Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FAA-AM-75-5		

4. Title and Subtitle	5. Report Date
TO SEE OR NOT TO SEE: VISUAL ACUITY OF PILOTS INVOLVED IN MIDAIR COLLISIONS	6. Performing Organization Code: AAM-110
	8. Performing Organization Report No.
7. Author(s) Leonard C. Ryan, S.J. Gerathewohl, Stanley R. Mohler, and Charles F. Booze, Jr.	
9. Performing Organization Name and Address: Aeromedical Applications Division, Research Planning Branch, Federal Aviation Administration, Washington D.C. 20591	10. Work Unit No. (TRAIS)
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: Office of Aviation Medicine, Federal Aviation Administration, 800 Independence Avenue, S.W., Washington, D.C. 20591	13. Type of Report and Period Covered: OAM Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The Medical records of airmen involved in midair collisions from 1970 through 1973 were reviewed and compared with two other groups of pilots: (1) pilots involved in other types of accidents, and (2) pilots without any accident records. There is nothing in the results to indicate that the pilots with visual corrections are a greater risk.

17. Key Words	18. Distribution Statement
Midair Collision Aircraft Accidents Visual	Document is available to the public through the National Technical Information Service, Springfield, Virginia 22151

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		$3.00 PC .95 MF

TO SEE OR NOT TO SEE: VISUAL ACUITY OF PILOTS INVOLVED IN MIDAIR COLLISIONS

I. INTRODUCTION

Midair collisions remain an area of great concern in aviation safety. Midair collisions are unlike other types of aircraft accidents, in that in almost 50% of all cases, there is at least one death.

Various methods and techniques have been tried and some are presently in use to enable the pilot to avoid the potential midair collision. Various studies have been performed on visual collision avoidance techniques. New and different lighting systems have been tested. The Federal Aviation Administration, Department of Transportation, adopted new rules requiring all powered U.S. civil aircraft with a standard airworthiness certificate to be equipped with approved anticollision lights for night operations after August 11, 1972, as an aid in preventing midair collisions. With the sky becoming more and more crowded and aircraft flying at higher speeds, it is conceivable that the problem of preventing midair collisions will be worse in the future. The most often probable cause of the midair collision cited by the National Transportation Safety Board is "pilot in command failed to see and avoid other aircraft." From the above, one can begin to realize the importance of vision in avoiding a collision in the see-and-be-seen system.

In order to answer the question of whether there is a correlation between visual acuity and midair collision, all available medical records of U.S. civil pilots involved in fatal midair collisions from 1970 through 1973 were reviewed and analyzed as to visual functions, impairments and corrections as to visual acuity and compared with two groups of pilots: (1) Pilots who had no aircraft accidents, and (2) pilots involved in other types of aircraft accidents.

Since we were unable to study all of the pilots involved in other types of accidents and all of the pilots who had no aircraft accidents, it was desirous to select representative samples from these two groups. For this reason, random samples were selected using systematic sampling techniques. If the airman's medical record stated that he needed glasses for near, distant, or near and distant vision, the pilot was placed in the visual correction group. No consideration was given to the degree of visual impairment.

II. RESULTS AND DISCUSSION

Table I shows there were 118 midair collisions from 1970 through 1973. At least one fatality occurred in 66 of these accidents. There were 221 fatalities in all and 28 serious injuries.

These midair collisions occurred generally during daylight hours. Figure I depicts the percent of accidents that occurred at various times of day. Fifty-six percent of the accidents occurred in the afternoon, 32% in the morning, with the remaining 12% occurring at night, dusk and dawn. Most occurred in weather conditions when the visibility was acceptable (3 miles or more).

TABLE I

MID-AIR ACCIDENTS-INJURIES

U.S. CIVIL AVIATION: 1970-1973*

ACCIDENTS	FATAL ACCIDENTS	FATALITIES	SERIOUS INJURIES
118	66	221	28

*NTSB RECORDS

Figure 2 shows that the accidents occurred generally throughout the year, for this four-year period, with the exception of March, April and May. Only 8% of the accidents occurred during this three-month period.

The fatal midair collisions occurred in 27 states (see Figure 3).

Tables II, III, and IV depict visual corrections for pilots. Table II shows pilots involved in midair collisions, Table III shows nonaccident pilots and Table IV shows accident pilots. As expected, in all three groups the nonaccident, the accident and pilots involved in midair collisions, most visual corrections occurred in pilots 40 years of age or more. However, 62% of the pilots involved in midair collisions had no visual corrections. Fifty-four percent of the nonaccident pilots had no visual corrections as did 51% of the pilots involved in other types of accidents. From this, it appears that visual corrections were not a factor in the midair accidents. In fact, it appears that the pilots involved in midair collisions had fewer visual corrections than the other two groups.

The recency of flight experience was also examined. Tables V, VI, and VII show the flight time for the last six months with the per-

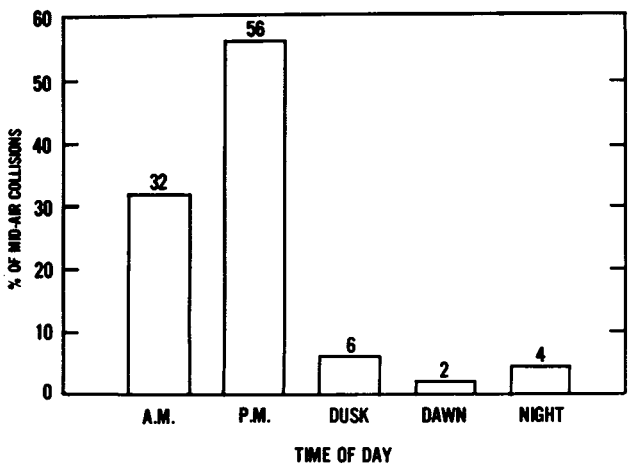

FIGURE 1. Percent of fatal midair collisions occurring at different times of day.

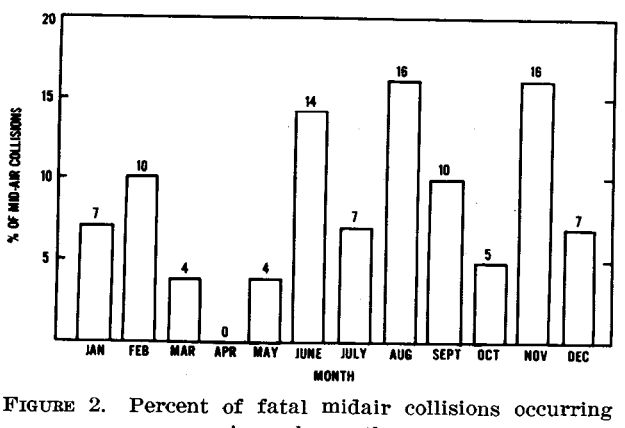

FIGURE 2. Percent of fatal midair collisions occurring in each month.

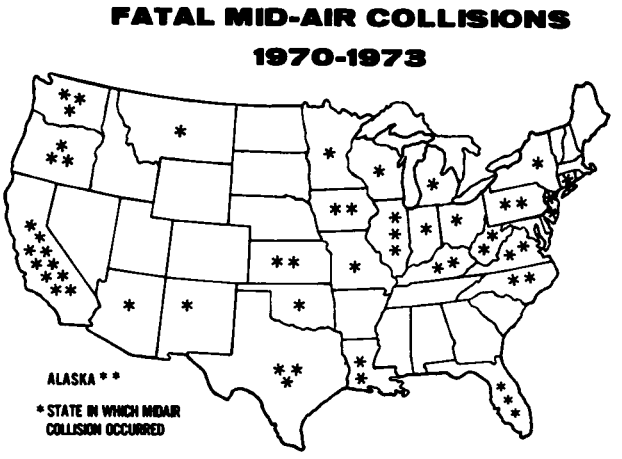

FIGURE 3. States in which fatal midair collisions occurred.

TABLE II

VISUAL CORRECTIONS: PILOTS IN MID-AIR COLLISIONS

	CORRECTIONS*			
AGE	DISTANT	NEAR	NEAR/DISTANT	NONE
17-29	5%	–	6%	89%
30-39	6%	–	16%	78%
40-49	3%	14%	14%	69%
50-59	–	17%	61%	22%
60 & OVER	–	20%	80%	–

*FAA RECORDS

cent of pilots under each heading. The number in parenthesis is the average number of hours flown.

When the midair accident group was compared with the nonaccident group, the midair group had flown significantly more. There was no significant difference in total flight time between the three groups.

Since it appears that visual corrections had no effect on midair collisions and the pilots involved had flown more in the last 6 months than the nonaccident pilots, the question arose as to pilot fatigue contributing to the midair accidents. To try to get some indication as to whether this was the case, the amount of flight time on the flight that the accident occurred was reviewed. The average flight time prior to the collision was 45 minutes. However, this varied from take-off to over 7 hours. Sixty percent of these pilots on the fateful flight had been airborne 30 minutes or less. In fact 33% had been up only 10 minutes or less. Eighty percent had been up one hour or less. Only 6% had been flying longer than 2 hours (see Table VIII).

From these results, it would appear that fatigue was not a major factor in the collisions, at least fatigue from the flights that the acci-

TABLE III

VISUAL CORRECTIONS:

NON-ACCIDENT AIRMEN

	CORRECTIONS*			
AGE	DISTANT	NEAR	NEAR/DISTANT	NONE
17-29	40%	–	10%	50%
30-39	19%	–	7%	74%
40-49	5%	23%	5%	67%
50-59	7%	26%	60%	7%
60 & OVER	–	20%	80%	–

* FAA RECORDS

TABLE IV

VISUAL CORRECTIONS

ACCIDENT AIRMEN

	CORRECTIONS*			
AGE	DISTANT	NEAR	NEAR/DISTANT	NONE
17-29	10%	–	15%	75%
30-39	23%	–	6%	71%
40-49	9%	17%	28%	46%
50-59	7%	36%	50%	7%
60 & OVER	–	40%	60%	–

*FAA RECORDS

TABLE V

NON-ACCIDENT AIRMEN FLIGHT TIME

LAST SIX MONTHS

AGE	0-10 HRS*	11-50 HRS*	51-100 HRS*	101 HRS & UP*
17-29	50% (3)	25% (24)	5% (60)	20% (400)
30-39	29% (4)	39% (32)	6% (100)	26% (417)
40-49	42% (1)	19% (31)	11% (83)	28% (334)
50-59	14% (1)	43% (33)	14% (70)	29% (290)
60 & OVER	20% (2)	60% (15)	–	20% (130)

* ( ) AVERAGE NO. HRS. FLOWN

TABLE VI

ACCIDENT AIRMEN FLIGHT TIME

LAST SIX MONTHS

AGE	0-10 HRS*	11-50 HRS*	51-100 HRS*	101 HRS & UP*
17-29	35% (3)	20% (38)	5% (100)	40% (234)
30-39	29% (5)	36% (31)	6% (93)	29% (304)
40-49	19% (2)	31% (31)	22% (71)	28% (326)
50-59	29% (9)	29% (35)	14% (85)	28% (293)
60 & OVER	20% (0)	20% (15)	60% (84)	–

*( ) AVERAGE NO. HRS. FLOWN

TABLE VII

MID-AIR COLLISION

AIRMEN FLIGHT TIME

LAST SIX MONTHS – 1970-1973

AGE	0-10 HRS*	11-50 HRS*	51-100 HRS*	101 HRS & UP*
17-29	25% (4)	20% (29)	15% (67)	40% (429)
30-39	20% (3)	15% (29)	21% (90)	44% (329)
40-49	28% (5)	29% (37)	6% (65)	37% (340)
50-59	10% (2)	37% (31)	16% (85)	37% (425)
60 & OVER	20% (10)	20% (40)	20% (60)	40% (325)

* ( ) AVERAGE NO. HRS. FLOWN

TABLE VIII

LENGTH OF FLIGHT PRIOR TO MID-AIR COLLISION*

10 MINUTES OR LESS	11-30 MINUTES	31-60 MINUTES	61-120 MINUTES	121 MINUTES & ABOVE
33% (6)	27% (23)	20% (46)	14% (88)	6% (231)

*% PERCENT OF ACCIDENTS THAT OCCURRED WITHIN THIS TIME PERIOD.
( ) = AVERAGE NO. OF MINUTES IN FLIGHT PRIOR TO ACCIDENT.

dents occurred. However, this does not eliminate the possibility of the pilot being fatigued prior to take-off.

III. SUMMARY

Records of airmen involved in fatal midair collisions from 1970 through 1973 were examined and compared with two other groups of pilots: (1) pilots involved in other types of accidents, and (2) pilots without any accident records. There is nothing in the results to indicate that the pilots with visual corrections are a greater risk. In fact, the pilots involved in midair collisions as a group were better off visually.

The analysis of the pilot's flight time for the last six months, showed that pilots involved in midair accidents had flown the greater number of hours than the pilots in the nonaccident group. There was no significant difference in other accident pilot group.

There was no significant difference in total flight time in the three groups.

It can be concluded from the results of this study that visual impairment if corrected in accordance with out present medical standards, does not constitute a midair collision risk for U.S. civil aviation pilots.