

AD \_\_\_\_\_

USAARU REPORT NO. 66-5

SOME CREW SPACE MEASUREMENTS IN  
ARMY AIRCRAFT

By

W. P. Schane, Major, MC  
K. E. Slinde, Pfc, US Army

MAY 1966

U. S. ARMY AEROMEDICAL RESEARCH UNIT  
Fort Rucker, Alabama



Unclassified  
 Security Classification

DOCUMENT CONTROL DATA - R&D		
<i>(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)</i>		
1 ORIGINATING ACTIVITY (Corporate author)		2a REPORT SECURITY CLASSIFICATION
US Army Aeromedical Research Unit Fort Rucker, Alabama		Unclassified
		2b GROUP
3 REPORT TITLE		
SOME CREW SPACE MEASUREMENTS IN ARMY AIRCRAFT		
4 DESCRIPTIVE NOTES (Type of report and inclusive dates)		
5 AUTHOR(S) (Last name, first name, initial)		
Schane, W. P., Maj., MC Slinde, K. E., Pfc, US Army		
6 REPORT DATE	7a TOTAL NO OF PAGES	7b NO OF REFS
May 1966	43	1
8a CONTRACT OR GRANT NO		9a ORIGINATOR'S REPORT NUMBER(S)
b PROJECT NO 3AO 2560 IA 819		'ESAKL 66-5
c Task No. 054		
d		
		9b OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
10 AVAILABILITY/LIMITATION NOTICES		
This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of the US Army Aeromedical Research Unit. Qualified requestors may obtain copies of this report from DDC.		
11 SUPPLEMENTARY NOTES		12 SPONSORING MILITARY ACTIVITY
		US Army Medical Research and Development Command, Washington, D. C. 20315
13 ABSTRACT		
<p>Measurements were made in the cockpits of every type of aircraft presently in the U. S. Army inventory, and in most prototype aircraft scheduled for delivery to the U. S. Army through FY 1970. From these measurements it appears that a pilot of standing height greater than 76 inches or sitting height greater than 38 inches would be unable to comfortably and safely pilot many U. S. Army aircraft. This applies particularly to the aircraft used in both fixed and rotary wing pilot training.</p>		

14	KEY WORDS	LINK A		LINK B		LINK C	
		ROLE	WT	ROLE	WT	ROLE	WT
Anthropometry Crew Space Dimensions Army Aircraft							
<b>INSTRUCTIONS</b>							
<p><b>1. ORIGINATING ACTIVITY.</b> Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization (<i>corporate author</i>) issuing the report.</p> <p><b>2a. REPORT SECURITY CLASSIFICATION:</b> Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.</p> <p><b>2b. GROUP.</b> Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.</p> <p><b>3. REPORT TITLE:</b> Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.</p> <p><b>4. DESCRIPTIVE NOTES.</b> If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.</p> <p><b>5. AUTHOR(S)</b> Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.</p> <p><b>6. REPORT DATE:</b> Enter the date of the report as day, month, year, or month, year. If more than one date appears on the report, use date of publication.</p> <p><b>7a. TOTAL NUMBER OF PAGES:</b> The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.</p> <p><b>7b. NUMBER OF REFERENCES:</b> Enter the total number of references cited in the report.</p> <p><b>8a. CONTRACT OR GRANT NUMBER.</b> If appropriate, enter the applicable number of the contract or grant under which the report was written.</p> <p><b>8b, 8c, &amp; 8d. PROJECT NUMBER:</b> Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.</p> <p><b>9a. ORIGINATOR'S REPORT NUMBER(S):</b> Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.</p> <p><b>9b. OTHER REPORT NUMBER(S):</b> If the report has been assigned any other report numbers (<i>either by the originator or by the sponsor</i>), also enter this number(s).</p>				<p><b>10. AVAILABILITY/LIMITATION NOTICES:</b> Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements, such as:</p> <p>(1) "Qualified requesters may obtain copies of this report from DDC."</p> <p>(2) "Foreign announcement and dissemination of this report by DDC is not authorized."</p> <p>(3) "U. S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through _____."</p> <p>(4) "U. S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through _____."</p> <p>(5) "All distribution of this report is controlled. Qualified DDC users shall request through _____."</p> <p>If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.</p> <p><b>11. SUPPLEMENTARY NOTES:</b> Use for additional explanatory notes.</p> <p><b>12. SPONSORING MILITARY ACTIVITY:</b> Enter the name of the departmental project office or laboratory sponsoring (<i>paying for</i>) the research and development. Include address.</p> <p><b>13. ABSTRACT:</b> Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.</p> <p>It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as (TS), (S), (C), or (U).</p> <p>There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.</p> <p><b>14. KEY WORDS:</b> Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical content. The assignment of links, roles, and weights is optional.</p>			

## NOTICE

Qualified requesters may obtain copies from the Defense Documentation Center (DDC), Cameron Station, Alexandria, Virginia. Orders will be expedited if placed through the librarian or other person designated to request documents from DDC (formerly ASTIA).

### Change of Address

Organizations receiving reports from the US Army Aeromedical Research Unit on automatic mailing lists should confirm correct address when corresponding about unit reports.

### Disposition

Destroy this report when it is no longer needed. Do not return it to the originator.

### Distribution Statement

This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of the US Army Aeromedical Research Unit.

### Disclaimer

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

AD \_\_\_\_\_

USAARU REPORT NO. 66-5

SOME CREW SPACE MEASUREMENTS IN  
ARMY AIRCRAFT

By

W. P. Schane, Major, MC  
K. E. Slinde, Pfc, US Army

MAY 1966

U. S. ARMY AEROMEDICAL RESEARCH UNIT  
Fort Rucker, Alabama

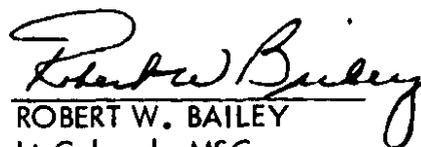
U. S. Army Medical Research and Development Command

Distribution Statement. This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of the US Army Aeromedical Research Unit.

## ABSTRACT

Measurements were made in the cockpits of every type of aircraft presently in the U. S. Army inventory, and in most prototype aircraft scheduled for delivery to the U. S. Army through FY 1970. From these measurements it appears that a pilot of standing height greater than 76 inches or sitting height greater than 38 inches would be unable to comfortably and safely pilot many U. S. Army aircraft. This applies particularly to the aircraft used in both fixed and rotary wing pilot training.

APPROVED:

  
ROBERT W. BAILEY  
Lt Colonel, MSC  
Commanding

## TABLE OF CONTENTS

Introduction	1
Methods and Materials	1
Present Operational Situation of US Army Aircraft	4
Discussion	37
Conclusions and Recommendations	38
Table 1 - Summary of Data	40
Figure 1 - Schematic Diagram of Measurements Taken	43
Distribution List	
DD Form 1473	

## SOME CREW SPACE MEASUREMENTS IN ARMY AIRCRAFT

### INTRODUCTION

At the request of the Director of Army Aviation certain dimensions of US Army aircraft were reviewed to determine if these aircraft could accommodate pilots taller than the 76" maximum presently allowable under the provision of AR 40-501, Change 14, Chapter 14, Paragraph 16a. The US Navy and US Air Force both limit pilot height to no greater than 76" standing height or 38" sitting height. It was thought that the more spacious cockpits of US Army aircraft might permit relaxing the height limitation to some extent and thereby increase the available pool from which Army pilots could be drawn.

### METHODS AND MATERIALS

Measurements were made in the cockpits of every type of aircraft in the US Army inventory, and in several prototype aircraft. In each case, measurements were made: 1) with the seat in all of its extremes of movement, and 2) with the foot pedals\* adjusted full forward, where such adjustment is possible. A parachute was worn during measurement in aircraft in which a parachute is regularly worn by the pilot during flight. All measurements are reported in inches. Where pilot and co-pilot seats are symmetrical, only a single group of measurements is reported. In several of our aircraft, however, the configurations of pilot's and co-pilot's seats differ. In these cases, measurements for each seat are given.

The following measurements were made and assigned the noted arbitrary terms:

1) "Seat to Roof" - the distance from contact of buttock with the seat to the nearest overhead obstacle.

\*The foot pedals are called by various names in different aircraft. In fixed wing aircraft, they are called "rudder pedals"; in single rotor helicopters they are either "anti-torque pedals" or "tail rotor pitch control pedals"; in tandem rotor helicopters they are called either "directional pedals" or "yaw control pedals". To avoid the repeated need for alternative construction, they will all be referred to as "foot pedals" throughout this report.

2) "Back of seat to panel" - the distance from contact of buttock with the back rest cushion to the nearest instrument panel contact.

3) "Back of seat to pedals at rest" - the shortest distance over the edge of the seat from contact of buttock with the back rest cushion to the foot pedals in a neutral position.

4) "Back of seat to full left pedal" - the distance, measured as #3, but with the left foot pedal extended to its limit of forward movement\*.

5) "Seat adjustment" - range of adjustment of the seat in all adjustable planes.

6) "Pedal adjustment" - range of foot pedal adjustment fore and aft.

7) "Pedal travel" - foot pedal excursion measured from neutral position to the fore and aft limits of movement.

The measurement "seat to roof" is comparable to the anthropomorphic measurement "sitting height"; "back of seat to panel" is comparable to "buttock knee length", and the "back of seat to pedal" measurements are the anthropomorphic equivalent of "leg length - sitting".

Because of the compressibility of the seat and back cushions, measurement without an occupant in the seat would produce bias; i.e., such measurements would be consistently shorter than if an occupant were in the seat. Therefore, a subject with a sitting height of 36", body weight of 215 pounds, and a seated trunk weight of 185 pounds was used to compress the cushions. This trunk weight is about 5% greater than the trunk weight expected of a 200 pound man, and was used to assure maximum allowable dimensions. Measurements should be viewed in this light.

There are factors which influence the accuracy of such measurements. Those peculiar to one aircraft will be mentioned during discussion of the aircraft to which they apply. These errors may occur in any aircraft.

\*In all single rotor rotary wing aircraft because of greater requirement for anti-torque control to the left, the travel of the left anti-torque pedal is from 1/2" to 1" greater than the travel of the right pedal. Therefore, travel of the left foot pedal was measured in all aircraft.

1) There is considerable variation in compressibility of cushions, even in aircraft of the same type and model. When measurements of "seat to roof" showed marked variability in different aircraft of a particular type and model, an average figure of several measurements is given, using different cushions.

2) Full foot pedal pressure frequently causes additional compression of the back cushion, producing measurements of "back of seat to full left pedal" greater than the sum of "back of seat to pedals at rest" and "pedal travel".

3) Movement of the seat forward or back occasionally changed the pertinent overhead obstacle, causing measurements to vary from the expected figure.

4) Movement of the seat often is not solely forward or back, but a simultaneous movement forward and up or backward and down. This changes measurements in two axes with only one seat movement.

It is our impression that the measurements recorded are correct to the given figure  $\pm 1/2$  inch.

The helmet adds from  $29/32$ " to  $1\ 1/2$ "\* to the pilot's sitting height when it is worn. In addition, the visor locking knob which protrudes  $3/8$ " from the upper anterior portion of the helmet may further restrict head movement anteriorly. In the OV-1, if the head is immediately under the face curtain handle, this visor locking knob catches on the handle. Although inadvertent ejection is unlikely since the face curtain must be pulled through approximately 8" of travel before the ejection system is fired, it is a nuisance, and a trifle unnerving, to have your helmet constantly being snagged by this overhead trigger.

---

*Fiberglass shell	$1/8$ "
Styrofoam liner	$1/2$ "
Sizing crown pad:	
Thin	$9/32$ "
Medium	$19/32$ "
Thick	$7/8$ "

## PRESENT OPERATIONAL SITUATION OF U. S. ARMY AIRCRAFT

### Training Aircraft:

#### Fixed Wing

O-1A, to be phased out by 1970  
T-42

#### Rotary Wing

TH-55  
TH-13T  
UH-1B

### Operational Aircraft:

#### Fixed Wing

O-1A, to be phased out by 1970  
U-6A, to be phased out by 1970  
U-1A, to be phased out by 1970  
OV-1  
U8-D  
U8-F  
U-10

#### Rotary Wing

OH-13, to be phased out by 1970  
OH-23, to be phased out by 1970  
CH-21  
CH-34  
CH-37  
UH-1B  
UH-1D

Obsolete or rarely used Aircraft:

Fixed Wing

T-28  
C-45  
C-47  
CV-2  
CV-7

Rotary Wing

UH-1A  
CH-19

Developmental Aircraft:

Rotary Wing

OH-6  
Skycrane (Sikorsky)  
LH-480 (AAFSS) (Lockheed)  
Bell Huey Cobra

## OH-13E

A two-place, single rotor observation and reconnaissance helicopter, pilots seated side-by-side. Seats do not adjust. The bubble curves down posteriorly such that when a pilot of sitting height of 38" sits erect in the seat with a helmet on, his helmet touches the bubble.

Seat adjustment:	none
Pedal adjustment:	4"
Pedal travel:	3"
Seat to roof:	39"
Back of seat to panel:	31"
Back of seat to pedals at rest:	41"
Back of seat to full left pedal:	44"

## OH-13T

A two-place single rotor helicopter, used as rotary wing instrument trainer. Pilots are seated side-by-side. Cockpit configuration is similar to earlier model OH-13's, with the same limitation to sitting height. It contains a full set of flight instruments on a much larger instrument panel than present in earlier OH-13 models.

Seat adjustment:	none
Pedal adjustment:	4"
Pedal travel:	3 1/2"
Seat to roof:	39"
Back of seat to panel:	32"
Back of seat to pedals at rest:	40"
Back of seat to full left pedal:	43 1/2"

## OH-23D

A three-place single rotor observation and reconnaissance helicopter, pilots seated side-by-side. The pilot sits in the middle of the seat, with leg straddling the console. His co-pilot sits at his left. Because of the curved roof of the bubble, the pilot has 1 1/2" more head room than his co-pilot. This same curving roof severely restricts sitting head clearance of both pilots if they sit erect.

### Pilot

Seat adjustment:	none
Pedal adjustment:	2 1/2"
Pedal travel:	3 1/2"
Seat to roof:	38"
Back of seat to panel:	31 1/2"
Back of seat to pedals at rest:	39"
Back of seat to full left pedal:	42 1/2"

### Co-Pilot

Seat adjustment:	none
Pedal adjustment:	2 1/2"
Pedal travel:	3 1/2"
Seat to roof:	36 1/2"
Back of seat to panel:	40"
Back of seat to pedals at rest:	40"
Back of seat to full left pedal:	43"

CH-19D

A single-rotor utility helicopter. Pilots are seated side-by-side.

Seat adjustment:

Up and down 4 1/2"

Fore and aft none

Pedal adjustment: 5"

Pedal travel: 3 1/2"

Seat to roof:

Seat up 38 1/2"

Seat down 43 1/2"

Back of seat to panel:

Seat up 30"

Seat down 30"

Back of seat to pedals at rest:

Seat up 39"

Seat down 37"

Back of seat to full left pedal:

Seat up 43"

Seat down 40 1/2"

## CH-34C

A single rotor tactical transport helicopter, pilots are seated side-by-side.

### Seat adjustment:

Up and down 5 1/2"

Fore and aft none

Pedal adjustment: 4 1/2"

Pedal travel: 3 1/2"

### Seat to roof:

Seat up 43 1/2"

Seat down 49"

### Back of seat to panel:

Seat up 28"

Seat down 28"

### Back of seat to pedals at rest:

Seat up 37 1/2"

Seat down 36"

### Back of seat to full left pedal:

Seat up 40"

Seat down 39"

CH-37

A single rotor, twin-engine cargo helicopter, pilots seated side-by-side. This aircraft, once considered obsolete, is seeing increased service in Viet Nam.

Seat adjustment:

Up and down 5"

Fore and aft none

Pedal adjustment: 3 1/2"

Pedal travel: 2 1/2"

Seat to roof:

Seat up 39"

Seat down 45"

Back of seat to panel:

Seat up 30"

Seat down 30"

Back of seat to pedals at rest:

Seat up 36 1/2"

Seat down 35 1/2"

Back of seat to full left pedal:

Seat up 38 1/2"

Seat down 38"

UH-1A

A single-rotor, gas turbine driven utility helicopter. Pilots seated side-by-side. This model is being replaced by the B and D models. There is a tinted sun visor above each pilot's seat which reduces head clearance by 2 inches when the visor is not in use, and the seat is in full forward adjustment.

Seat adjustment:		
Up and down	5 1/2"	
Fore and aft	4 1/2"	
Pedal adjustment:		
	4"	
Pedal travel:		
	3"	
Seat to roof:		
Seat up and back	44"	
Seat up and forward	42"	44"
Seat down and back	49"	
Seat down and forward	47"	49"
Back of seat to panel:		
Seat up and back	31 1/2"	
Seat up and forward	26"	
Seat down and back	29 1/2"	
Seat down and forward	25 1/2"	
Back of seat to pedals at rest:		
Seat up and back	42 1/2"	
Seat up and forward	38"	
Seat down and back	38"	
Seat down and forward	35"	
Back of seat to full left pedal:		
Seat up and back	45 1/2"	
Seat up and forward	41 1/2"	
Seat down and back	42"	
Seat down and forward	38 1/2"	

## UH-1B

A single-rotor, gas turbine driven utility tactical helicopter. Pilots are seated side-by-side. This model, armed with rockets and machine guns, is the flying gun platform used by the U. S. Army for armed tactical escort for troop-carrying aircraft and for close fire support for ground troops.

Seat adjustment:	
Up and down	4 1/2"
Fore and aft	4 1/2"
Pedal adjustment:	4 1/2"
Pedal travel:	3 1/2"
Seat to roof:	
Seat up and back	43"
Seat up and forward	43"
Seat down and back	48 1/2"
Seat down and forward	48 1/2"
Back of seat to panel:	
Seat up and back	28"
Seat up and forward	24"
Seat down and back	27 1/2"
Seat down and forward	24 1/2"
Back of seat to pedals at rest:	
Seat up and back	39 1/2"
Seat up and forward	35"
Seat down and back	37 1/2"
Seat down and forward	33 1/2"
Back of seat to full left pedal:	
Seat up and back	43"
Seat up and forward	38 1/2"
Seat down and back	41"
Seat down and forward	37 1/2"

## UH-1D

A single rotor, gas turbine driven tactical transport helicopter. Pilots are seated side-by-side. This aircraft is very similar to the UH-1B, however an enlarged cargo compartment provides an improved seating arrangement, larger windows, and better visibility.

### Seat adjustment:

Up and down	5"
Fore and aft	4 1/2"

Pedal adjustment:	4 1/2"
-------------------	--------

Pedal travel:	4"
---------------	----

### Seat to roof:

Seat up and back	45"
Seat up and forward	45"
Seat down and back	49 1/2"
Seat down and forward	49 1/2"

### Back of seat to panel:

Seat up and back	30"
Seat up and forward	25 1/2"
Seat down and back	30"
Seat down and forward	26"

### Back of seat to pedals at rest:

Seat up and back	42"
Seat up and forward	38"
Seat down and back	41"
Seat down and forward	36"

### Back of seat to full left pedal:

Seat up and back	46"
Seat up and forward	42"
Seat down and back	44 1/2"
Seat down and forward	40"

## OH-6 (LOH)

A single rotor, gas turbine driven observation, reconnaissance, and utility helicopter, pilots are seated side-by-side. This aircraft, manufactured by Hughes, is scheduled to replace all OH-13 models (excluding OH-13T), all OH-23's, and O-1A's on a one for one basis by FY 1969. Purchase of 714 OH-6's is certain. Some sources have estimated the total purchase may reach 3,000 - 4,000 aircraft. The top of the bubble slopes sharply at the sides, reducing by 1 inch head clearance on each outboard side, therefore two seat to roof measurements are given.

Seat adjustment:	none
Pedal adjustment:	3"
Pedal travel:	4 1/2"
Seat to roof:	40 1/2"
	39 1/2"
Back of seat to panel:	40 1/2"
Back of seat to pedals at rest:	39"
Back of seat to full left pedal:	42 1/2"

## TH-55A

A two-place single rotor, off-the-shelf training helicopter, pilots sit side-by-side. Sides of the bubble slope sharply on each outboard side, seriously restricting outboard head movement. The console is placed between the pilots and does not constitute a knee clearance obstruction. Back of seat to panel measurement was made to a plane even with the front of the console.

Seat adjustment:	none
Pedal adjustment:	3 1/2"
Pedal travel:	4"
Seat to roof:	40"
Back of seat to panel:	40"
Back of seat to pedals at rest:	39 1/2"
Back of seat to full left pedal:	43"

## CH-21C

A tandem rotor, single-engine cargo helicopter. Pilots sit side-by-side. This aircraft, once considered obsolete, has seen extensive employment as a troop carrier in Viet Nam and is now being utilized as a troop carrier in CONUS. The transmission case for the forward rotor is above the heads and between the pilot and co-pilot, extending about half way over the head of each. Two figures are given in the "seat to roof" section: the first is a measurement to the transmission; the second is to the cabin roof.

### Seat adjustment:

Up and down	4 1/2"
Fore and aft	none

Pedal adjustment: 6"

Pedal travel: 3 1/2"

### Seat to roof:

Seat up	37"	43 1/2"
Seat down	41 1/2"	49"

### Back of seat to panel:

Seat up	30"
Seat down	29 1/2"

### Back of seat to pedals at rest:

Seat up	42"
Seat down	40"

### Back of seat to full left pedal:

Seat up	45"
Seat down	43 1/2"

## CH-47A

A tandem rotor, twin-gas-turbine engine driven medium transport helicopter. Experimental armed prototypes are in the process of field testing at this time. There is a cockpit light overhead. With the seat in the back positions this light decreases head clearance by 2 1/2". Head measurements are made to the cockpit light with the seat aft, and to the cabin roof with the seat forward.

Seat adjustment:		
Up and down		5"
Fore and aft		4 1/2"
Pedal adjustment:		6"
Pedal travel:		4"
Seat to roof:		
Seat up and back	51"	48 1/2"
Seat up and forward		51"
Seat down and back	57 1/2"	54 1/2"
Seat down and forward		56"
Back of seat to panel:		
Seat up and back		32 1/2"
Seat up and forward		28"
Seat down and back		30"
Seat down and forward		27"
Back of seat to pedals at rest:		
Seat up and back		42 1/2"
Seat up and forward		38 1/2"
Seat down and back		41"
Seat down and forward		36 1/2"
Back of seat to full left pedal:		
Seat up and back		45 1/2"
Seat up and forward		41"
Seat down and back		44"
Seat down and forward		40"

## CH-54A

A twin-engine, single rotor heavy lift helicopter. Pilot and co-pilot are seated side-by-side. A pilot-rated winch operator is seated in a aft facing seat behind and below the co-pilot.

### Flight Deck Seats

Seat adjustment:		
Up and down	Pilot	5"
Fore and aft		5" Co-pilot (7")
Pedal adjustment:		5"
Pedal travel:		2 1/2"
Seat to roof:		
Seat up and back		44 1/2"
Seat up and forward		44 1/2"
Seat down and back		50"
Seat down and forward		50"
Back of seat to panel:		
Seat up and back		36" (38")
Seat up and forward		31"
Seat down and back		36" (38")
Seat down and forward		31"
Back of seat to pedal at rest:		
Seat up and back		43 1/2" (45 1/2")
Seat up and forward		38 1/2"
Seat down and back		42 1/2" (44 1/2")
Seat down and forward		37 1/2"
Back of seat to full left pedal:		
Seat up and back		49" (51")
Seat up and forward		44 1/2"
Seat down and back		48 1/2" (50")
Seat down and forward		43 1/2"

### Winch Operator's Position

Seat adjustment:	0
Pedals:	0
Seat to roof:	57"
Back of seat to panel:	41 1/2"

## LH-840 (AAFSS)

This two-place high performance aircraft, designated "advanced aerial fire support system" is a developmental aircraft tentatively scheduled for delivery in 1970. The pilots are seated in tandem, the command pilot aft, and the gunnery officer forward. The gunnery officer's seat rotates through a full 360°. Head clearances were measured with the seat facing forward and full aft. Measurements were taken from scale diagram of the aircraft, and therefore are approximate. Final cockpit dimensions have not as yet been established.

### Command Pilot Seat

Seat adjustment:	
Up and down	5"
Fore and aft	3"
Pedal adjustment:	6"
Pedal travel:	3"
Seat to roof:	
Seat up and back	38 1/2"
Seat up and forward	38 1/2"
Seat down and back	43 1/2"
Seat down and forward	43 1/2"
Back of seat to panel:	
Seat up and back	29 1/2"
Seat up and forward	26 1/2"
Seat down and back	29 1/2"
Seat down and forward	26 1/2"
Back of seat to pedals at rest:	
Seat up and back	37"
Seat up and forward	34"
Seat down and back	35"
Seat down and forward	32"

### Command Pilot Seat

Back of seat to full left pedal:	
Seat up and back	40"
Seat up and forward	37"
Seat down and back	38"
Seat down and forward	35"

### Gunnery Officer's Seat

Seat adjustment:	
Up and down	5"
Pedal adjustment:	6"
Pedal travel:	3 1/4"
Seat to roof:	
Seat up facing front	48"
Seat down facing front	53"
Seat up facing aft	39 1/2"
Seat down facing aft	44 1/2"
Back of seat to panel:	
Seat up	31 1/2"
Seat down	31 1/2"
Back of seat to pedals at rest:	
Seat up	37 1/2"
Seat down	32 1/2"
Back of seat to full left pedal:	
Seat up	40 1/2"
Seat down	35 1/2"

O-1A

This light observation and training airplane seats two pilots in tandem. The plane is flown solo from the front seat. A parachute and helmet ordinarily are worn during flight. The front seat adjusts 4" fore and aft. The back seat does not adjust. Foot pedals do not adjust.

Front Seat

Seat adjustment:	
Up and down	none
Fore and aft	4"
Pedal adjustment:	none
Pedal travel:	2 1/2"
Seat to roof:	
Seat back	39"
Seat forward	38 1/2"
Back of seat to panel:	
Seat back	30"
Seat forward	26"
Back of seat to pedals at rest:	
Seat back	40"
Seat forward	36"
Back of seat to full left pedal:	
Seat back	42 1/2"
Seat forward	38"

Back Seat

Seat adjustment:	
Up and down	none
Fore and aft	none
Pedal adjustment:	none
Pedal travel:	2 1/2"
Seat to roof:	38"
Back of seat of back seat to back of front seat:	
Front seat forward	39"
Front seat back	35"
Back of seat to pedals at rest:	36"
Back of seat to full left pedal:	40"

## U-1A

A utility airplane, with pilots seated side-by-side. Helmet is generally worn, but back pack parachute is usually not worn. The pilot's seat adjusts both up and down and forward and back. The co-pilot's seat, on the other hand, adjusts only diagonally forward and up or back and down.

### Pilot's Seat

Seat adjustment:	
Up and down	4"
Fore and aft	3"
Pedal adjustment:	3 1/2"
Pedal travel:	3 1/2"
Seat to roof:	
Seat up and back	38"
Seat up and forward	37 1/2"
Seat down and back	42"
Seat down and forward	41 1/2"
Back of seat to panel:	
Seat up and back	30"
Seat up and forward	27"
Seat down and back	30"
Seat down and forward	27"
Back of seat to pedals at rest:	
Seat up and back	38 1/2"
Seat up and forward	36 1/2"
Seat down and back	38 1/2"
Seat down and forward	36"
Back of seat to full left pedal:	
Seat up and back	42"
Seat up and forward	40"
Seat down and back	41 1/2"
Seat down and forward	39 1/2"

U-1A

Co-Pilot's Seat

Seat adjusts diagonally forward and up and back and down:	6 1/2"
Pedal adjustment:	3 1/2"
Pedal travel:	3 1/2"
Seat to roof:	
Seat back and down	43"
Seat forward and up	40"
Back of seat to panel:	
Seat back and down	30 1/2"
Seat forward and up	25"
Back of seat to pedals at rest:	
Seat back and down	35 1/2"
Seat forward and up	32"
Back of seat to full left pedal:	
Seat back and down	38 1/2"
Seat forward and up	34"

## U-6A

A utility airplane, with pilots seated side-by-side. Parachute and helmet are usually worn. Seats adjust diagonally. When the seat is forward, an overhead curtain roller is the obstacle. With the seat back, cabin roof is the obstacle.

Seat adjusts diagonally forward and up and down:	5"
Pedal adjustment:	none
Pedal travel:	4 1/2"
Seat to roof:	
Seat back and down	39 1/2"
Seat forward and up	36"
Back of seat to panel:	
Seat back and down	27 1/2"
Seat forward and up	22 1/2"
Back of seat to pedals at rest:	
Seat back and down	38"
Seat forward and up	33 1/2"
Back of seat to full left pedal:	
Seat back and down	41 1/2"
Seat forward and up	36"

U-8D

A twin-engine utility transport airplane, pilots seated side-by-side. Neither helmet nor parachute is worn while piloting this aircraft. Seat adjustment moves the seat simultaneously forward and slightly up or backward and slightly down.

Seat adjustment:

Up and down 0

Fore and aft 3 1/2"

Pedal adjustment: 2"

Pedal travel: 5"

Seat to roof:

Seat back 39"

Seat forward 38"

Back of seat to panel:

Seat back 25"

Seat forward 22"

Back of seat to pedals at rest:

Seat back 37"

Seat forward 35"

Back of seat to full left pedal:

Seat back 42"

Seat forward 40"

## U-8F

A twin-engine command liaison aircraft, pilots are seated side-by-side. The aircraft is similar to the U-8D, but the fuselage is redesigned to provide a larger passenger area and ground level loading capabilities.

### Seat adjustment:

Up and down 0

Fore and aft 4"

Pedal adjustment: 2"

Pedal travel: 4"

### Seat to roof:

Seat back 40"

Seat forward 40"

### Seat to panel:

Seat back 30"

Seat forward 26"

### Seat to pedals at rest:

Seat back 41"

Seat forward 37"

### Seat to full left pedal:

Seat back 45"

Seat forward 41"



U-10

A STOL single engine reconnaissance and utility aircraft, used mostly by Special Forces. Pilots are seated side-by-side. The seat is adjustable, but the adjustment cannot be made with the aircraft in flight, since it requires the removal of 2 bolts, and a major rearrangement of the seat under-shoring, to affect the change. There are three possible positions for the seat, with adjustment possible only up and down, the positions are each 1 1/2 inches apart. The rudder pedals are adjustable, but this also requires removal of wired bolts, and cannot be performed in flight. There are four positions, with an over-all adjustment of 3 inches.

Measurements were made with the seat in its lowest adjustment, pedals fully extended.

Seat adjustment:	
Up and down	3"
Fore and aft	0
Pedal adjustment:	3"
Pedal travel:	3"
Seat to roof:	39"
Back of seat to panel:	30"
Back of seat to pedals at rest:	42 1/2"
Back of seat to full left pedal:	45"

T-42

A twin engine off-the-shelf instrument trainer, pilots seated side-by-side. Neither helmet nor parachute is worn when piloting this airplane. The seat adjusts forward and back; the seat back adjusts into four reclining positions. Students are instructed to fly with the seat erect, therefore measurements were made with the seat in this position.

Seat adjustment:

Up and down 0

Fore and aft 4 1/2"

Pedal adjustment: 1 1/2"

Pedal travel: 2 1/2"

Seat to roof:

Seat back 38 1/2"

Seat forward 38 1/2"

Back of seat to panel:

Seat back 30"

Seat forward 25"

Back of seat to pedals at rest:

Seat back 43"

Seat forward 39 1/2"

Back of seat to full left pedal:

Seat back 46"

Seat forward 42"

OV-1

A two place twin-engine high-performance surveillance airplane, pilots seated side-by-side in Martin-Baker J5 ejection seats. Overhead obstacle is the face curtain handle which is the ejection seat firing lanyard. Seat adjusts electrically, up and down only. Helmets are always worn; the parachute is packed as a part of the ejection system.

Seat adjustment:

Up and down 5"

Fore and aft none

Pedal adjustment: 8"

Pedal travel: 4"

Seat to roof:

Seat up 36"

Seat down 41"

Back of seat to panel:

Seat up 29"

Seat down 29"

Back of seat to pedals at rest:

Seat up 42"

Seat down 40"

Back of seat to full left pedal:

Seat up 45 1/2"

Seat down 45"

## CV-2

A twin-engine cargo airplane with a roomy cockpit. Pilots sit side-by-side. Seats adjust both up and down and forward and back. Helmets are generally worn, back-pack parachutes are not worn. Overhead obstacle with the seat moved back is a structural support; with the seat moved forward the overhead obstacle is cabin roof.

### Seat adjustment:

Up and down	5"
Fore and aft	4"

Pedal adjustment: 4 1/2"

Pedal travel: 4"

### Seat to roof:

Seat up and back	38"
Seat up and forward	39 1/2"
Seat down and back	43"
Seat down and forward	45"

### Back of seat to panel:

Seat up and back	34"
Seat up and forward	30 1/2"
Seat down and back	33 1/2"
Seat down and forward	29"

### Back of seat to pedals at rest:

Seat up and back	42"
Seat up and forward	37"
Seat down and back	39 1/2"
Seat down and forward	36 1/2"

### Back of seat to full left pedal:

Seat up and back	46"
Seat up and forward	42 1/2"
Seat down and back	44"
Seat down and forward	41"

## CV-7

A roomy twin gas-turbine engine tactical transport airplane, pilots are seated side-by-side. Helmet is worn, but back-pack parachute is not worn while piloting this airplane. Overhead clearance is measured to a structural support beam with the seat in the up and back position. All other measurements are to cabin roof.

### Seat adjustment:

Up and down	5"
Fore and aft	4"

Pedal adjustment: 6"

Pedal travel: 3"

### Seat to roof:

Seat up and back	42"
Seat up and forward	44 1/2"
Seat down and back	49 1/2"
Seat down and forward	49"

### Back of seat to panel:

Seat up and back	33"
Seat up and forward	29"
Seat down and back	31 1/2"
Seat down and forward	28"

### Back of seat to pedals at rest:

Seat up and back	43 1/2"
Seat up and forward	40"
Seat down and back	41"
Seat down and forward	37 1/2"

### Back of seat to full left pedal:

Seat up and back	48"
Seat up and forward	45"
Seat down and back	45 1/2"
Seat down and forward	41"

C-45

A twin-engine transport airplane with pilots seated side-by-side. Helmet is rarely worn, back-pack parachute is not worn while piloting this aircraft. The seat and foot pedals do not adjust.

Seat adjustment:	none
Pedal adjustment:	none
Pedal travel:	4"
Seat to roof:	39 1/2"
Back of seat to panel:	27"
Back of seat to pedals at rest:	36"
Back of seat to full left pedal:	40"

## C-47

A twin-engine transport airplane, pilots seated side-by-side. Neither helmet nor back-pack parachute is worn while piloting this aircraft.

### Seat adjustment:

Seat up and down	5"
Seat fore and aft	3"

Pedal adjustment: 4"

Pedal travel: 4 1/2"

### Seat to roof:

Seat up and back	39 1/2"
Seat up and forward	37 1/2"
Seat down and back	45"
Seat down and forward	45"

### Back of seat to panel:

Seat up and back	34"
Seat up and forward	31"
Seat down and back	33"
Seat down and forward	29 1/2"

### Back of seat to pedals at rest:

Seat up and back	42 1/2"
Seat up and forward	39 1/2"
Seat down and back	40"
Seat down and forward	37 1/2"

### Back of seat to full left pedal:

Seat up and back	46 1/2"
Seat up and forward	43 1/2"
Seat down and back	44 1/2"
Seat down and forward	42"

T-28B

This single-engine Navy training airplane seats two (2) in tandem.

The plane is flown solo from the front seat.

Front Seat

Seat adjustment:

Up and down 8"

Fore and aft 0

Pedal adjustment: 2 1/2"

Pedal travel: 2 1/2"

Seat to roof:

Seat up 40 1/2"

Seat down 46 1/2"

Back of seat to panel:

Seat up 26"

Seat down 28"

Back of seat to pedals at rest:

Seat up 37 1/2"

Seat down 34 1/2"

Back of seat to full left pedal:

Seat up 39 1/2"

Seat down 37"

T-28B

Back Seat

Seat adjustment:	
Up and down	8"
Fore and aft	0
Pedal adjustment:	3"
Pedal travel:	2 1/2"
Seat to roof:	
Seat up	39 1/2"
Seat down	46"
Back of seat to panel:	
Seat up	25"
Seat down	28"
Back of seat to pedals at rest:	
Seat up	35"
Seat down	35 1/2"
Back of seat to full left pedal:	
Seat up	37 1/2"
Seat down	38"

## DISCUSSION

The collected data show that the aircraft used to train Army pilots have marginally adequate seat to roof measurements at best. (See definitions on page 1 and 2 of this report).

1. O1-A	39"
2. T-42	38 1/2"
3. T-55	40"
4. H-13T	39"

Unless the student can safely fly these training aircraft, he never will fly the Army aircraft that provide more spacious cockpits.

The OH-6, presently scheduled to replace all O-1A's, H-13's, H-23's, and many U-6A's has a very confining flight crew space.

Even in aircraft with adequate head room, windshield placement is based upon sitting eye height on 5 - 95 percentile of a 1950 population as described by Hertzberg<sup>1</sup>. Therefore, visibility is less than optimum when eye level is greater than 33.1 inches above the seat (the 95th percentile for sitting eye height).

Head movement is necessary for adequate visibility. In every aircraft there are obstructions in the cockpit which restrict vision (windshield supports, the compass, console, map light, etc.). With the head confined by overhead obstructions the head movement necessary to look around these obstacles is not possible. It appears therefore that the visibility of pilots with sitting heights greater than 38" is compromised.

Leg length seems to be less of a problem than sitting height. Generous pedal adjustment and fore and aft seat adjustment in some of the newer aircraft provide a wide range of acceptable leg lengths. Again, however, the O1-A, the Army's primary fixed wing trainer, is among the most restrictive.

HIAD<sup>1</sup>(Handbook of Instructions for Aircraft Design) AFSCM 80-1 is the "bible" for aircraft designers in matters of crew space allowances and human factors. This tome specifies minimum allowable dimensions for cockpits. Since the designer wishes to develop a fast, maneuverable aircraft, and since man is the bulkiest portion of the man-machine system which he cannot modify, the designer

frequently provides as little space for man as he can get away with, to save weight and bulk. The present standards provided for the designer's guidance by HIAD are that the cockpit must be able to accommodate from the 5th to the 95th percentile of anthropomorphic measurements as derived from a study in 1950 by Hertzberg et al upon a population of U.S.A.F. flying personnel. HIAD indicates the size limitations to which the designers must presently comply. As an example, LH-840, due for delivery to the U. S. Army in FY 1970, is being designed from these specifications. This means that an aircraft due for delivery in 1970 is being designed from anthropomorphic information collected in 1950.

There are several other considerations that come to mind when one contemplates taller pilots in our present family of aircraft.

1. Present procurement of flight suits is from Navy and Air Force suppliers. Both these services limit their pilots to standing height of 76" or sitting height of 38". If the Army were to allow taller pilots it might require the Army to make other arrangements to outfit pilots that exceed these limits.

2. The present maximum weight acceptable for soldiers of 76" is 212 pounds. This exceeds by 12 pounds the upper limit imposed upon the Army pilot. It is difficult for our taller pilots to maintain their weight below 200 pounds. It would be even more difficult for a pilot of height greater than 76" to maintain a weight below 200 pounds. I gather it is unlikely that the 200 pound weight restriction will be relaxed. In fact, there have been recent inquiries here at Fort Rucker on how best to reduce the basic weight of helicopters. It has been suggested that doors, interior sound insulation and first aid kits be deleted from armed helicopters to allow for increased payload. If two and one-fourth pound first-aid kits are to be left at home, can we then afford a heavier pilot? Weight restriction will become more necessary in the future, since the percentage of rotary wing aircraft in our inventory is scheduled to increase markedly over fixed wing aircraft, and helicopter performance is particularly sensitive to changes in operating weight.

## CONCLUSIONS AND RECOMMENDATIONS

Present aircraft are designed for a man with a maximum sitting height of 38" and a maximum standing height of 76".

To put taller pilots than this in these aircraft is to ask for higher accident rates, increased pilot fatigue, and compromise in mission accomplishment.

If it becomes clear that young college men are becoming taller, and our pilot needs cannot be met without an increase in the allowable height for pilots, we should first increase the size of the crew space, and 5-10 years later when aircraft designed to the new specifications begin to appear in the inventory, then increase the heights allowable.

If immediate steps are necessary to meet pilot needs, and relaxing the height limitation is selected as the means to accomplish this, I would recommend imposing a requirement for a maximum seated height of 38", and then change the present 76" standing height limitation to 78". This would allow for a longer leg length, but maintain the more critical requirement of sitting height.

It is recommended that anthropologists be encouraged to attempt to predict the anthropomorphic dimensions of military, populations 5-10 years hence, rather than merely record their present measurements. Not until this type of information is placed into the hands of aircraft designers will we be able to place a 1975 man into a properly proportioned 1975 cockpit.

---

<sup>1</sup> AFSCM 80-1, Handbook of Instructions for Aircraft Design, Volume I, Piloted Aircraft (HIAD), Headquarters, Air Force Systems Command, Tenth Edition

TABLE I  
SUMMARY OF DATA

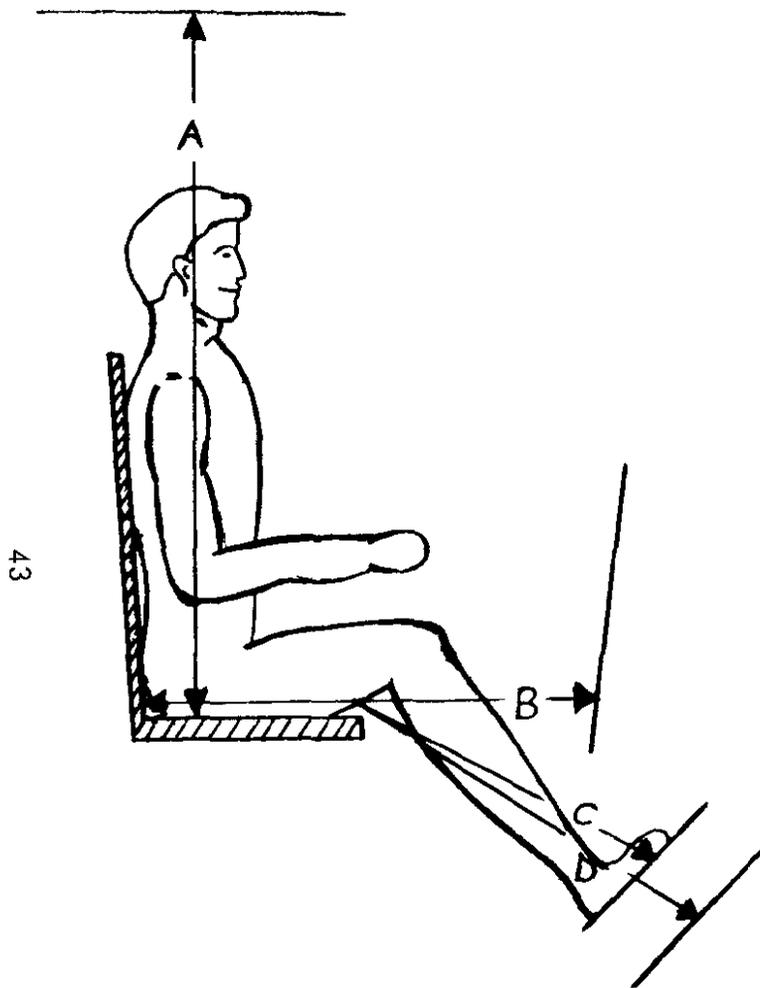
Type Aircraft	Seat Adjustment		Pedal Adjust	Pedal Travel	SEAT TO ROOF		SEATBACK TO PANEL		SEATBACK TO PEDALS AT REST		SEATBACK TO FULL LI PEDAL	
	↑	↓			↑	↓	↑	↓	↑	↓	↑	↓
04-13E	0	0	4	3								
04-13T	0	0	4	3½								
04-23D Pilot	0	0	2½	3½								
Co-Pilot	0	0	2½	3½								
04-19D	4½	0	5	3½								
04-30C	5½	0	4½	3½								
04-37	5	0	3½	2½								
04-14	0	5½	4	3								
04-15	0	0	4½	4½								
04-16	0	0	4½	4½								
04-17	0	0	4½	4½								
04-18	0	0	4½	4½								
04-19	0	0	4½	4½								
04-20	0	0	4½	4½								
04-21	0	0	4½	4½								
04-22	0	0	4½	4½								
04-23	0	0	4½	4½								
04-24	0	0	4½	4½								
04-25	0	0	4½	4½								
04-26	0	0	4½	4½								
04-27	0	0	4½	4½								
04-28	0	0	4½	4½								
04-29	0	0	4½	4½								
04-30	0	0	4½	4½								
04-31	0	0	4½	4½								
04-32	0	0	4½	4½								
04-33	0	0	4½	4½								
04-34	0	0	4½	4½								
04-35	0	0	4½	4½								
04-36	0	0	4½	4½								
04-37	0	0	4½	4½								
04-38	0	0	4½	4½								
04-39	0	0	4½	4½								
04-40	0	0	4½	4½								
04-41	0	0	4½	4½								
04-42	0	0	4½	4½								
04-43	0	0	4½	4½								
04-44	0	0	4½	4½								
04-45	0	0	4½	4½								
04-46	0	0	4½	4½								
04-47	0	0	4½	4½								
04-48	0	0	4½	4½								
04-49	0	0	4½	4½								
04-50	0	0	4½	4½								
04-51	0	0	4½	4½								
04-52	0	0	4½	4½								
04-53	0	0	4½	4½								
04-54	0	0	4½	4½								
04-55	0	0	4½	4½								
04-56	0	0	4½	4½								
04-57	0	0	4½	4½								
04-58	0	0	4½	4½								
04-59	0	0	4½	4½								
04-60	0	0	4½	4½								
04-61	0	0	4½	4½								
04-62	0	0	4½	4½								
04-63	0	0	4½	4½								
04-64	0	0	4½	4½								
04-65	0	0	4½	4½								
04-66	0	0	4½	4½								
04-67	0	0	4½	4½								
04-68	0	0	4½	4½								
04-69	0	0	4½	4½								
04-70	0	0	4½	4½								
04-71	0	0	4½	4½								
04-72	0	0	4½	4½								
04-73	0	0	4½	4½								
04-74	0	0	4½	4½								
04-75	0	0	4½	4½								
04-76	0	0	4½	4½								
04-77	0	0	4½	4½								
04-78	0	0	4½	4½								
04-79	0	0	4½	4½								
04-80	0	0	4½	4½								
04-81	0	0	4½	4½								
04-82	0	0	4½	4½								
04-83	0	0	4½	4½								
04-84	0	0	4½	4½								
04-85	0	0	4½	4½								
04-86	0	0	4½	4½								
04-87	0	0	4½	4½								
04-88	0	0	4½	4½								
04-89	0	0	4½	4½								
04-90	0	0	4½	4½								
04-91	0	0	4½	4½								
04-92	0	0	4½	4½								
04-93	0	0	4½	4½								
04-94	0	0	4½	4½								
04-95	0	0	4½	4½								
04-96	0	0	4½	4½								
04-97	0	0	4½	4½								
04-98	0	0	4½	4½								
04-99	0	0	4½	4½								
04-100	0	0	4½	4½								

TABLE 1 (Cont'd)

Type Aircraft	Seat Adjustment			Pedal Adjust	Pedal Travel	SEAT TO ROOF				SEATBACK TO PANEL				SEATBACK TO PEDALS AT REST				SEATBACK TO FULL LL PEDAL														
	↑	↓	↔			↑		↓		↑		↓		↑		↓		↑		↓												
						←	→	←	→	←	→	←	→	←	→	←	→	←	→	←	→											
CH-21C	4½	0		6	3½	43½	37	49	41½	30	29½	42	40	45	43½																	
CH-47A	5	4½		6	4	51	48½	51	57½	56	54½	32½	28	30	27	42½	38½	41	36½	45½	41	44	40									
CH-54A	5	5	7	5	2½	44½	44½	50	50	36	33	31	36	38	31	43½	45½	38½	42½	44½	37½	49	51	44½	48½	50	43½					
LH-840 Pilot	5	3		6	3	38½	38½	43½	43½	29½	26½	29½	26½	37	34	35	32	40	37	38	35											
LH-840 Gunner	5	0		6	3½	39½	48	44½	53	31½	31½	37½	32½	40½	35½																	
O-1A Front	0	4		0	2½			39	38½			30	26			40	36										42½	38				
O-1A Rear	0	0		0	2½			38				39	35			36												40				
O-1A Pilot	4	3		3½	3½	38	37½	42	41½	30	27	30	27	38½	36½	38½	36	42	40	41½	39½											
O-1A Co-Pilot	0	6½		3½	3½			40	43			25	30½			32	35½											34	38½			
U-6A	0	5		0	4½			36	39½			22½	27½			33½	38												36	41½		
U-8D	0	3½		2	5				39	38			25	22			37	35												42	40	
U-8F	0	4		2	4				40	40			30	26			41	37												45	41	
U-9	0	3		0	3½				41½	41			31½	28½			42	38½													45	42
U-10	3	0		3	3				39				30				42½														45	

TABLE 1 (Cont'd)

Type Aircraft	Seat Adjustment		Pedal Adjust	Pedal Travel	SEAT TO ROOF				SEATBACK TO PANEL				SEATBACK TO PEDALS AT REST				SEATBACK TO FULL LT PEDAL			
	↑ ↓	↔			↑		↓		↑		↓		↑		↓		↑		↓	
			←	→	←	→	←	→	←	→	←	→	←	→	←	→	←	→		
T-42	0	4½	1½	2½			38½	38½			30	25			43	39½			40	42
OV-1	5	0	8	4	30		41		29		29		42		40		45½		45	
CV-2	5	4	4½	4	30	39½	43	45	34	30½	33½	29	42	37	39½	30½	40	42½	44	41
CV-7	5	4	6	3	42	44½	49½	49	33	29	31½	28	43½	40	41	37½	48	45	45½	41
C-45	0	0	0	4			39½				27				30				40	
C-47	5	3	4	4½	39½	37½	45	45	34	31	33	29½	42½	39½	40	37½	40½	42½	44½	42
T-28B Pilot	8	0	2½	2½	40½		46½		26		25		37½		34½		39½		37	
Rear	8	0	3	2½	39½		46		25		25		35		45½		37½		35	



- A. Seat to Roof
- B. Back of Seat to Panel
- C. Back of Seat to Pedals at Rest
- D. Back of Seat to Full Left Pedal

Figure 1  
Schematic Diagram of Measurements Taken