MID-AIR COLLISION AVOIDANCE

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Prepared in the interest of Aviation Safety by the
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INTRODUCTION

Midair Collision Avoidance (MACA) is a subject that is gaining heightened awareness among both civilian and military aviation communities. With increasing numbers of aircraft taking flight and many airports approaching gridlock, knowledge of air traffic and airfield operating procedures becomes more vital for pilots and aircrews. This pamphlet contains information on locally based aircraft operations, traffic patterns, arrival, and departure routes at Dover Air Force Base. The goal of the 436th Airlift Wing Flight Safety Office (436 AW/SEF) is to provide sufficient information to pilots and aircrew to enable recognition of potential midair collision hazards and help everyone enjoy a safe flying environment.

"See and avoid" is the proverb by which all aircrews must adhere regardless of operating IFR or VFR. In the local Dover airspace, large military aircraft tend to be relatively easy to see while smaller civilian aircraft tend to cause more difficulty in accurate visual acquisition. Nonetheless, it is everyone's responsibility to visually scan for traffic at all times. Therefore, all aircraft transiting the Dover airspace are highly encouraged to use all available aircraft lighting, transponder, and Air Traffic Control (ATC) advisory services to the maximum extent possible.

The 436 AW/SEF is the Office of Primary Responsibility (OPR) for the development, publishing, and maintenance of the Dover AFB Midair Collision Avoidance (MACA) pamphlet. If you have any questions concerning information contained within this pamphlet, contact the 436 AW/SEF at (302) 677-2048 or Air Traffic Control at (302) 677-3262.

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DOVER AFB

Dover Air Force Base is part of Air Mobility Command, a worldwide network of bases whose primary mission is transporting people and equipment. Our base is located 60 miles east of the Baltimore/Washington area, and 60 miles south of Philadelphia.

The base is home to the 436th Airlift Wing (AW) and the 512th Airlift Wing (Reserves). Together, the wings operate over 25 jumbo strategic airlift C-5 Galaxy aircraft.

There are over 50 civilian airfields within a 60 mile radius of Dover AFB. Since Dover is the largest military aerial port on the East Coast, local air traffic is often congested. The types of aircraft transiting the Delmarva airspace range from home-built ultra lights to huge jumbo-jets to supersonic fighter aircraft.

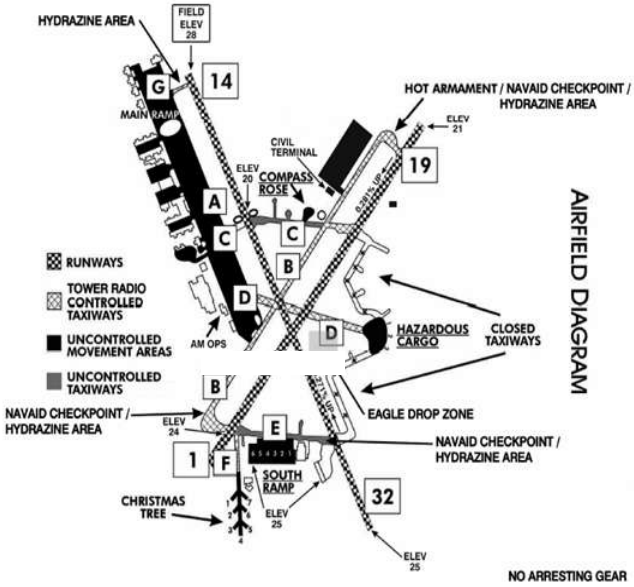
BOTTOM LINE….The potential for a mid-air collision is extremely high!

C-172 after midair with C-150

AIRFIELD INFORMATION

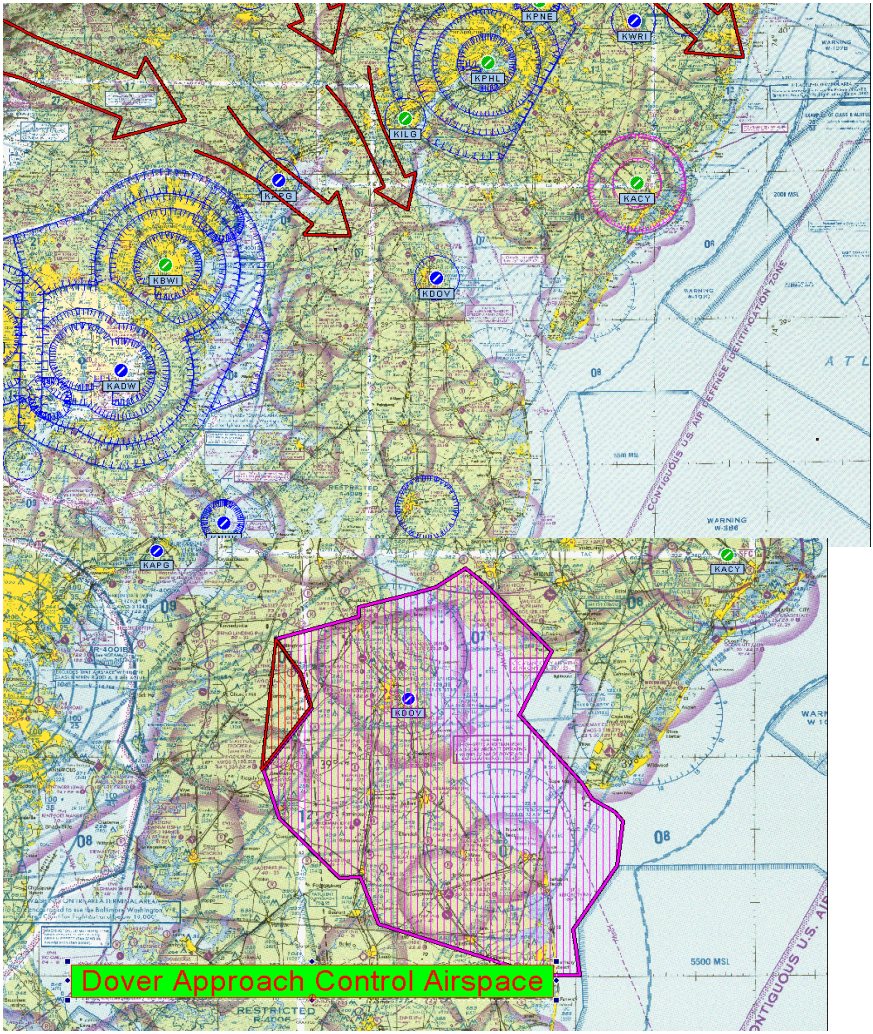
ICAO:	KDOV
Location:	N39º07.77' W75º27.96'
Elevation:	28' MSL
Runway 01/19:	9602' by 200'
Runway 32/14:	12,903' by 150'
Navaids:	RWY 01 ILS: 109.95 RWY 19 ILS: 111.9
Frequencies:	TWR: 126.35 GND: 118.875 APP: 132.425/135.15 VFR: 125.9 (25NM OUT)

This information is
flight publications



DOVER AIRSPACE

The airspace surrounding Philadelphia, Baltimore, and Washington DC is some of the busiest in the country. Dover's proximity to these areas brings a high volume of traffic through the Delmarva Peninsula and increases the chances of a mid-air collision.



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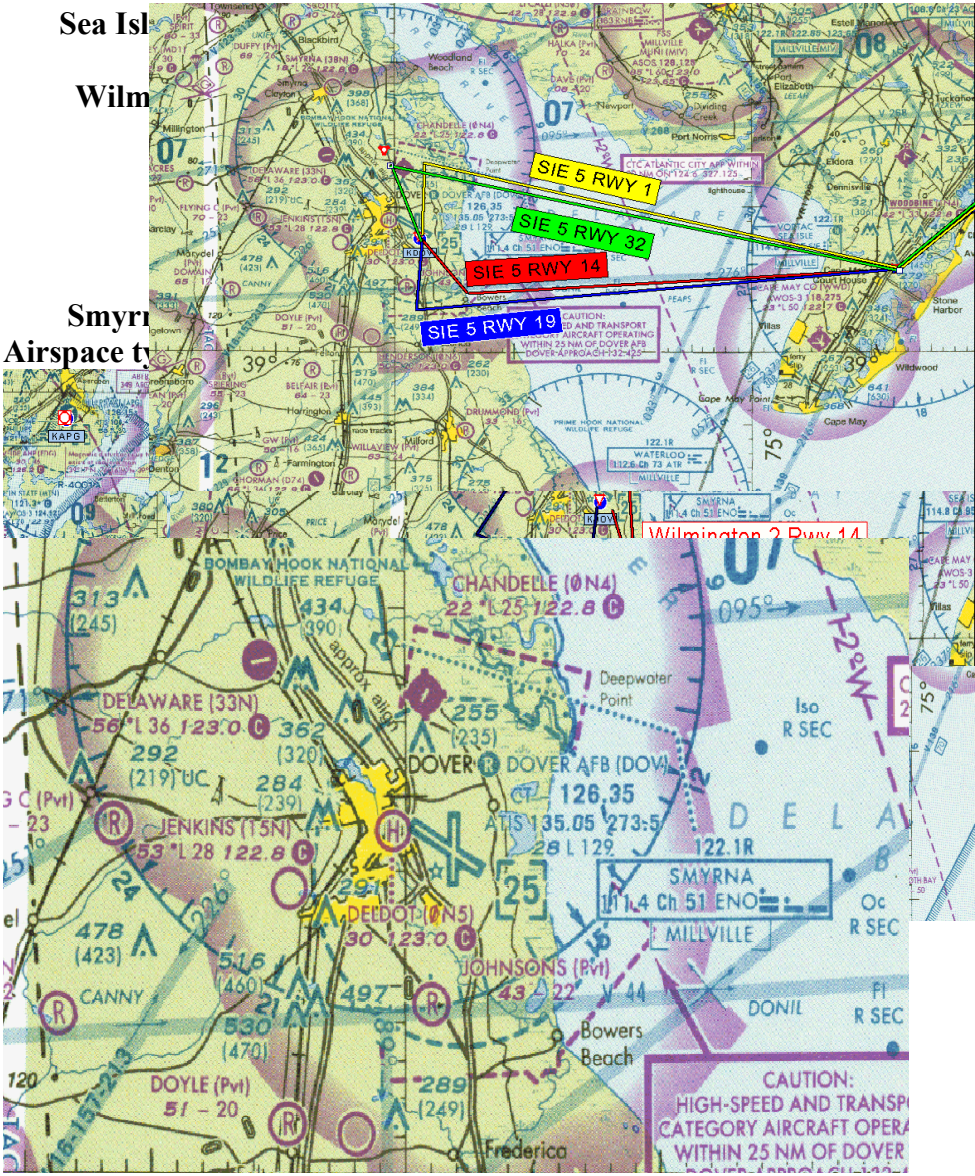

Pilots should be especially alert for heavy C-5 jet traffic when flying within 15 nautical miles of Dover AFB since extensive operations are conducted 24 hours a day, 7 days a week, every day of the year. Our normal traffic pattern is 3,000 feet MSL and below. However, we occasionally fly non-standard VFR approaches to the airfield from altitudes as high as 5,000 feet MSL.

When flying training sorties, our crews use special call signs. Expect to hear “BOLAR” or “HAGAR” when flying in Dover’s airspace. Our mission crews use the “REACH” call-sign.

Our traffic pattern is normally flown east of the airfield. IFR radar pattern altitude is usually 3,000 feet MSL, while our VFR traffic pattern is flown at 1,800 feet MSL.

Typical Dover VFR traffic patterns.

nationally-organized low-level Military Training Routes (MTRs). High-speed combined with low altitude make see-and-avoid much more difficult. Be vigilant when crossing a published MTR as any type of military aircraft could be on the route. Generally, the MTRs are established below 10,000 feet MSL for military operations at speeds in excess of 250 knots. Various aircraft use these routes from our large C-5 Galaxy to the small F-16 fighter jets. There are four operational MTRs within 50 miles of Dover AFB: SR-800, SR-844, SR-847, and VR-1709.

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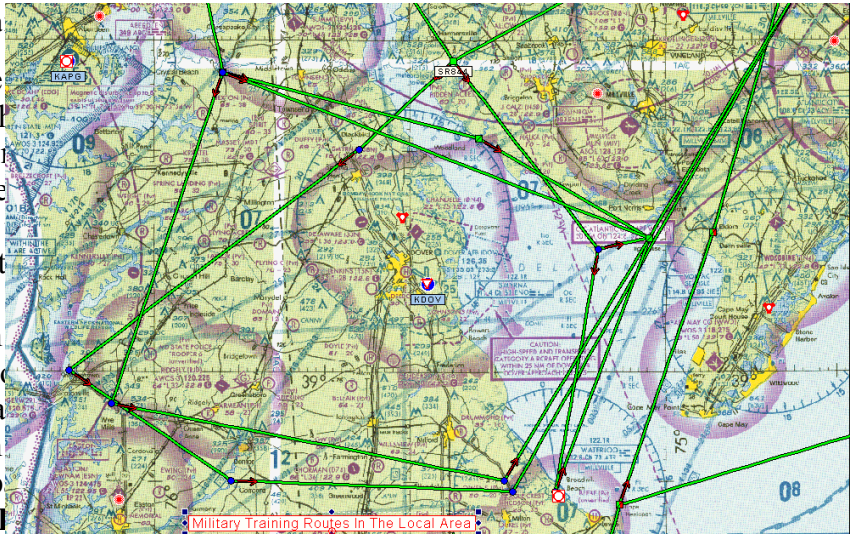


ACTIONS TO REMEMBER

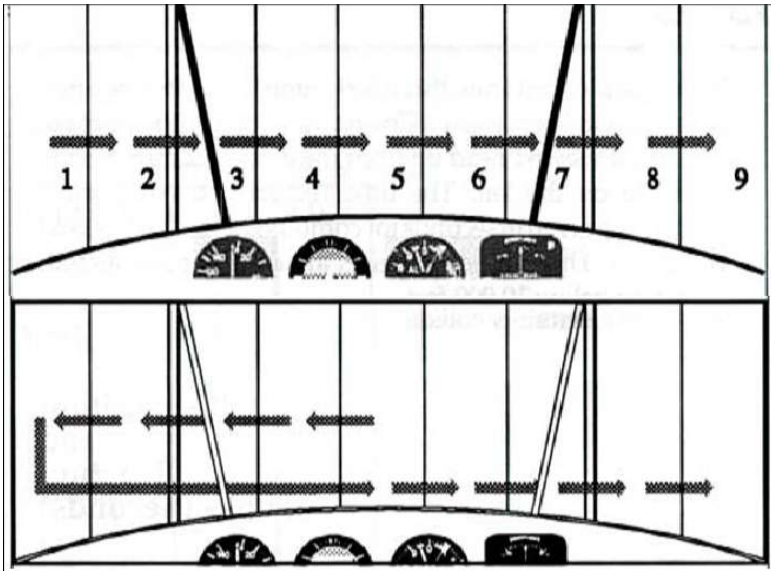
1. When planning a flight, especially below 1,500 feet AGL, carefully crosscheck available charts for the presence of MTRs and avoid them when possible. Only VR routes are depicted on sectional charts. SR and IR routes are not shown!
2. MTR corridors are not depicted on sectional charts; only the centerline of the route is shown. The actual corridor along the route is normally 5 NM on either side of the centerline.
3. When flying in close proximity to MTRs, contact the nearest Flight Service Station (FSS) for current flight activity along the route.
4. If you must operate near or through an MTR, do so above 1,500 feet AGL, and maintain a vigilant watch for aircraft.
5. When crossing an MTR, plan on crossing perpendicular to the route.
6. If you see a military aircraft, assume he does not see you.
7. Wake turbulence from heavy, high-speed aircraft is severe!

C-5 at less than ½ mile.

COMMON MISCONCEPTIONS

Do you believe all air traffic in the radar-controlled airspace is shown on the controller's scope? It is not! This assumption can be fatal. Radar cannot protect you from unidentified aircraft. Most radar has "blind spots." Just because you are under radar contact does not mean the controller can keep you away from 100% of air traffic. ATC can only control participating aircraft.

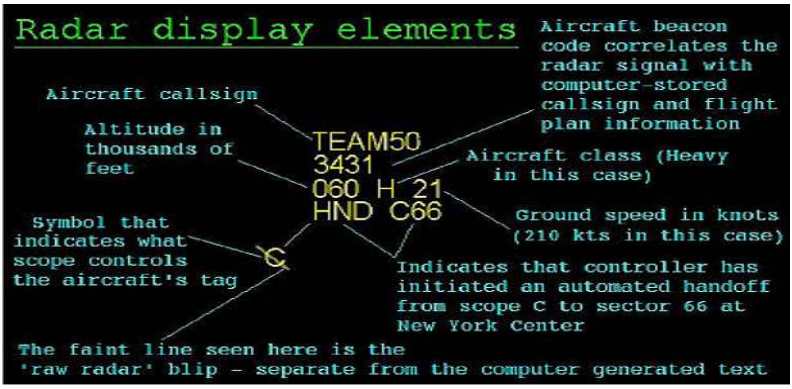
Many pilots believe any time they hear "Radar Contact" the controller has taken over all separation responsibilities. Never are pilots exempt from seeing and avoiding traffic conflicts. When under radar contact, the controller will share the responsibility with the pilot to resolve traffic conflicts. In the air, pilots are expected to pay attention to their surroundings. Anticipate what might happen by scanning the sky and listening to ATC frequencies. Know where traffic is and where you are. Most conflicts can be avoided by knowing where traffic is and where they are headed. Don't put all your trust in ATC when it comes to traffic avoidance! However, use radar services to the maximum extent possible. ATC is responsible to resolve traffic conflicts and can help you safely traverse controlled airspace. VFR pilots are highly encouraged to communicate with ATC and tell them their intentions.



Common traffic scan patterns.

TRANSPONDERS

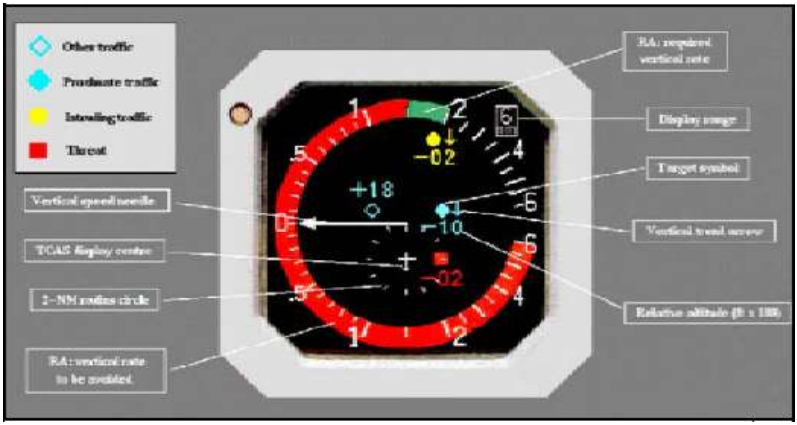
Private pilots can help ATC by installing a transponder in their aircraft. The difference between a non-transponder equipped aircraft and one with a transponder is substantial. Transponders make the radar signature "size" of a Piper Cub the same as a C-5 Galaxy. If you have a transponder (preferably with "MODE C" altitude encoding), USE IT. Many pilots turn the transponder off when leaving terminal areas to "save" its useful life. There are two dangers in this practice. One danger is you become less visible on the controller's radar scope, and the other is the possibility of forgetting to turn it back on at your destination. A final thought…your operative altitude-encoding transponder can help Traffic Alert and Collision Avoidance System (TCAS) equipped C-5 aircrews see and avoid you.



Depiction of aircraft information, provided by an aircraft's transponder, as displayed on the controller's screen.

TCAS

As a GA pilot, you're probably wondering "what does TCAS have to do with me?" First of all, knowing the basics of TCAS will assist you when flying in congested areas shared by the larger aircraft and you'll realize *how important it is to have your transponder on.* Secondly, collision avoidance technology is finding its way to the GA market and is becoming more capable and affordable.



Example of a TCAS display.

Airliners and larger commuter aircraft with passenger seat capacity greater than 30 are now equipped with TCAS. In order for TCAS to provide alerts and advisories, the conflicting aircraft

must have an operational transponder. A Resolution Advisory (RA), which is the active vertical guidance provided by TCAS, requires the conflicting aircraft to have Mode C altitude reporting capability. **TCAS is blind to aircraft without a transponder or with their transponder turned off.**

MID-AIR COLLISION STATISTICS

Almost 50 percent of mid-air collisions result in at least one death. Naturally, mid-air collision avoidance (MACA) is an important aviation safety topic. With the sky becoming more and more congested, the threat of a mid-air collision is increasing. According to the NTSB, the most probable cause of mid-air collision is the "pilot in command failed to see and avoid other aircraft." Aircraft speeds today challenge our ability to "see and avoid." Here are a few facts about mid-air collision:

1. Mid-air collisions generally occur during weekend daylight hours
- ✈ 56% of the accidents occurred in the afternoon.
- ✈ 32% of the accidents occurred in the morning.
- ✈ 2% of the accidents occurred at night, dusk, or dawn.

2. Most mid-air collisions occur under good visibility.
3. The majority of the aircraft involved in collisions are not on any type of flight plan.
4. Nearly all accidents occur at or near uncontrolled airports and at altitudes below 1000 ft.
5. Flight fatigue (fatigue resulting directly from flight related operations) is not a major factor in most mid-air collisions.
- ✈ The average flight time prior to the collision is 45 minutes. This time varies from takeoff to over seven hours.
- ✈ 60% of the pilots on the mishap flight had been airborne thirty minutes or less.
- ✈ Only 6% had been flying longer than two hours.

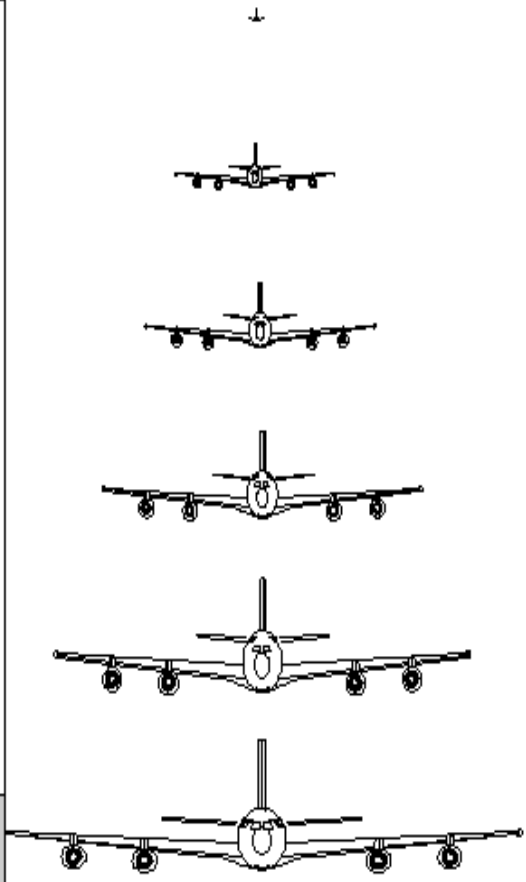
6. Pilots of all experience levels are involved in mid-air collisions, from the first solo ride to 20,000 hour veterans.

AIRCRAFT CLOSURE RATE CHART

Based on combined speeds of two aircraft

Distance	At 600 MPH	At 210 MPH
10 Miles	60	170
5 Miles	30	85
3 Miles	18	56
2 Miles	12	38
1 Mile	6	18
.5 Mile	3	9

Move back six feet from this illustration. From that position the pictures of the KC-135 approximate your perception of the aircraft at the corresponding distances on the chart. Taking into account the recognition and reaction times shown in the table to the left, the shaded blocks in the chart indicate distances where aircraft on collision courses would surely collide.



The areas in the gray box are the danger areas. This is based on recognition and reaction times.

DETECTING TRAFFIC

The detection of airborne object depends on six conditions:
1. Image size – size of the object relative to visual field-of-view
2. Contrast – difference between object and background brightness, color, and shape
3. Adaptation – degree to which your eyes adjust to surrounding illumination
4. Motion – velocity of the object relative to you
5. Exposure – length of time object is in view

C-5 ILLUSIONS

Since the C-5 is so huge, it may appear to be hanging in the sky and traveling quite slowly. Don't be deceived! A typical C-5 final approach speed with flaps down is around 125 knots!

Another illusion involves our flight path. When flying at slower airspeeds, the high deck angle of the airplane gives the illusion the airplane is climbing. We've had airplanes at higher altitudes descend toward us thinking the C-5 was climbing toward them! If you doubt the altitude of the C-5 traffic, ask the controller…or even the C-5.

COLLISION AVOIDANCE TIPS

1. Clear constantly for other aircraft, both visually and over the radios.
2. Know where high-density traffic areas are.
3. Always monitor the appropriate frequencies.
4. Obtain an IFR clearance or participate in radar flight following whenever possible and continue to practice "see and avoid" at all times.
5. Under IFR control, do not count on ATC to keep you away from other aircraft. There may be VFR aircraft operating in your environment that ATC is unaware of.
6. Use landing lights at lower altitudes, especially when near airports.
7. Announce your intentions on UNICOM and use standard traffic pattern procedures at uncontrolled airfields…. Be predictable!
8. If your aircraft is equipped with a transponder, turn it on and adjust it to reply on both Mode 3/A and C.
9. Use the appropriate hemispherical altitudes and don't let your altitude "wander."
10. Fly as high as possible.
11. Keep your windscreen clean. A bug on the windscreen can obstruct other airborne aircraft coming your way.
12. Don't get complacent during instruction! Statistically, instructors are on board during 37 percent of flying accidents.
13. When flying at night, avoid white light in the cockpit. White light disrupts your night vision, even when used momentarily.
14. Beware of wake turbulence.
15. Understand the limitations of your eyes and use proper visual scanning techniques. If an aircraft appears to have no relative motion but is increasing in size, you are on a collision course.
16. Practice appropriate clearing procedures before and during all climbs, descents, and turns.
17. Be aware of the type airspace in which you intend to operate and comply with applicable rules.
18. Avoid complacency. SEE AND BE SEEN!

NEAR MIDAIR COLLISION REPORTING

Definition: A near midair collision (NMAC) as defined by the **AIM (7-6-3)** is *"an incident associated with the operation of an aircraft in which a possibility of collision occurs as a result of proximity of less than 500 feet to another aircraft, or a report is received from a pilot or a flight crew member stating that a collision hazard existed between two or more aircraft."* Although the AIM mentions a definitive 500-foot proximity in this definition, it goes on to allow the pilot or flight crew member to make a determination as to if a collision hazard existed regardless of how close the aircraft came to one another. Therefore, use your judgment and make an honest assessment. If you believe a collision hazard existed, report it. It's your responsibility!

Reporting a NMAC: First of all, you must inform ATC by using the following verbiage. ***"I wish to report a near midair collision."*** This is in accordance with the **AIM 7-6-3**. A "Man that was close!" will not necessarily convey your intent. Properly notifying ATC will ensure the necessary data is saved. NMACs are reported on **FAA Form 8020-21**, "Preliminary Near Midair Collision Report," and should contain the following information:

- Date, time, and location of the NMAC
- Fix or facility nearest the NMAC
- The NMAC location in respect to the fix or facility
- Aircraft information, such as make, model, and registration number
- Type of flight rules during the NMAC
- The aircraft altitude during the NMAC
- A brief description of the NMAC, along with comments
- Aircraft altitude when the deviation was detected
- A brief description of the deviation, with appropriate comments

Your participation in the reporting process is highly encouraged and essential for improvements in the air traffic system and mishap prevention.

MILITARY AIRCRAFT IN DOVER AREA

V C - 2 5 A		**Wingspan**: 195 ft **Length**: 231 ft **Height**: 63 ft **Color:** White/Blue	**Normal Rate of Climb**: 2,000 to 4,000 FPM **Normal App Speed**:
C - 2 1		**Wingspan:** 40 ft **Length:** 49 ft **Height:** 17 ft **Color:** Grey or Green	**Normal Rate of Climb**: 2,000 to 4,000 FPM **Normal App Speed**:
C - 1 3		**Wingspan:** 132 ft **Length:** 97 ft **Height:** 38 ft **Color:** Grey or Green	**Normal Rate of Climb:** 1,500 FPM **Normal App Speed:** 140 Knots
C - 1 7		**Wingspan:** 169 ft **Length:** 174 ft **Height:** xx ft **Color:** Dark grey	**Normal Rate of Climb**: 2,000 to 4,000 FPM **Normal App Speed**:
C - 5		**Wingspan:** 222 ft **Length:** 247 ft **Height:** 65 ft **Color:** Dark grey	**Normal Rate of Climb**: 1,500 to 2,000 **Normal App Speed**:
A - 1 0		**Wingspan:** 57 ft **Length:** 53 ft **Height:** 15 ft **Color:** Grey or Green	**Normal Rate of Climb**: 2,000 to 4,000 FPM **Normal App Speed**:

NOTES


436TH AIRLIFT WING