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Prescribing Spectacles For Aviators

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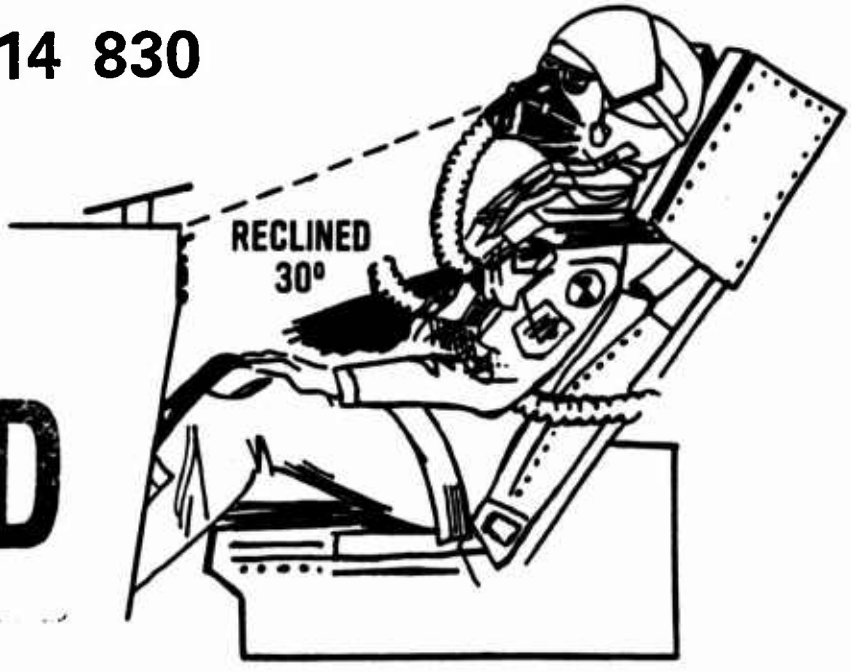

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NOTICES

This final report was submitted by personnel of the Ophthalmology Branch, Clinical Sciences Division, USAF School of Aerospace Medicine, Human Systems Division, AFSC, Brooks Air Force Base, Texas, and the Optometry Services, Wilford Hall USAF Medical Center, Lackland Air Force Base, Texas, under job order 7755-24-07.

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The Office of Public Affairs has reviewed this report, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This report has been reviewed and is approved for publication.

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This special report was written as a review and reference for USAF vision specialists in prescribing spectacles for aviators. Vision correction in flyers presents unique problems, especially for the presbyopes. The demands of each individual aircraft environment need to be well understood. USAF ophthalmologists and optometrists must consider the pertinent aeromedical factors before prescribing spectacles for ametropic aircrew members. This report includes a comprehensive guide to cockpit instrument panel distances and print sizes for most USAF aircraft.

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PRESCRIBING SPECTACLES FOR AVIATORS

INTRODUCTION

A popular saying in World War II (WW II) was "A pilot's eyes are his finest weapon!" Even today, in this age of radar, infrared imaging systems, head-up displays, and electronic warfare, a pilot's eyes are still "his finest weapon." Thus, prescribing appropriate spectacles is critically important for ametropic aircrew members.

The correction of vision in aviators, however, presents unique problems, especially when aviators become presbyopic. Although prescribing distance correction is seemingly easy, certain problems may arise, e.g., unbalanced binocular corrections, overminusing, or overcorrection of astigmatism. However, there are many sources of potential problems in prescribing bifocals for aviators, including distance refractive error, amplitude of accommodation, aircraft and position of gaze, sitting height and seat position, and ambient illumination. United States Air Force (USAF) ophthalmologists and optometrists must consider these many factors when assessing the unique operational needs of each aviator for distant and near visual corrections. This manual provides background information for the Air Force ophthalmologist/optometrist about the visual needs of aviators and reviews pertinent aeromedical factors. A comprehensive guide to cockpit instrument panel distances and print sizes for most USAF aircraft is also included.

BACKGROUND

A 1988 study of USAF aircrew by the Ophthalmology Branch, USAF School of Aerospace Medicine, Clinical Sciences Division (USAFSAM/NGO), found that 27.4% of pilots, 51.5% of navigators/weapons systems operators, and 40.2% of other aircrew members were required to wear spectacles when flying (Table 1). These flyers are faced with, and many have reported, problems with wearing eyeglasses in an often hostile and dangerous environment. The problems include, but are not limited to, a reduced field of view, fogging and perspiration on the lenses, nasal bridge discomfort, reflections at night, excessive weight, decentration from G-forces and/or vibrations, and hot spots underneath the helmet.

Furthermore, many USAF pilots are faced with the visual problems of presbyopia, the loss of ocular accommodative ability that occurs in middle age. The 1988 USAFSAM/NGO study also found that 16.5% of USAF pilots and 7.1% of navigators/weapons systems operators (Nav/WSO) are 40 years of age or older. The curve of aviator ages has a significant second peak around age 40 (Fig. 1). Other data from that study revealed that, of those who wear spectacles, 12.4% of pilots, 2.4% of Nav/WSO and 3.8% of other aircrew were required to wear bifocals when flying. These numbers actually underestimate the magnitude of this population, because they do not include the senior rated officers in

TABLE 1. AIRCREW MEMBERS REQUIRING SPECTACLES

MAJCOM	Pilots	Nav/WSO	Others
ATC[1]	25.8%	51.1%	56.2%
MAC[2]	25.9%	49.2%	36.1%
SAC[3]	29.2%	51.3%	41.0%
TAC[4]	30.2%	54.8%	53.9%
Total	27.4%	51.5%	40.2%
N	3226	1634	1596

N = Total number of aircrew members surveyed.
[1] Air Training Command; [2] Military Airlift Command;
[3] Strategic Air Command; [4] Tactical Air Command

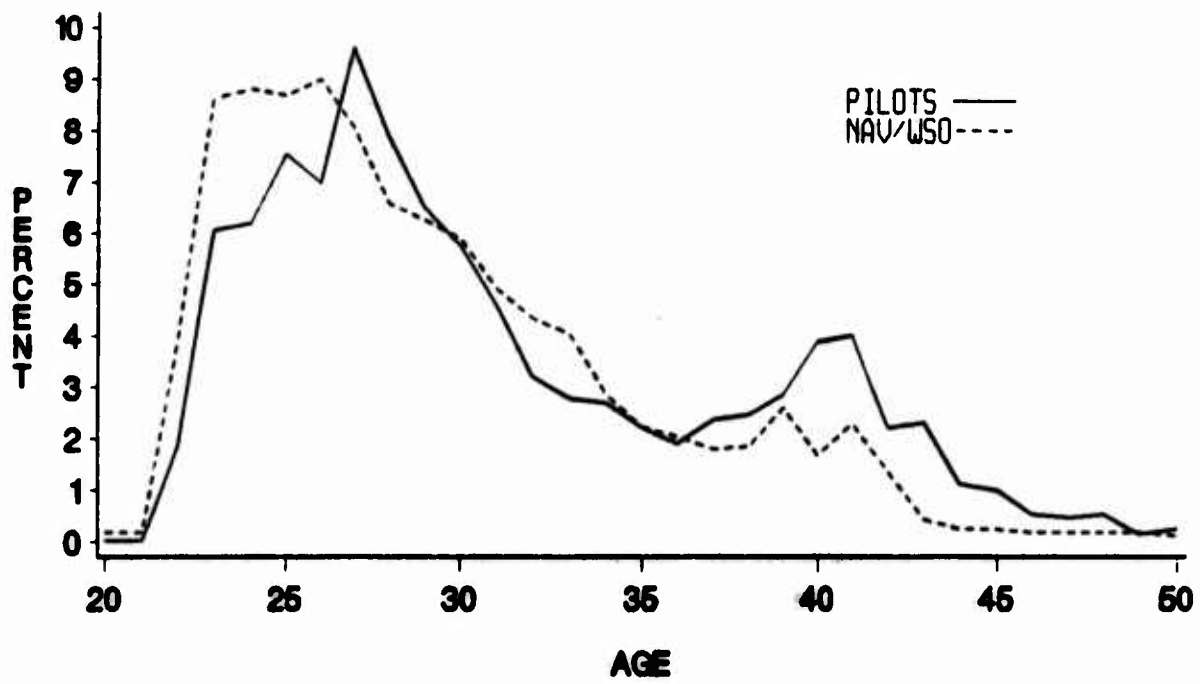


Figure 1. Ages of USAF aviators by frequency.

nonflying staff or administrative positions. Also, many of the Air National Guard and Air Force Reserve flyers are bifocal wearers because their average age is 7 years greater than those in the active force.

It is important to assure the presbyopic aviator that presbyopia is not a pathologic condition. While it is not usually a problem for most individuals until they reach their mid-forties, some latent hyperopes may have problems much earlier. Because of strict entry vision standards for aircrew training, most USAF pilots do not wear spectacles before the age of presbyopia. However, this, in itself, causes problems when they must adjust to wearing spectacles in late middle age.

Asthenopia, or eyestrain, with near work may be the earliest symptom of presbyopia. In flyers, however, eyestrain may manifest itself as difficulty in seeing the flight instruments or flight charts under dim illumination. Furthermore, red cockpit lighting at night will cause more difficulties for the pre-presbyope than blue or white lights, because it requires more accommodation to read under red illumination due to chromatic aberration in the eye.

USAF ophthalmologists and optometrists should consider the particular cockpit environment and the unique needs of each aviator when prescribing spectacles. The need for a prescription that provides sharp distance visual acuity in the military aviator is obvious. If distance visual acuity is found to be decreased (i.e., worse than 20/20), spectacles should be ordered and required for flying. On the other hand, the need to prescribe correction for near vision is not as apparent. The Armed Forces Vision Test Apparatus-Near/Distance (VTA-ND) is set for a 13-inch near testing distance, and the Armed Forces Near Point Card is calibrated for 14 inches. Testing at these distances is helpful in identifying those individuals requiring a spectacle correction for desk work, but these distances do not necessarily correlate with reading flight instruments or performing other cockpit tasks. The viewing distances for most aircraft instrument panels are 26-28 inches (Appendix A). Obviously, it is inappropriate to base near vision standards for flying exclusively on the findings of the VTA-ND or, for that matter, on instrument panel distances. Thus, a presbyopic flyer's visual needs may or may not require near vision correction and must be assessed on an individual basis. Many early presbyopic aviators need only carry in their flight suits a pair of spectacles with the bifocal set for desk reading, in case they need them for a specific visual task during night flying. With advancing age, however, this will not be an option.

It may be necessary for the ophthalmologist or optometrist to visit the aviator on the flight line and personally evaluate the cockpit environment. Also, measurements may need to be taken with the flyer wearing his own life-support equipment to determine the appropriate bifocal add and segment height. The flight surgeon is always available to help the ophthalmologist/optometrist develop this understanding.

The professional judgment of the ophthalmologist/optometrist, based on prudent aeromedical knowledge, should be the most important factor in prescribing or not prescribing spectacles for the aviator. USAF ophthalmologists and optometrists play a crucial role in prescribing appropriate spectacle corrections for aircrew members.

Prescribing Single-Vision Spectacles

The majority of ametropic flyers will need only single-vision spectacles. During the evaluation, a detailed history should be obtained from the flyer, including the type of aircraft and crew position. An accurate refraction is essential to maximize visual efficiency, and the vision specialist should be careful not to overplus or overminus the patient. If prepresbyopic or presbyopic aircrew members are overcorrected in the minus direction, they may have difficulty reading flight publications, especially at night. Many flight publications have very small print. Overcorrection in the plus direction will blur the flyer's distance vision, with resulting dissatisfaction. Inserting the final prescription in a trial frame and testing far and near vision, as well as measuring near working distances, are ways to avoid error.

Two pair of clear, single-vision spectacles and two pair of N-15, single-vision sunglasses should normally be ordered. An extra set of clear spectacles is ordered, when required, for gas mask inserts. Antireflective lenses are also available and may be prescribed when reflections due to spectacle lenses create a problem for the flyer, e.g., during night flying. Whether aviators wear spectacles or contact lenses, it is mandatory, per Air Force Regulation (AFR) 60-16, paragraph 6-3 (3 March 1989) and current directives, that they carry in their flight suits a spare set of current aircrew spectacles that are properly adjusted. In case of trouble with spectacles or contact lenses, flyers must be able to remove the problem eyewear immediately and use their spare spectacles. A recent survey by USAFSAM/NGO (1989) revealed that 20% of spectacle-wearing aircrew members have had a lens fall out of their spectacle frame during a flight; therefore, this requirement should not be taken lightly.

One of the most overlooked factors in prescribing single-vision aircrew spectacles is frame adjustment. Flyers should bring their helmets, oxygen masks, and/or headphones to the eye clinic for the dispensing visit, so that all spectacles may be properly adjusted with the flight gear in place. Having to perform frame adjustments on a spare pair of spectacles while flying is definitely not a good idea!

Prescribing Multi-Vision Spectacles

Good clinical judgment, along with a working knowledge of the aviator's environment, is essential in order to properly prescribe multifocal spectacles for aviators. It is important to determine the aircraft type, crew position, size of print, and working distances at which the flyer is required to see. Specific questions regarding the flyer's ability to perform nearpoint cockpit tasks, especially at night, should also be asked. Near visual acuity demands and working distances vary for each aircraft and flight crew position. For example, in the F-4 Phantom II, the pilot's front instrument panel is approximately 32 inches from the pilot's eyes, while the working distance from the navigator's instrument panel is approximately 20 inches. Because of the F-16's 30-degree reclining seat, a pilot who wears bifocals will likely require a much lower bifocal segment than an F-15 pilot who sits more erect. A presbyopic pilot who flies multiple aircraft may require a different set of spectacles for each aircraft.

Slightly presbyopic pilots may require bifocal correction for a working distance of 14-18 inches (desk work), and yet not normally require a bifocal correction for flying due to the farther working distance. However, they should be fitted for bifocal flying spectacles (2 clear, 2 sunglass) and carry a set of clear bifocal spectacles in their flight suits, so they are available, should they be needed. A lower segment position may be useful for those pre-presbyopic flyers who usually wear only distance spectacles, or none at all, so that the spare pair of bifocal spectacles would be a visually acceptable backup.

The USAF Cockpit Vision Guide (Appendix A) is a good source for approximating cockpit working distances and the letter sizes of cockpit instruments. The initial bifocal add should be inserted into a trial frame and evaluated at the cockpit working distance to determine whether it provides acceptable near vision. The spectacle prescription should also be evaluated under both normal illumination and dim illumination. The dim illumination should simulate the lighting condition in the cockpit during night missions.

Various bifocal segment types and sizes are available; for details, consult AFR 167-3 (1 January 1986). The ST-25 bifocal is usually the lens of choice, especially in fighter/attack aircraft. The main advantage of the ST-25 over the Executive bifocal is that the ST-25 allows for distant peripheral vision around the bifocal segment. This additional peripheral vision is helpful during air combat maneuvering and in the landing flare. Navigators/weapons system operators and other aircrew members in tanker/transport/bomber aircraft may find that the wider reading area of the Executive bifocal is useful if they need to monitor wide instrument arrays or read large navigation charts. The vision specialist should work closely with the flyer, explaining the advantages and disadvantages of each type of bifocal, in order to best satisfy each individual.

The authors recommend adjusting the bifocal segment height so that the top of the segment falls just above the highest instrument on the aircraft's instrument panel and below the glare shield. Some flyers may request that the bifocal height be set slightly higher or lower than this recommended height. Oxygen masks and helmets will affect the fit of the frame; in particular, the mask may cause the bifocals to sit higher than normal. It is essential that presbyopic flyers bring their helmets and oxygen masks on the initial and dispensing visits to obtain the proper bifocal segment height and the proper fitting of the frame. The adjustable nose pads on the flight frame provide a range of adjustment to maintain the proper bifocal height. On occasion, it may be necessary for vision specialists to perform final bifocal fitting adjustments while the flyers are sitting at their crew positions in the aircraft.

By enlisting the flyer's help, the eye clinic can eliminate some of the uncertainty in determining proper bifocal height. An aircrew spectacle frame with plano sphere lenses can be fitted and loaned to the flyer. In the aircraft, after attaining his normal seat adjustment and while wearing his helmet and oxygen mask, the flyer should mark on the template lenses with a black marker the location where the glare shield begins (Appendix B). Thus, the vision specialist can accurately determine the proper operational bifocal height. This method may be especially helpful for F-16 pilots.

Trifocals are available in the ST-7X25 and Executive styles, but standard trifocals have limited usefulness in the cockpit because of the small area devoted to the intermediate segment. Although the intermediate segment is what the trifocal wearer normally employs for general cockpit work, the height of this segment is too narrow to view the complete instrument panel without moving the head. As with bifocals, the vision specialist must consider the unique needs of the aviator when prescribing trifocals.

The Double-D and, to a lesser extent, the Double-Executive multifocal lenses are excellent prescriptions for presbyopic flyers such as Nav/WSO and flight engineers who must read overhead panels at relatively close distances. The Double-D segment has a vertical separation of 13 mm between the top and bottom reading segments. The reading segments may be ordered with any combination of power. The Double-Executive lens has a vertical separation of 14 mm, and the top segment has a power that is two-thirds of the power in the bottom segment. Because of the capability of specifying any power for the top and bottom segments to meet the aircrew member's needs, the Double-D segment is probably the lens of choice. Illustrations of the multifocal lenses available for flight crews are contained in Appendix C.

Two pair of clear and two pair of N-15 multi-vision spectacles are ordered for and dispensed to any actively flying aviator requiring such correction. Finally, special spectacles, e.g., night-vision goggle (NVG) safety eyeglasses, are available per AFR 160-43, paragraph 6-13 (29 April 1988), for aircrew members required to wear NVGs. Other unique spectacles include laser protective lenses and MAG-1 combat spectacles for chemical defense. Questions about these special spectacles should be referred to USAFSAM/NGOP (AUTOVON 240-2745/2735).

Adjustment Period

Whenever flyers are given new spectacle prescriptions, they should be informed about the possible problems that may be encountered while adjusting to the new spectacles. They should be warned about possible visual distortions that may make the visual scene appear to slant up, down, or to one side. Objects may appear larger or smaller than they really are. With a minor change in prescription or a lens parameter, visual distortions may be present for a few minutes or hours, or not at all. With a significant change of prescription or lens parameter, the adaptation period may last for several days. To adjust to these new perceptual clues while safely on the ground, first-time bifocal wearers should be told to practice scanning techniques while wearing their bifocals in a simulator or in the cockpit of a parked aircraft. This would also be an ideal opportunity to ensure that the spectacles fit properly.

Appendix D is an article on spectacle adaptation that may be reprinted and given to aircrew members at the time of spectacle dispensing. The article describes spectacle adaptation and suggests several methods that a flyer may use to safely adjust to new spectacles.

APPENDIX A

USAF COCKPIT VISION GUIDE

AIRCRAFT PANEL DISTANCES AND LETTER SIZES

Note: (1) All distances are approximate and will vary depending upon pilot height and seat adjustment. Average variation is ±6-8 inches. All distances are given in inches, except as noted.

(2) Letter size was measured by comparing instrument letter size to the Armed Forces Near Vision Chart. Conversion of print size from paragraph number to Jaeger print size and Alza Near Point Chart is listed below.

Alza Chart paragraph #	Jaeger at 14"	Armed Forces Near Vision Chart at 14"
1	1	20/20-20/25
2	2	20/30
3	3	
4	4	
5	6	20/50
6	8	20/65
7	10	20/70
8	12	20/80

I. Helicopters

	Distance	Print size
HH-3 Helicopter		
Pilot & copilot		
front panel	29	20/70
center panel	34	20/50-20/70
refueling console	27	20/70
radios	34	20/70
center overhead panel	22	20/70
overhead circuit breakers	14	20/70
pilot's console	28	20/70
Flight engineer		
overhead panel	25-26	20/70
left & right circuit breakers	30	20/70
center panel	48-52	20/50-20/70

	Distance	Print size
HH-53 Helicopter		
Pilot & copilot		
front panel	33-35	20/40-20/80
radio panel	37-41	20/50-20/80
overhead panel	20-26	20/50-20/70
Flight engineer		
front panel	36-38	20/40-20/80
radio panel	26-36	20/50-20/80
overhead panel	10-27	20/50-20/70
HH-60 Helicopter		
Pilot & copilot		
front panel	18-40	20/70-20/80
radio panel	30-41	20/60-20/70
overhead panel	14-26	20/60-20/70
UH-1N Helicopter		
Pilot & copilot		
front panel	25-30	20/50-20/70
center console	27	20/50-20/70
overhead panel	14-18	20/50-20/70

II. Fighter/Attack/Reconnaissance/Trainer Aircraft

	Distance	Print size
A-10 Thunderbolt II		
front panel	24-31	20/40-20/70
right panel	26-32	20/60
left panel	26-32	20/40-20/70
F-4 Phantom II		
Front seat		
front panel	32	20/40-20/60
right panel	32-36	20/50
left panel	30-34	20/40-20/50
Rear seat		
front panel	20	20/40-20/60
right panel	26-32	20/40-20/60
left panel	26-32	20/40-20/60
F-15 Eagle and TF-15		
Front seat		
front panel	27-30	20/50-20/70
H.U.D.	20	20/70
right panel	28-33	20/70
left panel	28-31	20/70
Rear seat = same as front seat		
F-16 Fighting Falcon		
front panel	28	20/50
right panel	28-33	20/50
left panel	26-29	20/60-20/70

	Distance	Print size
F-111		
front panel	26-28	20/40-20/60
gunsight	17	20/70
right console	24-32	20/60-20/70
left console	24-29	20/60-20/70
T-38 Talon		
Front seat		
main panel	31	20/30-20/70
left panel	32-36	20/30-20/70
right panel	32-36	20/30-20/70
Rear seat = same as front seat		
T-39 Sabreliner		
map on yoke	15	20/20-20/50
front panel	31-37	20/60-20/70
left panel	27-33	20/60-20/70
right panel	27-33	20/60-20/70
console (center)	30-40	20/60-20/70
overhead	10-16	20/60-20/70

III. Tanker/Transport/Bomber Aircraft

	Distance	Print size
B-1B		
Pilot & copilot		
front instrument panel	27-41	20/50-20/200
center console	29-40	20/70-20/200
overhead panel	14-30	20/50-20/200
throttle quadrant	26-32	20/70-20/200
Offensive systems operator		
instrument panel	27-33	20/50-20/200
circuit breakers	17-21	20/100
panel between DSO & OSO	27-37	20/50-20/100
Defensive systems operator		
instrument panel	27-33	20/50-20/200
circuit breakers	17-21	20/100
panel between DSO & OSO	27-37	20/50-20/100
B-52H		
Pilot & copilot		
front panel	28-38	20/60
center overhead panel (radio)	22-28	20/50
side panel (window)	30-33	20/50-20/80
center lower panel	30-35	20/80
overhead front panel	28-32	20/60
Electronic Warfare Officer		
front lower panel	28	20/60
front upper panel	23	20/60
instrument panel, left side	17	20/60
instrument panel, right side	32 (max)	20/60
Gunner		
front instruments	23-25	20/60

	Distance	Print size
B-52H, cont.		
Navigator		
multiple function display	22	20/60
front panel (above eye level)	20-24	20/60
left panel	30-32	20/60
pull-out desk	16-19	maps, flight charts, etc.
Radar navigator		
multiple function display	22	20/60
oil gauge (above left)	25	20/60
overhead panel	20	20/60
desk	16	maps, flight charts, etc.
C-12F		
Pilot & copilot		
front main panel	24-26	20/40-20/60
right panel (pilot's)	29-32	20/40-20/60
left panel	20-22	20/40-20/60
overhead panel	12-14	20/40-20/60
center panel	28-30	20/40-20/60
approach plate holder	15-17	20/30-20/60

	Distance	Print size
AC 130 (where different from HC-130)		
TV sensor		
front bottom & top consoles	27-29	20/30-20/70
side consoles	28-29	20/30-20/70
F.C.O.		
consoles	27-30	20/30-20/40
FLIR	25-28	20/30-20/70
Radar		
consoles	19-32	20/30-20/50
Navigator		
front & side consoles	27-32	20/40-20/70
Pilot's gunsight	12	20/30

	Distance	Print size
HC-130H Hercules		
Pilot & copilot		
approach plates	20	20/30-20/40
instrument panel	28	20/60-20/70
center panel	32	20/40
forward center console	35	20/50-20/70
AFT center console	32	20/50-20/70
overhead panel	18-21	20/60
pilot's left panel	31	20/30-20/60
copilot's right panel	31	20/30-20/60
Flight engineer		
center panel	56	20/40
fuel panel (center overhead)	20-38	20/60
fuel panel (directly overhead)	15	20/60-20/70
left circuit breakers	37-51	20/60-20/70
right circuit breakers	37-51	20/60-20/70
Navigator		
radar	24	20/40-20/70
main panel	22-29	20/60-20/80
overhead gauges	22-24	20/60-20/80
right panel	18-24	20/40-20/70
Radio operator		
cockpit position:		
front panel	24-27	20/50-20/70
bottom panel	28	20/50-20/70
cabin observer position:		
left (front) panel	23-24	20/40-20/70
right (rear) panel	25	20/40-20/70
satellite tracker	24	20/50-20/60
Loadmaster		
O_2 regulator (eye level)	24	20/40-20/70
headset interphone	24	20/70

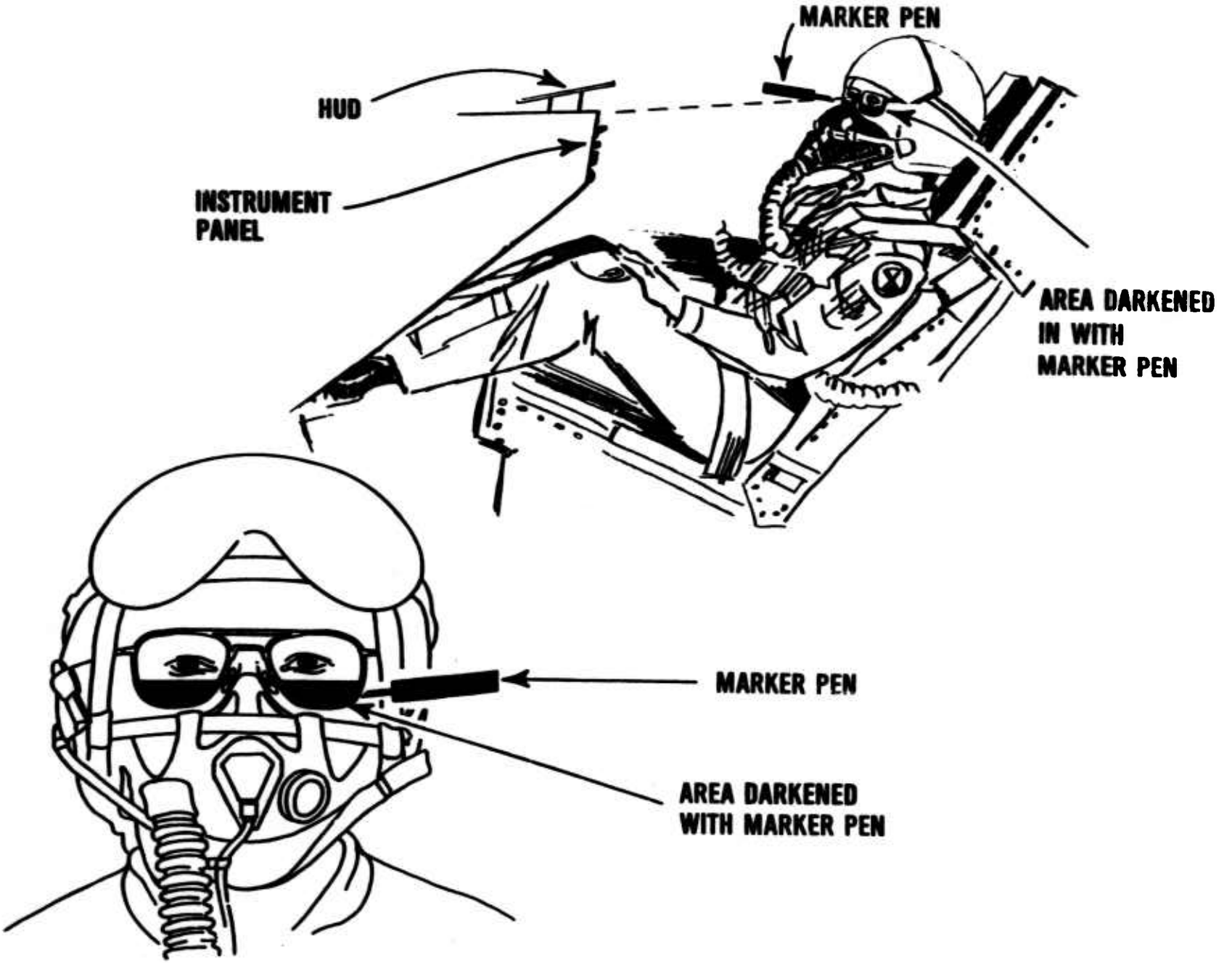
	Distance	Print size
C-140		
Pilot & copilot		
front main panel	29-31	20/40-20/60
right panel (pilot's)	36-39	20/40-20/60
left panel (window)	26-29	20/40-20/60
overhead panel	8-21	20/40-20/60
fuel panel	33-34	20/40-20/60
approach plates	17-18	20/30-20/60
C-141		
Pilot & copilots		
front panel	33-39	20/70
center panel	39	20/70
side panel	24	20/70
Navigator		
front panel	18	20/70
overhead panel	22	20/70
Flight engineer		
front panel (lower)	22	20/70
front panel (slightly above eye level)	18	20/70-20/100
overhead panel	20	20/100
C-21A Lear Jet		
Pilot & copilot		
front main panel	25-27	20/40-20/60
right panel (pilot's)	29-31	20/30-20/60
left panel (windows)	29-31	20/30-20/60
center panel	26-29	20/40-20/60
circuit breaker panel	24-31	20/40-20/60

	Distance	Print size
C-5A		
Pilot & copilots		
main front panel	30	20/100-20/150
center panel	40	20/100
overhead panel	16-22	20/100
radios	40	20/70
Flight engineer		
front panel	22	20/100
overhead panel	22	20/100
E-3A AWACS		
Pilot & copilot		
approach plates	16-18	20/30-20/40
front panel	33-35	20/40
overhead panel	23-25	20/40
center main panel	35	20/40
center lower panel	27-29	20/40
side panel	25-27	20/40
Navigator		
instrument, OMEG overhead	10-12	20/40
right upper panel	16-17	20/40
charts	12-14	varies
left upper panel	17-19	20/40
Flight engineer		
main front panel	20-22	20/40
upper panel	16-18	20/40
performance data manual	16-18	20/40
far right panel	32-34	20/40
overhead circuit breakers	17-19	20/40
Computer operators		
Work at standard VDTs with adjustable seats and many variations of working distances		

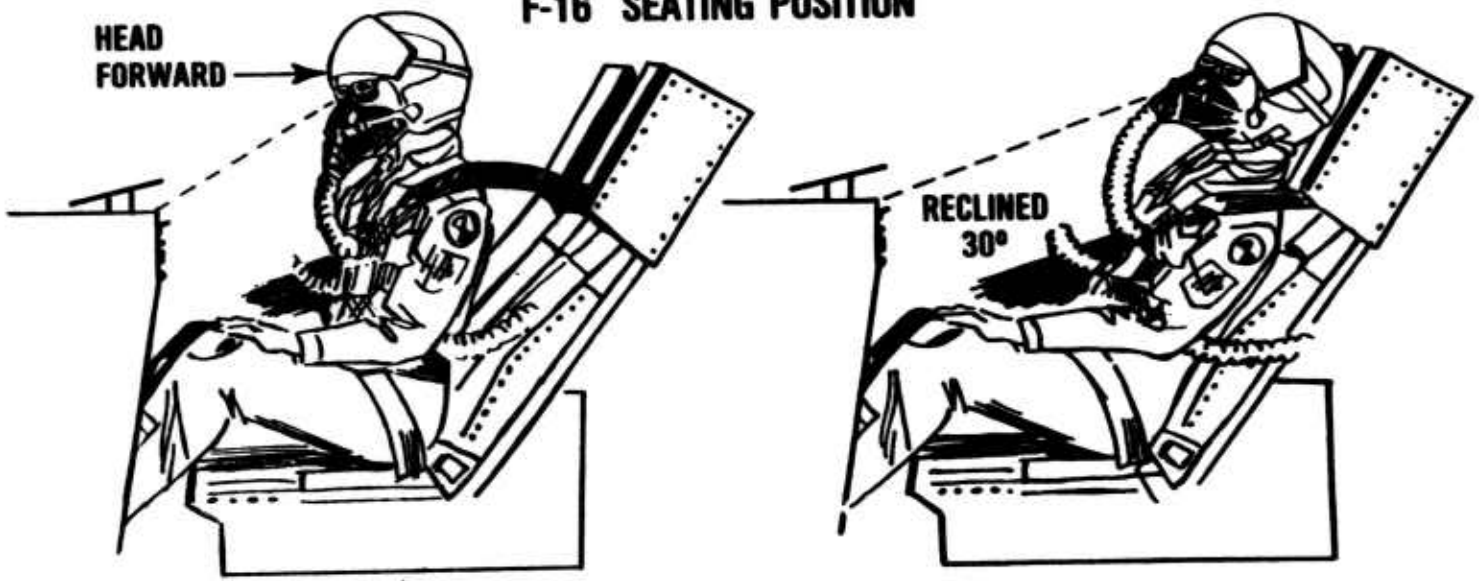
	Distance	Print size
KC-10 Extender		
Pilot & copilot		
main instrument panel	32-41	20/100-20/200
FGS panel (on glare shield)	20-30	20/100-20/250
center panel	29-39	20/80-20/250
overhead panel	16-20	20/80-20/100
radar	33	20/80
approach plates	16	20/25-20/40
Flight engineer		
hydraulic fuel panel	26-30	20/80-20/100
environmental panel	26-34	20/100-20/200
overhead circuit breaker panel	28-36	20/80-20/150
forward AFT overhead circuit breaker panel	34-39	20/80-20/150
flight engineer upper main panel	23-34	20/80-20/150
flight engineer lower main panel	27-38	20/80-20/150
In-flight refueling station		
front instrument panel	25-26	20/100-20/200
left control panel	24-29	20/60-20/80
drogue control panel	29	20/80
overhead panel	24-36	20/40-20/70
KC-135A		
Pilot & copilots		
front panel	36-41	20/40
side panel (window)	27	20/40
center overhead panel	15-33	20/60
center lower panel	30-40	20/80
Navigator		
front overhead panel	22-26	20/60
front panel	27	20/60
desk top	16	maps, other materials
Boom operator		
instruments	16-22	20/80
tip of boom	22+ feet	---

APPENDIX B

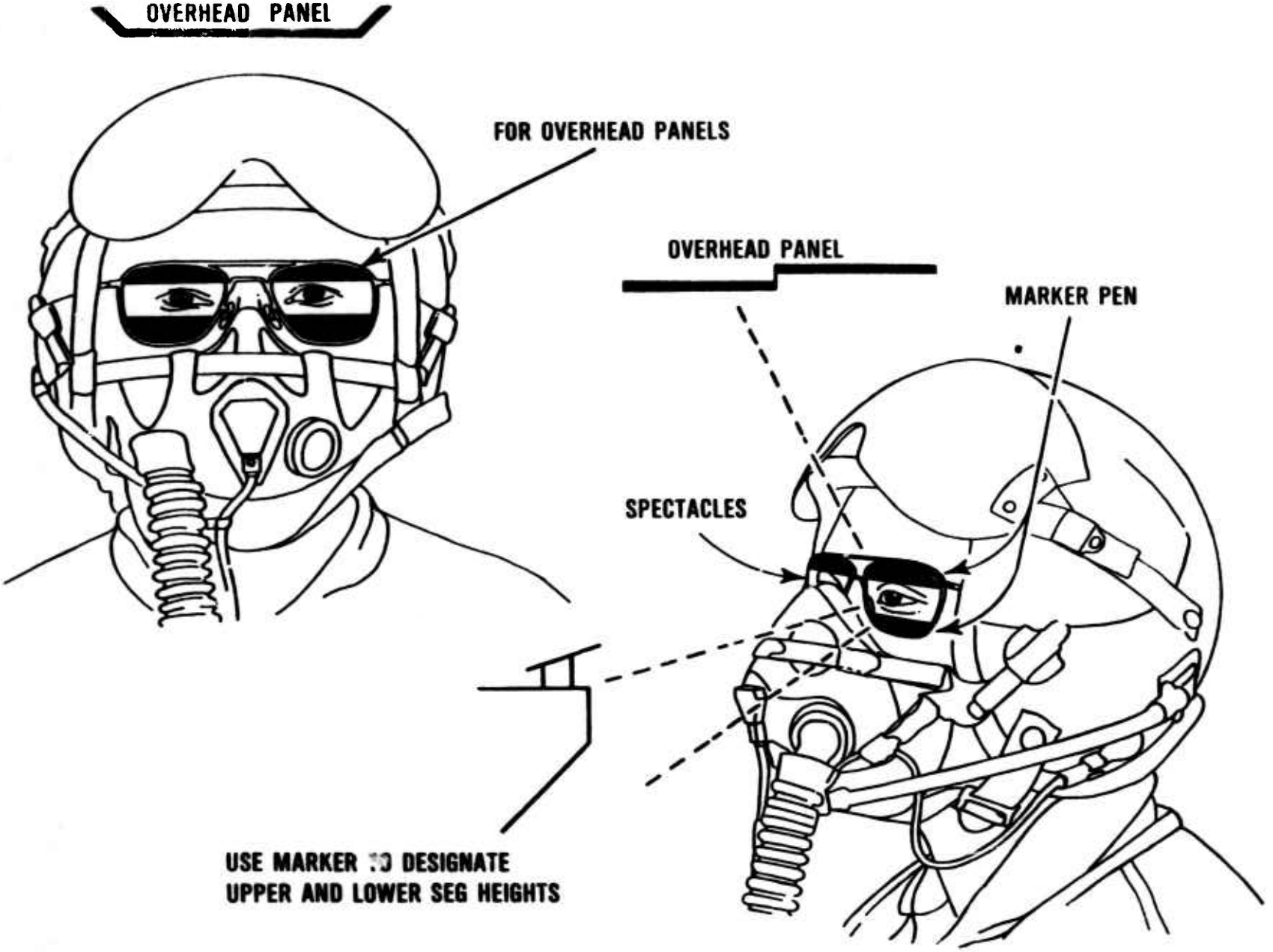
METHODS TO DETERMINE PROPER BIFOCAL SEGMENT HEIGHT


MARKER PEN
HUD
INSTRUMENT PANEL
AREA DARKENED IN WITH MARKER PEN
MARKER PEN
AREA DARKENED WITH MARKER PEN

F-16 SEATING POSITION



F-15 SEATING POSITION

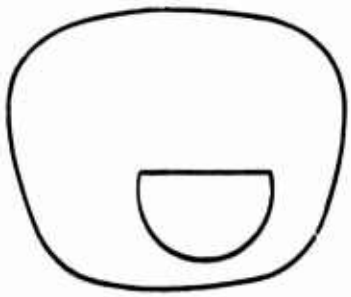

OVERHEAD PANEL
FOR OVERHEAD PANELS
OVERHEAD PANEL
MARKER PEN
SPECTACLES
USE MARKER TO DESIGNATE
UPPER AND LOWER SEG HEIGHTS

APPENDIX C

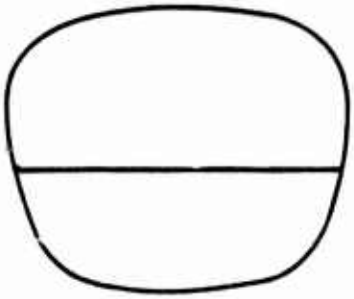
MULTIFOCAL LENSES AVAILABLE FOR AVIATORS

MULTIFOCAL LENSES

BIFOCAL LENSES

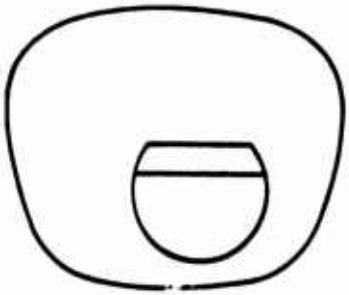


ST-25

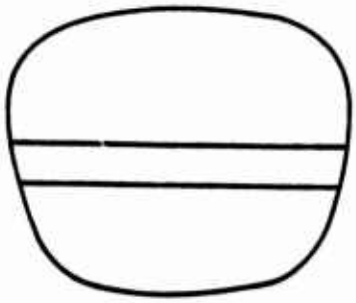


EXECUTIVE

TRIFOCAL LENSES

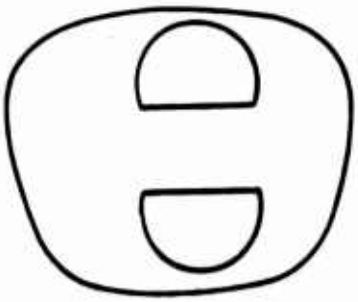


ST-7X25

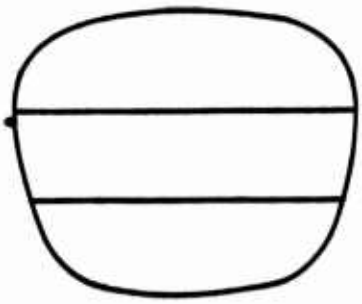


EXECUTIVE
TRIFOCALS

DOUBLE SEGMENT LENSES



"DOUBLE D"



DOUBLE EXECUTIVE

APPENDIX D

ADJUSTING TO NEW SPECTACLES THE EASY WAY

ADJUSTING TO NEW SPECTACLES THE EASY WAY*

"If you want to keep flying, you must wear glasses." These are dreaded words for most pilots. Some of the fear of wearing glasses may be from having either witnessed or heard about some pilot making a "spectacle" of himself as he tried to fly while adapting to his new glasses.

There are four common types of refractive errors. Nearsightedness, or myopia, is a condition in which the distance vision is more blurry than the near vision. Farsightedness, or hyperopia, is a condition in which the vision is usually worse at near than at distance. Astigmatism, on the other hand, is a condition in which there is unequal focusing of light inside the eye. This unequal focusing may cause blurry vision at distance and at near. Presbyopia is a condition in which the eye is unable to focus properly at near due to aging changes of the eye and occurs in virtually all individuals in their forties. It is common for several of these refractive conditions to occur at the same time. For example, an individual may have myopic astigmatism and presbyopia. This person would wear bifocals to improve both his distance and near vision.

Thus, corrective spectacle lenses compensate for inherent refractive errors of the eye. While doing so, however, they may also cause slight changes in a person's visual perception. For small changes in refractive error, the perceptual changes are minimal and most people can readily adapt to them. With large changes, however, optical distortion can make the visual scene appear to slant slightly up, down, or to one side. Also, objects may appear larger or smaller than they really are. Normally, these changes only cause a slight feeling of uneasiness for a period of a few hours to several days.

There is a difference, however, between adjusting to corrective lenses on the ground and while flying. When a pilot is using a new prescription for the first time and the runway appears smaller, i.e., farther away than normal or slightly tilted to one side, the false cues may jeopardize flight safety. Therefore, the spectacle wearer must be completely adjusted to any new spectacles before flying with them.

The problem of adapting to corrective lenses is compounded by bifocals. These lenses are prescribed for people who have a problem focusing their eyes at distant and at near targets. The reading segment (bifocal) height is normally set so that the top of the segment falls just above the highest instrument on the aircraft's instrument panel and just below the glare shield. Along with the usual visual perceptual problems experienced with new single-vision glasses, the new bifocal wearer must also learn different scanning techniques and head movements to properly use the bifocal reading segment.

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*Adapted from an Air Scoop article (pp. 8-9, Oct 1988) by Capt John F. Kent. Air Scoop is a USAFE safety publication.

One of the most common problems of learning to fly with bifocals is that the pilot can mistakenly look through the bifocals when flaring for a landing. This results in a blurry and slightly magnified view of the runway and, most likely, a rough landing. Also, if the pilot tries to focus on the instrument panel through both the upper and lower parts of the bifocals, visual confusion will result from the blurred images.

Vertigo may be induced in a new bifocal wearer when flying under instrument conditions, especially when his head moves excessively to find the best position for reading the instruments and approach plates. Trying to learn to use new bifocals while flying under Instrument Flight Rules is definitely not a good idea.

Pilots who are new bifocal wearers can do several things to help themselves adapt to their new way of looking at things. The most important task is for the pilot to spend half an hour or so in the cockpit of a parked aircraft and practice the various head positions and movements needed to clearly see the instrument panel, approach plates, and switches.

It would be even better for the flyer to spend an hour or so in a simulator working with the new bifocals. Only after feeling confident with bifocals should the pilot try a familiarization flight with them. If possible, this familiarization flight should be done with another pilot. Several VFR and IFR approaches with touchdowns should be made until scanning techniques can be done with confidence while wearing the new bifocals.

Another often overlooked factor affecting spectacle wearers is obtaining the proper frame adjustment. Helmets, headphones, and oxygen masks can play havoc with the spectacle frame, and frequently the wearer may need one set of glasses adjusted for the mask and another set adjusted for nonflying wear. The best way for the pilot to obtain the most comfortable frame adjustment is to be fitted while in flight gear (helmet, headphones, and oxygen mask) at the optometry clinic.

Most people adapt to new single-vision glasses within several days, if the change in prescription is not great. A bifocal wearer may require a longer period to adjust to a new prescription, but that time can be minimized if the patient wears the bifocals all the time and follows the ground practice techniques.

Flyers should keep in mind that changes in visual perception may occur with new glasses. They should be more cautious when flying until they feel confident with their new vision.

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