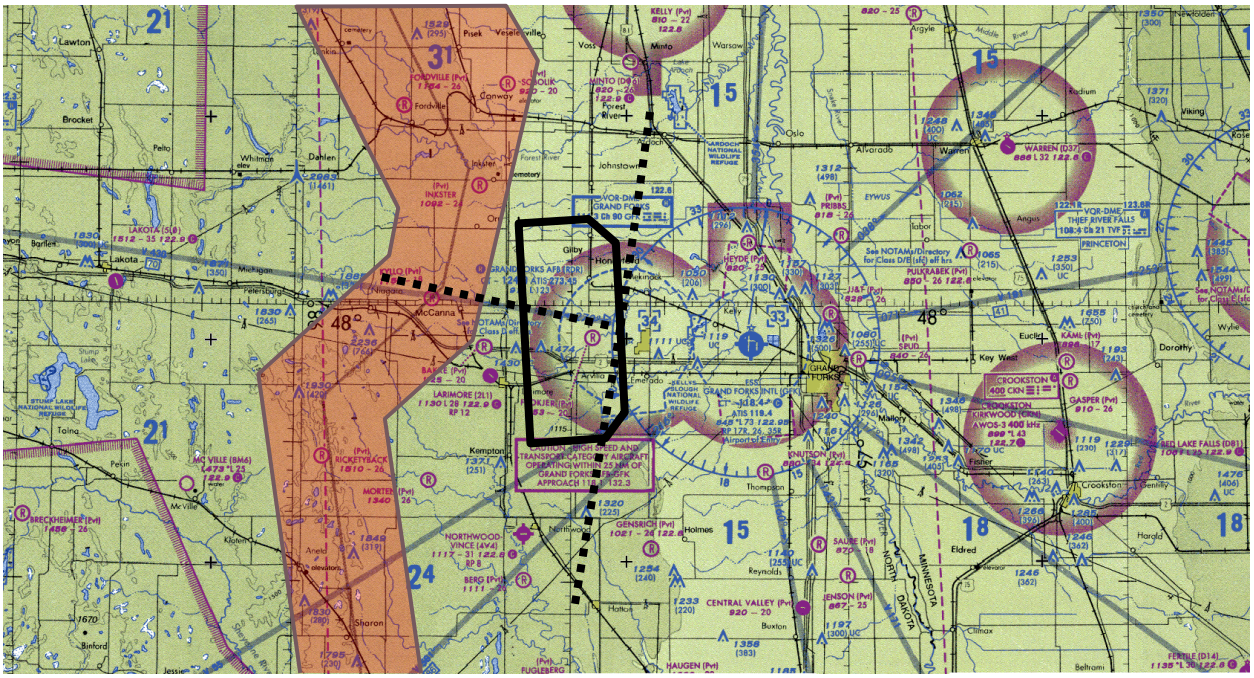
Aircraft assigned to the base routinely conduct practice operations, both VFR and IFR. All patterns are flown west of the base.

VFR PATTERNS:

- **OVERHEAD: Pattern altitude at 3000' MSL, 3-5 miles from runway. These patterns are not routinely used, but are permitted using FAAO 7110.65 procedures.**
- **CONVENTIONAL RECTANGULAR: Pattern altitude at 2500'MSL, 2-3 miles parallel to runway.**
- **LIGHT RECTANGULAR: Pattern altitude 2000'MSL (this will include helicopters and light civilian aircraft)**

RADAR PATTERN: Flown west of the base at 3000' MSL. Downwind is flown from 6-10 NM west and the base turn occurs 10 - 15 NM from the runway.

MILITARY AIRSPACE



UND OPERATIONS

The University of North Dakota conducts pilot training from their base of operation at Mark Andrews (Grand Forks) International Airport. These student training flights are usually conducted within 40 NM of the Grand Forks International Airport, at low level (below 5000' MSL), and are usually restricted to the practice areas depicted on page 9. However, UND aircraft may also perform practice maneuvers while enroute to the satellite airports. Be aware and watchful for student training activity at all times.

In additional to flying low-level, UND operates a Cessna Citation II and several Piper Seminoles that train aircrews well above 5000' MSL. In fact, some of these aircraft may operate well into the flight levels.

UND aircraft arriving and departing GFK under VFR are usually on assigned headings or stereo routes while operating in Grand Forks Approach's airspace. Arriving UND aircraft are directed to one of four VFR pattern entry points approximately 5-7 miles from the International Airport to the NE, NW, SW, and SE. UND has a Standard Operating Procedure (SOP) regarding departure and arrival procedures.

Transient aircraft are encouraged to enter the VFR pattern at GFK from the VFR fixes, if the pilot can readily identify them while approaching the airport. Approach control will vector aircraft to these points if necessary.

All aircraft are encouraged to operate navigation, beacon, and landing lights when approaching the airport. Even if you're receiving basic radar service from Approach Control, the requirement for "see and avoid" applies.

The UND fleet consists of 46 Warriors, 12 Arrows, 11 Seminoles, 2 Decathlons, 3 helicopters, 1 C-182 Float Plane, 1 Cheyenne, 1 Baron, 1 Supercub, and 1 Citation.

UND CAUTION AREAS

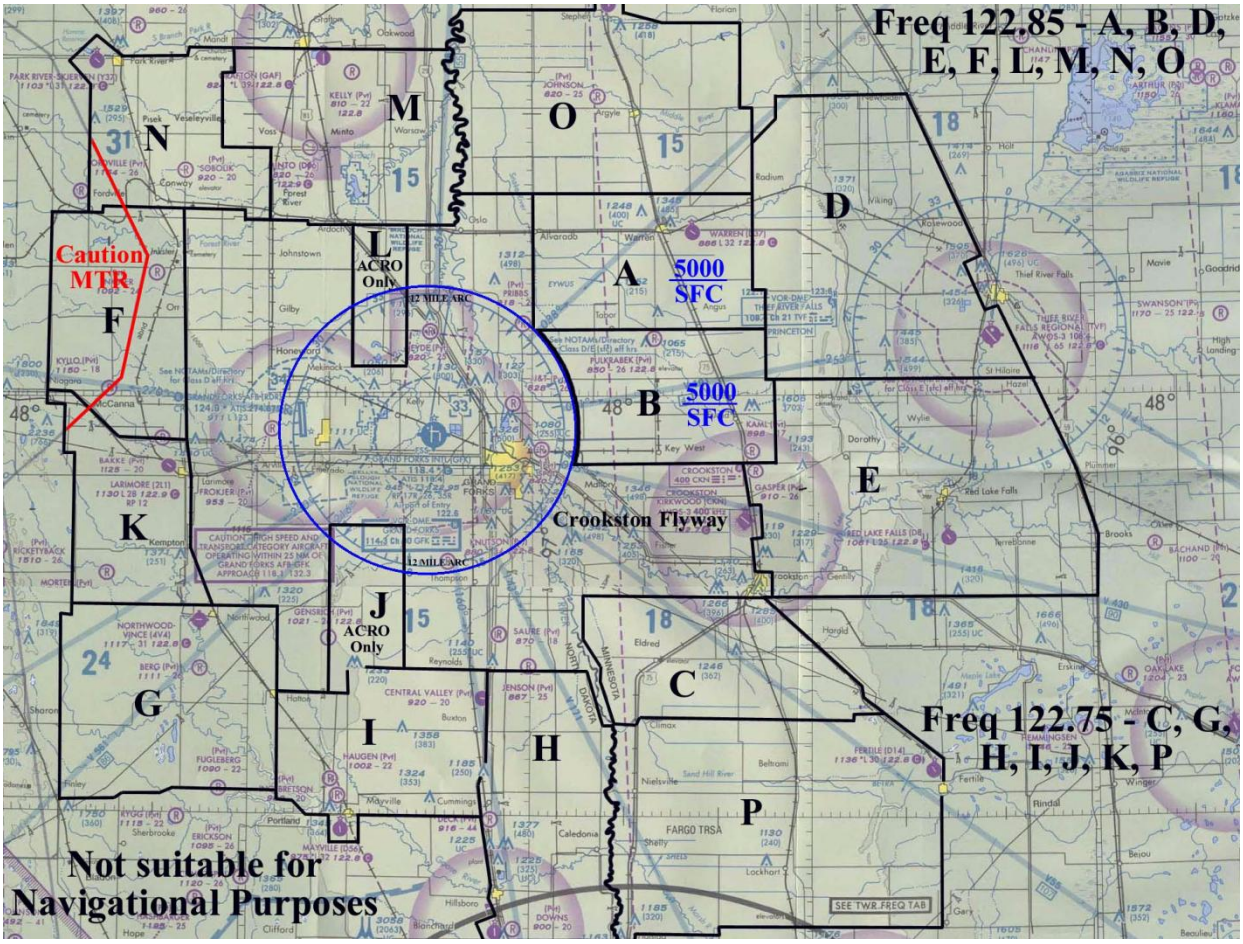
Pilots should use extreme caution when operating near or in the following areas due to the increased potential for conflict.

1. **Aerobatic Area "J" (3500 - 7000 feet MSL) - Aircraft in area "J" may stray across the runway extended centerline of RDR runway 17.**
2. **Area "K" (Larimore Practice Area) - Aircraft crossing the RDR extended runway centerline to/from GFK airport below 3200' MSL.**
3. **Aerobatic Area "L" (Northwest of Grand Forks International) - Aircraft stray across extended runway centerline of RDR runway 35.**
4. **Over flying Grand Forks AFB - Aircraft crossing extended runway centerline within 5 miles of Grand Forks AFB.**
5. **Military Training Route (IR-678) - Aircraft will fly through Grand Forks Approach airspace from SFC to 3000' MSL, Point Q is 10 NM West of Grand Forks AFB.**

UND PRACTICE AREAS

1. **"A" Warren (Warriors below 5000' MSL)**
2. **"B" Grand Forks Practice Area (Warriors below 5000' MSL)**
3. **"C" Crookston Practice Area (Warriors below 5000' MSL)**
4. **"D" Thief River Falls Practice Area (Aircraft fly to "D" at 5500' MSL and from "D" at 6500' MSL) (Popular Multi-Engine practice area)**
5. **"E" Red Lake Falls Practice Area**
6. **"F" Fordville Practice Area (Aircraft will cross KRDR at 3200' MSL enroute)**
7. **"G" Northwood Practice Area**
8. **"H" Hillsboro Practice Area (Popular Multi-Engine practice area)**
9. **"I" Mayville Practice Area**
10. **"J" Aerobatic Area (3500' – 7000' MSL)**
11. **"K" Larimore Practice Area**
12. **"L" Aerobatic Area (3500' – 7000' MSL)**
13. **"M" Grafton Practice Area (Popular Multi-Engine practice area)**
14. **"N" Park River Practice Area (Popular Multi-Engine practice area)**
15. **"O" Stephen Practice Area**
16. **"P" Fertile Practice Area**

UND PRACTICE AREAS



AIR TRAFFIC OPERATIONS

The 319th Operations Support Squadron Air Traffic Control facilities operate 24 hours a day, 365 days a year. They provide ATC services to the 319th Air Base Wing, the University of North Dakota (UND) flight training program, and other transient and local aircraft.

The Grand Forks International Airport tower is the 39th busiest in the nation, and 5th busiest in the region behind Chicago O'Hare, Chicago Midway, Detroit Metro, and Minneapolis St. Paul International airports. Last year, there were 155,550 operations without a single operational error.

Red River (RDR) Tower at Grand Forks AFB is responsible for all operations conducted within a 5 statute mile radius of the Base from the surface up to 2500' AGL. Approval to enter this class "D" airspace must be obtained from RDR tower on 124.9/349.0. If you're working with Approach on 118.1, they will coordinate your transition through tower's airspace.

Grand Forks Approach provides Instrument Flight Rules (IFR) separation standards between all IFR aircraft within its area of jurisdiction (Terminal Area). They also provide practice approaches to VFR aircraft, traffic permitting. Basic radar services for VFR aircraft are provided to all aircraft arriving at the Air Force Base and Grand Forks International Airport. The purpose of this radar service is to adjust the flow of VFR and IFR traffic into the pattern in a safe, orderly, and expeditious manner. Departing VFR aircraft will receive flight following or departure services on request, if traffic load permits.

The Grand Forks Approach Control area of responsibility is a 30-40 NM radius of the Grand Forks AFB, with an extension to the east, which includes the Crookston Municipal Airport. The vertical limit of the airspace is 10,000' MSL, except in the Crookston area, which tops out at 4,000' MSL. Approach Control frequencies are VHF 118.1 and UHF 318.1.

MACA WHILE UNDER ATC CONTROL

The single common factor in an overwhelming number of incidents under ATC control is the breakdown of communications between pilots and controllers. In 1988, the FAA launched a Communication Awareness Initiative focused on preventing this breakdown. Eleven items were addressed.

1. SIMILAR SOUNDING ALPHANUMERICS

Sometimes instructions and clearances are issued to the wrong aircraft, especially when multiple aircraft are operating on the same frequency with similar call signs. In this case the controller will, in accordance with AIM 4-2-4, emphasize certain parts of the call sign or even ask pilots to use a different call sign temporarily. They are also obligated to announce to all traffic that there are similar sounding call signs on the frequency.

2. CONTROLLER HEAR-BACK PROBLEMS

One of many contributing factors prompting hear-back problems is ambient noise. Pilots must ensure that the controller heard, repeated, and understood what was said. If either party has any doubts about what was or was not heard, it is important to initiate clarification or repeat the read-back.

3. PHRASEOLOGY

Of the numerous communications problems evident throughout the ATC system the most common and troublesome is the improper use of established and recommended phraseology by pilots and controllers. One very effective way to reduce the communications problems caused by improper use of phraseology is for both pilots and controllers to know and use standard terminology prescribed in the Pilot/Controller Glossary contained in the AIM.

4. BLOCKED OR SIMULTANEOUS TRANSMISSIONS

Simultaneous transmissions on the same frequency in proximity to the same intended receiver are frequent and self-defeating phenomena detrimental to effective communication. Initiation of a transmission on an occupied frequency can (and does) result in information not being received by the intended ATC facility or aircraft. The most basic solution is for controllers and pilots to listen before transmitting on the frequency.

5. STUCK MICROPHONES

The pilot's microphone on many occasions has been the disruptive link in the chain, not only for the pilot whose microphone was stuck but for others sharing the frequency -- and the airspace. The solution is for increased pilot and controller attention to microphone keying and deliberate effort to preclude accidental keying caused by sitting on the microphone, jammed keys, loose connections, and other inadvertent keying.

6. READ-BACK PROBLEMS

Spoken communication is the most essential activity in aircraft operations; and the most vulnerable to human error. Controllers are responsible for assuring read-back of a clearance is correct. However, pilots must help controllers fulfill that responsibility by providing them with consistent read-backs of all clearances in the sequence they were issued.

7. INITIAL RADIO CONTACT

To contact most facilities within the ATC system, pilots must use the procedures in AIM 4-2-3. If these procedures are not followed, the result may be delayed or even failed communications. Pilots must follow appropriate procedures when attempting initial contact with a ground facility; controllers must respond with appropriate phraseology.

8. ENUNCIATION

Although English is the official language of aviation, we don't all speak it with the same clarity and understanding. What can be done to minimize the problems stemming from the enunciation pitfalls? If you have an accent, remember it effects both your speaking and your listening. Second, properly adjust your radio equipment. Finally, when you open your mouth to speak use a normal speaking voice and proper phraseology to minimize confusion.

9. HEADSETS VERSUS SPEAKERS

Pilots and controllers have their own preferences as to individual use of speakers versus headsets. However, communication problems occur more frequently when using only speakers. If personal preference dictates the use of a speaker for communications, consider the empty gap between the source of the clearance and the ear. With a headset there is considerably less noise.

10. RADIO DISCIPLINE

Poor technique by pilots and controllers in the application of radio discipline tends to confuse and frustrate each party. Use proper radio techniques and standardize all communication to the extent possible. AIM, Chapter 4, Section 2 standardizes communications techniques.

11. INTRA-COCKPIT COMMUNICATIONS

What could be simpler? Most pilots do not believe it is possible to have a communications or information transfer problem when only two or three people are present in the cockpit and are "communicating" among themselves. By using cockpit/crew resource management, clearly and explicitly conveying clearances and checklist items, always using full call signs and read-back of clearances, questioning a clearance if in doubt, and avoiding complacency, pilots will improve overall aircrew communications.

AIRCRAFT IDENTIFICATION AND CHARACTERISTICS

MQ-9 Predator UAV Operated by US Border Patrol

RQ-4 Global Hawk UAV

C-21

The C-21s that do transition work at Grand Forks AFB belong to the North Dakota ANG in Fargo. They also conduct air work in the Military Operating Areas (MOAs) 40 - 60 NM NW, and SW of Grand Forks.

A. DEPARTURE
1. **250 KIAS to 10,000 MSL.**
2. **Climb approximately 3,000 - 5,000 feet per minute.**
3. **Should be above 10,000 MSL, 15 NM from Grand Forks Air Force Base.**

B. APPROACH
1. **230 KIAS on downwind, pattern altitude 2,100 MSL.**
2. **140 KIAS on final approach.**

C. POTENTIAL THREATS
1. **High performance aircraft, very rapid closure rate.**
2. **Small, difficult to see.**
3. **Paint scheme may blend with fog/smoke/winter ground cover.**

Northwest Airlines Saab 340

Northwest Airlines DC-9

FedEx Boeing 757

Fedex Boeing 727

Piper Supercub

Bellanca Decathlon

Piper Warrior

Piper Arrow

Piper Seminole

Piper Cheyenne

Beech Baron

Cessna Citation II

Cessna 172

Grumman AgCat

Rockwell Thrush

WAKE TURBULENCE

INTRODUCTION: All aircraft generate wake turbulence while in flight. Originally believed to be "prop wash" it was later discovered to be a pair of counter-rotating vortices trailing from the wing tips. As aircraft became larger and heavier, the intensity of the vortices began to pose problems for smaller aircraft. Most of today's jet aircraft, and particularly the "jumbo" jets, generate vortices with roll velocities exceeding the roll capability of some aircraft. Further, turbulence generated with the vortices can damage aircraft components and equipment if encountered at close range. The pilot must learn to envision the location of vortex wake generated by a large aircraft and adjust his/her flight path accordingly. See the Airman's Information Manual (AIM) 7-3-1 through 7-3-9 for more information.

VORTEX STRENGTH: The strength of the vortex is governed primarily by the weight, speed and shape of the wing of the generating aircraft. The basic factor

is weight, and the vortex strength increases with increased weight and span loading. During a recent test, vortex tangential velocities were recorded at 150 feet per second, or about 90 knots. The greatest vortex occurs when the generating aircraft is HEAVY, CLEAN, and SLOW.

INDUCED ROLL: A serious wake encounter could result in structural damage. However, the primary hazard is loss of control because of induced roll. Aircraft intentionally flown directly up the core of a vortex during flight tests tended to roll with the vortex.

VORTEX CHARACTERISTICS

Trailing vortex wakes have certain characteristics which pilots can use in visualizing the location and avoiding it.

1. Vortex generation starts with rotation when the nose wheel lifts off and ends when the nose wheel touches down on landing. Pilots should note the touchdown point of the preceding aircraft.

2. The vortex circulation is outward, upward, and around the wing tip when viewed from either ahead or behind the aircraft. Tests with heavy aircraft have shown that the diameter of the vortex core ranges from 25 to 50 feet, but the field of influence is larger. The vortices stay close together (about 3/4 of the span) until dissipation.

3. Flight tests have shown that the vortices from heavy jets start to sink immediately at about 400 to 500 feet per minute. They tend to level off about 800 to 900 feet below the generator's flight path. Vortex strength diminishes with time and distances behind the generating aircraft. Atmospheric turbulence hastens breakup. Residual choppiness remains after vortex breakup as much as 10 miles behind a heavy aircraft flying at slow to moderate speed.

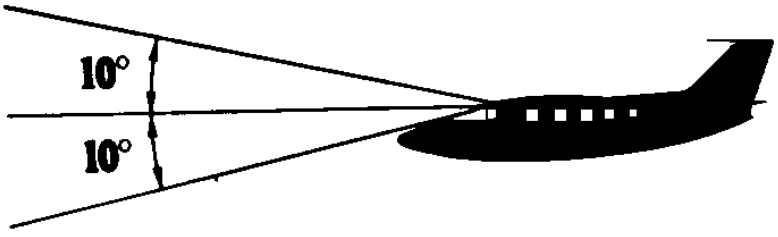
4. When the vortices sink into ground effect, they tend to move laterally outward over the ground at a speed of about 5 knots. A crosswind component will decrease the lateral movement of the upwind vortex and increase the movement of the downwind vortex. This may result in the upwind vortex remaining in the touchdown zone or hasten the drift of the downwind vortex toward a parallel runway. Similarly, a tail wind condition can move the vortices of the preceding aircraft forward into the touchdown zone.

5. One sure way to improve the quality of ATC service is to give PIREPS. As you know, ATC doesn't always have the scoop on flight conditions "at altitude". You can change that--the more information you pass to ATC, the better the service

you will receive, especially in IFR conditions. Do yourself and others a favor...issue PIREPS.

WHAT CAN I DO FOR MACA?

1. **Ensure your windscreen is clean.**
2. **Have your charts, approach plates, etc. well organized prior to flight.**
3. **Do not assume an IFR clearance or "radar contact" guarantees separation.**
4. **If you're informed of or see conflicting traffic, don't fixate: scan other areas.**
5. **Avoid congested and/or training areas as much as possible**
6. **Listen to the radio to clear for other aircraft.**
7. **Use other crewmembers and/or passengers to "clear" airspace.**
8. **On descents or landings, complete checklists ASAP; stay heads up.**
9. **Intersperse checklist items with deliberate outside looks**
10. **Scan, scan, scan. Next time you fly, consciously note how much time you spend looking outside the cockpit.**



You can generally avoid the threat of an inflight collision by vertically scanning 60 degrees to the left and right horizontally scanning 10 degrees up and down

crossing are good examples. Objects in motion against a stationary background tend to attract attention; if the eyes themselves are also in motion, this is less true. After this momentary resting of the eyes, you should resume your scan of all quadrants. – Adapted from "The Flight Deck"

PILOT'S ROLE IN COLLISION AVOIDANCE

This section contains actions that you, the pilot, can take to assist in collision avoidance. Also included are visual scanning techniques and information on the limitations of the human eye.

MAINTAIN VIGILANCE!!

1. Maintain a vigilant lookout regardless of the type aircraft being flown. Remember that most near misses occur during VFR weather conditions and during the hours of daylight.

2. Prior to takeoff, scan the approach areas for possible landing aircraft by maneuvering your aircraft to provide a clear view of such areas.

3. During climbs and descents in flight conditions which permit visual detection of other traffic, execute gentle banks left and right at a frequency which permits continuous visual scanning of the airspace about you.

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4. **Execute appropriate clearing procedures before all turns, abnormal maneuvers or aerobatics.**

5. **Beware of the type of airspace in which you intend to operate in order to comply with the flight rules applicable to that airspace.**

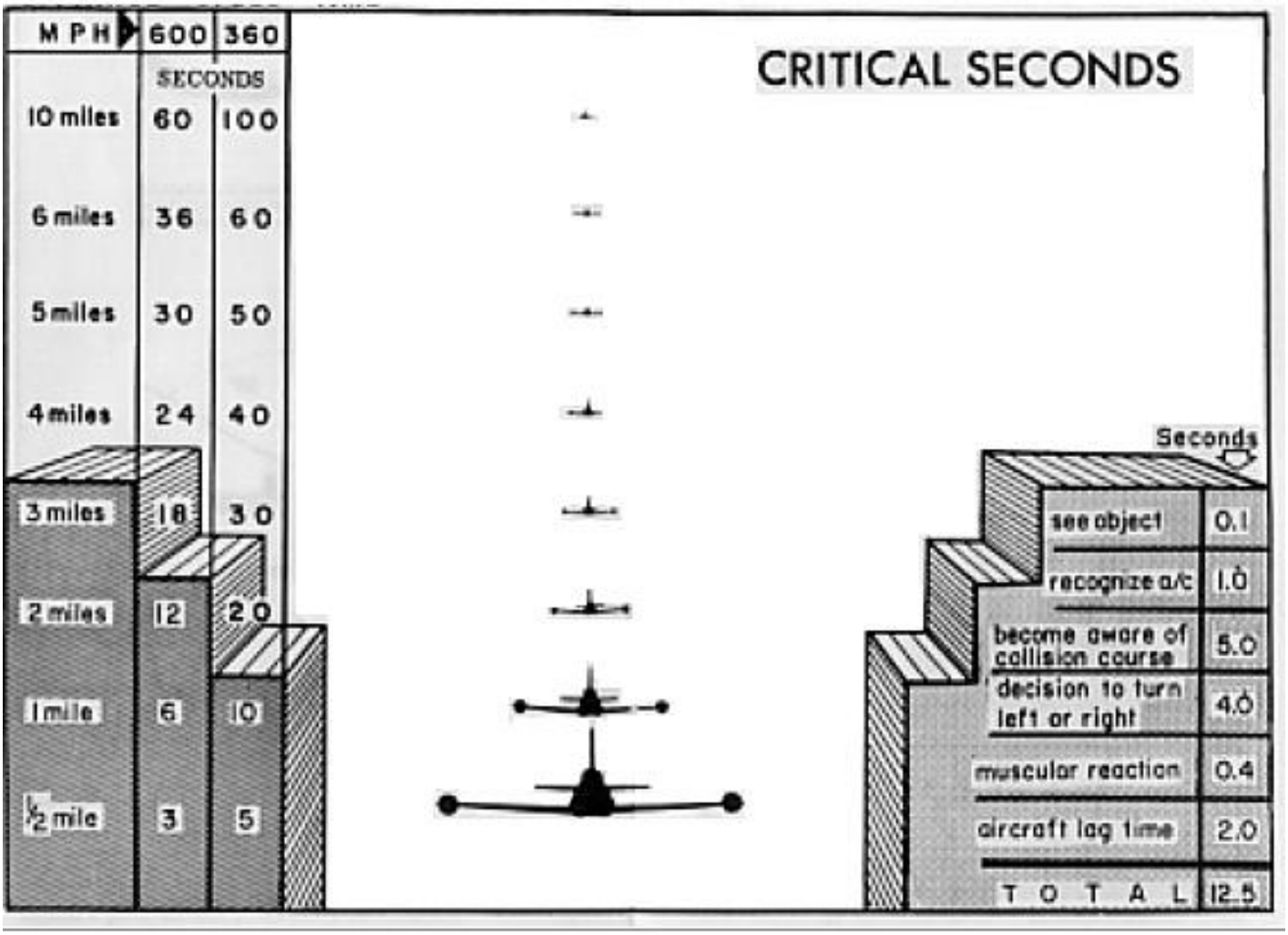
6. **Be knowledgeable of the specific flight rules governing operation of aircraft within the various airspaces.**

7. **Be familiar with and exercise caution in areas where you may expect to find high volume of traffic or special types of aircraft operation (i.e., airport traffic patterns, restricted areas, training areas, military bases, etc.)**

8. **Make maximum use of communications equipment and radar advisory services. Know the facilities providing traffic advisory service and the areas in which they give these services.**

9. **Request and use traffic advisories when available in avoiding other traffic.**

10. **Compensate for blind spots due to aircraft design and flight attitude by aggressive scanning and maneuvering the aircraft.**



Move back 12 feet from this illustration. From that position the silhouettes represent a T-33 aircraft as it would appear to you from the distances indicated in the table on the left. The time required to cover these distances is given in seconds for combined speeds of 360 and 600 mph.

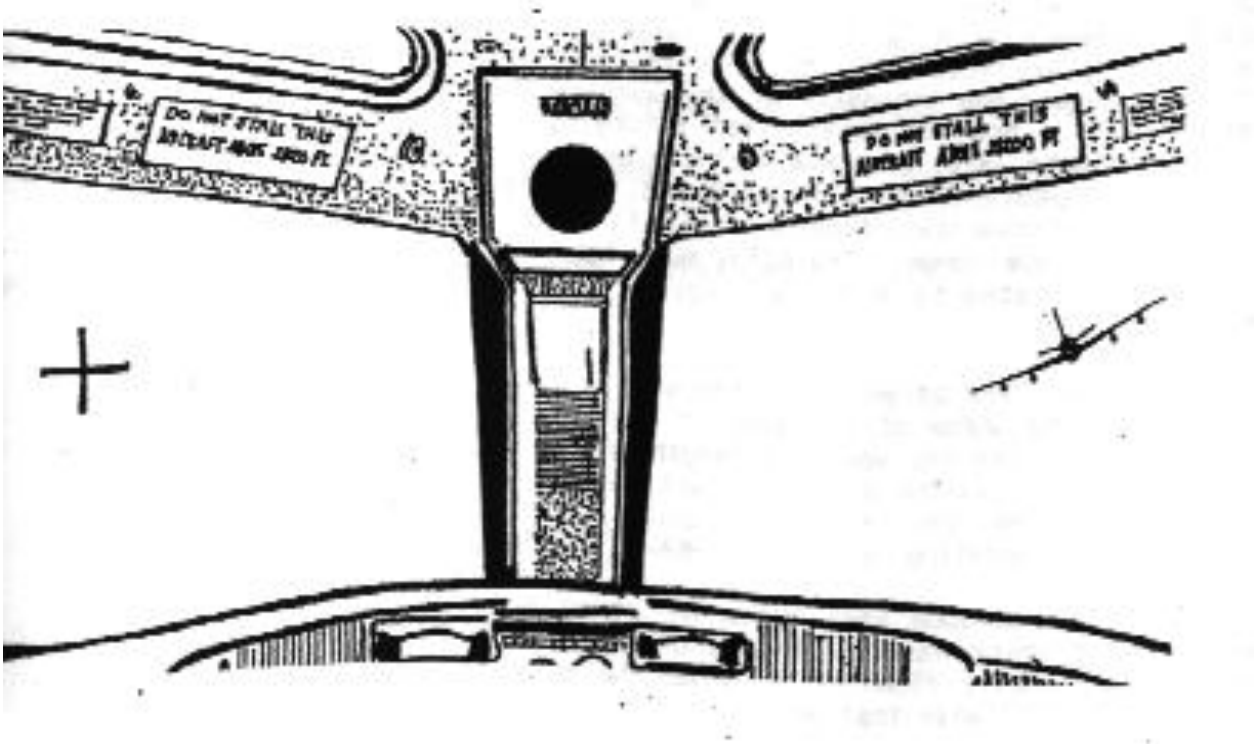
The blocks on the lower left mark the danger area for speeds quoted, when aircraft are on a collision course. This danger area is based on the recognition and reaction times shown in the table on the lower right.

DON'T STARE

We're all a little bit blind. That's right, you may pass eye tests without a blink, have 20-20 vision, or even see in the dark. You could miss seeing a jumbo jet at a mile and a half if the conditions are right. There's a blind spot in your eye about 30 degrees right of center when you're looking straight ahead. Your peripheral vision from the other eye compensates for this "defect" because your brain normally combines the pictures from both eyes.

When the peripheral vision from one eye is obstructed, the brain can't fill in the missing part of the picture. That's really not a problem when you're walking around on the ground. But when you get inside a flying machine, things start getting in the way, like passengers, co-pilots, or windscreen posts.

"Big deal," you say, "All I have to do is move my head." Maybe so, but try this test. Hold the picture shown on the following page at arm's length and focus both eyes on the cross on the left windscreen. Now move the picture towards your face; you should be able to see the KC-135 all the way in. Okay! Try it again with your left eye closed keeping your right eye focused on the cross. The tanker will disappear and then reappear as you draw the picture closer to your face. Ask yourself: How much airspace will my aircraft cover during the time the KC-135 disappeared?



AIRFIELD OPERATIONS AND AIR TRAFFIC CONTROL POINTS OF CONTACT

Please feel free to contact any person of the airfield operations or air traffic control staff regarding questions, concerns, or special requests.

Air traffic/Airfield Operations Flight Commander - 701 - 747-4550

Airfield Manager - 701 - 747- 4365

Base Operations - 701 - 747- 4409/4410

Radar Approach Control Chief - 701 – 747 - 3345

Tower Chief - 701 - 747 - 3830

Note: Air traffic controllers from the base are available for speaking engagements upon request and would be happy to speak to your organization on any ATC-related topic. To arrange for a speaker, please contact the air traffic services branch during normal duty hours (Mon - Fri, 0730-1630).