DEPARTMENT OF THE NAVY
NAVAL AIR SYSTEMS COMMAND
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IN REPLY REFER TO

NAVAIRINST 3710.9C
AIR-4.6
12 Dec 01

NAVAIR INSTRUCTION 3710.9C

From: Commander, Naval Air Systems Command

Subj: ANTHROPOMETRIC ACCOMMODATION IN NAVAL AIRCRAFT

Ref: (a) OPNAVINST 3710.37
(b) Manual of the Medical Department, U.S. Navy (NOTAL)
(c) BUMEDINST 3710.1 Series
(d) NOMI 6110 Ser 00/1262 of 10 Dec 97 (NOTAL)
(e) NOMI 6110 Ser 00/1541 of 20 Nov 96 (NOTAL)
(f) CNATRA msg dtg 301600Z of Mar 98
(g) COMTRAWING TWO msg dtg 201602Z of Mar 98
(h) VT-21 msg dtg 162359Z of Jan 98
(i) VT-21 msg dtg 170001Z of Jan 98
(j) HS-10 msg dtg 102158Z of Mar 98
(k) NAVAIRPAC MSG dtg 271806Z of Apr 98
(l) DoD JSSG-1776-B, 2010, Chapter 3 of Oct 98
(m) NAWCADPAX/TM-2000/2, of 8 Feb 00
(n) CNATRAINST 13520.1 Series
(o) NAVAIRINST 4130.1C
(p) NAVAIRINST 4355.8C

Encl: (1) Personal Anthropometric Codes for Tactical, Trainer, and Rotary Wing Aircraft
(2) Personal Anthropometric Codes for Unmapped Aircraft
(3) Trainer and Tactical Aircraft Anthropometric Restriction Codes
(4) Rotary Wing and U.S. Coast Guard HH-65 Aircraft Anthropometric Restriction Codes
(5) Fixed Wing Non-Ejection and U.S. Coast Guard HU-25 Aircraft Anthropometric Restriction Codes
(6) A Guide to Using the Tactical, Trainer, Rotary Wing, and Fixed Wing Non-Ejection Aircraft Anthropometric Restriction Codes
(7) Unmapped Aircraft Anthropometric Restriction Codes

1. Purpose

a. To establish Naval Air Systems Command (NAVAIR) policy and assign responsibilities for implementing reference (a) to ensure the physical dimensions of flight crew personnel, fully-equipped, are accommodated by the dimensions and configurations of the aircraft crew stations to which they are assigned.

b. To establish responsibilities for the timely development of crew station geometric data on aircrew physical accommodation, and issuance of this information to those agencies responsible for assigning flight crew personnel.

c. To improve aircrew and aviation safety, operational readiness, and affordability through implementation of an aggressive, proactive aircrew anthropometric accommodation program.

2. Cancellation. This instruction supersedes NAVAIR Instruction 3710.9B of 3 March 1987. Since this is a major revision, changes are not indicated.

3. Scope. This instruction applies to all echelons and all weapons systems and equipment under the management of the Commander, Naval Air Systems Command (COMNAVAIRSYSCOM).

4. Definitions

a. Accommodation and compatibility refer to whether there is, at minimum, one seat position in an aircraft that allows a particular aviator to see, reach, and actuate all that must be seen or activated during all phases of flight, and to safely egress a disabled aircraft.

b. For purposes of this instruction, flight crew personnel refer to naval (Navy and Marine Corps) pilots, Naval Flight Officers (NFOs), and naval aircrew personnel who have met the physical entrance requirements for flight programs outlined in reference (b). In some cases, civilian aircrew personnel are also included (e.g., contracted flight instructors or test pilots).

5. Background

a. For many years, the anthropometric data of flight crew personnel has been collected, coded, and recorded by the Bureau of Medicine following reference (c). These measurements have been valuable in assigning naval pilots and NFOs to Navy aircraft with some assurance that no anthropometric limitations or hazards existed. However, as detailed in references (d) and (e), this process has been problematic. Some of the problems are inconsistent or inaccurate measurement techniques, and inconsistent enforcement of the results as supported by references (f) through (k).

b. It is a recognized fact of naval aviation that aircrew stations in some aircraft do not physically accommodate all personnel potentially eligible for aviation accession. The consequences of assigning an anthropometrically incompatible crewmember to an aircraft can be catastrophic. It is essential to accurately identify these aircraft that must have anthropometric restrictions, including the anthropometric dimensions associated with those restrictions to properly match potential aircrew candidates to appropriate aircraft. Some important considerations include helmet-to-canopy or canopy breaker clearances (ejection seat equipped aircraft), functional reach (leg and arm) to critical controls, and external vision as defined in references (l) and (m).

6. Discussion

a. General. Emerging technologies have made it more viable and much easier to take accurate, consistent, anthropometric measurements of both personnel and cockpit geometry. Reference (m) establishes the anthropometric measuring procedures for both personnel and aircraft. The entire inventory of Navy and Marine Corps aircraft is currently being re-measured and re-coded using reference (m). This will ensure that cockpit geometry changes resulting from configuration changes are captured in a baseline database. This will be an ongoing process as new cockpit configuration changes and aircrew clothing/equipment changes impact cockpit geometry and/or accommodation.

b. Anthropometric Restriction Codes

a. Personal anthropometric codes are a numeric value or combination of values assigned to a set of anthropometric dimensions divided into discrete intervals. Four anthropometric dimensions (sitting eye height, thumb tip reach, buttock-knee length, and sitting height) have been codified in 13 intervals, 0-12 (enclosure (1)). This coding system is currently in place for tactical and rotary wing aircraft and their respective trainer aircraft. For fixed wing non-ejection seat equipped and those soon-to-be obsolete aircraft not yet re-measured under reference (m), four different anthropometric dimensions (sitting height, functional reach, buttock-knee length, and leg length) were codified in intervals of 0-9 (enclosure (2)) in previous instruction releases.

b. Anthropometric Restriction Codes (ARCs) for tactical, trainer, rotary wing, and fixed wing non-ejection aircraft are identified in red in enclosures (3-5), which indicate that for a range of anthropometric dimensions, there is not a suitable seat position to maintain safety of flight in that particular aircraft. NAVAIR does not recommend flight crew personnel with that set of dimensions be assigned for flight duty to a respective aircraft receiving that ARC. A guide for reading enclosures (3-5) is included as enclosure (6). Pre-existing ARCs are identified for fixed wing non-ejection seat equipped and other aircraft not yet re-measured in enclosure (7), where numbers within parentheses indicate the need for a fit check, and numbers outside parentheses indicate there is not a suitable seat position to maintain safety of flight in that particular aircraft. NAVAIR does not recommend flight crew personnel with that set of dimensions be assigned for flight duty to a respective aircraft receiving that ARC.

c. As each category of aircraft evaluations is completed, this instruction will be updated to apply the 13 coded intervals described in enclosure (1) to new ARCs as displayed in enclosures (3-5).

7. Policy. The following aircrew accommodation policies are set forth for NAVAIR:

a. New aircraft developed and procured for Navy and Marine Corps use will accommodate the anthropometric range of the aviator population specified by reference (l) which will be incorporated in the aircraft Type/Detail specification/Statement of Work. Accommodation of less than the full range will be justified through trade studies and cost-benefit analysis.

b. Modifications to existing aircraft crew stations will not degrade existing accommodation unless sufficient justification is presented to and accepted by the appropriate Aircraft Program Office.

c. The impact of proposed crew station designs and/or modifications on aircrew accommodation will be determined and, where ARCs are justified, restrictions will be identified to those agencies responsible for assigning and training aircrew personnel. Once established for particular flight stations, ARCs apply to civilian aircrew and aircraft pilots (e.g., contracted flight instructors and test pilots) assigned to support an aircraft program. For those aircraft not yet re-measured under reference (m), where fit check codes are indicated in enclosure (7) to verify accommodation, reference (n) fit check procedures will be used as guidance.

d. Due to the catastrophic nature of the consequences of assigning an anthropometrically incompatible crewmember to an aircraft, no waivers should be granted for anthropometric incompatibilities.

8. Responsibilities

a. Naval Air Systems Command Headquarters (NAVAIRHQ)

(1) The Acquisition Executive for Program Management (AIR-1.0), Program Executive Officer, Tactical Aircraft Programs (PEO(T)), Program Executive Officer, Air Anti-Submarine Warfare, Assault and Special Mission Program (PEO(A)), Program Executive Officer for Strike Weapons and Unmanned Aviation (PEO(W)), and Program Executive Officer for Joint Strike Fighter (PEO(JSF)), and Program Managers, AIR (PMAs) are responsible for ensuring flight crew personnel are accommodated in the crew stations of the aircraft under their cognizance, and for justifying any deviation from full accommodation, as stated in paragraph 7a above. For new aircraft (including prototypes), the level of accommodation of flight crew personnel will be documented and presented to the reviewing authority at each major program milestone, along with justification for less than full accommodation. For existing aircraft, the Configuration Control Board (CCB) will be provided with a statement reflecting the impact of any Engineering Change Proposal (ECP), Rapid Action Minor Engineering Change (RAMEC), or other proposed change on aircrew accommodation. Aircraft Program Managers, via the appropriate Systems Engineering (AIR-4.1) Class Desk, will request information regarding the level of accommodation and/or extent of anthropometric restrictions at the following times:

(a) no later than 60 days prior to program initiation, milestone B, and full-rate production decision review (previous milestones I, II, and III);

(b) during mockup inspections as required by reference (p), (if applicable); and

(c) no later than 30 days prior to clearing the aircraft for flight by Navy or Marine Corps flight crew and enlisted aircrew. PMAs will direct sufficient resources to Crew Systems Department (AIR-4.6) to document the level of accommodation and generate codes in accordance with enclosures (3-5).

(2) The Assistant Commander for Research and Engineering (AIR-4.0) and Systems Engineering (AIR-4.1) will support paragraph 8a(l) above responsibilities and notify Crew Systems (AIR-4.6) of any planned ECPs, RAMECs, or other changes which may impact crew station geometry or aircrew physical accommodation in aircraft under their cognizance, and will ensure this instruction is referenced in Fleet Support Team (FST) charters/agreements and design cognizance transfers.

(3) Advanced Development Program Officers will support paragraph 8a(l) above responsibilities and provide direction and resources to AIR-4.6 to measure the crew stations of each aircraft and provide results prior to clearing the aircraft for flight by naval pilots, NFOs, and civilian pilots.

(4) AIR-4.6 will:

(a) investigate ECPs, RAMECs, and other proposed changes suspected or predicted to impact crew station geometry or aircrew physical accommodation when reviewing CCB change requests per reference (o) or when requested by PMAs via AIR-4.1, or other cognizant offices. If a proposed change is determined to impact aircrew physical accommodation, AIR-4.6 will coordinate the requirements and resources, via AIR-4.1, or other applicable offices for the assessment of the magnitude of the impact in the affected aircraft. AIR-4.6 will provide the results of such an assessment to the cognizant class desk and PMA prior to CCB action. When an assessment indicates ARCs or revised ARCs are recommended for the aircraft and a change is approved by the CCB, AIR-4.6 will ensure Naval Air Warfare Center Aircraft Division (NAVAIRWARCENACDIV) and Naval Air Warfare Center Weapon Division (NAVAIRWARCENWPNDIV) and other Navy activities participating in flight test of the aircraft under change are advised of the new anthropometric restrictions and will then revise the ARC's contained within this instruction;

(b) assess the design of crew stations in new aircraft (including prototypes) with respect to physical compatibility in accordance with reference (l) defined eligible aircrew population. Provide input as requested for use in trade studies with respect to anthropometric accommodation. Where it is determined that new aircraft will not accommodate a proportion of the specified population, AIR-4.6 will ensure NAVAIRWARCENAD and NAVAIRWARCENWD and/or other Navy activities participating in flight test of the new aircraft are advised of recommended ARCs placed on the aircraft;

(c) investigate new items of aircrew flight clothing and equipment, life support systems, escape systems (e.g. ejection seats), fixed seating, and other aircrew mounted systems undergoing development (including prototypes), proposed aircrew system changes, or other proposed changes to existing aircrew physical accommodation in crew stations. If it is determined that a new item of aircrew flight clothing, equipment, etc. will impact aircrew accommodation, the appropriate PMA will provide direction and resources to NAVAIRWARCENACDIV to assess the magnitude of the impact in each affected aircraft model and provide results to AIR-4.6 prior to CCB action;

(d) manage and maintain the Man-Machine Integration Laboratory including related field equipment and the expertise and resources required to measure aircraft crew stations, analyze and develop anthropometric measuring procedures and identify required anthropometric restriction codes;

(e) monitor all existing inventory aircraft, investigate suspected or reported aircrew accommodation problems and notify AIR-4.1 and appropriate PMAs when it is determined that aircraft anthropometric restrictions need revision; and

(f) revise and update the ARCs contained in this instruction as required and issue revised ARCs to appropriate commands involved in the aviation accession process on a timely basis through a message change to the instruction.

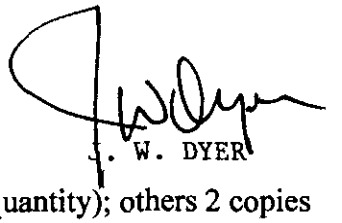
9. Procedures and Actions. Commands with responsibilities under this instruction shall develop appropriate procedures and take whatever actions necessary to fully implement and support the intent of this instruction.

10. Forms

a. NAVAIR Field Activities, NAVAIR 13050/2, CCB Change Request, is available from NAVAIRHQ.

b. NAVAIRHQ. NAVAIR 3930/1, AIRTASK/Work Unit Assignment, and NAVAIR 13050/2 are available.

11. Review. AIR-4.6 shall annually review the contents herein and provide recommendations for changes and additions/deletions.



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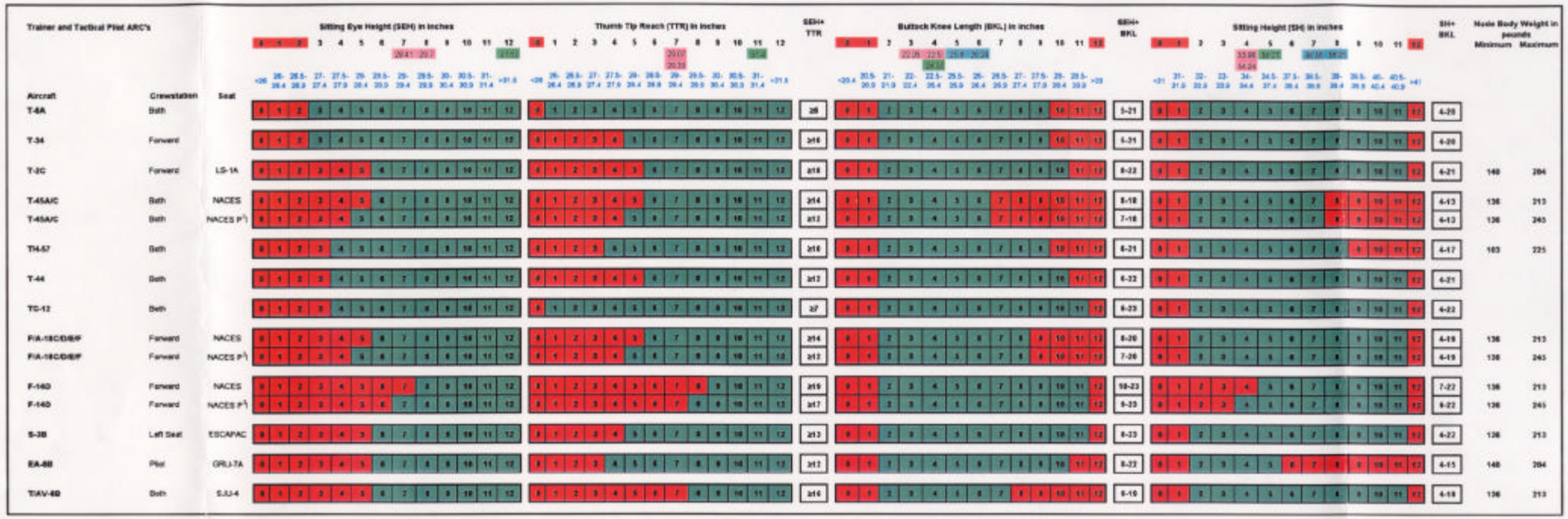
NAVAIR Web Site: https://directives.navair.navy.mil

PERSONAL ANTHROPOMETRIC CODES FOR TACTICAL, TRAINER, AND ROTARY WING AIRCRAFT

CODE	Nude Body Weight (lbs.)	Sitting Eye Height (in.)	Thumb Tip Reach (in.)	Buttock-Knee Length (in.)	Sitting Height (in.)
0	<100	<26	<26	<20.4	<31
1	100-116.5	26-26.4	26-26.4	20.5-20.9	31-31.9
2	116.6-136	26.5-26.9	26.5-26.9	21-21.9	32-32.9
3	136.1-140	27-27.4	27-27.4	22-22.4	33-33.9
4	140.1-155	27.5-27.9	27.5-27.9	22.5-25.4	34-34.4
5	155.1-170	28-28.4	28-28.4	25.5-25.9	34.5-37.4
6	170.1-185	28.5-28.9	28.5-28.9	26-26.4	37.5-38.4
7	185.1-195	29-29.4	29-29.4	26.5-26.9	38.5-38.9
8	195.1-204	29.5-29.9	29.5-29.9	27-27.4	39-39.4
9	204.1-213	30-30.4	30-30.4	27.5-27.9	39.5-39.9
10	213.1-235	30.5-30.9	30.5-30.9	28-28.4	40-40.4
11	235.1-245	31-31.4	31-31.4	28.5-28.9	40.5-40.9
12	>245	>31.5	>31.5	>29	>41

PERSONAL ANTHROPOMETRIC CODES FOR UNMAPPED AIRCRAFT

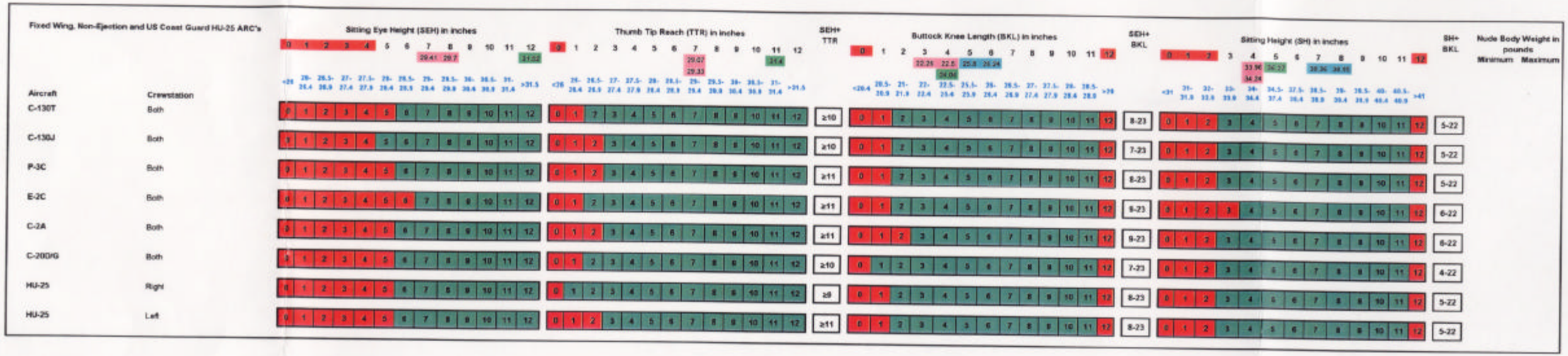
CODE	Sitting Height (in.)	Functional Reach (in.)	Buttock Knee Length (in.)	Functional Leg Length (in.)
9	40.0-41.0	< or = 27.9	> 28.0	49.0-50.0
8	39.5-39.9	28.0-28.4	27.0-28.0	48.0-48.9
7	39.0-39.4	28.5-28.9	26.5-26.9	47.0-47.9
6	38.5-38.9	29.0-29.4	26.0-26.4	46.0-46.9
5	38.0-38.4	29.5-30.4	25.5-25.9	45.0-45.9
4	35.0-37.9	30.5-30.9	25.0-25.4	43.0-44.9
3	34.0-34.9	31.0-31.4	24.0-24.9	40.0-42.9
2	33.0-33.9	31.5-32.4	23.0-23.9	39.0-39.9
1	32.5-32.9	32.5-33.9	22.0-22.9	38.0-38.9
0	32.0-32.4	> or = 34.0	< or = 21.9	36.0-37.9


Trainer and Tactical Pilot ARC's
Sitting Eye Height (SEH) in inches
Thumb Tip Reach (TTR) in inches
SEH+ TTR
Buttock Knee Length (BKL) in inches
SEH+ BKL
Sitting Height (SH) in inches
SH+ BKL
Node Body Weight in pounds
Minimum
Maximum
Aircraft
Crewstation
Seat
T-6A
Both
T-34
Forward
T-2C
Forward
LS-1A
T-45A/C
Both
NACES
T-45A/C
Both
NACES P1
T-44
Both
TC-12
Both
F/A-18C/D/E/F
Forward
NACES
F/A-18C/D/E/F
Forward
NACES P1
F-14D
Forward
NACES
F-14D
Forward
NACES P1
S-3B
Left Seat
ESCAPAC
EA-6B
Pilot
GRU-7A
T/AV-8B
Both
SJU-4


Trainer and Tactical Non Pilot/Officer's WSO, RIO, NAV, and ECMO ARC's
Sitting Eye Height (SEH) in inches
Thumb Tip Reach (TTR) in inches
Buttock Knee Length (BKL) in inches
Sitting Height (SH) in inches
SH+ BKL
Node Body Weight in pounds
Minimum
Maximum
Aircraft
Crewstation
Seat
T-34
Aft
T-2C
Aft
LS-1A
F/A-18C/D/E/F
Aft
NACES
F/A-18C/D/E/F
Aft
NACES P1
F-14D
Aft
NACES
F-14D
Aft
NACES P1
S-3B
Right Seat
ESCAPAC
EA-6B
ECMO 1
GRU-7A
EA-6B
ECMO 2
GRU-7A
EA-6B
ECMO 3
GRU-7A

Rotary Wing and U.S. Coast Guard HH-65 Aircraft ARC's

Aircraft	Crewstation	Sitting Eye Height (SEH) in inches	Thumb Tip Reach (TTR) in inches	SEH+ TTR	Buttock Knee Length (BKL) in inches	SEH+ BKL	Sitting Height (SH) in inches	SH+ BKL	Nude Body Weight in pounds Minimum	Nude Body Weight in pounds Maximum
AH-1W	Forward	0 1 2 3 4 5 6 7 8 9 10 11 12	0 1 2 3 4 5 6 7 8 9 10 11 12	≥10	0 1 2 3 4 5 6 7 8 9 10 11 12	7-23	0 1 2 3 4 5 6 7 8 9 10 11 12	4-20	103 (140)	220
AH-1W	Aft	0 1 2 3 4 5 6 7 8 9 10 11 12	0 1 2 3 4 5 6 7 8 9 10 11 12	≥10	0 1 2 3 4 5 6 7 8 9 10 11 12	7-23	0 1 2 3 4 5 6 7 8 9 10 11 12	4-22	103	220
CH-46	Both	0 1 2 3 4 5 6 7 8 9 10 11 12	0 1 2 3 4 5 6 7 8 9 10 11 12	≥12	0 1 2 3 4 5 6 7 8 9 10 11 12	8-22	0 1 2 3 4 5 6 7 8 9 10 11 12	5-21	103	225
CH-53	Both	0 1 2 3 4 5 6 7 8 9 10 11 12	0 1 2 3 4 5 6 7 8 9 10 11 12	≥12	0 1 2 3 4 5 6 7 8 9 10 11 12	8-22	0 1 2 3 4 5 6 7 8 9 10 11 12	5-21	103	225
SH-60B	Both	0 1 2 3 4 5 6 7 8 9 10 11 12	0 1 2 3 4 5 6 7 8 9 10 11 12	≥15	0 1 2 3 4 5 6 7 8 9 10 11 12	9-23	0 1 2 3 4 5 6 7 8 9 10 11 12	6-22	103	212
UH-1N	Both	0 1 2 3 4 5 6 7 8 9 10 11 12	0 1 2 3 4 5 6 7 8 9 10 11 12	≥10	0 1 2 3 4 5 6 7 8 9 10 11 12	6-23	0 1 2 3 4 5 6 7 8 9 10 11 12	4-22	103	212
MV-22	Both	0 1 2 3 4 5 6 7 8 9 10 11 12	0 1 2 3 4 5 6 7 8 9 10 11 12	≥10	0 1 2 3 4 5 6 7 8 9 10 11 12	6-21	0 1 2 3 4 5 6 7 8 9 10 11 12	4-20	107	323
HH-65	Both	0 1 2 3 4 5 6 7 8 9 10 11 12	0 1 2 3 4 5 6 7 8 9 10 11 12	≥14	0 1 2 3 4 5 6 7 8 9 10 11 12	8-23	0 1 2 3 4 5 6 7 8 9 10 11 12	5-22		


Fixed Wing, Non-Ejection and US Coast Guard HU-25 ARC's
Sitting Eye Height (SEH) in inches
Thumb Tip Reach (TTR) in inches
SEH+ TTR
Buttock Knee Length (BKL) in inches
SEH+ BKL
Sitting Height (SH) in inches
SH+ BKL
Nude Body Weight in pounds
Minimum Maximum
Aircraft
Crewstation
C-130T Both ≥10 8-23 5-22
C-130J Both ≥10 7-23 5-22
P-3C Both ≥11 8-25 5-22
E-2C Both ≥11 9-23 6-22
C-2A Both ≥11 9-23 6-22
C-20D/G Both ≥10 7-23 4-22
HU-25 Right ≥9 8-23 5-22
HU-25 Left ≥11 8-23 5-22

A Guide to Using the Tactical, Trainer, Rotary Wing, and Fixed Wing Non Ejection Aircraft Anthropometric Restriction Codes

Enclosures (3) and (5) were prepared for insertion to future releases of the NAVAIR 3710.9 and CNATRA 13520.1 series instructions. They are presented in chart format for ready viewing of pipeline relationships.

They have been designed to be used by personnel responsible for assigning candidate USN/USMC aviators to appropriate pipelines.

Enclosures (3) and (5) use the coding intervals as established in enclosure (1), and indicate all the specification thresholds with respect to how these aircraft and future aircraft were designed.

These new ARC charts account for eight parameters of concern, including a first pass on five criteria (sitting eye height, thumb tip reach, buttock-knee length, sitting height, and weight). To potentially be compatible with the aircraft, an individual should have each dimension within one of the green cells and meet the weight criteria listed, when applicable. Then the assessment of aviator suitability should evaluate three critical relationships:

- sitting eye height and thumb tip reach (ability to attain Design Eye Point (DEP) and reach to controls)
- sitting eye height and buttock-knee length (ability to attain DEP and operate foot controls)
- sitting height and buttock-knee length (ability to attain overhead and knee clearances)

In order to calculate the sitting eye height measurement for an individual, subtract 4.8 inches from the sitting height for males, or subtract 4.5 inches from the sitting height for females. This will serve as an interim solution until this anthropometric measurement can be taken with emerging technology.

The ARC's were determined from AIR-4.6 univariate results that indicated thresholds required for all dimensions at various seat locations. The resultant minimums were evaluated concurrently to determine the combined scores required for the critical relationships described above.

UNMAPPED AIRCRAFT ANTHROPOMETRIC RESTRICTION CODES

Aircraft/ Crew Station	Anthropometric Restriction Codes							
	Sitting Height		Thumb Tip Reach		Buttock-Knee Length		Functional Leg Length	
	Exclude[1]	Fit Check[2]	Exclude[1]	Fit Check[2]	Exclude[1]	Fit Check[2]	Exclude[1]	Fit Check[2]
F-14A Pilot NFO	0 1 2	8 9 8 9		7 8 9 7 8 9		7 8 9 7 8 9		0 1 7 8 9 7 8 9
F-18A, TF-18	0 1 2	8 9		7 8 9		7 8 9		7 8 9
H-3 Series	0 1 2			7 8 9		0 9		0 9

NOTES: (1) "Exclude" means a candidate aviator having a listed ARC for a listed aircraft/crew station is anthropometrically incompatible with that aircraft/crew station.

(2) "Fit Check" means a candidate aviator having a listed ARC for a listed aircraft/crew station might be anthropometrically incompatible with that aircraft/crew station and must undergo a fit check to determine whether or not he or she is anthropometrically compatible.