Generalizable Skills and Knowledge for Exploration Class Missions NNX15AW34G / NNX16AQ86G

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Tasks and Abilities for the Human Exploration of Mars NNX15AW34G / NNX16AQ86G

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NASA Risks

NASA's Human Research Program (HRP) is composed of five elements:

- Human Factors and Behavioral Performance;
- Exploration Medical Capability;
- Human Health Countermeasures;
- ✤ ISS Medical Project; and,
- Space Radiation.

The HRP Elements are responsible for 30 major risks concerning crew.



HFBP Risks

- ₩ Risk of Incompatible Vehicle/Habitat Design.
- ₩ Risk of Inadequate Human-Computer Interaction.
- ₩ Risk of Inadequate Mission, Process and Task Design.
- ₩ Risk of Performance Errors Due to Training Deficiencies.
- ₩ Risk of Injury from Dynamic Loads (occupant protection).
- ₩ Risk of Inadequate Design of Human and Automation/Robotic Integration.
- * Risk of Adverse Cognitive or Behavioral Conditions/Psychiatric Disorders.
- ₭ Risk of Performance Decrements and Adverse Health Outcomes Resulting from Sleep Loss, Circadian Desynchronization, and Work Overload.
- Risk of Performance and Behavioral Health Decrements Due to Inadequate Cooperation Coordination, Communication, and Psychosocial Adaptation within a Team.



Project Purpose

This study addresses the Risk of Inadequate Mission, Process, and Task Design and the Risk of Performance Errors Due to Training Deficiencies by identifying the work that will be performed during an expedition to Mars and the abilities, skills, and knowledge that will be required of crew members.

Conducted For: The Human Factors & Behavioral Performance (HFBP) Element.

Image: Earth and moon from HiRISE near Mars.

Project Tasks

Review Mission Planning Documents



Assumptions

Conjunction-class;
 12 mission phases;

- 6-month Cruise to Mars;
- 500-day Surface Operations;
- Mars Orbit Mars Surface Descent Mars Surface Operations Mars Surface Ascent Trans-Earth Injection Cruise to Earth Earth Approach Earth Surface Descent

Launch

Trans-Mars Injection

Mars Orbit Injection

Cruise to Mars

- Communications Lag/Autonomous;
- 6-month Cruise to Earth followed by;
- 5-day Earth Approach and Direct Descent.

Assumptions

Conjunction and Opposition

The terms "conjunction class" and "opposition class" refer to the position of Mars relative to Earth during the expedition. In the former, Mars moves behind the Sun as seen from Earth (i.e., it reaches conjunction) halfway through the expedition; in the latter, Mars is opposite the Sun in Earth's skies (i.e., at opposition) at the expedition's halfway point. A 600-day opposition-class expedition (with 30 days on the surface) can require as much as ten times the fuel as a 1,000-day conjunctionclass expedition (with 500 days on the surface).

Assumptions



Conjunction / Fast Track



Mars Transit (Cruise)



Mars Surface Descent











"Weather affects everything." – Douglas Mawson, Explorer/Scientist

Martian Dust Storm Activity





Mars Surface Ascent



Earth Transit (Cruise)



"All the conditions necessary for murder are met if you shut two men in a cabin measuring 18 feet by 20 and leave them together for two months."

- Valery Ryumin, Cosmonaut

Imagine living in a motor home with five other people for six months, followed by 18 months in a cabin on Mars. You may go outside occasionally, but must wear a space suit. Then, there is the six-month trip home in the motor home.

An expedition to Mars would be a lot like this.

Human Factors Method



Human Factors Method





Our review began with von Braun's The Mars Project, 1952.



Review included all major mission plans, reference missions, and other sources.



Assumptions are consistent with Design Reference Architecture 5.0.



Assumptions are consistent with Design Reference Architecture 5.0 (2009).

Adjust attitude control thrusters, manually wearing pressure suit/gloves, to dock Earth Ascent Vehicle (EAV) to space craft in LEO/CLO.



Task statements are formatted systematically to eliminate syntax as a variable.

Walk on planetary surface while carrying hand tools and wearing surface EVA suit to conduct geological research.



Some tasks have human performance implications.

Dig loose regolith from around surface rover wheel, manually using shovel while wearing surface EVA suit, to regain traction to proceed.



Some tasks have design implications (e.g., flexible surface EVA suits).

Use space craft waste management system for solid waste (i.e., toilet/bodily function).



Some tasks have procedural implications.

Research Products

- A rating of expedition tasks by (likely) frequency, difficulty to learn, importance, and overall criticality;
- A rank-ordered list of the physical, cognitive, and social abilities necessary;
- Identification of the abilities, skills, and knowledge that can be retained and generalized across tasks and specialties;

Research Products

- Recommendations for optimum training strategies;
- Recommendations for crew size and composition; and,
- Recommendations for the design of equipment, habitats, and procedures for exploration-class space missions.







Taska	Task		How frequently is the task performed?				How difficult is it to learn the task?				How important is the task to mission success?					
Task #			: 			Very	Not at all	t			Very	Not at all			-	Very
25	Perform surface rover maintenance functions during Mars Surface Operations.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Remove accumulated dust from surface rover windows, manually while wearing surface EVA suit, to maintain optimal visibility.	Comm	nents?													
	Conduct troubleshooting, manually/visually using schematics, procedures, and hand tools while wearing surface EVA suit, to identify fault in surface rover.	5														
	Remove/replace faulty component/connector manually/visually using hand tools and spare parts while wearing surface EVA suit to restore surface rover to operation.															

Example from the task-rating form.

Least Frequent Task: Respond to dental emergencies during Cruise to Mars.

Task Analysis

Most Frequent Task: Communicate with other crew members during Mars Surface Operations.



Dot Color = Mission Phase Dot Size = Difficulty

The positions and values reflect internal validity of study results.

Crew Roles

The task analysis identified 8 primary crew specialties/roles and 4 ancillary crew roles:

CMO

Botanist

Astrophysicist

Equipment Operator

Leader
Biologist
Geologist
Physician

Electrician

- Pilot/Navigator
- Mechanic/Engineer
- Computer Specialist

Objective: Develop cross-training and/or personnelselection strategies to achieve a crew size of 5 or 6 astronauts.

Difficulty to Learn

			Summary Task Statement	Frequency	Difficulty	Importance	Criticality	Function	
	and the second second	1	Respond to medical emergencies, following procedures and with equipment provided, during Gruine to Mars (CTM)	1.948	4.509	4.724	11.181	Medical	Medical
			Conduct Extra-Vehicular Activity (EVA) to perform maintenance or retrieve items from						Wiedical
		2	outside the interplanetary space vehicle during Cruise to Mars	2.246	4.491	4.596	11.333	EVA	
		3	Perform piloting functions during Mars Surface Descent	2,589	4.375	4.821	11,786	Piloting	
	5.50	4	Respond to medical emergencies, following procedures and with equipment provided,	2.000	4.327	4.696	11.024	Medical	
			during Cruise to Earth.						
		5	Perform piloting functions during Earth Descent.	2.545	4.268	4.750	11.563	Piloting	Piloting
		6	Respond to medical emergencies, following procedures and with equipment provided,	2.069	4.263	4.825	11.157	Medical	
			during Mars Surface Operations (MSO).						-
		7	Perform piloting functions during Mars Orbit Injection.	2.386	4.246	4.860	11.491	Piloting	-
		8	Perform piloting functions during Mars Orbit operations	2.556	4.241	4.691	11.487	Piloting	-
		9	Conduct EVA to perform maintenance or retrieve items from outside the	2.036	4.196	4.357	10.589	EVA	
E	Number of		interplanetary space vehicle during Cruise to Earth.						
Functional	Number of	10	Monitor systems and perform piloting functions during Mars Surface Ascent.	2.912	4.158	4.807	11.877	Piloting	
Category	Task Statements	11	Perform piloting functions during Earth Approach.	2.518	4.107	4.786	11.411	Piloting	Contraction of the second s
Medical	13	12	Perform medical diagnoses and evaluations, cognitively, during Cruise to Mars.	2.649	4.055	4.491	11.195	Medical	
Piloting	12	13	Respond to technical emergencies, following procedures and with equipment provided, during Cruise to Mars.	2.109	4.055	4.818	10.982	Technical	C lechnica
EVA	5	14	Perform medical diagnoses and evaluations, cognitively, during Mars Surface Operations.	2.690	4.053	4.517	11.260	Medical	
Technical	2	15	Respond to technical emergencies, following procedures and with equipment	2 1 4 0	4 05 3	4 930	11 1 22	Technical	a line in
		15	provided, during Cruise to Mars.	2.140	4.055	4.930	11.125	recificat	and the second s
		16	Perform science-related EVA functions during Mars Surface Operations.	3.679	4.036	4.286	12.000	EVA	
		17	Enter control inputs, manually/visually with gloved hand, to pilot Earth Ascent Vehicle (EAV) during launch and cruise to LEO/CLO.	2.772	4.000	4.702	11.474	Piloting	Manufact - Con
		18	Perform medical treatments during Mars Surface Operations.	2,328	3,965	4.586	10.879	Medical	
		19	Perform science-related EVA functions with heavy equipment during Mars Surface	2.877	3.964	3.946	10.788	EVA	
		20	Perform medical diagnoses and evaluations, cognitively, during Cruise to Earth	2.696	3.964	4.321	10.981	Medical	
			Respond to dental emergencies, following procedures and with equipment provided,						
		21	during Cruise to Mars.	1.807	3.947	3.948	9.703	Medical	
		22	Conduct piloting functions during Cruise to Mars.	2.509	3.930	4.298	10.737	Piloting	
		23	Respond to dental emergencies during Mars Surface Operations.	2.018	3.929	4.052	9.998	Medical	
		24	Perform construction-related EVA functions with heavy equipment during MSO.	2.375	3.911	4.286	10.571	EVA	
		25	Perform post-Mars Descent maneuver functions.	2.333	3.907	4.556	10.796	Piloting	
		26	Monitor systems and perform piloting functions during Trans Earth Injection.	2.800	3.893	4.732	11.425	Piloting	
		27	Respond to dental emergencies, following procedures and with equipment provided,	1.875	3.891	3.964	9.730	Medical	
		28	Perform tests and examinations, physically, to support medical diagnoses during	2.759	3.877	4.362	10.998	Medical	
			Cruise to Mars.						
		29	Adjust system controls, manually during buffetted descent, in response to displayed information.	2.673	3.870	4.585	11.128	Piloting	
		30	Perform medical treatments during Cruise to Earth.	2.273	3.870	4.436	10.579	Medical	
		31	Perform tests and examinations, physically, to support medical diagnoses during Mars Surface Operations.	2.741	3.860	4.483	11.084	Medical	
		32	Conduct niloting functions during Cruise to Farth	2 407	3 852	4 500	10 759	Piloting	

Frequency

	Summary Task Statement	Frequency	Difficulty	Importance	Criticality	Function
1	Interact/communicate with other crew members directly during Mars Surface Operations (MSO).	4.638	2.298	4.672	11.609	Comms
2	Exercise daily using onboard equipment during Cruise to Mars (CTM).	4.390	2.179	4.500	11.068	Exercise
3	Prepare/eat meal, manually, using interplanetary space vehicle food	4.345	1.963	4.291	10.599	Habitability
4	Prenare and consume meals in surface habitat during MSO	4 293	1 982	4 4 6 6	10 741	Habitability
5	Exercise daily using onboard equipment during Cruise to Earth	4.235	2 073	4.400	10.591	Exercise
6	Sleep for approximately 8 hours each 24-hour period during CTE	4.250	1 5/15	4.202	10.331	Habitability
-	Drenara (ast maal, manually, using interplanetary chase vehicle food	4.230	1.545	4.321	10.117	Tabitability
7	hydration/heating equipment/galley during Cruise to Mars.	4.237	1.982	4.254	10.474	Habitability
8	Sleep for approximately 8 hours each 24-hour period during MSO.	4.203	1.483	4.397	10.083	Habitability
9	Use interplanetary space vehicle waste management systems for	4.185	2.113	4.093	10.391	Habitability
	liquid/solid waste (i.e., toilet/bodily function) during Cruise to Earth.					
10	Use interplanetary space vehicle waste management systems for liquid/solid waste (i.e., toilet/bodily function) during Cruise to Mars.	4.172	2.375	4.172	10.720	Habitability
11	Sleep for approximately 8 hours each 24-hour period during CTM.	4.153	1.621	4.542	10.316	Habitability
	Use surface habitat waste management systems for liquid/solid waste (i.e.					
12	toilet/bodily function) during Mars Surface Operations.	4.138	2.281	4.103	10.522	Habitability
	Conduct communications checks/communicate observations/evaluations					
13	to crew/MCC, verbally using communications system during MSO	4.123	2.500	4.368	10.991	Comms
	Perform exercise in surface habitat to maintain cardiovascular, muscle and					
14	hone conditioning during Mars Surface Operations	4.017	2.035	4.322	10.374	Exercise
	Conduct communications checks/communicate observations/evaluations					
15	to crew/MCC verbally using communications system during CTM	3.982	2.429	4.107	10.518	Comms
	Conduct communications checks/communicate observations/ovaluations					
16	to crow/MCC workally using comme system, during Launch to Orbit	3.965	2.158	4.421	10.544	Comms
17	Use surface habitat hygione systems for cleaning during MSO	3 0 1 9	2 105	3 702	0.847	Habitability
1.9	Use internlanetary space vehicle bygione systems for cleaning during CTM	3.940	2.105	3.795	9.047	Habitability
10	Use interplanetary space vehicle hygiene systems for cleaning during CTM.	2.947	2.101	2 750	9.627	
19	Berform monitoring functions in surface habitat or modules to ensure crow	3.920	2.000	3.759	9.065	nabitability
20	and system health during Mars Surface Operations.	3.897	3.000	4.386	11.283	Monitoring
21	Monitor systems to ensure proper functioning during Cruise to Mars.	3.897	2.983	4.328	11.207	Monitoring
22	Conduct communications checks/communicate observations/evaluations	3.855	2.473	4.364	10.691	Comms
22	Conduct reconstituent extinities individually and as a serve of the CTM	2.020	1 414	2.000	0.201	Linkingh (1)
23	Conduct recreational activities, individually and as a crew, during CTM.	3.828	1.411	3.966	9.204	Habitability
24	Conduct science and planning functions during Cruise to Mars.	3.821	3.625	3.607	11.054	Planning
25	Conduct recreational activities, individually and as a crew, during CTE.	3.821	1.537	3.982	9.341	Habitability
26	Perform surface habitat houskeeping functions during MSO.	3.810	2.158	3.759	9.727	Habitability
27	Prepare/eat meals during Earth Approach.	3.786	1.907	3.945	9.639	Habitability
28	Monitor systems to ensure proper functioning during Cruise to Earth.	3.778	3.074	4.185	11.037	Monitoring
29	Conduct communications checks/communicate observations/evaluations to crew and MCC, verbally using communications system during CTE.	3.768	2.161	4.107	10.036	Comms
30	Perform planning and administrative functions, individually and with other	3.754	2.526	4.070	10.351	Planning
	crew members during Mars Surface Operations.					8
31	Conduct science and planning functions during Cruise to Earth.	3.722	3.278	3.593	10.593	Planning
32	Perform science-related EVA functions during Mars Surface Operations.	3.679	4.036	4.286	12.000	EVA

Functional Number Category Task Staten

16

6

3

3

3

1

Habitability

Monitoring

Exercise

Planning

EVA

Communicating

CommunicateHabitabilityExercise

Monitoring

Planning

Importance

		Summary Task Statement	Frequency	Difficulty	Importance	Criticality	Function
and the second se	1	Respond to technical emergencies, following procedures and with	2 1 4 0	4 052	1 0 2 0	11 1 7 2	Tochnical
and the second second		equipment provided, during Cruise to Mars.	2.140	4.055	4.950	11.125	Technical
	2	Perform piloting functions during Mars Orbit Injection.	2.386	4.246	4.860	11.491	Piloting
	3	Perform emergency functions in surface habitat or modules during MSO.	2.052	3.810	4.845	10.707	Technical
	4	Respond to medical emergencies, following procedures/with equipment	2 060	1 263	1 8 2 5	11 157	Medical
	-	provided, during Mars Surface Operations.	2.005	4.205	4.025	11.157	wiedical
and the second se		Perform piloting functions during Mars Surface Descent.	2.589	4.375	4.821	11.786	Piloting
	6	Respond to technical emergencies, following procedures and with	2 1 0 0	4.055	1 0 1 0	10 092	Technical
	Ŭ	equipment provided, during Cruise to Earth.	2.109	4.033	4.010	10.982	Technical
	7	Monitor systems/perform piloting functions during Mars Surface Ascent.	2.912	4.158	4.807	11.877	Piloting
		Perform piloting functions during Earth Approach.	2.518	4.107	4.786	11.411	Piloting
	9	Perform piloting functions during Earth Descent.	2.545	4.268	4.750	11.563	Piloting
	10	Prepare for Mars Surface Ascent during Mars Surface Operations.	2.069	3.586	4.741	10.397	Technical
Functional Number of	11	Perform initial installation/activation/inspection of surface habitat systems	2 386	3 649	4 737	10 772	Technical
Category Task Statements		during Mars Surface Operations.	2.500	3.045	4.757	10.772	reenneur
Technical 12	12	Monitor systems/perform piloting functions during Trans Earth Injection.	2.800	3.893	4.732	11.425	Piloting
Dilating 12	13	Respond to medical emergencies during Cruise to Mars.	1.948	4.509	4.724	11.181	Medical
Piloting 12	14	Configure systems for Mars Orbit operations and descent.	2.321	3.625	4.709	10.656	Technical
Medical 5	15	Enter control inputs, manually/visually with gloved hand, to pilot Earth	2 772	4 000	4 702	11 474	Piloting
Communicating 1	10	Ascent Vehicle (EAV) during launch and cruise to LEO/CLO.	2.772	4.000	4.702	11.474	Thoting
Ushitshility 1	16	Respond to medical emergencies, following procedures and with equipment	2 000	4 3 2 7	4 696	11 024	Medical
Habitability I	10	provided, during Cruise to Earth.	2.000	4.527	4.050	11.024	wiculcul
EVA 1	17	Perform piloting functions during Mars Orbit operations	2.556	4.241	4.691	11.487	Piloting
	18	Prepare for Mars Surface Ascent maneuver.	2.263	3.737	4.684	10.684	Technical
	19	Interact/communicate with other crew members directly during MSO.	4.638	2.298	4.672	11.609	Comms
	20	Assess displayed and aural information, cognitively, to determine	3 018	3 298	4 649	10 965	Technical
		appropriate course of action during Cruise to Mars.	0.010	0.200		10.000	
	21	Assess displayed information, cognitively, to determine readiness for TMI	3.018	3.571	4.643	11.232	Technical
	22	Enter control inputs, manually/visually with gloved hand, to configure and	2.821	3.614	4.625	11.060	Piloting
		operate Earth Ascent Vehicle (EAV) before and after launch.					
	23	Prepare for Earth Surface Descent.	2.370	3.200	4.600	10.170	Technical
	24	Conduct Extra-Vehicular Activity (EVA) to perform maintenance or retrieve	2.246	4.491	4.596	11.333	EVA
		items from outside the interplanetary space vehicle during Cruise to Mars.		-			
	25	Perform medical treatments during Mars Surface Operations.	2.328	3.965	4.586	10.879	Medical
	26	Adjust system controls, manually during buffetted descent, in response to	2.673	3.870	4.585	11.128	Piloting
		displayed information.					
		Assess displayed information, cognitively, to determine readiness to launch to LEO/CLO.	3.123	3.632	4.579	11.333	Technical
	28	Prepare for Mars Surface Descent maneuver.	2.236	3.527	4.564	10.327	Technical
	29	Perform post-Mars Descent maneuver functions.	2.333	3.907	4.556	10.796	Piloting
	30	Sleep for approximately 8 hours each 24-hour period during CTM.	4.153	1.621	4.542	10.316	Habitability
	31	Perform post-Mars Ascent maneuver functions.	2.286	3.772	4.526	10.584	Piloting
	32	Perform medical treatments during Cruise to Mars.	2.158	3.786	4.526	10.470	Medical

Technical Piloting Medical

Criticality

	Summary Task Statement	Frequency	Difficulty	Importance	Criticality	Function
1	Perform science-related EVA functions during Mars Surface Operations	3 670	4 036	1 286	12 000	Science EV/A
1	(MSO).	3.079	4.030	4.280	12.000	Science EVA
2	Monitor systems/perform piloting functions during Mars Surface Ascent.	2.912	4.158	4.807	11.877	Piloting
3	Perform piloting functions during Mars Surface Descent.	2.589	4.375	4.821	11.786	Piloting
4	Interact/communicate with crew members directly during MSO.	4.638	2.298	4.672	11.609	Comms
5	Perform piloting functions during Earth Descent.	2.545	4.268	4.750	11.563	Piloting
6	Perform piloting functions during Mars Orbit Injection.	2.386	4.246	4.860	11.491	Piloting
7	Perform piloting functions during Mars Orbit operations	2.556	4.241	4.691	11.487	Piloting
8	Enter control inputs, manually/visually with gloved hand, to pilot Earth Ascent Vehicle (EAV) during launch and cruise to LEO/CLO.	2.772	4.000	4.702	11.474	Piloting
9	Monitor systems/perform piloting functions during Trans Earth Injection.	2.800	3.893	4.732	11.425	Piloting
10	Perform piloting functions during Earth Approach.	2.518	4.107	4.786	11.411	Piloting
11	Assess displayed information, cognitively, to determine readiness to launch	3.123	3.632	4.579	11.333	Piloting
	LO LEO/CLO.					
12	items from outside the interplanetary space vehicle during Cruice to Mars	2.246	4.491	4.596	11.333	EVA
12	Monitor displays (vorify configurations before (during launch to LEO/CLO	2 6 6 /	2 2 2 2 2	4 4 2 0	11 276	Monitoring
14	Monitor systems during Earth Descent	3.334	3.333	4.439	11 200	Monitoring
14	Notificor systems during Earth Descent.	5.461	3.362	4.430	11.500	womening
15	and system health during Mars Surface Operations	3.897	3.000	4.386	11.283	Monitoring
	Enter/exit surface babitat, manually while wearing procesure suit and balmet					
16	during Mars Surface Operations	3.544	3.246	4.474	11.263	EVA
17	During Mars Surface Operations.	2 600	4.052	4 5 1 7	11 260	Modical
10	Perform robot operations related functions during MSO	2.030	2 750	2 0 0 2	11.200	Robotics
10	Perform goology related science functions in surface habitat or modules	5.527	5.750	5.962	11.239	Robotics
19	during Mars Surface Operations	3.491	3.754	4.000	11.245	Science
20	Assess displayed information, cognitively, to determine readiness for TMI	3.018	3 571	4 6 4 3	11 232	Piloting
	Monitor crew behavioral health/respond to behavioral health issues during	5.010	5.571	4.045	11.252	Thoting
21	Monto cew benavioral nearly respond to benavioral nearly issues during Mars Surface Operations.	3.133	3.559	4.517	11.209	Medical
22	Monitor systems to ensure proper functioning during Cruise to Mars.	3.897	2.983	4.328	11.207	Monitoring
23	Perform medical diagnoses/evaluations, cognitively, during Cruise to Mars.	2.649	4.055	4.491	11.195	Medical
24	Respond to medical emergencies, following procedures and with equipment provided, during Cruise to Mars.	1.948	4.509	4.724	11.181	Medical
25	Perform surface rover piloting/driving functions during MSO.	3.464	3.411	4.304	11.179	Piloting
26	Respond to medical emergencies, following procedures and with equipment provided, during Mars Surface Operations.	2.069	4.263	4.825	11.157	Medical
27	Perform surface EVA physical functions on foot during MSO.	3.298	3.482	4.368	11.149	EVA
28	Adjust system controls, manually during buffeted descent, in response to displayed information.	2.673	3.870	4.585	11.128	Piloting
29	Respond to technical emergencies, following procedures and with	2.140	4.053	4.930	11.123	Technical
30	Monitor systems during Mars Surface Descent	2 1 / 0	2 / / /	4 500	11 102	Piloting
	Perform tests and examinations indusically to support medical diagnoses	5.140	5.444	4.303	11.102	r noting
31	during Mars Surface Operations.	2.741	3.860	4.483	11.084	Medical
32	Perform biology-related science functions in surface habitat or modules during Mars Surface Operations.	3.474	3.579	4.018	11.070	Science

Criticality

Difficulty

Importance

Mean

9.93

on 16.80

Mechanic/Engineer (n=10) Mean More Important (13) 1.00 Inductive Reasoning 11.40 Problem Sensitivity 11.40 Deductive Reasoning 11.90 Manual Dexterity 14.00 Patience 17.70 Written Comprehension 17.70 Originality 18.60 Visualization 19.30 Mathematical Reasoning 22.20 Teamwork 22.30 Confidence 23.00 Information Ordering 23.80 Arm-Hand Steadiness 24.00 Important 24.10 Rate Control 24.30 Control Precision 25.90 Auditory Attention 26.40 Finger Dexterity 26.50 Reaction Time 26.50 Speed of Closure 26.70 Flexibility of Closure 26.80 Static Strength 27.60 Multi-Limb Coordination 28.50 Dynamic Strength 29.70 Oral Comprehension 30.00 General Hearing 30.50 Gross Body Coordination 30.90 Tolerance 31.10 Fluency of Ideas 31.60 Sound Localization 32.60 Emotional Control 34.10 Visual Color Discrimination 34.10 Speech Hearing 34.30 Time Sharing 34.40 Number Facility 34.70 Oral Expression 34.70 Response Orientation 34.70 Spatial Orientation 34.90 Memorization 35.10 Near Vision 35.30 Gross Body Equilibrium 35.50 Selective Attention 35.70 Speech Clarity 35.70 Affability 36.20 Stamina 36.70 Explosive Strength 37.20 Wrist-Finger Speed 37.30 Perceptual Speed 38.60 Depth Perception 38.90 Trunk Strength 39.20 Dynamic Flexibility 39.40 Written Expression 40.40 Category Flexibility 41.20 Extent Flexibility 42.80 Night Vision 44.50 Less Important 46.10 Peripheral Vision 46.60 Far Vision 49.30 Speed of Limb Movement 50.40 Glare Sensitivity 55.00

Computer Specialist (n=10) Mean Electrician (n=11) Mean More Important (15) 1.00 Inductive Reasoning 9.09 Problem Sensitivity 10.55 Confidence 10.64 Deductive Reasoning 11.45 Information Ordering 16.18 Visual Color Discrimination 17.18 Finger Dexterity 18.09 Manual Dexterity 18.91 Originality 19.09 Selective Attention 20.27 Mathematical Reasoning 20.82 Visualization 20.91 21.20 Patience 21.55 Near Vision 21.73 Speed of Closure 22.09 Important 24.36 Teamwork 24.55 Hand Steadiness 25.00 Night Vision 25.09 Oral Expression 26.27 Time Sharing 26.27 Written Comprehension 26.5 Number Facility 26.7 Memorization 26.82 Flexibility of Closure 28.45 Perceptual Speed 28.91 Oral Comprehension 29.00 General Hearing 29.73 Reaction Time 29.82 Speech Clarity 29.91 Auditory Attention 31.09 Sound Localization 31.73 Fluency of Ideas 32.18 Dynamic Flexibility 32.73 Control Precision 32.91 Extent Flexibility 33.36 Written Expression 33.82 Affability 34.82 Category Flexibility 36.36 Multi-Limb Coordination 36.73 Emotional Control 37.00 Speech Hearing 37.09 Wrist-Finger Speed 37.27 Response Orientation 38.09 Gross Body Equilibrium 38.27 Rate Control 38.73 Gross Body Coordination 40.09 Glare Sensitivity 40.73 Depth Perception 41.09 Stamina 42.73 Less Important 43.64 Spatial Orientation 44.27 Tolerance 45.00 Peripheral Vision 46.82 Dynamic Strength 49.82 Speed of Limb Movement 50.64 Far Vision 50.91 Static Strength 51.09 Trunk Strength 51.36 Explosive Strength 58.18

More Important (4) 1.00 Inductive Reasoning 7.10 Deductive Reasoning 7.80 Problem Sensitivity 8.80 Information Ordering 15.50 Important 18.80 Mathematical Reasoning 19.10 Written Comprehension 19.40 Oral Comprehension 20.20 Time Sharing 20.70 Oral Expression 20.80 nfidence 21.00 sion 21.10 Me Speed of Closure Originality 23.70 Speech Clarity 24.00 Patience 25.30 Teamwork 25.80 Finger Dexterity 28.00 Visualization 28.10 Fluency of Ideas 28.80 Perceptual Speed 29.00 Flexibility of Closure 30.00 Manual Dexterity 30.10 Emotional Control 30.50 Control Precision 30.90 Number Facility 31.60 Wrist-Finger Speed 31.90 Reaction Time 32.00 Category Flexibility 32.10 Arm-Hand Steadiness 32.50 Speech Hearing 32.60 Response Orientation 32.80 General Hearing 33.00 Sound Localization 33.00 Rate Control 33.30 Visual Color Discrimination 34.40 Auditory Attention 34.60 Multi-Limb Coordination 35.50 Affability 37.30 Gross Body Coordination 37.60 Tolerance 37.80 Written Expression 38.10 Extent Flexibility 39.60 Less Important 39.80 Depth Perception 41.50 Dynamic Flexibility 41.60 Spatial Orientation 42.00 Night Vision 42.40 Glare Sensitivity 43.60 Stamina 43.80 Gross Body Equilibrium 44.20 Trunk Strength 44.90 Peripheral Vision 46.00 Static Strength 46.30 Far Vision 46.60 Speed of Limb Movement 47.10 Dynamic Strength 47.20 Explosive Strength 53.30

Geologist (n=15) More Important (14) 1.00 Inductive Reasoning Deductive Reasoning 12.60 Teamwork 12.80 Patience 15.80 onfidence 15.87 Oral Expression 17.4 Selective Attention 19.07 Visualization 19.40 Flexibility of Closure 20.6 Problem Sensitivity 21.40 Emotional Control 22.07 Stamina 22.60 Important 22.67 Fluency of Ideas 23.27 Written Comprehension 23.33 Affability 23.47 Far Vision 23.53 visual Color Discrimination 24.40 Speech Clarity 25.67 Tolerance 25.93 Speed of Closure 26.13 Near Vision 26.33 Oral Comprehension 26.33 Manual Dexterity 27.07 Written Expression 27.20 Information Ordering 27.73 Gross Body Coordination 28.53 Gross Body Equilibrium 28.87 Time Sharing 29.87 Category Flexibility 30.80 Dynamic Strength 31.20 Memorization 31.87 Depth Perception 33.20 Finger Dexterity 33.47 Perceptual Speed 33.47 Mathematical Reasoning 33.87 Trunk Strength 33.93 Arm-Hand Steadiness 36.40 Extent Flexibility 36.67 Speech Hearing 36.80 Static Strength 36.87 Number Facility 37.60 Multi-Limb Coordination 39.40 Control Precision 41.60 Dynamic Flexibility 41.80 Less Important 44.67 Reaction Time 45.40 Rate Control 46.20 Glare Sensitivity 46.40 Explosive Strength 47.33 General Hearing 48.27 Response Orientation 48.93 Wrist-Finger Speed 49.33 Auditory Attention 49.73 Speed of Limb Movement 50.53 Sound Localization 51.40 Peripheral Vision 53.47 Night Vision 55.27

Biologist (n=12) Mean e Important (21) 1.00 9.17 Deductive Rea Information Ordering 12.25 Patience 12.4 Selective Attention 12.58 Problem Sensitivity 14.00 Arm-Hand Steadiness 17.75 Finger Dexterity 17.75 Originality 18.17 Written Comprehension 18.50 Manual Dexterity 18.83 Near Vision 19.25 Flexibility of Closure 19.58 Time Sharing 20.67 Speed of Closure 21.50 Fluency of Ideas 22.08 Written Expression 22.75 Visual Color Discrimination 23.17 Mathematical Reasoning 23.92 Wrist-Finger Speed 24.08 Important 24.50 Teamwork 24.50 Oral Expression 24.75 Category Flexibility 25.17 Number Facility 25.42 Oral Comprehension 25.50 Control Precision 26.17 Memorization 26.75 Visualization 27.25 Emotional Control 27.58 Perceptual Speed 29.67 Speech Clarity 30.17 Tolerance 33.17 Affability 33.25 Depth Perception 34.25 Reaction Time 34.42 Rate Control 37.08 Speech Hearing 41.08 Glare Sensitivity 41.33 Multi-Limb Coordination 42.75 Auditory Attention 42.83 Spatial Orientation 43.00 Response Orientation 43.33 General Hearing 43.58 Gross Body Coordination 44.67 Less Important 44.75 Extent Flexibility 45.75 Stamina 45.75 Trunk Strength 45.83 Dynamic Flexibility 47.83 Gross Body Equilibrium 47.83 Peripheral Vision 47.83 Sound Localization 48.08 Dynamic Strength 48.67 Night Vision 48.75 Speed of Limb Movement 50.42 Static Strength 51.50 Far Vision 52.75 Explosive Strength 58.00

0) Mean (18) Physician (n=11) Mean More Important (18) 1.00 imme 10.30 Problem Sensitivity 6.00 Sono 10.80 Inductive Reasoning 7.55 tion 10.30 Deductive Reasoning 7.55 Deductive Reasoning 7.55 tion 11.30 Confidence 12.36 Confidence 12.36 Soneed of Closure 15.30 tion 18.30 Oral Comprehension 17.82 Teamwork 16.18 Soneed of Closure 15.30 vork 19.00 Soneed of Closure 19.00 Written Comprehension 17.82 vork 19.00 Written Comprehension 20.18 Oral Emperational Control 20.55 vork 19.00 Written Comprehension 20.18 Oral Expression 20.00 vritte 24.70 Selective Attention 21.00 Written Comprehension 20.01 vritte 25.50 Oral Expression 22.00 Peroperof Closure 25.18 vritto 26.10 Tolerance 25.30 Speech Hearing 27.00 vritto 26.10 Tolerance 25.30 Speech Hearing 27.00				-	
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tion 12.10 Deductive Reasoning 8.00 ntrol 15.30 Confidence 12.36 ntrol 17.30 Confidence 12.36 ntrol 17.50 Confidence 15.36 ntrol 17.50 Teamwork 16.18 ovark 19.00 Manual Dexterity 1791 sure 20.50 Finger Dexterity 19.00 ovark 19.00 Written Comprehension 20.35 originality 19.00 Written Comprehension 20.35 originality 19.00 Written Comprehension 20.35 originality 20.40 Primery Dexterity 20.40 ritty 24.40 Filexontonal Control 20.35 ritty 25.50 Oral Expression 21.00 tata 25.90 Important 24.91 ntime Sacon Arrm-Hand Steadines 25.18 tion 26.10 Visualization 25.50 oral Expression 22.00 Speech Hearing <td< td=""><td>sion</td><td>10.80</td><td>Inc</td><td>luctive Reasoning</td><td>7.55</td></td<>	sion	10.80	Inc	luctive Reasoning	7.55
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Speech Clarity 12.88 Deductive Reasoning 13.19 Oral Comprehension 13.71 Affability 14.71 Fluency of Ideas 16.98 Time Sharing 17.26 Originality 17.60 Information Ordering 18.86 Speech Hearing 19.10 Written Comprehension 19.43 Written Expression 21.93 Speed of Closure 23.02 Category Flexibility 23.60 Category Flexibility 23.60 Category Flexibility 23.60 Auditory Attention 25.97 Auditory Attention 27.19 Memorization 21.93 Reaction Time 29.07 Ferceptual Speed 28.33 General Hearing 31.00 Mathematical Reasoning 32.17 Spatial Orientation 35.38 Number Facility 35.33 Number Facility 35.37 Manual Decatization 37.65 Sound Localization	Inductive Reasoning	12.48
Deductive Reasoning 13.12 Oral Comprehension 13.71 Fluency of Ideas 16.98 Time Sharing 17.60 Originality 17.60 Information Ordering 18.86 Speech Hearing 19.10 Written Comprehension 19.43 Written Comprehension 19.43 Written Expression 21.93 Speed of Closure 23.02 Category Flexibility 23.60 Category Flexibility 23.60 Memorization 25.81 Selective Attention 27.52 Perceptual Speed 28.93 Reaction Time 29.07 Flexibility of Closure 30.30 General Hearing 31.00 Mathematical Reasoning 31.71 Spatial Orientation 35.32 Sound Localization 37.05 Sound Localization 37.05 Sound Localization 38.76 Sound Localization 37.07 Sound Localization 37.07 Sound Loc	Speech Clarity	12.88
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Fluency of Ideas 16.98 Time Sharing 17.26 Originality 17.60 Information Ordering 18.86 Speech Hearing 19.10 Written Comprehension 19.43 Written Expression 21.93 Speech Hearing 23.00 Category Flexibility 23.60 Important 24.17 Visualization 25.07 Auditory Attention 25.81 Selective Attention 27.51 Perceptual Speed 28.93 Reaction Time 29.07 Flexibility of Closure 30.38 General Hearing 31.00 Mathematical Reasoning 31.10 Methematical Reasoning 35.17 Response Orientation 35.38 Number Facility 35.35 Sound Localization 38.76 Sound Localization 38.76 Control Precision 41.88 Rate Control 42.83 Gross Body Coordination 45.69 Visual Color Discrimination 45.69 <	Affability	14.71
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Written Comprehension 19.43 Written Expression 21.93 Speed of Closure 23.02 Category Flexibility 23.60 Category Flexibility 23.60 Important 24.17 Visualization 25.07 Auditory Attention 25.81 Selective Attention 27.62 Perceptual Speed 28.93 Reaction Time 29.07 Flexibility of Closure 30.38 General Hearing 31.00 Mathematical Reasoning 32.17 Spatial Orientation 35.12 Stamina 35.33 Number Facility 35.57 Response Orientation 37.62 Sound Localization 37.62 Control Precision 42.83 Gross Body Coordination 42.83 Gross Body Coordination 45.69 Visual Color Discrimination 45.69 Visual Color Discrimination 45.69 Visual Color Discrimination 45.69 Visual Color Discrimination 45.69	Speech Hearing	19.10
Written Expression 21.93 Speed of Closure 23.02 Category Flexibility 23.60 Important 24.17 Visualization 25.07 Auditory Attention 25.81 Selective Attention 27.52 Perceptual Speed 28.93 Reaction Time 29.07 Flexibility of Closure 30.38 General Hearing 31.00 Mathematical Reasoning 32.17 Spatial Orientation 35.12 Stamina 35.38 Number Facility 35.57 Respondent Vision 39.98 Less Important 40.81 Depth Perception 41.88 Rate Control 42.52 Control Precision 42.83 Gross Body Coordination 45.69 Visial Color Discrimination 45.69 Visial Color Discrimination 45.69 Visial Color Discrimination 45.69 Visual Color Discrimination 45.69 Static Strength 48.31 Dynamic Strength 48.3	Written Comprehension	19.43
Speed of Closure 23.00 Category Flexibility 23.60 Important 24.17 Visualization 25.07 Auditory Attention 25.81 Selective Attention 27.19 Memorization 27.62 Perceptual Speed 28.93 Reaction Time 29.07 Flexibility of Closure 30.38 General Hearing 31.00 Mathematical Reasoning 32.17 Spatial Orientation 35.33 Number Facility 35.57 Response Orientation 37.05 Sound Localization 37.05 Sound Localization 37.05 Sound Localization 39.84 Less Important 40.81 Depth Perception 42.83 Gross Body Equilibrium 43.33 Drynamic Strength 44.33 Multi-Limb Coordination 45.74 Finger Dexterity 48.02 Visual Color Discrimination 45.74 Kinger Dexterity 48.02 Night Vision	Written Expression	21.93
Category Flexibility 23.60 Important 24.17 Visualization 25.07 Auditory Attention 25.81 Selective Attention 27.52 Perceptual Speed 28.93 Reaction Time 29.07 Flexibility of Closure 30.38 General Hearing 31.00 Mathematical Reasoning 32.17 Spatial Orientation 35.12 Stamina 35.33 Number Facility 35.57 Response Orientation 37.05 Sound Localization 37.05 Sound Localization 37.62 Control Precision 42.52 Control Precision 42.52 Control Precision 42.52 Control Precision 42.53 Gross Body Coordination 45.69 Visual Color Discrimination 45.69	Speed of Closure	23.02
Important 24.1/ Visualization 25.07 Auditory Attention 25.81 Selective Attention 27.62 Perceptual Speed 28.93 Reaction Time 29.07 Flexibility of Closure 30.38 General Hearing 31.00 Mathematical Reasoning 31.17 Spatial Orientation 35.38 Number Facility 35.37 Response Orientation 37.05 Sound Localization 38.76 Number Facility 32.57 Response Orientation 43.83 Control Precision 41.88 Rate Control 42.52 Control Precision 41.88 Gross Body Coordination 45.69 Visual Color Discrimination	Category Flexibility	23.60
Visualizatio 25.07 Auditory Attention 25.81 Selective Attention 27.19 Memorization 27.62 Perceptual Speed 28.93 Reaction Time 29.07 Flexibility of Closure 30.38 General Hearing 31.00 Mathematical Reasoning 32.17 Spatial Orientation 35.38 Number Facility 35.37 Response Orientation 37.05 Sound Localization 39.98 Less Important 40.81 Depth Perception 42.88 Gross Body Equilibrium 43.83 Dynamic Strength 44.33 Gross Body Coordination 45.79 Visual Color Discrimination 45.70 Visual Color Discrimination 45.70 Visual Color Discrimination 45.70 Might Vision 48.02 Night Vision 48.02 Statitic Strength 48.13 Dynamic Flexibility 51.04 Finger Dexterity 48.02	Important	24.17
Auditory Attention 23.81 Selective Attention 27.49 Memorization 27.42 Perceptual Speed 28.93 Reaction Time 29.07 Flexibility of Closure 30.38 General Hearing 31.00 Mathematical Reasoning 32.17 Spatial Orientation 35.12 Stamina 35.38 Number Facility 35.57 Response Orientation 38.76 Sound Localization 38.76 Near Vision 39.98 Less Important 40.81 Depth Perception 41.88 Rate Control 42.52 Control Precision 42.57 Manual Dexterity 42.83 Gross Body Equilibrium 43.83 Dynamic Strength 44.33 Gross Body Equilibrium 43.83 Dynamic Strength 44.33 Multi-Limb Coordination 45.69 Visual Color Discrimination 45.74 Kata Stadies 49.00 Trunk Strength 48.12 Arm-Hand Steadiness 49.00 Trunk Strength 49.43 Dynamic Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.01 Glare Sensitivity 52.17	Visualization	25.07
Selective Attention 27.12 Memorization 27.62 Perceptual Speed 28.93 Reaction Time 29.07 Flexibility of Closure 30.38 General Hearing 31.00 Mathematical Reasoning 31.17 Spatial Orientation 35.12 Stamina 35.38 Number Facility 35.57 Response Orientation 37.05 Sound Localization 38.76 Number Facility 42.83 Rate Control 42.52 Control Precision 41.88 Rate Control 42.52 Control Precision 42.83 Gross Body Coordination 45.69 Visual Color Discrimination	Auditory Attention	25.81
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Reaction Time 25:07 Flexibility of Closure 30.38 General Hearing 31.00 Mathematical Reasoning 32.17 Spatial Orientation 35.12 Stamina 35.33 Number Facility 35.57 Response Orientation 37.05 Sound Localization 38.76 Near Vision 39.98 Less Important 40.81 Depth Perception 41.88 Rate Control 42.52 Control Precision 42.83 Far Vision 42.83 Gross Body Coordination 45.69 Visual Color Discrimination 45.69 Multi-Limb Coordination 45.69 Visual Color Discrimination 45.69 Static Strength <	Perceptual Speed	28.93
Trexbinity of Closelie 53-36 General Hearing 31.00 Mathematical Reasoning 32.17 Spatial Orientation 35.12 Stamina 35.38 Number Facility 35.57 Response Orientation 37.05 Sound Localization 38.76 Near Vision 39.98 Less Important 40.81 Depth Perception 41.88 Rate Control 42.52 Control Precision 42.83 Gross Body Equilibrium 43.83 Dynamic Strength 44.33 Gross Body Coordination 45.69 Visual Color Discrimination 45.69 Visual Color Discrenthation 45.69 Static Strength 48.02 Static Strength 48.02 Arm-Hand Steadiness <t< td=""><td>Flovibility of Closure</td><td>29.07</td></t<>	Flovibility of Closure	29.07
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Spatial Orientatio 35.12 Spatial Orientatio 35.12 Stamina 35.38 Number Facility 35.57 Response Orientation 37.05 Sound Localization 38.76 Near Vision 39.78 Less Important 40.81 Depth Perception 41.88 Rate Control 42.52 Control Precision 42.83 Gross Body Coordination 42.83 Dynamic Strength 44.33 Orios Body Coordination 45.69 Visual Color Discrimination 45.69 Static Strength 48.02 Night Vision 48.02 Static Strength 49.03 Dynamic Flexibility	Mathematical Peaconing	22.17
Apatial Chemation 35.18 Stamina 35.38 Number Facility 35.57 Response Orientation 37.05 Sound Localization 33.76 Near Vision 39.98 Less Important 40.81 Depth Perception 41.88 Rate Control 42.52 Control Precision 42.57 Manual Dexterity 42.83 Far Vision 42.88 Gross Body Equilibrium 43.83 Dynamic Strength 44.33 Gross Body Coordination 45.69 Visual Color Discrimination 45.74 Finger Dexterity 48.02 Night Vision 48.02 Static Strength 48.31 Dynamic Flexibility 50.30 Extent Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.01 Glare Sensitivity 52.17	Spatial Oriontation	25 12
Number Facility 35.57 Response Orientation 37.05 Sound Localization 38.76 Near Vision 39.98 Less Important 40.81 Depth Perception 41.88 Rate Control Precision 42.52 Control Precision 42.52 Control Precision 42.52 Manual Dexterity 42.83 Gross Body Equilibrium 43.83 Dynamic Strength 44.33 Peripheral Vision 44.33 Ross Body Coordination 45.69 Visual Color Discrimination 45.74 Finger Dexterity 48.02 Night Vision 48.02 Static Strength 48.21 Arm-Hand Steadiness 49.00 Trunk Strength 49.43 Dynamic Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Spatial Orientation Stamina	35.12
Response Orientation 37.05 Sound Localization 37.05 Sound Localization 38.76 Near Vision 39.98 Less Important 40.81 Depth Perception 41.88 Rate Control 42.52 Control Precision 42.57 Manual Dexterity 42.83 Gross Body Equilibrium 43.83 Dynamic Strength 44.33 Peripheral Vision 44.83 Multi-Limb Coordination 45.69 Visual Color Discrimination 45.74 Finger Dexterity 48.02 Night Vision 48.02 Static Strength 48.21 Arm-Hand Steadiness 49.00 Trunk Strength 49.43 Dynamic Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Number Facility	35 57
Sound Localization 38.76 Near Vision 39.98 Less Important 40.81 Depth Perception 41.88 Rate Control 42.52 Control Precision 42.57 Manual Dexterity 42.83 Far Vision 42.88 Gross Body Equilibrium 43.83 Dynamic Strength 44.33 Gross Body Coordination 45.69 Visual Color Discrimination 45.74 Finger Dexterity 48.02 Night Vision 48.02 Static Strength 48.21 Arm-Hand Steadiness 49.00 Trunk Strength 48.43 Dynamic Flexibility 50.30 Extent Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.01 Glare Sensitivity 52.17	Response Orientation	37.05
Near Vision 33.98 Less important 40.81 Depth Perception 41.88 Rate Control 42.52 Control Precision 42.57 Manual Dexterity 42.83 Gross Body Equilibrium 43.83 Dynamic Strength 44.33 Gross Body Coordination 44.33 Peripheral Vision 44.83 Multi-Limb Coordination 45.69 Visual Color Discrimination 45.74 Finger Dexterity 48.02 Night Vision 48.02 Static Strength 48.21 Arm-Hand Steadiness 49.00 Trunk Strength 49.43 Dynamic Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Sound Localization	38.76
Less Important 40.81 Depth Perception 41.88 Rate Control 42.52 Control Precision 42.57 Manual Dexterity 42.83 Far Vision 42.88 Gross Body Equilibrium 43.83 Dynamic Strength 44.33 Peripheral Vision 44.83 Multi-Limb Coordination 45.59 Visual Color Discrimination 45.59 Visual Color Discrimination 45.74 Finger Dexterity 48.02 Night Vision 48.02 Static Strength 48.21 Arm-Hand Steadiness 49.00 Trunk Strength 94.93 Dynamic Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Near Vision	39.98
Depth Perception 41.88 Rate Control 42.52 Control Precision 42.57 Manual Dexterity 42.83 Far Vision 42.87 Gross Body Equilibrium 43.83 Dynamic Strength 44.33 Gross Body Coordination 44.33 Peripheral Vision 44.83 Multi-Limb Coordination 45.69 Visual Color Discrimination 45.74 Finger Dexterity 48.02 Night Vision 48.02 Static Strength 48.21 Arm-Hand Steadiness 49.00 Trunk Strength 48.43 Dynamic Flexibility 50.30 Extent Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.01 Glare Sensitivity 52.17	Less Important	40.81
Rate Control 42.52 Control Precision 42.57 Manual Dexterity 42.83 Far Vision 42.83 Gross Body Equilibrium 43.83 Dynamic Strength 44.33 Gross Body Coordination 44.33 Gross Body Coordination 44.33 Gross Body Coordination 45.69 Visual Color Discrimination 45.69 Visual Color Discrimination 45.70 Static Strength 48.21 Arm-Hand Steadiness 49.00 Trunk Strength 49.43 Dynamic Flexibility 50.30 Gexten tFlexibility 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.01	Depth Perception	41.88
Control Precision 42.57 Manual Dexterity 42.83 Far Vision 42.88 Gross Body Equilibrium 43.83 Dynamic Strength 44.33 Peripheral Vision 44.83 Multi-Limb Coordination 45.69 Visual Color Discrimination 45.74 Finger Dexterity 48.02 Night Vision 48.02 Static Strength 48.21 Arm-Hand Steadiness 49.00 Trunk Strength 94.93 Dynamic Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Rate Control	42.52
Manual Dexterity 42.83 Far Vision 42.88 Gross Body Equilibrium 43.83 Dynamic Strength 44.33 Gross Body Coordination 44.83 Peripheral Vision 44.83 Multi-Limb Coordination 45.69 Visual Color Discrimination 45.74 Finger Dexterity 48.02 Night Vision 44.02 Static Strength 48.02 Grunk Strength 48.13 Dynamic Flexibility 50.36 Extent Flexibility 50.30 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Control Precision	42.57
Far Vision 42.88 Gross Body Equilibrium 43.83 Dynamic Strength 44.33 Gross Body Coordination 44.33 Peripheral Vision 44.33 Multi-Limb Coordination 45.69 Visual Color Discrimination 45.69 Visual Color Discrimination 45.79 Visual Color Discrimination 45.79 Static Strength 48.02 Night Vision 48.02 Static Strength 48.21 Arm-Hand Steadiness 49.00 Trunk Strength 49.33 Dynamic Flexibility 50.36 Extensity 50.36 Explosive Strength 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Manual Dexterity	42.83
Gross Body Equilibrium 43.83 Dynamic Strength 44.33 Gross Body Coordination 44.33 Peripheral Vision 44.83 Multi-Limb Coordination 45.69 Visual Color Discrimination 45.74 Finger Dexterity 48.02 Night Vision 48.02 Static Strength 48.21 Arm-Hand Steadiness 49.00 Trunk Strength 94.43 Dynamic Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Far Vision	42.88
Dynamic Strength 44.33 Gross Body Coordination 44.33 Peripheral Vision 44.83 Multi-Limb Coordination 45.69 Visual Color Discrimination 45.74 Finger Dexterily 48.02 Night Vision 48.02 Static Strength 48.13 Dynamic Flexibility 50.36 Extend Steadiness 49.00 Trunk Strength 48.43 Dynamic Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.30 Explosive Strength 52.00 Glare Sensitivity 52.01	Gross Body Equilibrium	43.83
Gross Body Coordination 44.33 Peripheral Vision 44.83 Multi-Limb Coordination 45.69 Visual Color Discrimination 45.74 Finger Dexterity 48.02 Night Vision 48.02 Static Strength 48.21 Arm-Hand Steadiness 49.00 Trunk Strength 49.43 Dynamic Flexibility 50.36 Extent Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Dynamic Strength	44.33
Peripheral Vision 44.83 Multi-Limb Coordination 45.69 Visual Color Discrimination 45.74 Finger Dexterity 48.02 Night Vision 48.02 Static Strength 48.21 Arm-Hand Steadiness 49.00 Trunk Strength 49.43 Dynamic Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Gross Body Coordination	44.33
Multi-Limb Coordination 45.69 Visual Color Discrimination 45.74 Finger Dexterity 48.02 Night Vision 48.02 Static Strength 48.21 Arm-Hand Steadiness 49.03 Dynamic Flexibility 50.36 Extent Flexibility 51.04 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.01 Glare Sensitivity 52.17	Peripheral Vision	44.83
Visual Color Discrimination 45.74 Finger Dexterity 48.02 Night Vision 48.02 Static Strength 48.21 Arm-Hand Steadiness 49.00 Trunk Strength 49.43 Dynamic Flexibility 50.36 Extent Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Multi-Limb Coordination	45.69
Finger Dexterity 48.02 Night Vision 48.02 Static Strength 48.11 Arm-Hand Steadiness 49.00 Trunk Strength 49.43 Dynamic Flexibility 50.36 Extent Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Visual Color Discrimination	45.74
Night Vision 48.02 Static Strength 48.21 Arm-Hand Steadiness 49.00 Trunk Strength 49.43 Dynamic Flexibility 50.36 Extent Flexibility 51.04 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Finger Dexterity	48.02
Static Strength 48.21 Arm-Hand Steadiness 49.00 Trunk Strength 49.43 Dynamic Flexibility 50.36 Extent Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Night Vision	48.02
Arm-Hand Steadiness 49.00 Trunk Strength 49.43 Dynamic Flexibility 50.36 Extent Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Static Strength	48.21
Trunk Strength 49.43 Dynamic Flexibility 50.36 Extent Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Arm-Hand Steadiness	49.00
Dynamic Flexibility 50.36 Extent Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Trunk Strength	49.43
Extent Flexibility 51.00 Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Dynamic Flexibility	50.36
Speed of Limb Movement 51.14 Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Extent Flexibility	51.00
Wrist-Finger Speed 51.38 Explosive Strength 52.00 Glare Sensitivity 52.17	Speed of Limb Movement	51.14
Explosive Strength 52.00 Glare Sensitivity 52.17	Wrist-Finger Speed	51.38
Glare Sensitivity 52.17	Explosive Strength	52.00
	Glare Sensitivity	52.17

Social Skills / Abilities / All Specialties Combined Ability Analysis

Inductive Reasoning	Flexibility of Closure	Depth Perception		
Deductive Reasoning	Fluency of Ideas	General Hearing		
Problem Sensitivity	Mathematical Reasoning	Response Orientation		
Confidence	Arm-Hand Steadiness	Stamina		
Patience	Reaction Time	Gross Body Coordination		
Teamwork	Affability	Wrist-Finger Speed		
Information Ordering	Perceptual Speed	Gross Body Equilibrium		
Originality	Memorization	Sound Localization		
Speed of Closure	Control Precision	Far Vision		
Selective Attention	Tolerance	Dynamic Strength		
Written Comprehension	Visual Color Discrimination	Dynamic Flexibility		
Visualization	Speech Hearing	Extent Flexibility		
Oral Comprehension	Spatial Orientation	Night Vision		
Time Sharing	Number Facility	Peripheral Vision		
Manual Dexterity	Written Expression	Glare Sensitivity		
Oral Expression	Auditory Attention	Static Strength		
Emotional Control	Category Flexibility	Trunk Strength		
Speech Clarity	Rate Control	Speed of Limb Movement		
Near Vision	Multi-Limb Coordination	Explosive Strength		
Finger Dexterity				

Cognitive (i.e., Problem-Solving) Abilities

Inductive Reasoning	Flexibility of Closure	Depth Perception
Deductive Reasoning	Fluency of Ideas	General Hearing
Problem Sensitivity	Mathematical Reasoning	Response Orientation
Confidence	Arm-Hand Steadiness	Stamina
Patience	Reaction Time	Gross Body Coordination
Teamwork	Affability	Wrist-Finger Speed
Information Ordering	Perceptual Speed	Gross Body Equilibrium
Originality	Memorization	Sound Localization
Speed of Closure	Control Precision	Far Vision
Selective Attention	Tolerance	Dynamic Strength
Written Comprehension	Visual Color Discrimination	Dynamic Flexibility
Visualization	Speech Hearing	Extent Flexibility
Oral Comprehension	Spatial Orientation	Night Vision
Time Sharing	Number Facility	Peripheral Vision
Manual Dexterity	Written Expression	Glare Sensitivity
Oral Expression	Auditory Attention	Static Strength
Emotional Control	Category Flexibility	Trunk Strength
Speech Clarity	Rate Control	Speed of Limb Movement
Near Vision	Multi-Limb Coordination	Explosive Strength
Finger Dexterity		

Physical Abilities

Inductive Reasoning	Flexibility of Closure	Depth Perception			
Deductive Reasoning	Fluency of Ideas	General Hearing			
Problem Sensitivity	Mathematical Reasoning	Response Orientation			
Confidence	Arm-Hand Steadiness	Stamina			
Patience	Reaction Time	Gross Body Coordination			
Teamwork	Affability	Wrist-Finger Speed			
Information Ordering	Perceptual Speed	Gross Body Equilibrium			
Originality	Memorization	Sound Localization			
Speed of Closure	Control Precision	Far Vision			
Selective Attention	Tolerance	Dynamic Strength			
Written Comprehension	Visual Color Discrimination	Dynamic Flexibility			
Visualization	Speech Hearing	Extent Flexibility			
Oral Comprehension	Spatial Orientation	Night Vision			
Time Sharing	Number Facility	Peripheral Vision			
Manual Dexterity	Written Expression	Glare Sensitivity			
Oral Expression	Auditory Attention	Static Strength			
Emotional Control	Category Flexibility	Trunk Strength			
Speech Clarity	Rate Control	Speed of Limb Movement			
Near Vision	Multi-Limb Coordination	Explosive Strength			

Pilot / Navigator Abilities

Inductive Reasoning	Flexibility of Closure	Depth Perception
Deductive Reasoning	Fluency of Ideas	General Hearing
Problem Sensitivity	Mathematical Reaso	Response Orientation
Confidence	Arm-Hand Steadiness	Stamina
Patience	Reaction Time	Gross Body Coordination
Teamwork	Affability	Wrist-Finger Speed
Information Ordering	Perceptual Speed	Gross Body Equilibrium
Originality	Memorization	Sound Localization
Speed of Closure	Control Precision	Far Vision
Selective Attention	Tolerance	Dynamic Strength
Written Comprehension	Visual Color Discrimination	Dynamic Flexibility
Visualization	Speech Hearing	Extent Flexibility
Oral Comprehension	Spatial Orientation	Night Vision
Time Sharing	Number Facility	Peripheral Vision
Manual Dexterity	Written Expression	Glare Sensitivity
Oral Expression	Auditory Attention	Static Strength
Emotional Control	Category Flexibility	Trunk Strength
Speech Clarity	Rate Control	Speed of Limb Movement
Near Vision	Multi-Limb Coordination	Explosive Strength
Finger Dexterity		

Top 15 Skills/Abilities by Crew Specialty/Role								
	Leader	Pilot/Nav	Physician	Biologist	Geologist	Computer	Electrician	Mechanic
Inductive Reasoning	8		2	1	1	1	1	1
Deductive Reasoning	10		3	3	2	2	4	3
Problem Sensitivity	3		1	7	12	3	2	2
Confidence	2	6	4	2	5	10	3	11
Patience	4		5	5	4		13	5
Teamwork	1	9	7		3			10
Information Ordering			15	4		4	5	12
Originality	15		11	10	7	15	9	7
Speed of Closure		10	6			14	15	
Selective Attention				6	9	12	10	
Written Comprehension			12	11		6		6
Visualization		15			10		12	8
Oral Comprehension	11		8			7		
Time Sharing	14	5		15		8		
Oral Expression	6				8	9		
Manual Dexterity			9	12			8	4
Emotional Control	5	7	14		13			
Speech Clarity	9							
Near Vision		11		13		11	14	
Finger Dexterity			10	9			7	
Flexibility of Closure				14	11			
Fluency of Ideas	13				15			
Mathematical Reasoning						5	11	9
Affability	12		13					
Arm-Hand Steadiness				8				13
Reaction Time		1						
Perceptual Speed		12						
Memorization						13		
Control Precision		2						15
Tolerance	7							
Visual Color Discrimination							6	
Spatial Orientation		3			6			
Rate Control		4						14
Multi-Limb Coordination		13						
Response Orientation		8						
Stamina					14			
Far Vision		14						

Top 15 Skills/Abilities by Crew Specialty/Role										
	Leader	Pilot/Nav	Physician	Biologist	Geologist	Computer	Electrician	Mechanic		
Inductive Reasoning	8		2	1	1	1	1	1		
Deductive Reasoning	10		3	3	2	2	4	3		
Problem Sensitivity	3		1	7	12	3	2	2		
Confidence	2	6	4	2	5	10	3	11		
Patience	4		5	5	4		13	5		
Teamwork	1	9	7		3			10		
Information Ordering			15	4		4	5	12		
Originality	15		11	10	7	15	9	7		
Speed of Closure		10	6			14	15			
Selective Attention				6	9	12	10			
Written Comprehension			12	11		6		6		
Visualization		15			10		12	8		
Oral Comprehension	11		8			7				
Time Sharing	14	5		15		8				
Oral Expression	6				8	9				
Manual Dexterity			9	12			8	4		
Emotional Control	5	7	14		13					
Speech Clarity	9									
Near Vision		11		13		11	14			
Finger Dexterity			10	9			7			
Flexibility of Closure				14	11					
Fluency of Ideas	13				15					
Mathematical Reasoning						5	11	9		
Affability	12		13							
Arm-Hand Steadiness				8				13		
Reaction Time		1								
Perceptual Speed		12								
Memorization						13				
Control Precision		2						15		
Tolerance	7									
Visual Color Discrimination							6			
Spatial Orientation		3			6					
Rate Control		4						14		
Multi-Limb Coordination		13								
Response Orientation		8								
Stamina					14					
Far Vision		14								



Physical

	Skill/Ability Rank by Crew Specialty/Role Ranks 1 - 29								
	Leader	Pilot	Physician	Biologist	Geologist	Computer	Electrician	Mechanic	Combined
1	Teamwork	Reaction Time	Problem	Inductive	Inductive	Inductive	Inductive	Inductive	Inductive
		<u> </u>	Sensitivity	Reasoning	Reasoning	Reasoning	Reasoning	Reasoning	Reasoning
2	Confidence	Control	Inductive	Confidence	Deductive	Deductive	Problem	Problem	Deductive
	Droblom	Frecision	Reasoning	Deductive	Reasoning	Broblom	Sensitivity	Doductivo	Broblom
3	Sonsitivity	Orientation	Peaconing	Beasoning	Teamwork	Sonsitivity	Confidence	Reasoning	Sonsitivity
	Sensitivity	Onentation	Reasoning	Information		Information	Deductive	Manual	Sensitivity
4	Patience	Rate Control	Confidence	Ordering	Patience	Ordering	Reasoning	Dexterity	Confidence
5	Emotional Control	Time Sharing	Patience	Patience	Confidence	Mathematical Reasoning	Information Ordering	Patience	Patience
6	Oral Expression	Confidence	Speed of Closure	Selective	Spatial Orientation	Written Comprehension	Visual Color	Written Comprehension	Teamwork
		Emotional	closure	Problem	Onentation	Oral	Discrimination	comprehension	Information
7	Tolerance	Control	Teamwork	Sensitivity	Originality	Comprehension	Finger Dexterity	Originality	Ordering
0	Inductive	Response	Oral	Arm-Hand	Oral Everaccion	Time Charing	Manual	Visualization	Originality
٥	Reasoning	Orientation	Comprehension	Steadiness	Oral Expression	Time sharing	Dexterity	VISUAIIZALIOII	Originality
9	Speech Clarity	Teamwork	Manual Dexterity	Finger Dexterity	Selective Attention	Oral Expression	Originality	Mathematical Reasoning	Speed of Closure
10	Deductive Reasoning	Speed of Closure	Finger Dexterity	Originality	Visualization	Confidence	Selective	Teamwork	Selective
	Oral	closure		Written	Elexibility of		Mathematical		Written
11	Comprehension	Near Vision	Originality	Comprehension	Closure	Near Vision	Reasoning	Confidence	Comprehension
		Perceptual	Written	Manual	Problem	Selective		Information	
12	Affability	Speed	Comprehension	Dexterity	Sensitivity	Attention	Visualization	Ordering	Visualization
4.2	Fluency of	Multi-Limb	A 66 - 1 - 11-1		Emotional			Arm-Hand	Oral
13	Ideas	Coordination	Affability	Near Vision	Control	Memorization	Patience	Steadiness	Comprehension
14	Time Sharing	Far Vision	Emotional Control	Flexibility of Closure	Stamina	Speed of Closure	Near Vision	Rate Control	Time Sharing
			Information	closure	Fluency of	closure	Speed of	Control	
15	Originality	Visualization	Ordering	Time Sharing	Ideas	Originality	Closure	Precision	Oral Expression
	Information	Information	Fluency of	Speed of	Written		-	Auditory	Manual
16	Ordering	Ordering	Ideas	Closure	Comprehension	Speech Clarity	Teamwork	Attention	Dexterity
17	Speech Hearing	Manual	Selective	Fluency of	Affability	Dationco	Arm-Hand	Finger Deutority	Emotional
1/	speech nearing	Dexterity	Attention	Ideas	Anability	Patience	Steadiness	Finger Dextenty	Control
18	Written	Deductive	Oral Expression	Written	Far Vision	Teamwork	Night Vision	Reaction Time	Speech Clarity
10	Comprehension	Reasoning	Cial Expression	Expression		Teamwork	Night Vision	Reaction Time	speech clarity
19	Written	Arm-Hand	Arm-Hand	Visual Color	Visual Color	Finger Dexterity	Oral Expression	Speed of	Near Vision
	Expression	Steadiness	Steadiness	Discrimination	Discrimination	and benefity	2.012.0010031011	Closure	
20	Speed of	Depth	Tolerance	Mathematical	Speech Clarity	Visualization	Time Sharing	Flexibility of	Finger Dexterity
	Closure	Perception		Reasoning	,,			Closure	
21	Category	Selective	Visualization	Wrist-Finger	Tolerance	Fluency of	Written	Static Strength	Flexibility of
_	Flexibility	Attention		Speed	Speed of	Rereastual	Comprenension	Multi Limk	Eluonariof
22	Visualization	Sensitivity	Time Sharing	Teamwork	Closure	Speed	Number Facility	Coordination	Ideas
22	Auditory	Night Vision	Speech Clarity	Oral Expression	Near Vision	Flexibility of	Memorization	Dynamic	Mathematical
20	Attention	Night VISION	spectricianty	Crai Expression		Closure	memorization	Strength	Reasoning
24	Selective	Sneech Hearing	Flexibility of	Category	Oral	Manual	Flexibility of	Oral	Affability
27	Attention		Closure	Flexibility	Comprehension	Dexterity	Closure	Comprehension	
25	Memorization	Patience	Speech Hearing	Number Facility	Manual	Emotional	Perceptual	General	Arm-Hand
	Dorsostur	Oral	Doregativel	Orel	Dexterity	Control	Speed	Hearing Crocs Dart	Steadiness
26	Speed	Comprehension	Speed	Comprehension	Expression	Precision	Comprehension	Coordination	Reaction Time
27	Reaction Time	Inductive	Spatial	Control	Information	Number Facility	General	Tolerance	Perceptual
		Reasoning	Orientation	Precision	Ordering		Hearing	Tolerance	Speed
28	Flexibility of	Glare	Reaction Time	Memorization	Gross Body	Wrist-Finger	Reaction Time	Fluency of	Memorization
	Closure	Sensitivity			Coordination	Speed		Ideas	
29	General	Peripheral	Depth	Visualization	Gross Body	Reaction Time	Speech Clarity	Sound	Control
	Hearing	Vision	Perception		Equilibrium		, ,	Localization	Precision
	Key: Cognitive Abilities=				Social Skills=		Phy	Physical Abilities=	

	Skill/Ability Rank by Crew Specialty/Role Ranks 30 - 58										
	Leader	Pilot	Physician	Biologist	Geologist	Computer	Electrician	Mechanic	Combined		
30	Mathematical Reasoning	Speech Clarity	Auditory Attention	Emotional Control	Time Sharing	Category Flexibility	Auditory Attention	Emotional Control	Tolerance		
31	Spatial Orientation	Visual Color Discrimination	Written Comprehension	Perceptual Speed	Category Flexibility	Arm-Hand Steadiness	Sound Localization	Visual Color Discrimination	Visual Color Discrimination		
32	Stamina	Finger Dexterity	Written Expression	Speech Clarity	Dynamic Strength	Speech Hearing	Fluency of Ideas	Speech Hearing	Speech Hearing		
33	Number Facility	Auditory Attention	Memorization	Tolerance	Memorization	Response Orientation	Dynamic Flexibility	Time Sharing	Spatial Orientation		
34	Response Orientation	Gross Body Equilibrium	Multi-Limb Coordination	Affability	Depth Perception	General Hearing	Control Precision	Number Facility	Number Facility		
35	Sound Localization	Memorization	Number Facility	Depth Perception	Finger Dexterity	Sound Localization	Extent Flexibility	Oral Expression	Written Expression		
36	Near Vision	General Hearing	Control Precision	Reaction Time	Perceptual Speed	Rate Control	Written Expression	Response Orientation	Auditory Attention		
37	Depth Perception	Affability	Response Orientation	Rate Control	Mathematical Reasoning	Visual Color Discrimination	Affability	Spatial Orientation	Category Flexibility		
38	Rate Control	Oral Expression	Stamina	Speech Hearing	Trunk Strength	Auditory Attention	Category Flexibility	Memorization	Rate Control		
39	Control Precision	Tolerance	Mathematical Reasoning	Glare Sensitivity	Arm-Hand Steadiness	Multi-Limb Coordination	Multi-Limb Coordination	Near Vision	Multi-Limb Coordination		
40	Manual Dexterity	Stamina	General Hearing	Multi-Limb Coordination	Extent Flexibility	Affability	Emotional Control	Gross Body Equilibrium	Depth Perception		
41	Far Vision	Number Facility	Gross Body Coordination	Auditory Attention	Speech Hearing	Gross Body Coordination	Speech Hearing	Selective Attention	General Hearing		
42	Gross Body Equilibrium	Wrist-Finger Speed	Wrist-Finger Speed	Spatial Orientation	Static Strength	Tolerance	Wrist-Finger Speed	Speech Clarity	Response Orientation		
43	Dynamic Strength	Mathematical Reasoning	Category Flexibility	Response Orientation	Number Facility	Written Expression	Response Orientation	Affability	Stamina		
44	Gross Body Coordination	Dynamic Flexibility	Gross Body Equilibrium	General Hearing	Multi-Limb Coordination	Extent Flexibility	Gross Body Equilibrium	Stamina	Gross Body Coordination		
45	Peripheral Vision	Gross Body Coordination	Visual Color Discrimination	Gross Body Coordination	Control Precision	Depth Perception	Rate Control	Explosive Strength	Wrist-Finger Speed		
46	Multi-Limb Coordination	Written Comprehension	Peripheral Vision	Extent Flexibility	Dynamic Flexibility	Dynamic Flexibility	Gross Body Coordination	Wrist-Finger Speed	Gross Body Equilibrium		
47	Visual Color Discrimination	Flexibility of Closure	Dynamic Flexibility	Stamina	Reaction Time	Spatial Orientation	Glare Sensitivity	Perceptual Speed	Sound Localization		
48	Finger Dexterity	Originality	Dynamic Strength	Trunk Strength	Rate Control	Night Vision	Depth Perception	Depth	Far Vision		
49	Night Vision	Category Flexibility	Rate Control	Dynamic Flexibility	Glare Sensitivity	Glare Sensitivity	Stamina	Trunk Strength	Dynamic Flexibility		
50	Static Strength	Extent Flexibility	Far Vision	Gross Body Equilibrium	Explosive Strength	Stamina	Spatial Orientation	Dynamic Flexibility	Dynamic Strength		
51	Arm-Hand Steadiness	Dynamic Strength	Sound Localization	Peripheral Vision	General Hearing	Gross Body Equilibrium	Tolerance	Written Expression	Extent Flexibility		
52	Trunk Strength	Sound Localization	Extent Flexibility	Sound Localization	Response Orientation	Trunk Strength	Peripheral Vision	Category Flexibility	Night Vision		
53	Dynamic Flexibility	Trunk Strength	Static Strength	Dynamic Strength	Wrist-Finger Speed	Peripheral Vision	Dynamic Strength	Extent Flexibility	Glare Sensitivity		
54	Extent Flexibility	Speed of Limb Movement	Glare Sensitivity	Night Vision	Auditory Attention	Static Strength	Speed of Limb Movement	Night Vision	Peripheral Vision		
55	Speed of Limb Movement	Fluency of Ideas	Trunk Strength	Speed of Limb Movement	Sound Localization	Far Vision	Far Vision	Peripheral Vision	Static Strength		
56	Wrist-Finger Speed	Written Expression	Speed of Limb Movement	Static Strength	Speed of Limb Movement	Speed of Limb Movement	Static Strength	Far Vision	Trunk Strength		
57	Explosive Strength	Static Strength	Explosive Strength	Far Vision	Peripheral Vision	Dynamic Strength	Trunk Strength	Speed of Limb Movement	Speed of Limb Movement		
58	Glare Sensitivity	Explosive Strength	Night Vision	Explosive Strength	Night Vision	Explosive Strength	Explosive Strength	Glare Sensitivity	Explosive Strength		
	Key: Cogr	nitive Abilities=			Social Skills=		Phy	sical Abilities=			

Crew Composition / Cross-Training

A: Six-Person Crew

Primary Specialties/Roles

Pilot/Navigator (Robotics & Rovers) Physician/Astrophysicist Mechanic/Equipment Operator Electrician/Computer Specialist Geologist/Leader Biologist/Botanist

Backup Responsibilities

Equipment Operator/CMO Biologist/Geologist Pilot/Navigator/Astrophysicist Mechanic/CMO/Botanist Electrician/Computer Specialist Leader/CMO

B: Five-Person Crew

Primary Specialty/Roles

Pilot/Navigator (Robotics & Rovers) Physician/Biologist/Astrophysicist Mechanic/Equipment Operator Electrician/Computer Specialist Geologist/Leader/Botanist

Backup Responsibilities

Geologist/Leader/CMO Electrician/Computer Specialist Biologist/CMO/Botanist Mechanic/Equipment Operator/CMO Pilot/Navigator/Astrophysicist

C: Five-Person Crew

Primary Specialty/Roles

Pilot/Navigator (Robotics & Rovers) Physician/Astrophysicist/Botanist Mechanic/Equipment Operator Electrician/Computer Specialist Geologist/Biologist/Leader

Backup Responsibilities

Geologist/Leader/CMO Pilot/Navigator/Biologist Electrician/Computer Specialist/CMO Mechanic/Equipment Operator Botanist/Astrophysicist/CMO

D: Four-Person Crew

Primary Specialty/Roles

Pilot/Navigator/Leader/Astrophysicist Physician/Computer Specialist Mechanic/Electrician/Equipment Operator Geologist/Biologist/Botanist

Backup Responsibilities

Geologist/Computer Specialist/CMO Biologist/Mechanic/Electrician/Botanist Pilot/Navigator/Astrophysicist/CMO Equipment Operator/Leader/CMO

The Pilot/Navigator would have lead responsibility for robotics and rovers during Mars Surface Operations in all four hypothetical crew compositions.



First photo taken on Mars; Viking 1, 20 July 1976.

Fram Crater





Louth Crater



Happy Face Galle Crater

Graben

Sunset on Mars



Earth From Mars



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