U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: PILOTS' ROLE IN COLLISION AVOIDANCE

Date: 3/18/83
Initiated by: AFO-820

AC No: 90-48C
Change:

1. PURPOSE. This advisory circular is issued for the purpose of alerting all pilots to the potential hazards of midair collision and near midair collision, and to emphasize those basic problem areas related to the human causal factors where improvements in pilot education, operating practices, procedures, and improved scanning techniques are needed to reduce midair conflicts.

2. CANCELLATION. AC 90-48B, Pilots' Role in Collision Avoidance, dated 9/5/80 is canceled.

3. BACKGROUND.

a. From 1978 through October 1982 a total of 152 midair collisions (MAC) occurred in the United States resulting in 377 fatalities. Throughout this approximate 5-year time period the yearly statistics remained fairly constant, with a recorded high of 38 accidents in 1978 and a low of 25 in both 1980 and 1981. During this same time period there were 2,241 reported near midair collisions (NMAC). Statistics indicate that the majority of these midair collisions and near midair collisions, occurred in good weather and during the hours of daylight.

b. The FAA has introduced several significant programs designed to reduce the potential for midair and near midair collisions. This advisory circular is but one of those programs and is directed towards all pilots operating in the National Airspace System, with emphasis on the need for recognition of the human factors associated with midair conflicts.

4. ACTION. The following areas warrant special attention and continuing action on the part of all pilots to avoid the possibility of becoming involved in a midair conflict.

a. "See and Avoid" Concept.

(1) The flight rules prescribed in Part 91 of the Federal Aviation Regulations (FAR) set forth the concept of "See and Avoid." This concept requires that vigilance shall be maintained at all times, by each person operating an aircraft, regardless of whether the operation is conducted under Instrument Flight Rules (IFR) or Visual Flight Rules (VFR).

(2) Pilots should also keep in mind their responsibility for continuously maintaining a vigilant lookout regardless of the type of aircraft being flown. Remember that most MAC accidents and reported NMAC incidents occurred during good VFR weather conditions and during the hours of daylight.

b. Visual Scanning.

(1) Pilots should remain constantly alert to all traffic movement within their field of vision, as well as periodically scanning the entire visual field outside of their aircraft to ensure detection of conflicting traffic. Remember that the performance capabilities of many aircraft, in both speed and rates of climb/descent, result in high closure rates limiting the time available for detection, decision, and evasive action. (See the "Distance-Speed-Time" chart in Appendix 1.)

(2) The probability of spotting a potential collision threat increases with the time spent looking outside, but certain techniques may be used to increase the effectiveness of the scan time. The human eyes tend to focus somewhere, even in a featureless sky. In order to be most effective, the pilot should shift glances and refocus at intervals. Most pilots do this in the process of scanning the instrument panel, but it is also important to focus outside to set up the visual system for effective target acquisition.

(3) Pilots should also realize that their eyes may require several seconds to refocus when switching views between items in the cockpit and distant objects. Proper scanning requires the constant sharing of attention with other piloting tasks, thus it is easily degraded by such psychophysiological conditions such as fatigue, boredom, illness, anxiety, or preoccupation.

(4) Effective scanning is accomplished with a series of short, regularly-spaced eye movements that bring successive areas of the sky into the central visual field. Each movement should not exceed 10 degrees, and each area should be observed for at least 1 second to enable detection. Although horizontal back-and-forth eye movements seem preferred by most pilots, each pilot should develop a scanning pattern that is most comfortable and then adhere to it to assure optimum scanning.

(5) Peripheral vision can be most useful in spotting collision threats from other aircraft. Each time a scan is stopped and the eyes are refocused, the peripheral vision takes on more importance because it is through this element that movement is detected. Apparent movement is almost always the first perception of a collision threat and probably the most important, because it is the discovery of a threat that triggers the events leading to proper evasive action. It is essential to remember, however, that if another aircraft appears to have no relative motion, it is likely to be on a collision course with you. If the other aircraft shows no lateral or vertical motion, but is increasing in size, take immediate evasive action.

(6) Visual search at night depends almost entirely on peripheral vision. In order to perceive a very dim lighted object in a certain direction, the pilot should not look directly at the object, but scan the area adjacent to it. Short stops, of a few seconds, in each scan will help to detect the light and its movement.

(7) Lack of brightness and color contrast in daytime and conflicting ground lights at night increase the difficulty of detecting other aircraft.

(8) Pilots are reminded of the requirement to move one's head in order to

search around the physical obstructions, such as door and window posts. The doorpost can cover a considerable amount of sky, but a small head movement may uncover an area which might be concealing a threat.

c. Clearing Procedures.

(1) Pilots should:

(i) Prior to taxiing onto a runway or landing area for takeoff, scan the approach areas for possible landing traffic by maneuvering the aircraft to provide a clear view of such areas. It is important that this be accomplished even though a taxi or takeoff clearance has been received.

(ii) 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 them.

(iii) Execute appropriate clearing procedures before all turns, abnormal maneuvers, or acrobatics.

d. Airspace, Flight Rules, and Operational Environment.

(1) Pilots should be aware of the type of airspace in which they intend to operate in order to comply with the flight rules applicable to that airspace. Aeronautical information concerning the National Airspace System is disseminated by three methods: aeronautical charts (primary); the Airman's Information Manual (AIM); and the Notices to Airmen (NOTAM) system. The general operating and flight rules governing the operation of aircraft within the United States are contained in Part 91 of the FAR.

(2) Pilots should:

(i) Use currently effective aeronautical charts for the route or area in which they intend to operate.

(ii) Note and understand the aeronautical legend and chart symbols related to airspace information depicted on aeronautical charts.

(iii) Develop a working knowledge of the various airspace segments, including the vertical and horizontal boundaries.

(iv) Develop a working knowledge of the specific flight rules (FAR 91) governing operation of aircraft within the various airspace segments.

(v) Use the AIM. The Basic Flight Information and ATC Procedures describe the airspace segments and the basic pilot responsibilities for operating in such airspace.

(vi) Contact the nearest FAA Flight Service Station for any pertinent NOTAMS pertaining to their area of operation.

(3) Pilots should also be familiar with, and exercise caution, in those operational environments where they may expect to find a high volume of traffic or special types of aircraft operation. These areas include Terminal Radar Service Areas (TRSA's), airport traffic patterns, particularly at airports without a control tower; airport traffic areas (below 3,000 feet above the surface within five statute miles of an airport with an operating control tower); terminal control areas; control zones, including any extensions; Federal airways; vicinity of VOR's; restricted areas; warning areas; alert areas; Military Operating Areas (MOA); intensive student jet training areas; military low-level high-speed training routes; instrument approach areas; and areas of high density jet arrival/departure routings, especially in the vicinity of major terminals and military bases.

e. Use of Communications Equipment and Air Traffic Advisory Services.

(1) One of the major factors contributing to the likelihood of NMAC incidents in terminal areas that have an operating air traffic control (ATC) system has been the mix of known arriving and departing aircraft with unknown traffic. The known aircraft are generally in radio contact with the controlling facility (local, approach, or departure control) and the other aircraft are neither in two-way radio contact nor identified by ATC at the time of the NMAC. This precludes ATC from issuing traffic advisory information to either aircraft.

(2) Although pilots should adhere to the necessary communications requirements when operating VFR, they are also urged to take advantage of the air traffic advisory services available to VFR aircraft.

(3) Pilots should:

(i) Use the AIM.

(A) The basic AIM contains a section dealing with services available to pilots, including information on VFR advisory services, radar traffic information services for VFR pilots, and recommended traffic advisory practices at nontower airports.

(B) The airport/facility directory contains a list of all major airports showing the services available to pilots and the applicable communication frequencies.

(ii) Develop a working knowledge of those facilities providing traffic advisory services and the area in which they give these services.

(iii) Initiate radio contact with the appropriate terminal radar or nonradar facility when operating within the perimeters of the advertised service areas or within 15 miles of the facility when no service area is specified.

(iv) When it is not practical to initiate radio contact for traffic information, at least monitor the appropriate facility communication frequency, particularly when operating in or through arrival/departure routes and instrument approach areas.

(v) Remember that controller observation of aircraft in the terminal area is often limited by distance, depth perception, aircraft conspicuity, and other normal visual acuity problems. Limitations of radar (when available), traffic volume, controller workload, unknown traffic, etc., may prevent the controller from providing timely traffic advisory information. Traffic advisories are secondary to the controllers' primary duties (which are separating aircraft under their control and issuing safety advisories when aware of safety conflicts). Therefore, the pilot is responsible for seeing and avoiding other traffic. Traffic advisories should be requested and used when available to assist the pilot to see and avoid other traffic by assisting, but not substituting in any way, the pilot's own visual scanning. It is important to remember that advisories which air traffic control may provide are not intended to lessen in any manner the pilot's obligation to properly scan to see and avoid traffic.

f. Airport Traffic Patterns.

(1) A significant number of midair collisions, as well as near midair collisions, have occurred within the traffic pattern environment.

(2) Pilots should:

(i) When operating at tower-controlled airports, maintain two-way radio contact with the tower while within the airport traffic area. Make every effort to see and properly avoid any aircraft pointed out by the tower, or any other aircraft which may be in the area and unknown to the tower.

(ii) When entering a known traffic pattern at a nontower airport, keep a sharp lookout for other aircraft in the pattern. Enter the pattern in level flight and allow plenty of spacing to avoid overtaking or cutting any aircraft out of the pattern.

(iii) When approaching an unfamiliar airport fly over or circle the airport at least 500 feet above traffic pattern altitude (usually at 2,000 feet or more above the surface) to observe the airport layout, any local traffic in the area, and the wind and traffic direction indicators. Never descend into the traffic pattern from directly above the airport.

(iv) Be particularly alert before turning to the base leg, final approach course, and during the final approach to landing. At nontower airports, avoid entering the traffic pattern on the base leg or from a straight-in approach to the landing runway.

(v) Compensate for blind spots due to aircraft design and flight attitude by moving your head or maneuvering the aircraft.

g. Flying In Formation.

(1) Several midair collisions have occurred which involved aircraft on the same mission, with each pilot aware of the other's presence.

(2) Pilots who are required, by the nature of their operations, to fly in pairs or in formation are cautioned to:

(i) Recognize the high statistical probability of their involvement in midair collisions.

(ii) Make sure that adequate preflight preparations are made and the procedures to be followed are understood by all pilots intending to participate in the mission.

(iii) Always keep the other aircraft in sight despite possible distraction and preoccupation with other mission requirements.

(iv) Avoid attempting formation flight without having obtained instruction and attained the skill necessary for conducting such operations.

h. Flight Instructors, Pilot Examiners, and Persons Acting As Safety Pilots.

(1) The importance of flight instructors training pilot applicants to devote maximum attention to collision avoidance while conducting flight operations in today's increasing air traffic environment cannot be overemphasized.

(2) Flight instructors should set an example by carefully observing all regulations and recognized safety practices, since students consciously and unconsciously imitate the flying habits of their instructors.

(3) Flight instructors and persons acting as safety pilots should:

(i) Guard against preoccupation during flight instruction to the exclusion of maintaining a constant vigilance for other traffic.

(ii) Be particularly alert during the conduct of simulated instrument flight where there is a tendency to "look inside."

(iii) Place special training emphasis on those basic problem areas of concern mentioned in this advisory circular where improvements in pilot education, operating practices, procedures, and techniques are needed to reduce midair conflicts.

(iv) Notify the control tower operator, at airports where a tower is manned, regarding student first solo flights.

(v) Explain the availability of and encourage the use of expanded radar services for arriving and departing aircraft at terminal airports where this service is available, as well as, the use of radar traffic advisory services for transiting terminal areas or flying between en-route points.

(vi) Understand and explain the limitations of radar that may frequently limit or prevent the issuance of radar advisories by air traffic controllers (refer to AIM).

(4) Pilot examiners should:

(i) During any flight test, direct attention to the applicant's vigilance of other air traffic and an adequate clearance of the area before performing any flight maneuver.

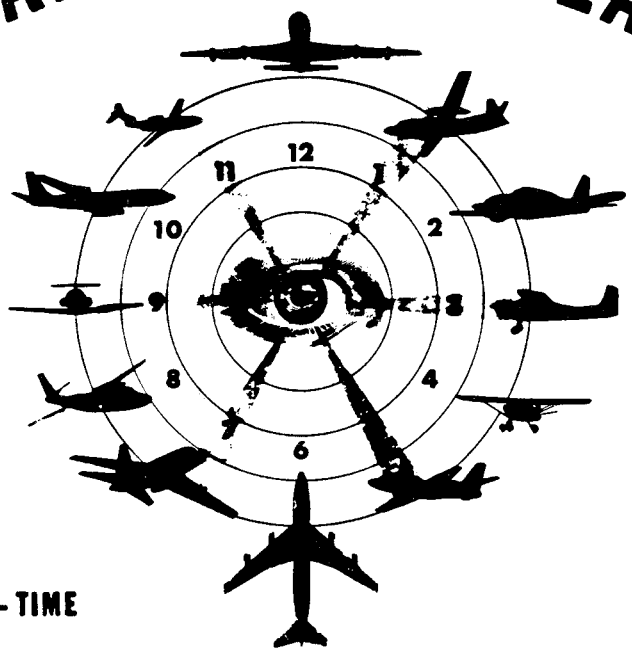
(ii) Direct attention to the applicant's knowledge of the airspace, available FAA air traffic services and facilities, essential rules, good operating practices, procedures, and techniques that are necessary to achieve high standards of air safety.

i. Scan Training. The Aircraft Owners and Pilots Association (AOPA) Air Safety Foundation has developed an excellent educational program designed to inform pilots on effective visual scan techniques. All pilots are encouraged to attend FAA/industry sponsored safety meetings which feature this program. The program, called "Take Two and See," is available on loan through the AOPA Air Safety Foundation, 7315 Wisconsin Avenue, Bethesda, Maryland 20814. For further information on the availability of this or any other Accident Prevention Program dealing with collision avoidance, interested persons may contact the Accident Prevention Specialist at any FAA General Aviation District Office or Flight Standards District Office.

Kenneth S. Hunt

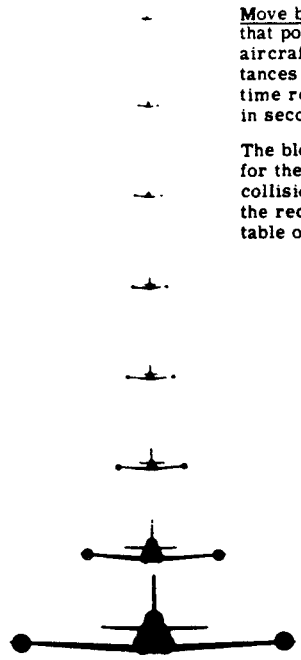
KENNETH S. HUNT
Director of Flight Operations

A RADAR FOR ALL SEASONS



DISTANCE - SPEED - TIME

MPH	600	360
	SECONDS	
10 miles	60	100
6 miles	36	60
5 miles	30	50
4 miles	24	40
3 miles	18	30
2 miles	12	20
1 mile	6	10
½ mile	3	5



CRITICAL SECONDS

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 the 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.

RECOGNITION and REACTION TIMES (from U.S. Naval Aviation Safety Bulletin) Excerpt

	Seconds
see object	0.1
recognize a/c	1.0
become aware of collision course	5.0
decision to turn left or right	4.0
muscular reaction	0.4
aircraft lag time	2.0
TOTAL	12.5

LOOK ALIVE AND LIVE