

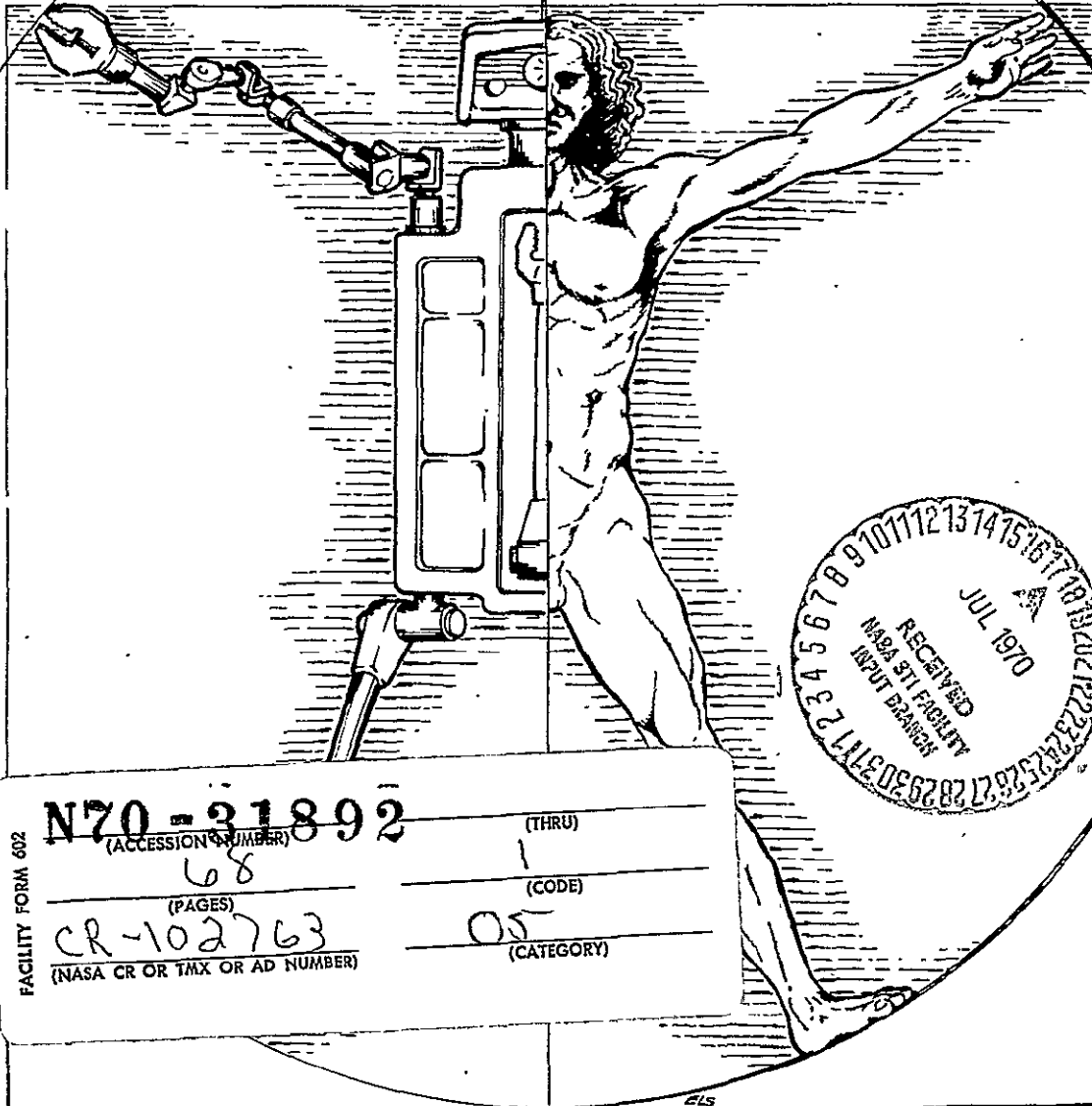
SELECTION OF SYSTEMS TO PERFORM EXTRAVEHICULAR ACTIVITIES

Man and Manipulator

DOE F

Volume 1

PERFORMANCE EFFECTIVENESS
EVALUATION SCHEME (PEEVS)
PART B REFERENCE DATA



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SELECTION OF SYSTEMS TO PERFORM
EXTRAVEHICULAR ACTIVITIES
Man and Manipulator
Contract No. NAS8-24384

Volume 1 - Performance Effectiveness
Evaluation Scheme (PEEVS)

Part B - Reference Data

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FOREWORD

The following represents work which was performed on a study of Man vs Manipulator Functions and is the Guidebook on Contract NAS8-24384, National Aeronautics and Space Administration, Marshall Space Flight Center, Alabama.

This volume (one of two volumes) has three separately bound parts. Part A contains instructions for using the Performance Effectiveness Evaluation Scheme (PEEVS). Part B contains PEEVS Reference Data Sheets. Part C contains the worksheets required to use PEEVS.

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3.0 DEFINITION OF EXTRAVEHICULAR (EV) FUNCTIONS

Twelve FSAS Mission Functions are defined below. For this analysis consider each Function as a complete unit starting when the FSAS is prepared to perform the function and ending when the FSAS is stowed. Therefore, while activities such as translation and cargo transfer might be required to perform a function such as "Remove/Replace," they should not be included as EV Functions unless they are major objectives. All functions except "Repair," "Translation," "Astronaut Rescue," and "Satellite Recovery" are conducted at prepared worksites.

a) *Deploy*

During the mission, an FSAS will be required to extend or arrange hardware in the EV environment.

b) *Remove/Replace*

During the mission, an FSAS will be required to take units out of and/or replace into a special receptacle in the EV environment.

c) *Inspect*

During the mission, an FSAS will be required to closely examine system status in the EV environment.

d) *Cargo Transfer*

During the mission, an FSAS will be required to move material from one point in space to another.

e) *Maintain*

During the mission, the FSAS will be required to perform periodic, planned system re-ferbishment.

f) *Assemble*

During the mission, the FSAS will be required to fit together parts of specific systems.

g) *Repair*

During the mission, the FSAS will be required to inspect, diagnose, and carry out appropriate corrective action on specific space systems.

h) *Operate/Monitor*

During the mission, the FSAS will be required to cause to function, and observe the functioning of, selected space systems.

i) *Data Acquisition*

During the mission, the FSAS will be required to direct, operate, and monitor data recording systems.

j) *Satellite Recovery*

During the mission, the FSAS will be required to intercept, attach to, and possibly transfer unmanned satellites from one point in space to another.

k) *Astronaut Rescue*

During the mission, the FSAS may be required to safely release trapped and/or transfer disabled astronauts from an extravehicular to an intra-vehicular environment.

l) *Translation*

During the selected mission, the FSAS will be required to safely move healthy astronauts from one point in space to another.

4.0 DEFINITION OF PERFORMANCE EFFECTIVENESS AND COST MEASURES

The following tables list the performance effectiveness and cost measures provided for use in the evaluation of candidate FSAS. These tables are (reduced) duplicates of the Step III worksheets. Therefore, when a measure is selected for inclusion in the analysis, check it on the Step III worksheet.

Provided with each measure is a matrix which cross-references the measure to applicable EV functions. Also, the measure is defined, and both interval scale and rating scale units are given.

STEP III Definitions of Performance Effectiveness and Cost Measures

4-2

EXTRAVEHICULAR FUNCTIONS												MEASURE	DEFINITION	UNIT		CK	
Deploy	Remove/Replace	Inspect	Cargo Transfer	Maintain	Assemble	Repair	Operate/Monitor	Data Acquisition	Satellite Recovery	Astronaut Rescue	Translation			Interval Scale	Rating Scale		
•	•	•	•	•	•	•	•	•	•	•	•	Operational Lifetame	C	The expected duration of system usefulness. This refers to operational or "up" time only. The expenditure of irreplaceable consumables or the likelihood of failure in a critical subsystem or component usually delimits this measure.	Time - Standard Units (years, months, etc.)	1. Unlimited 2. Short term 3. One time Unknown	
•	•	•	•	•	•	•	•	•	•	•	•	On-Site Time Limit	P	The upper limit on the duration of stay at a worksite. Limit may be imposed by astronaut or system constraints such as energy expenditure or consumable replenishment requirements.	Time - Standard Units (hours, minutes, etc.)	1. Unlimited 2. Limited-Long Term 3. Limited-Short Term Unknown	
			•			•			•	•		Worksite Flexability	P	The capability of an Extravehicular System to be used at unplanned worksites. That is, to provide translation and transportation between, and stabilization and actuation at a site which has no special hardware for FSAS interface.		1. Unlimited 2. Limited-Special Interface 3. Prepared Worksite Only Unknown	
•	•	•	•	•	•	•	•	•	•	•	•	Range	P	Distance from the FSAS origin on the prime vehicle (e.g., astronaut EVA ingress/egress hatch or remote manipulator stowed position) to the maximum point at which a worksite may be located.	Lineal - Standard Units (miles, feet, etc.)	1. Unlimited 2. Limited-Medium Range 3. Close Proximity Unknown	
•	•	•	•	•	•	•	•	•	•	•	•	Environmental Flexibility	P	The proportion of the expected extravehicular environment in which the FSAS could operate. Factors such as high radiation levels could preclude the use of certain systems.		1. Unlimited 2. Limited (Specific conditions) Unknown	
•	•	•	•	•	•	•	•	•	•	•	•	Dependability	P	The confidence that may be placed in a system's performing its assigned functions when called upon to do so. Lack of confidence will result in a requirement for a redundant or backup system to perform the mission.	Reliability - Standard Units (MBTF, etc.)	1. No Redundancy Required 2. Redundancy Required Unknown	
•	•	•	•	•	•	•	•	•	•	•	•	Crew Requirements	C	The number of crewmen who must devote full time and attention to FSAS operations. Their roles might be actuation, cargo transport, system support, or backup operations.	Number of Crewmen		
•	•	•	•	•	•	•	•	•	•	•	•	Expendable Requirements	C	Resources required to operate an FSAS per unit time, including life support consumables, propellant, etc. It is assumed that depletion of the expendables will prevent FSAS use.	Weight per Unit Time (pounds per standard mission)	1. Low 2. Medium 3. High Unknown	

C - Cost Measure
P - Performance Effectiveness Measure

STEP III Definitions of Performance Effectiveness and Cost Measures

4-3

EXTRAVEHICULAR FUNCTIONS											MEASURE	DEFINITION	UNIT		CK		
Deploy	Remove/Replace	Inspect	Cargo Transfer	Maintain	Assemble	Repair	Operate/Monitor	Data Acquisition	Satellite Recovery	Astronaut Rescue			Translation	Interval Scale		Rating Scale	
▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽			▽				
•	•	•	•	•	•	•	•	•	•	•	•	Emergency Provisions	P	Backup systems required to safely terminate the FSAS mission given a major subsystem failure. Of primary concern is the safe return of an EVA astronaut to the prime vehicle.		1. None Required 2. Integral to System 3. Extra Unknown	
•	•	•	•	•	•	•	•	•	•	•	•	Mass	C	Earth (1-G) weight of the FSAS, less expendables.	Weight (1-G)-For a Standard Mission (pounds, ounces, etc.)	1. Light 2. Moderate 3. Heavy Unknown	
•	•	•	•	•	•	•	•	•	•	•	•	Maintenance Time Requirements	C	Percentage of time in orbit when the FSAS will be inoperative because of servicing, preventive maintenance, or repair.		1. None 2. Infrequent 3. Frequent Unknown	
•	•	•	•	•	•	•	•	•	•	•	•	Stowed Volume	C	Amount of space occupied by the FSAS while in a stowed configuration. This space will define the requirements for FSAS transport and orbital stowage.	Volume - For a Standard Mission (Cubic feet, etc.)	1. Small 2. Moderate 3. Large Unknown	
•	•	•	•	•	•	•	•	•	•	•	•	Average Translation Velocity	P	The average rate at which an FSAS will move between points. In some cases an FSAS can traverse at a higher rate; however, safety, comfort, and rate of expendable consumption must be considered.	Velocity - Standard Units (Feet per second)	1. Fast 2. Medium 3. Slow Unknown	
•	•	•	•	•	•	•	•	•	•	•	•	Translation Rate Control	P	The maximum acceleration/deceleration rate available to the FSAS.	Acceleration, Deceleration - Standard Units (Feet per second ²)	1. High 2. Medium 3. Low Unknown	
•	•	•	•	•	•	•	•	•	•	•	•	Translation Stability	P	Average time required for an FSAS to return to a programmed attitude after being offset.	Time (minutes, seconds) - Standard offset $FM = \sqrt{Tp^2 + Ty^2 + Tr^2}$	1. Stable 2. Moderate Stability 3. Instable Unknown	
			•			•			•	•	•	Translation Maneuverability	P	Rate with which an FSAS can change direction to avoid an obstacle, to select a different worksite, or to follow a pre-programmed flight path.	Angular Acceleration - Standard Units (Degrees per second ²)	1. High 2. Medium 3. Low Unknown	

C - Cost Measure
P - Performance Effectiveness Measure

STEP III Definitions of Performance Effectiveness and Cost Measures

EXTRAVEHICULAR FUNCTIONS												
Deploy	Remove/Replace	Inspect	Cargo Transfer	Maintain	Assemble	Repair	Operate/Monitor	Data Acquisition	Satellite Recovery	Astronaut Revue	Translation	
•	•			•	•	•			•			
•	•			•	•	•			•	•		
•	•		•	•	•				•	•		
•	•		•	•	•				•	•		
•	•	•			•	•	•	•	•	•		
•	•		•		•	•	•	•	•	•		
•	•		•	•	•	•			•	•		
•	•		•	•	•	•			•	•	•	

MEASURE		DEFINITION	UNIT		CK
			Interval Scale	Rating Scale	
•	P	Actuation Force (Normal)	Force - Standard Units (Pounds)	1. High 2. Moderate 3. Low Unknown	
•	P	Actuation Force (Rotation)	Torque - Standard Units (e.g., foot-pounds)	1. High 2. Moderate 3. Low Unknown	
•	P	Worksite Mass Handling Limit	Weight - Standard Units (pounds)	1. Heavy 2. Moderate 3. Light	
•	P	Worksite Size Handling Limit	Length, Width, and Breadth (Feet, inches) $FM = L \times W \times B$	1. Large 2. Moderate 3. Small Unknown	
•	P	Actuator Position Accuracy	Error (E) - Lineal (Inches, etc.) $FM = K \sqrt{E_x^2 + E_y^2 + E_z^2}$	1. Accurate 2. Moderate 3. Inaccurate Unknown	
•	P	Actuator Orientation Accuracy	Error - Rotational (Degrees, etc.) $FM = K \sqrt{E_p^2 + E_y^2 + E_z^2}$	1. Accurate 2. Moderate 3. Inaccurate Unknown	
•	P	Worksite Reach Envelope	Sum of reach distances on body axes.	1. Large 2. Medium 3. Small Unknown	
•	P	Cargo Transport Range	Distance - Standard Units (Feet, etc.)	1. Unlimited 2. Limited-Medium Range 3. Limited-Close Proximity	

C - Cost Measure
P - Performance Effectiveness Measure

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STEP III Definitions of Performance Effectiveness and Cost Measures

4-5

EXTRAVEHICULAR FUNCTIONS												MEASURE	DEFINITION	UNIT		CK	
Deploy	Remove/Replace	Inspect	Cargo Transfer	Maintain	Assemble	Repair	Operate/Monitor	Data Acquisition	Satellite Recovery	Astronaut Rescue	Translation			Interval Scale	Rating Scale		
▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽						
•	•	•	•	•	•	•	•	•	•	•	•	Visibility	P	The percentage of the visual field which is unobstructed by the FSAS and associated hardware.	FM = (% of Visual Field)	1. Unobstructed 2. Obstructed 3. Very limited Unknown	
•	•	•	•	•	•	•	•	•	•	•	•	Deployed Volume	C	The space taken up by an FSAS once it is deployed.	Volume - For a Standard Mission (Cubic feet)	1. Small 2. Medium 3. Large Unknown	
•	•		•									Transport Velocity	P	The rate with which materials can be moved by the FSAS between points in space.	Velocity - For a Standard Mission (Feet/second)	1. Fast 2. Medium 3. Slow Unknown	
•	•		•			•				•	•	Cargo Mass Limit	P	The maximum cargo weight (1-G) that can be transported by an FSAS between points in space.	Weight - Standard Units (Pounds, etc.)	1. Heavy 2. Moderate 3. Low Unknown	
•	•		•							•	•	Cargo Stabilization	P	Average time required for an FSAS to return to a programmed attitude after being offset.	Time (minutes, seconds) - Standard mass and offset $FM = \sqrt{Tp^2 + Ty^2 + Tr^2}$	1. Stable 2. Moderate Stability 3. Unstable Unknown	
•	•		•							•	•	Cargo Size	P	The maximum cargo volume that can be transported by an FSAS between points in space.	Volume in Standard Units (Cubic feet)	1. Large 2. Medium 3. Small Unknown	
•	•		•	•	•	•	•	•	•	•	•	Worksite Stability (Normal)	P	The maximum force counteracted in lateral axes.	Force Reacted-Standard Units (pounds) $FM = K \sqrt{Fx^2 + Fy^2 + Fz^2}$	1. Stable 2. Moderate Stability 3. Unstable Unknown	
•	•		•	•	•	•	•	•	•	•	•	Worksite Stability (Rotation)	P	The maximum force counteracted in rotation about the axis normal to the worksite.	Force Reacted-Standard Units (Foot-pounds)	1. Stable 2. Moderate Stability 3. Unstable Unknown	

C - Cost Measure
P - Performance Effectiveness Measure

5.0 FREE SPACE ACTIVITY SYSTEM SPECIFICATION AND DATA SHEETS

The following tables include interval and rating scale data gathered on each Free Space Activity System reviewed. Both EVA subsystem and EV system data are provided (paragraphs 5.1 and 5.2, respectively).

Notes identified in the data blocks are given on Sheet B of each (a, b) pair.

5.1 EVA SUBSYSTEM DATA SHEETS

Translation Handrails and Handholds	5-1-1 (a, b)
Handheld Maneuvering Unit (HHMU)	5-1-2 (a, b)
Astronaut Maneuvering Unit (AMU)	5-1-3 (a, b)
Automatic Stabilized Maneuvering Unit (ASMU)	5-1-4 (a, b)
Translation Trolley	5-1-5 (a, b)
Servo Powered Hardsuit	5-1-6 (a, b)
Unaided Astronaut (Actuator)	5-1-7 (a, b)
Stabilization Handrails and Handholds	5-1-8 (a, b)
Dutch Shoes	5-1-9 (a, b)
Handrails/Foot Restraints	5-1-10(a, b)
Maintenance Waist Restraint	5-1-11(a, b)
Variable Flexibility Tether	5-1-12(a, b)
Boom Attachment	5-1-13(a, b)
Astrogrid Shoes	5-1-14(a, b)
STEM for Cargo Transfer	5-1-15(a, b)
Handrails for Cargo Transfer	5-1-16(a, b)
Dolly & Rails for Cargo Transfer	5-1-17(a, b)
Personnel Harness & Rails	5-1-18(a, b)
Clothesline	5-1-19(a, b)

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	5	SUBSYSTEM NOMENCLATURE	
						RAILS	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS			ACTUATION FORCE (NORMAL)		
Interval	Rating	Interval	Rating	Interval	Rating	Interval	Rating
--	1-Unlimited	--	1-None Req'd.				
Notes		Notes			Notes N/A		
ON-SITE TIME LIMIT		MASS			ACTUATION FORCE (ROTATION)		
Interval	Rating	Interval	Rating	Interval	Rating	Interval	Rating
--	1-Unlimited	100 lbs	1-Light				
Notes		Notes (2)			Notes N/A		
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS			WORKSITE MASS HANDLING LIMIT		
Interval	Rating	Interval	Rating	Interval	Rating	Interval	Rating
		None	1-None				
Notes N/A		Notes			Notes N/A		
RANGE		STOWED VOLUME			WORKSITE SIZE HANDLING LIMIT		
Interval	Rating	Interval	Rating	Interval	Rating	Interval	Rating
60 ft (E)	3-Close Prox.	995 in ³ (E)	1-Small				
Notes (1)		Notes (2)			Notes N/A		
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY			ACTUATOR POSITION ACCURACY		
Interval	Rating	Interval	Rating	Interval	Rating	Interval	Rating
--	1-Unlimited	2 ft/sec (E)	3-Slow				
Notes		Notes			Notes N/A		
DEPENDABILITY		TRANSLATION RATE CONTROL			ACTUATOR ORIENTATION ACCURACY		
Interval	Rating	Interval	Rating	Interval	Rating	Interval	Rating
--	1-No Redund.	--	1-High				
Notes		Notes			Notes N/A		
CREW REQUIREMENTS		TRANSLATION STABILITY			WORKSITE REACH ENVELOPE		
Interval	Rating	Interval	Rating	Interval	Rating	Interval	Rating
		--	1-Stable				
Notes N/A		Notes			Notes N/A		
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY			CARGO TRANSPORT RANGE		
Interval	Rating	Interval	Rating	Interval	Rating	Interval	Rating
--	1-Low	--	1-High*				
Notes		Notes *Select. route			Notes N/A		

LEGEND: P - Published Data T - Typical
E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	5	SUBSYSTEM NOMENCLATURE RAILS
VISIBILITY		<p style="text-align: center;">NOTES</p> <p>(1) Based on SKYLAB 60 ft. umbilical limitation.</p> <p>(2) 60 feet of dual, aluminum, Gemini handrails.</p> <p>DEVELOPED BY NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. (CONTACT MAN/SYSTEMS INTEGRATION BRANCH, ASTRONAUTICS LABORATORY, MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALABAMA)</p> <p style="text-align: right;">Reference Bip. No. 8, 13, 19, 27, 29, 52, 57, 61, 63, 68, 69, 71, 78, 79, 80, 87, 94, 96</p>		
Interval	Rating			
--	2-Obstructed			
Notes				
DEPLOYED VOLUME				
Interval	Rating			
995 in ³ (E)	1-Small			
Notes				
TRANSPORT VELOCITY				
Interval	Rating			
Notes N/A				
CARGO MASS LIMIT				
Interval	Rating			
Notes N/A				
CARGO STABILIZATION				
Interval	Rating			
Notes N/A				
CARGO SIZE				
Interval	Rating			
Notes N/A				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
Notes N/A				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
Notes N/A				

REV-

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET		DEV LEVEL	5	SUBSYSTEM NOMENCLATURE	
				HAND HELD MANEUVERING UNIT (HHMU)	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)	
Interval	Rating	Interval	Rating	Interval	Rating
--	2-Short term	--	3-Extra		
Notes		Notes Tether backup		Notes N/A	
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)	
Interval	Rating	Interval	Rating	Interval	Rating
	3-Limited, Short term	--	1-Light		
Notes		Notes		Notes N/A	
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
--	1-Unlimited	--	Unknown	--	3-Light
Notes		Notes		Notes	
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
50 ft*	3-Close Prox.	--	1-Small		
Notes *Limited by tether		Notes		Notes N/A	
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	2-Limited	84 ft/sec (P)	2-Medium		
Notes Same astronaut		Notes		Notes N/A	
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	2-Redundancy Reg'd.	--	Unknown		
Notes		Notes		Notes N/A	
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE	
Interval	Rating	Interval	Rating	Interval	Rating
2	--	--	Unknown		
Notes 1 primary 1 back (tether mgt)		Notes		Notes N/A	
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE	
Interval	Rating	Interval	Rating	Interval	Rating
10 lbs (E)	3-High	--	Unknown		
Notes		Notes		Notes N/A	

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	5	SUBSYSTEM NOMENCLATURE HAND HELD MANEUVERING UNIT (HHMU)
VISABILITY				
Interval	Rating			
--	1-Unobstruct.			
Notes				
DEPLOYED VOLUME				
Interval	Rating			
--	1-Small			
Notes				
TRANSPORT VELOCITY				
Interval	Rating			
Notes N/A				
CARGO MASS LIMIT				
Interval	Rating			
Notes N/A				
CARGO STABILIZATION				
Interval	Rating			
Notes N/A				
CARGO SIZE				
Interval	Rating			
Notes N/A				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
Notes N/A				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
Notes N/A				
Reference: Bib. No. 68		REV-		

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET		DEV LEVEL	4	SUBSYSTEM NOMENCLATURE	
				ASTRONAUT MANEUVERING UNIT (AMU)	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)	
Interval	Rating	Interval	Rating	Interval	Rating
--	2-Short term	--	3-Extra		
Notes		Notes Likely to be used with tether/umbilical.		Notes N/A	
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)	
Interval	Rating	Interval	Rating	Interval	Rating
1 hr (P)	3-Limited Short term	168.3 lbs(P)	1-Light		
Notes 6 one-hr. duration missions		Notes 137 lbs empty		Notes N/A	
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
--	1-Unlimited	--	Unknown		
Notes		Notes		Notes N/A	
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
2000 ft (P)	2-Limited, Med.	15K sq in(E)	1-Small		
Notes Gemini use 125 ft. radius		Notes 35 in. h x 25 in. w x 17 in. deep (P)		Notes N/A	
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	2-Limited*	--	2-Medium		
Notes to environment of astronaut		Notes		Notes N/A	
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	2-redundancy req'd	.4 fps ²	2-Medium		
Notes		Notes		Notes N/A	
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE	
Interval	Rating	Interval	Rating	Interval	Rating
1	--	--	1-Stable		
Notes 2, if tether/umbilical is required.		Notes attitude ± 2.4 deg. deadhand, automatic 3 axis att. cont.		Notes N/A	
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE	
Interval	Rating	Interval	Rating	Interval	Rating
31 lbs (P)	3-High	--	1-High		
Notes		Notes 18°/sec pitch & yaw, 27°/sec roll		Notes N/A	

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET		DEV LEVEL	3	SUBSYSTEM NOMENCLATURE	
				AUTOMATIC STABILIZATION MANEUVERING UNIT (ASMU)	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)	
Interval	Rating	Interval	Rating	Interval	Rating
--	Unknown	--	1-None req'd		
Notes		Notes (1)		Notes N/A	
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)	
Interval	Rating	Interval	Rating	Interval	Rating
--	3-Limited Short term	--	1-Light		
Notes		Notes		Notes N/A	
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
		--	Unknown		
Notes N/A		Notes		Notes N/A	
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
--	3-Close prox.	--	1-Small		
Notes Limited by length of SKYLAB workshop (1)		Notes		Notes N/A	
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	2-Limited	--	2-Medium		
Notes (1)		Notes		Notes N/A	
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	Unknown	.4-.6 ft/sec ² (P)	2-Medium		
Notes		Notes		Notes N/A	
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE	
Interval	Rating	Interval	Rating	Interval	Rating
1	--	--	2-Mod. Stab.		
Notes		Notes		Notes N/A	
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE	
Interval	Rating	Interval	Rating	Interval	Rating
--	Unknown	--	2-Medium		
Notes		Notes		Notes N/A	

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	3	SUBSYSTEM NOMENCLATURE AUTOMATIC STABILIZATION MANEUVERING UNIT (ASMU)
VISABILITY		<p style="text-align: center;">NOTES</p> <p>(1) ASMU to be evaluated on SKYLAB M-509 experiment (to be conducted inside OWS); no life support capability included.</p>		
Interval	Rating			
--	1-Unobstruct.			
Notes				
Limited to OWS interior (1)				
DEPLOYED VOLUME				
Interval	Rating			
--	1-Small			
Notes				
TRANSPORT VELOCITY				
Interval	Rating			
Notes				
N/A				
CARCO MASS LIMIT				
Interval	Rating			
Notes				
N/A				
CARCO STABILIZATION				
Interval	Rating			
Notes				
N/A				
CARCO SIZE				
Interval	Rating			
Notes				
N/A				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
--	Unknown			
Notes				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
--	Unknown			
Notes				

Reference: Bib. No. 68

REV-

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	3	SUBSYSTEM NOMENCLATURE	
						TROLLEY	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Short term	--	1-None Req.				
Notes		Notes		Notes N/A			
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	2-Moderate				
Notes		Notes		Notes N/A			
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
		--	Unknown				
Notes N/A		Notes		Notes N/A			
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
60 ft.	--	--	1-Small				
Notes (1)		Notes		Notes N/A			
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	3-Slow				
Notes		Notes		Notes N/A			
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Redund. Reg.	--	1-High				
Notes		Notes		Notes N/A			
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
2 Crewman	--	--	1-stable				
Notes (2)		Notes		Notes N/A			
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Medium	--	3-Low				
Notes		Notes		Notes N/A			

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	3	SUBSYSTEM NOMENCLATURE TROLLEY
VISABILITY		<p style="text-align: center;">NOTES</p> <p>(1) Astronaut with umbilical</p> <p>(2) Primary and Support (Tending tether or umbilical)</p> <p>MANUFACTURED BY MARSHALL SPACE FLIGHT CENTER, ASTRONAUTICS LABORATORIES, HUNTSVILLE; ALABAMA.</p> <p style="text-align: right;">Reference Bib. NO. 8, 13, 19, 27, 29, 30, 57, 63, 68, 71, 78, 79, 80, '96</p>		
Interval	Rating			
--	1-Unobstructed			
Notes				
DEPLOYED VOLUME				
Interval	Rating			
--	1-Small			
Notes				
TRANSPORT VELOCITY				
Interval	Rating			
Notes				
N/A				
CARGO MASS LIMIT				
Interval	Rating			
Notes				
N/A				
CARGO STABILIZATION				
Interval	Rating			
Notes				
N/A				
CARGO SIZE				
Interval	Rating			
Notes				
N/A				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
Notes				
N/A				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
Notes				
N/A				

REV -

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET		DEV LEVEL	2	SUBSYSTEM NOMENCLATURE	
				SERVO POWERED HARDSUIT	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)	
Interval	Rating	Interval	Rating	Interval	Rating
--	Unknown	--	3-Extra	--	1-High
Notes		Notes		Notes	
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)	
Interval	Rating	Interval	Rating	Interval	Rating
--	Unknown	--	2-Moderate	--	1-High
Notes		Notes		Notes	
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
--	Unknown	--	Unknown	--	Unknown
Notes		Notes		Notes	
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
--	3-Close Prox.	--	2-Moderate	--	Unknown
Notes		Notes		Notes	
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	2-Limited	--	3-Slow		
Notes Superior to EMU suit		Notes		Notes N/A	
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	2-Redundancy Req'd	--	Unknown		
Notes		Notes		Notes N/A	
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE	
Interval	Rating	Interval	Rating	Interval	Rating
2	--	--	Unknown	--	Unknown
Notes 1 primary, 1 backup (tether/umbilical managment.)		Notes		Notes	
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE	
Interval	Rating	Interval	Rating	Interval	Rating
--	Unknown	--	Unknown	--	Unknown
Notes		Notes		Notes	

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	2	SUBSYSTEM NOMENCLATURE SERVO POWERED HARDSUIT
VISABILITY				
Interval		Rating		
--		Unknown		
Notes				
DEPLOYED VOLUME				
Interval		Rating		
Notes				
N/A				
TRANSPORT VELOCITY				
Interval		Rating		
--		Unknown		
Notes				
CARGO MASS LIMIT				
Interval		Rating		
--		Unknown		
Notes				
CARGO STABILIZATION				
Interval		Rating		
--		Unknown		
Notes				
CARGO SIZE				
Interval		Rating		
--		Unknown		
Notes				
WORKSITE STABILITY (NORMAL)				
Interval		Rating		
--		Unknown		
Notes				
WORKSITE STABILITY (ROTATION)				
Interval		Rating		
Notes				
N/A				

Reference: Bib. No. 68

REV-

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	5	SUBSYSTEM NOMENCLATURE	
						UNAIDED ASTRONAUT	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	3-Extras	--	--		
Notes		Notes		Notes			
(1)		(8)		(11)			
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
3.0 hrs.	3-Short term	296 lbs (T, E)	2-Moderate	--	--		
Notes		Notes		Notes			
(2)		(9)		(11)			
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	3-Prepared W/S only	50% (E)	3-Frequent	--	--		
Notes		Notes		Notes			
(3)		(10)		(11)			
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
60 feet	3 Close Prox.	22.5K in ³ (T,E)	2 Moderate	--	--		
Notes		Notes		Notes			
(4)				(11)			
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Limited			--	--		
Notes		Notes		Notes			
(5)		N/A		(11)			
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-No Redund.			--	--		
Notes		Notes		Notes			
		N/A		(11)			
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
2 Crewmen	--			--	--		
Notes		Notes		Notes			
(6)		N/A		(11)			
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Medium						
Notes		Notes		Notes			
(7)		N/A		N/A			

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	5	SUBSYSTEM NOMENCLATURE
		UNAIDED ASTRONAUT		
VISABILITY		<p style="text-align: center;">NOTES</p> <p>(1) Unlimited for projected mission durations.</p> <p>(2) SKYLAB EVA time constraints.</p> <p>(3) Translation, stabilization, and transportation devices must be provided as well as lighting and emergency support systems.</p> <p>(4) SKYLAB umbilical length.</p> <p>(5) No EVA under high electromagnetic radiation or high meteorite density.</p> <p>(6) Primary and support/emergency backup EVA astronauts.</p> <p>(7) O₂, LiOH, H₂O.</p> <p>(8) Backup astronaut, backup life support, life tether.</p> <p>(9) Includes EVA astronaut, pressure suit, ITMG, typical life support system weights.</p> <p>(10) Eating, sleeping, etc.</p> <p>(11) Recorded for each stabilization subsystem.</p>		
Interval	Rating			
Notes N/A				
DEPLOYED VOLUME				
Interval	Rating			
22.5K in ³ (T, E)	2-Medium			
Notes				
TRANSPORT VELOCITY				
Interval	Rating			
Notes N/A				
CARGO MASS LIMIT				
Interval	Rating			
Notes N/A				
CARGO STABILIZATION				
Interval	Rating			
Notes N/A				
CARGO SIZE				
Interval	Rating			
Notes N/A				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
Notes N/A				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
Notes N/A				

Reference Bib. No. 1, 8, 13, 19, 27, 29, 48, 50, 52, 57, 61, 63, 68, 71, 75, 78, 83, 84, 87, 94, 96

REV-

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	5	SUBSYSTEM NOMENCLATURE	
						HANDRAILS/HANDHOLDS	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	1-None Req'd.	43 lbs (P, T)	2-Moderate		
Notes		Notes		Notes			
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	.8 lbs (E)	1-Light	--	2-Moderate		
Notes		Notes (1)		Notes			
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	3-Prepared W/S	--	1-None	<118 lbs (E)	3-Light		
Notes		Notes		Notes			
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
		8.3 in ³ (E)	1-Small	< 4K in ³ (E)	3-Small		
Notes N/A		Notes (1)		Notes			
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited			--	1-Accurate		
Notes		Notes N/A		Notes			
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-No Redund.			--	1-Accurate		
Notes		Notes N/A		Notes			
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
				FM = 218	1-Small		
Notes N/A		Notes N/A		Notes			
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Low						
Notes		Notes N/A		Notes N/A			

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL 5	SUBSYSTEM NOMENCLATURE HANDRAILS/ HANDHOLDS
VISIBILITY		<p style="text-align: center;">NOTES</p> <p>(1) Assume handhold/rail one foot long in Gemini configuration, made of aluminum.</p> <p>(2) Pull force, impulse.</p> <p>DEVELOPED BY NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (CONTACT MAN/SYSTEMS INTEGRATION BRANCH, ASTRONAUTICS MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALABAMA)</p> <p style="text-align: right;">Reference Bib. No. 8, 13, 19, 25, 27, 29, 52, 57, 61, 63, 68, 69, 71, 75, 78, 79, 80, 94, 96</p>	
Interval	Rating		
--	2-Obstruct.		
Notes			
DEPLOYED VOLUME			
Interval	Rating		
8.3 in ³	1-Small		
Notes			
(1)			
TRANSPORT VELOCITY			
Interval	Rating		
Notes			
N/A			
CARGO MASS LIMIT			
Interval	Rating		
Notes			
N/A			
CARGO STABILIZATION			
Interval	Rating		
Notes			
N/A			
CARGO SIZE			
Interval	Rating		
Notes			
N/A			
WORKSITE STABILITY (NORMAL)			
Interval	Rating		
--	1-Stable		
Notes			
WORKSITE STABILITY (ROTATION)			
Interval	Rating		
--	1-Stable		
Notes			

REV-

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	5	SUBSYSTEM NOMENCLATURE	
						DUTCH SHOES	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	1-None Req'd.	48 lbs (T, Mx)	2-Moderate		
Notes		Notes		Notes			
				(2)			
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	121 lbs (E)	1-Light	--	2-Moderate		
Notes		Notes		Notes			
		(3)					
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	3-Prepared W/S	--	1-None	>235 lbs (P)	2-Moderate		
Notes		Notes		Notes			
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
		1.2K in ³ (E)	1-Small	12K in ³ (P)	2-Moderate		
Notes		Notes		Notes			
N/A							
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited			--	1-Accurate		
Notes		Notes		Notes			
		N/A					
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-No Redund.			--	1-Accurate		
Notes		Notes		Notes			
		N/A					
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
2 Crewmen	--			FM = 268	2-Medium		
Notes		Notes		Notes			
(1)		N/A					
EXPANDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Low						
Notes		Notes		Notes			
		N/A		N/A			

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)	DEV LEVEL	5	SUBSYSTEM NOMENCLATURE DUTCH SHOES
VISIBILITY		<div style="text-align: center;">NOTES</div> <p>(1) Primary and support astronauts.</p> <p>(2) Pull force, impulse.</p> <p>(3) Shoes and support structure.</p> <p style="margin-top: 20px;">DEVELOPED BY NASA MANNED SPACECRAFT CENTER, HOUSTON, TEXAS</p> <p style="margin-top: 100px;">Reference Bib. No. 8, 13, 19, 27, 29, 52, 57, 68, 71, 78, 80, 94, 96</p> <p style="text-align: right; margin-top: 20px;">REV-</p>	
Interval	Rating		
--	1-Unobstruct.		
Notes			
DEPLOYED VOLUME			
Interval	Rating		
1.2K ln ³ (E)	1-Small		
Notes			
TRANSPORT VELOCITY			
Interval	Rating		
Notes N/A			
CARGO MASS LIMIT			
Interval	Rating		
Notes N/A			
CARGO STABILIZATION			
Interval	Rating		
Notes N/A			
CARGO SIZE			
Interval	Rating		
Notes N/A			
WORKSITE STABILITY (NORMAL)			
Interval	Rating		
--	1-Stable		
Notes			
WORKSITE STABILITY (ROTATION)			
Interval	Rating		
--	1-Stable		
Notes			

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	5	SUBSYSTEM NOMENCLATURE	
						HANDRAIL & FOOT RESTRAINT	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	1-None Req'd.	62 lbs (P)	2-Moderate		
Notes		Notes		Notes		(1)	
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	13 lbs (E)	1-Light	--	2-Moderate		
Notes		Notes		Notes		(3)	
WORKSITE FLEXIBILITY		MAINTNANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	3-Prepared W/S	--	1-None	>235 lbs (P)	2-Moderate		
Notes		Notes		Notes			
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
		1.2K in ³ (E)	1-Small	> 12K in ³	2-Moderate		
Notes		Notes		Notes		(3)	
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited			--	1-Accurate		
Notes		Notes		Notes		N/A	
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-No Redund.			--	1-Accurate		
Notes		Notes		Notes		N/A	
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
2 Crewmen	--			FM=268	2-Medium		
Notes		Notes		Notes		(2)	
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Low						
Notes		Notes		Notes		N/A	

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	5	SUBSYSTEM NOMENCLATURE HANDRAIL & FOOT RESTRAINT
VISIBILITY		<p style="text-align: center;">NOTES</p> <p>(1) Impulse - push direction.</p> <p>(2) Primary and support.</p> <p>(3) Assumes Dutch Shoes and 1 foot of aluminum Gemini handrail.</p> <p>MANUFACTURED BY NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (Contact Man/Systems Integration Branch, Astronautics Laboratory, Marshall Space Flight Center, Huntsville, Alabama)</p> <p style="text-align: right;">Reference: Bib. No. 8, 13, 19, 26, 29, 57, 63, 68, 71, 77, 78, 80, 99, 96.</p>		
Interval	Rating			
---	1-Unobstruct.			
Notes				
DEPLOYED VOLUME				
Interval	Rating			
1.2K in ³	1-Small			
Notes				
(3)				
TRANSPORT VELOCITY				
Interval	Rating			
Notes				
N/A				
CARGO MASS LIMIT				
Interval	Rating			
Notes				
N/A				
CARGO STABILIZATION				
Interval	Rating			
Notes				
N/A				
CARGO SIZE				
Interval	Rating			
Notes				
N/A				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
--	1-Stable			
Notes				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
--	1-Stable			
Notes				

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET		DEV LEVEL	3	SUBSYSTEM NOMENCLATURE	
				MAINTENANCE RESTRAINT	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)	
Interval	Rating	Interval	Rating	Interval	Rating
--	1-Unlimited			30 ft lbs(E)	3-Low
Notes		Notes N/A		Notes In any principle axis	
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)	
Interval	Rating	Interval	Rating	Interval	Rating
--	1-Unlimited	8 lbs	1-Light	30 ft lbs(T)	3-Low
Notes		Notes		Notes	
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
--	3-Prep. W/S	--	1-None	--	3-Light
Notes Requires attach points		Notes		Notes	
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
		6"x6"x20" (E)	1-Small	--	3-Small
Notes N/A		Notes		Notes	
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	1-Unlimited				
Notes		Notes N/A		Notes N/A	
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	1-No redund. req'd				
Notes		Notes N/A		Notes N/A	
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE	
Interval	Rating	Interval	Rating	Interval	Rating
1	--			FM=230 (E)	2-Medium
Notes		Notes N/A		Notes	
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE	
Interval	Rating	Interval	Rating	Interval	Rating
Notes N/A		Notes N/A		Notes N/A	

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	3	SUBSYSTEM NOMENCLATURE MAINTENANCE RESTRAINT
VISIBILITY				
Interval	Rating			
---	1-Unobstruct.			
Notes				
DEPLOYED VOLUME				
Interval	Rating			
--	2-Medium			
Notes				
TRANSPORT VELOCITY				
Interval	Rating			
Notes N/A				
CARGO MASS LIMIT				
Interval	Rating			
Notes N/A				
CARGO STABILIZATION				
Interval	Rating			
Notes N/A				
CARGO SIZE				
Interval	Rating			
Notes N/A				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
30 ft lbs(T)	2-Mod. Stab.			
Notes				

References: Bib. No. 27 & 29

Martin Marrietta Corp. Report on Restraint
System Development, MRC-69-544, NAS8-24840. REV-

LEGEND: P - Published Data T - Typical
E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	3	SUBSYSTEM NOMENCLATURE	
						VARIABLE FLEXIBILITY TETHER	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Short term	--	2-Integral	46 lbs (P)	2-Moderate		
Notes		Notes		Notes			
(3)		(6)		(1)			
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	221 lbs (P)	1-Light	--	2-Moderate		
Notes		Notes		Notes			
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Spec. Interf.	--	1-None	235 lbs	2-Moderate		
Notes		Notes		Notes			
(2)		(7)					
RANGE		STORED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	3-Close Prox.	1728 in ³ (P)	1-Small	12K in ³	2-Moderate		
Notes		Notes		Notes			
(4)							
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited			--	1-Accurate		
Notes		Notes		Notes			
(3)		N/A					
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Redun. Req.			--	1-Accurate		
Notes		Notes		Notes			
		N/A					
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
2 men	--			FM = 720*	1-Large		
Notes		Notes		Notes			
(5)		N/A		*10 ft. radius sphere (approx)			
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Low						
Notes		Notes		Notes			
		N/A		N/A			

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	3	SUBSYSTEM NOMENCLATURE VARIABLE FLEXIBILITY TETHER
VISABILITY		<p style="text-align: center;">NOTES</p> <p>(1). Impulse force - pull direction.</p> <p>(2) Appropriate attach point.</p> <p>(3) Possible friction wear, deterioration.</p> <p>(4) Assumes astronaut close proximity limitations.</p> <p>(5) Primary astronaut with support astronaut tending umbilical and/or tether.</p> <p>(6) Unaided harness doffing.</p> <p>(7) Probably discarded if damaged.</p> <p>(8) F = 10 lbs for 8 ft, 80 ft.lbs.</p> <p>MANUFACTURED BY GENERAL ELECTRIC, SPACE DIVISION, VALLEY FORGE SPACE CENTER, P.O. BOX 8661, PHILADELPHIA, PENNSYLVANIA.</p> <p style="text-align: right;">Reference: Bib. No. 8, 19, 27, 29, 50, 57, 61, 63, 68, 71, 72, 78, 87, 94, 96.</p>		
Interval	Rating			
---	1-Unobstruct.			
Notes				
DEPLOYED VOLUME				
Interval	Rating			
1728 in ³ (E)	1-Small			
Notes				
TRANSPORT VELOCITY				
Interval	Rating			
Notes N/A				
CARGO MASS LIMIT				
Interval	Rating			
Notes N/A				
CARGO STABILIZATION				
Interval	Rating			
Notes N/A				
CARGO SIZE				
Interval	Rating			
Notes N/A				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
FM=17.3	2-Moderate			
Notes (8)				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
10 ft-lbs	2-Moderate			
Notes				

REV-

LEGEND: P - Published Data T - Typical
E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	3	SUBSYSTEM NOMENCLATURE	
						BOOM ATTACHMENT	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Short term	--	Unknown	>45 lbs (E)	2-Moderate		
Notes		(5)	Notes	(1)	Notes		
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	1-Light	--	2-Moderate		
Notes		Notes		Notes			
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Spec. Interf.	--	1-None	235lbs (E)	2-Moderate		
Notes		Notes		(1)	Notes		
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
60ft (E)	3-Close Prox.	--	1-Small	--	3-Small		
(3) Notes		Notes		Notes			
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited			--	1-Accurate		
Notes		Notes N/A		Notes			
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Redund. Req.			--	1-Accurate		
Notes		Notes N/A		Notes			
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
2 Crewmen	--			FM = 159	3-Small		
(2) Notes		Notes N/A		Notes			
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Low						
Notes		Notes N/A		Notes N/A			

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	3	SUBSYSTEM NOMENCLATURE BOOM ATTACHMENT
VISIBILITY		<p style="text-align: center;">NOTES</p> <p>(1) Assumed same as waist restraint</p> <p>(2) Primary and support astronauts</p> <p>(3) EVA astronaut with 60ft umbilical</p> <p>(4) Appropriate attach points</p> <p>(5) Backup (manual) STEM deployment system is provided</p> <p>DEVELOPED BY SPAR AEROSPACE PRODUCTS LIMITED. BOX 6022, TORONTO INTERNATIONAL AIRPORT, ONTARIO, CANADA.</p> <p style="text-align: right;">REV -</p>		
Interval	Rating			
--	2-Obstructed			
Notes				
DEPLOYED VOLUME				
Interval	Rating			
--	1-Small			
Notes				
TRANSPORT VELOCITY				
Interval	Rating			
Notes N/A				
CARGO MASS LIMIT				
Interval	Rating			
Notes N/A				
CARGO STABILIZATION				
Interval	Rating			
Notes N/A				
CARGO SIZE				
Interval	Rating			
Notes N/A				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
FM - 320 (E)	1-Stable			
Notes				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
90ft-lbs (P)	1-Stable			
Notes				

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	4	SUBSYSTEM NOMENCLATURE	
						ASTROGRID/SHOES	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	1-None Req.	48lbs (T, Mx)	2-Moderate		
Notes		Notes		Notes			
				(2)			
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	4lbs (T, E)	1-Light	--	2-Moderate		
Notes		Notes		Notes			
		(3)					
WORKSITE FLEXIBILITY		MAINTFNANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	3-Prepared w/S	--	1-None	>235lbs (P)	2-Moderate		
Notes		Notes		Notes			
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
		70in ³ (T,E)	1-Small	12K in ³ (P)	2-Moderate		
Notes		Notes		Notes			
N/A		(3)					
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited			--	1-Accurate		
Notes		Notes		Notes			
		N/A					
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-No Redund. Req.			--	1-Accurate		
Notes		Notes		Notes			
		N/A					
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
2 Crewmen	--			FM = 295	2-Moderate		
Notes		Notes		Notes			
(1)		N/A					
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Low						
Notes		Notes		Notes			
		N/A		N/A			

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	5	SUBSYSTEM NOMENCLATURE	
						STEM	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	1-None Reg'd.				
Notes		Notes		Notes			
		(3)		N/A			
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	28 lbs (E)	1-Light				
Notes		Notes		Notes			
		(1)		N/A			
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	3-Prepared W/S	--	1-None				
Notes		Notes		Notes			
				N/A			
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
		1350 in ³ (E)	1-Small				
Notes		Notes		Notes			
N/A		(1)		N/A			
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited						
Notes		Notes		Notes			
		N/A		N/A			
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Redund. Req.						
Notes		Notes		Notes			
		N/A		N/A			
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
2 Crewmen (Mn)	--						
Notes		Notes		Notes			
(2)		N/A		N/A			
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Low			60 ft (T)	2-Limited *		
Notes		Notes		Notes			
		N/A		*Medium Range'			

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	5	SUBSYSTEM NOMENCLATURE
		STEM		
VISIBILITY		<p style="text-align: center;">NOTES</p> <p>(1) Assume 60 ft STEM</p> <p>(2) Primary and receiver (possibly support) astronaut</p> <p>(3) Backup (manual) deployment provided</p> <p>MANUFACTURED BY SPAR AEROSPACE PRODUCTS LIMITED, BOX 6022, TORONTO INTERNATIONAL AIRPORT, ONTARIO, CANADA .</p> <p style="text-align: right;">Reference: Bib. No. 8, 13, 19, 27, 29, 35, 52, 57, 58, 63, 68, 77, 96.</p> <p style="text-align: right;">REV-</p>		
Interval	Rating			
--	2-Obstructed			
Notes				
DEPLOYED VOLUME				
Interval	Rating			
4,610 in ³ (E)	1-Small			
Notes				
TRANSPORT VELOCITY				
Interval	Rating			
5 in/sec (P)	3-Slow			
Notes				
CARGO MASS LIMIT				
Interval	Rating			
--	2-Moderate			
Notes				
CARGO STABILIZATION				
Interval	Rating			
--	2-Moderate			
Notes				
CARGO SIZE				
Interval	Rating			
--	1-Large			
Notes				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
Notes				
N/A				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
Notes				
N/A				

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	5	SUBSYSTEM NOMENCLATURE	
						RAILS	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	1-None				
Notes		Notes		Notes		N/A	
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
		100 lbs (E)	2-Moderate				
Notes		Notes		Notes		N/A	
N/A		(2)		N/A			
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	3-Prepared W/S only	None	1-None				
Notes		Notes		Notes		N/A	
N/A				N/A			
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
		995 in ³ (E)	1-Small				
Notes		Notes		Notes		N/A	
N/A		(2)		N/A			
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited						
Notes		Notes		Notes		N/A	
N/A		N/A		N/A			
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-No Redund.						
Notes		Notes		Notes		N/A	
N/A		N/A		N/A			
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
2 Crewmen	--						
Notes		Notes		Notes		N/A	
(1)		N/A		N/A			
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Low			60 ft.	3-Close Prox.		
Notes		Notes		Notes		(3)	
N/A		N/A		N/A			

LEGEND: P -- Published Data T -- Typical
 E -- Estimate Mx -- Maximum
 Mn -- Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	5	SUBSYSTEM NOMENCLATURE
		RAIL		
VISIBILITY		<p style="text-align: center;">NOTES</p> <p>(1) Primary astronaut and support for umbilical or life tether management.</p> <p>(2) Dual aluminum Gemini handrails, 60 ft. in length.</p> <p>(3) SKYLAB umbilical length is assumed as limit.</p> <p>(4) Manual handrail translation used as base.</p> <p>(5) "Shirtsleeve" transport capabilities used as a base.</p> <p>DEVELOPED NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. (CONTACT MAN/SYSTEMS INTEGRATION BRANCH, ASTRONAUTICS LABORATORY, MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALABAMA)</p> <p>Reference Bib. No. 8, 13, 19, 25, 27; 29, 52, 57, 61, 63, 68, 69, 71, 75, 78, 79, 80, 94, 96</p>		
Interval	Rating			
--	2-Obstructed			
Notes				
DEPLOYED VOLUME				
Interval	Rating			
995 in ³ (E)	1-Small			
Notes				
(2)				
TRANSPORT VELOCITY				
Interval	Rating			
<2 ft/sec	3-Slow			
Notes				
(4)				
CARGO MASS LIMIT				
Interval	Rating			
110 lbs (Mx, E)	3-Low			
Notes				
(5)				
CARGO STABILIZATION				
Interval	Rating			
--	2-Moderate			
Notes				
CARGO SIZE				
Interval	Rating			
3K in ³ (Mx, E)	3-Small			
Notes				
(5)				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
Notes				
N/A				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
Notes				
N/A				

REV--

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET		DEV LEVEL	3	SUBSYSTEM NOMENCLATURE	
				DOLLY & RAILS	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)	
Interval	Rating	Interval	Rating	Interval	Rating
--	1-Unlimited	--	1-None Req'd.		
Notes		Notes		Notes	
				N/A	
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)	
Interval	Rating	Interval	Rating	Interval	Rating
--	1-Unlimited	4 lbs (E)	1-Light		
Notes		Notes		Notes	
				N/A	
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
		--	1-None		
Notes		Notes		Notes	
N/A				N/A	
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
		1680 in ³ (E)	1-Small		
Notes		Notes		Notes	
N/A				N/A	
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	2-Limited				
Notes		Notes		Notes	
(1) (3)		N/A		N/A	
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	2-Redundancy Req'd.				
Notes		Notes		Notes	
		N/A		N/A	
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE	
Interval	Rating	Interval	Rating	Interval	Rating
2 Crewmen	--				
Notes		Notes		Notes	
(2)		N/A		N/A	
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE	
Interval	Rating	Interval	Rating	Interval	Rating
--	2-Medium			60 ft (E,Mx)	3-Close Prox.
Notes		Notes		Notes	
(5)		N/A		(6)	

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	3	SUBSYSTEM NOMENCLATURE DOLLY & RAILS
VISIBILITY		<p style="text-align: center;">NOTES</p> <p>(1) Different thermal conditions on rails may cause tolerance problems.</p> <p>(2) Primary astronaut with support astronaut tending life tether or umbilical.</p> <p>(3) Each rail must be "one piece." Joints may cause tolerance problems.</p> <p>(4) Assume astronaut translation velocity.</p> <p>(5) Rail slide frequently binds against rail causing substantial increases in astronaut energy expenditure.</p> <p>(6) Astronaut umbilical length for SKYLAB.</p> <p>MANUFACTURED BY MARSHALL SPACE FLIGHT CENTER, ASTRO-NAUTICS LABORATORY, HUNTSVILLE, ALABAMA</p> <p>Reference: Bib. No. 8, 13, 19, 27, 29, 52, 57, 63, 68, 71, 78, 79, 80, 81, 94.</p> <p style="text-align: right;">REV-</p>		
Interval	Rating			
--	3-Very Limited			
Notes				
DEPLOYED VOLUME				
Interval	Rating			
1680 in ³ (E)	1-Small			
Notes				
TRANSPORT VELOCITY				
Interval	Rating			
2 ft/sec	3-Slow			
Notes				
(4)				
CARGO MASS LIMIT				
Interval	Rating			
--	1-Heavy			
Notes				
CARGO STABILIZATION				
Interval	Rating			
--	1-Stable			
Notes				
CARGO SIZE				
Interval	Rating			
--	1-Large			
Notes				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
Notes				
N/A				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
Notes				
N/A				

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	3	SUBSYSTEM NOMENCLATURE	
						PERSONNEL HARNESS	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	1-None Req'd				
Notes		Notes		Notes		N/A	
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	105 lbs (E)	2-Moderate				
Notes		Notes		Notes		N/A	
		(3)					
WORKSITE FLEXIBILITY		MAINTNANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
		--	1-None				
Notes		Notes		Notes		N/A	
N/A							
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
		1025 in ³ (E)	1-Small				
Notes		Notes		Notes		N/A	
N/A		(3)					
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited						
Notes		Notes		Notes		N/A	
		N/A					
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-No Redund.						
Notes		Notes		Notes		N/A	
		N/A					
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
2 Crewmen	--						
Notes		Notes		Notes		N/A	
(1)		N/A					
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Medium			60 ft. (E, Mx)	3- Close Prox		
Notes		Notes		Notes		(2)	
		N/A					

LEGEND: P -- Published Data T -- Typical
 E -- Estimate Mx -- Maximum
 Mn -- Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	3	SUBSYSTEM NOMENCLATURE PERSONNEL HARNESS
VISIBILITY		<p style="text-align: center;">NOTES</p> <p>(1) Crewman to use transport and one other crewman to handle umbilical and/or life tether.</p> <p>(2) Maximum SKYLAB umbilical length.</p> <p>(3) Includes 60 ft. of dual parallel Gemini handrails of aluminum.</p> <p>(4) Assumes same rate as translation.</p> <p>DEVELOPED BY NASA MANNED SPACECRAFT CENTER, HOUSTON, TEXAS</p>		
Interval	Rating			
--	2-Obstructed			
Notes				
DEPLOYED VOLUME				
Interval	Rating			
1025 in ³ (E)	1-Small			
Notes				
(3)				
TRANSPORT VELOCITY				
Interval	Rating			
<.2 ft/sec (E)	3-Slow			
Notes				
(4)				
CARGO MASS LIMIT				
Interval	Rating			
150 lbs (E,Mx)	2-Moderate			
Notes				
CARGO STABILIZATION				
Interval	Rating			
--	2-Moderate			
Notes				
CARGO SIZE				
Interval	Rating			
6.7K in ³ (E,Mx)	2-Medium			
Notes				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
Notes				
N/A				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
Notes				
N/A				

Reference Bib. No. 8, 13, 19, 27, 29, 51, 63, 68, 71, 78, 79, 87, 94, 96

REV-

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	5	SUBSYSTEM NOMENCLATURE	
						CLOTHESLINE	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	1-None Req.				
Notes		Notes		Notes N/A			
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	1-Light				
Notes		Notes		Notes N/A			
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	3-Prepared W/S	--	1-None				
Notes		Notes		Notes N/A			
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
		--	1-Small				
Notes N/A		Notes		Notes N/A			
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited						
Notes		Notes N/A		Notes N/A			
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Red. Req.						
Notes		Notes N/A		Notes N/A			
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
2 Crewmen (Mn)	--						
Notes (1)		Notes N/A		Notes N/A			
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Low			50 ft(E)	3-Close Prox		
Notes		Notes N/A		Notes			

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)	DEV LEVEL	5	SUBSYSTEM NOMENCLATURE CLOTHESLINE						
VISIBILITY	<div style="text-align: center;">NOTES</div> <p>(1) One Astronaut at either end (Primary and Support at least)</p> <p>MANUFACTURED BY NASA, MANNED SPACECRAFT CENTER, HOUSTON TEXAS</p> <p style="text-align: right;">Reference: Bib. No. 8, 13, 19, 27, 29, 52, 57, 63, 68, 78, 80, 94, 96.</p> <p style="text-align: right;">REV -</p>								
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Interval</th> <th style="width: 50%;">Rating</th> </tr> <tr> <td style="text-align: center;">--</td> <td style="text-align: center;">2-Obstructed</td> </tr> <tr> <td colspan="2" style="text-align: center;">Notes</td> </tr> </table>				Interval	Rating	--	2-Obstructed	Notes	
Interval				Rating					
--				2-Obstructed					
Notes									
DEPLOYED VOLUME									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Interval</th> <th style="width: 50%;">Rating</th> </tr> <tr> <td style="text-align: center;">--</td> <td style="text-align: center;">1-Small</td> </tr> <tr> <td colspan="2" style="text-align: center;">Notes</td> </tr> </table>				Interval	Rating	--	1-Small	Notes	
Interval				Rating					
--				1-Small					
Notes									
TRANSPORT VELOCITY									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Interval</th> <th style="width: 50%;">Rating</th> </tr> <tr> <td style="text-align: center;">--</td> <td style="text-align: center;">3-Slow</td> </tr> <tr> <td colspan="2" style="text-align: center;">Notes</td> </tr> </table>				Interval	Rating	--	3-Slow	Notes	
Interval				Rating					
--				3-Slow					
Notes									
CARGO MASS LIMIT									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Interval</th> <th style="width: 50%;">Rating</th> </tr> <tr> <td style="text-align: center;">--</td> <td style="text-align: center;">3-Low</td> </tr> <tr> <td colspan="2" style="text-align: center;">Notes</td> </tr> </table>	Interval	Rating	--	3-Low	Notes				
Interval	Rating								
--	3-Low								
Notes									
CARGO STABILIZATION									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Interval</th> <th style="width: 50%;">Rating</th> </tr> <tr> <td style="text-align: center;">--</td> <td style="text-align: center;">3-Unstable</td> </tr> <tr> <td colspan="2" style="text-align: center;">Notes</td> </tr> </table>	Interval	Rating	--	3-Unstable	Notes				
Interval	Rating								
--	3-Unstable								
Notes									
CARGO SIZE									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Interval</th> <th style="width: 50%;">Rating</th> </tr> <tr> <td style="text-align: center;">--</td> <td style="text-align: center;">3-Small</td> </tr> <tr> <td colspan="2" style="text-align: center;">Notes</td> </tr> </table>	Interval	Rating	--	3-Small	Notes				
Interval	Rating								
--	3-Small								
Notes									
WORKSITE STABILITY (NORMAL)									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Interval</th> <th style="width: 50%;">Rating</th> </tr> <tr> <td style="text-align: center;"> </td> <td style="text-align: center;"> </td> </tr> <tr> <td colspan="2" style="text-align: center;">Notes</td> </tr> <tr> <td colspan="2" style="text-align: center;">N/A</td> </tr> </table>	Interval	Rating			Notes		N/A		
Interval	Rating								
Notes									
N/A									
WORKSITE STABILITY (ROTATION)									
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Interval</th> <th style="width: 50%;">Rating</th> </tr> <tr> <td style="text-align: center;"> </td> <td style="text-align: center;"> </td> </tr> <tr> <td colspan="2" style="text-align: center;">Notes</td> </tr> <tr> <td colspan="2" style="text-align: center;">N/A</td> </tr> </table>	Interval	Rating			Notes		N/A		
Interval	Rating								
Notes									
N/A									

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

5.2 EV SYSTEM DATA SHEETS

Serpentuator	5-2-1 (a, b)
Space Taxi	5-2-2 (a, b)
Maneuvering Work Platform	5-2-3 (a, b)
Remora	5-2-4 (a, b)
Humpty Dumpty	5-2-5 (a, b)
Schmoo	5-2-6 (a, b)
Modular EVA Work Platform	5-2-7 (a, b)
Remote Manipulator Spacecraft	5-2-8 (a, b)

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	3	SYSTEM NOMENCLATURE	
						SERPENTUATOR	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	--	10 lbs (T)	3-Low		
Notes		Notes Backup Astronaut And Tether/Umbilical		Notes			
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
3.0 Hrs	3-Short*	--	3 -Heavy	10lbs (T)	3-Low		
Notes *Astro. Lmt.		Notes		Notes			
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	Unknown	--	2-Moderate		
Notes Requires Special Attachment		Notes		Notes			
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
40ft (T)	3-Close Prox.	--	3-Large	--	2-Moderate		
Notes		Notes		Notes			
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Limited*	4 fps (E)	2-Med.	--	2-Moderate		
Notes *Same as Astronaut		Notes Rotation at Base - 1 rpm		Notes			
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Redundancy Required	--	2-Med.	--	2-Moderate		
Notes		Notes		Notes			
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
2	--	--	2-Mod. Stab.	FM-2400 (E)	1-Large		
Notes 1 Primary 1 Backup (Umbilical Mgt.)		Notes		Notes 40ft Long			
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE			
Interval	Rating	Interval	Rating	Interval	Rating		
		--	2-Med.	--	3-Ltd Close		
Notes N/A		Notes		Notes 40ft radius			

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	3	SYSTEM NOMENCLATURE SERPENTUATOR
VISIBILITY				
Interval	Rating			
--	1-Unlimited			
Notes				
DEPLOYED VOLUME				
Interval	Rating			
--	Unknown			
Notes				
TRANSPORT VELOCITY				
Interval	Rating			
4fps (T)	3-Slow			
Notes				
CARGO MASS LIMIT				
Interval	Rating			
--	2-Moderate			
Notes				
CARGO STABILIZATION				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
CARGO SIZE				
Interval	Rating			
--	2-Mod.			
Notes				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
--	2-Mod. Stab.			
Notes				

SYSTEM BEING DEVELOPED BY NASA MSFC ME LAB (W/SUPPORT FROM HAYES INTERNATIONAL AND ASTRO SPACE LABS)

Reference Bib: No. 6, 7, 36, 59, 60, 64

REV -

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	2	SYSTEM NOMENCLATURE	
				SPACE TAXI			
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
5 Yr. (P)	1-unlimited	--	2-Intergal	25 lbs. (P)	2-Moderate		
Notes Resupply cycle 120 days, 82 missions per year		Notes 25 ft. umbilical (P)		Notes (3)			
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
8 hrs. (P)	2-limited short term	3474 lbs. (Wet) (P)	3-Heavy	--	2-Moderate		
Notes 2 hrs. contingency		Notes 3198 lbs. (Dry) (P) *Includes 732 lbs. for Crew, tools, etc		Notes (3)			
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	Unknown	500 lbs (E)	1-Heavy		
Notes		Notes		Notes			
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
1 1/2 mi (P)	2-Limited Med.	610 sq ft (E)	3-Large	--	1-Large		
Notes Any orbital direction		Notes 150" h x 77" x 84"		Notes			
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	1-Fast	---	2-Moderate		
Notes		Notes		Notes			
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-No Red. Req.	---	2-Medium	--	2-Moderate		
Notes		Notes (2)		Notes			
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
1	--	--	2-Moderate	FM-400(2 ea)	1-Large		
Notes		Notes (2)		Notes Approx. 100" reach.			
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE			
Interval	Rating	Interval	Rating	Interval	Rating		
263 lbs (E)	3-High	--	2-Medium	--	2-Limited Med.		
Notes (1)		Notes (2)		Notes Same as range			

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	2	SYSTEM NOMENCLATURE
				SPACE TAXI
VISABILITY		<p style="text-align: center;">NOTES</p> <p>(1) Expendable Requirements -Propellant - 234 lbs -O₂ - 17 lbs -H₂O - 12 lbs -Energy consumption 5.1K WH/trip 47.7K BTU/trip</p> <p>(2) Translation/Stabilization -Acceleration Rate Angular - 8°/sec² Translational Fore/aft - 1.0 ft/sec² Lat./vert. - 0.5 ft/sec² Rotational Rate (Command) 5 & 15°/sec² Stabilization Accuracy - ± 2 deg.</p> <p>(3) Manipulators -2 bilateral (working) -2 bilateral (docking & anchoring)</p> <p>SYSTEM DEVELOPED BY THE LTV ASTRONAUTICS DIV., LTV AEROSPACE CORP.</p> <p>Reference: Bib. No. 3, 11, 29, 31, 32, 51, 53, 54, 97.</p> <p style="text-align: right;">REV-</p>		
Interval	Rating			
45°	2-Obstructed			
Notes Nominal-up & down				
DEPLOYED VOLUME				
Interval	Rating			
610 sq ft (E)	3-Large			
Notes 150" h x 77" x 84"				
TRANSPORT VELOCITY				
Interval	Rating			
--	1-Fast			
Notes				
CARGO MASS LIMIT				
Interval	Rating			
--	1-Heavy			
Notes				
CARGO STABILIZATION				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
CARGO SIZE				
Interval	Rating			
--	1-Large			
Notes				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
--	2-Mod. Stab.			
Notes				

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	3	SYSTEM NOMENCLATURE	
						MANEUVERING (MWP) WORK PLATFORM	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
1 yr (P)	1-Unlimited	--	2-Integral	25 lbs	2-Moderate		
Notes 62 eighty-hour missions		Notes 25 ft. umbilical & ½ hr life support		Notes tong(grasp) 25 lbs (3)			
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
8 hr (P)	2-Limited Long term	1690 lbs (P)	3-Heavy	--	2-Moderate		
Notes Plus 2 hrs contingency		Notes 1450 lbs (Dry) (P)		Notes			
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Limited Spec. Interface	--	Unknown	575 lbs (T)	2-Moderate		
Notes		Notes		Notes			
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
6500 ft (P, T)	2-Limited Med. range	140 sq ft (E)	3-Large	480K sq in	1-large		
Notes Rescue cap. of approx. 1½ mi.		Notes		Notes			
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Limited	--	1-Fast	--	2-Moderate		
Notes Same as astronaut		Notes		Notes			
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-redundancy req'd	--	1-High	--	2-Moderate		
Notes		Notes (2)		Notes			
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
1	--	--	2-Mod. Stab.	FM=260 (E)	2-Medium		
Notes		Notes (2)		Notes 2 ea. Manipulator reach-52 in.			
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARCO TRANSPORT RANG.			
Interval	Rating	Interval	Rating	Interval	Rating		
246 lbs (P)	2-Medium	--	2-Medium	--	2-Limit Med. close		
Notes (1)		Notes (2)		Notes			

LEGEND: P - Published Data T - Typical
E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	3	SYSTEM NOMENCLATURE MANEUVERING WORK PLATFORM (MWP)
VISABILITY		<p style="text-align: center;">NOTES</p> <p>(1) Expendable requirements: -Propellant - 210 lbs -O₂ - 2 lbs -H₂O - 26 lbs -LiOH - 7.51 lbs</p> <p>(2) Translation/stabilization (P): -Acceleration rate angular (pitch, roll, & yaw) - 180/sec² avg. translational Fore/aft - 1.0 ft/sec² Lt./vert. - 0.5/sec² -Rotational Rate (command) pitch, roll, & yaw - 15°/sec. max. -Stabilization Accuracy - ½ 2° (automatic)</p> <p>(3) Manipulators/Grapplers -3 forward & 1 aft</p> <p>SYSTEM DEVELOPED BY THE LTV ASTRONAUTICS DIV., LTV AEROSPACE CORP.</p>		
Interval	Rating			
---	1-Unobstruct.			
Notes				
DEPLOYED VOLUME				
Interval	Rating			
300 sq ft(E)	3-Large			
Notes				
TRANSPORT VELOCITY				
Interval	Rating			
---	1-Fast			
Notes				
CARGO MASS LIMIT				
Interval	Rating			
575 lbs (P)	2-Moderate			
Notes				
CARGO STABILIZATION				
Interval	Rating			
---	2-Mod. Stab.			
Notes				
CARGO SIZE				
Interval	Rating			
480K sq in	2-Medium			
Notes				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
Reference: Bib. No. 3, 11, 29, 31, 32, 51, 53, 54, & 97.				
REV-				

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	1	SYSTEM NOMENCLATURE	
						REMORA	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	Unknown	--	Unknown	--	2-Moderate		
Notes		Notes		Notes		(1)	
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
4 hrs (P)	3-Limited Short term	520 lbs. (Loaded)*	3-Heavy	--	2-Moderate		
Notes		Notes		Notes		(1)	
		*(P), 260 lbs (empty)					
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Limited*	--	Unknown	--	2-Moderate		
Notes		Notes		Notes			
*Special interface							
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
1000 ft (P)*	2-Limited, Mod.	43 cu ft (E)	2-Moderate	--	2-Moderate		
Notes		Notes		Notes			
*Tethered		*Height-6ft, Dia.-3ft (P)					
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	2-Limited*	--	2-Medium	--	2-Moderate		
Notes		Notes		Notes			
*High radiation, etc.							
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	Unknown	--	2-Medium	--	2-Moderate		
Notes		Notes		Notes		(1)	
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
1*	--	--	2-Moderate	--	3-Small		
Notes		Notes		Notes		(1)	
*Suited							
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE			
Interval	Rating	Interval	Rating	Interval	Rating		
--	Unknown	--	2-Medium	1000 ft*	2-Limited, Mod.		
Notes		Notes		Notes		*Tethered	

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	1	SYSTEM NOMENCLATURE
				REMORA
VISIBILITY		<p>NOTES</p> <p>(1). Manipulator - 2 ea arms. Anthropomorphic gloves - 2 ea.</p> <p>SYSTEM PROPOSED BY THE BELL AEROSYSTEMS CO., BELL AEROSPACE CORP.</p>		
Interval	Rating			
360° (P)*	1-Unobstruct.			
Notes				
*Clear glass dome				
DEPLOYED VOLUME				
Interval	Rating			
43 cu. ft*(E)	2-Moderate			
Notes				
*Height-6ft, Dia.-3ft (P)				
TRANSPORT VELOCITY				
Interval	Rating			
--	2-Medium			
Notes				
CARGO MASS LIMIT				
Interval	Rating			
--	2-Moderate			
Notes				
CARGO STABILIZATION				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
CARGO SIZE				
Interval	Rating			
--	2-Medium			
Notes				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
--	2-Mod. Stab.			
Notes				

Reference: Bib. No. 5

REV-

LEGEND: P - Published Data T - Typical
E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET		DEV LEVEL	1	SYSTEM NOMENCLATURE	
HUMPTY DUMPTY					
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)	
Interval	Rating	Interval	Rating	Interval	Rating
--	Unknown	--	Unknown	--	1-High
Notes		Notes		Notes	
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)	
Interval	Rating	Interval	Rating	Interval	Rating
30 hrs*(P)	2-Limited 2-Long term	--	3-Heavy	--	1-High
Notes *Approx.		Notes		Notes	
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
--	2-Limited*	--	Unknown	--	1-Heavy
Notes *Special interface		Notes		Notes	
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
--	Unknown	--	Unknown	--	1-Large
Notes		Notes		Notes	
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	1-Unlimited	--	2-Medium	--	1-Accurate
Notes		Notes		Notes	
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	Unknown	--	2-Medium	--	1-Accurate
Notes		Notes		Notes	
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH LIMITS	
Interval	Rating	Interval	Rating	Interval	Rating
1 (P)	--	--	2-Mod. Stab.	--	1-Large
Notes		Notes		Notes (1)	
CAPABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE	
Interval	Rating	Interval	Rating	Interval	Rating
--	Unknown	--	1-High	--	2-Limited*
Notes		Notes		Notes *Med. Range	

LEGEND: P - Published Data T - Typical
E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	1	SYSTEM NOMENCLATURE HUMPTY DUMPTY
VISABILITY		<p style="text-align: center;">NOTES</p> <p>(1) Number of manipulators - 3 ea. mechanical (work) - 3 ea. mechanical (anchoring) - 2 ea. anthropomorphic gloves</p> <p>SYSTEM PROPOSED BY DOUGLAS AIRCRAFT COMPANY.</p>		
Interval	Rating			
--	1-Unobstruct.			
Notes				
DEPLOYED VOLUME				
Interval	Rating			
--	3-Large			
Notes				
TRANSPORT VELOCITY				
Interval	Rating			
--	1-Fast			
Notes				
CARGO MASS LIMIT				
Interval	Rating			
--	1-Heavy			
Notes				
CARGO STABILIZATION				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
CARGO SIZE				
Interval	Rating			
--	1-Large			
Notes				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
--	1-Stable			
Notes				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
--	1-Stable			
Notes				

Reference: Bib. No. 5

REV-

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET				DEV LEVEL	2	SYSTEM NOMENCLATURE	
						SCHMOO	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	N/A	--	600 lbs. Mx (P)	1-High		
Notes		Notes		Notes			
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)			
Interval	Rating	Interval	Rating	Interval	Rating		
--	Unknown	11,300 lbs. (wet)*	3-Heavy	--	1-High		
Notes		Notes *(P) 7500 lbs. (dry)		Notes (2)			
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	--	Unknown	--	1-Heavy		
Notes		Notes		Notes			
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-Unlimited	3240 cu. ft. (E)	3-large	--	1-large		
Notes		Notes *Oblated spheroid - (P) 15 ft. W. & 18 ft. Lg. x 12h.		Notes			
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--	1-unlimited*	--	1-Last	--	1-Accurate		
Notes *Particularly suited for high radiation area		Notes		Notes			
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY			
Interval	Rating	Interval	Rating	Interval	Rating		
--		--	1-High	--	1-Accurate		
Notes		Notes		Notes			
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE			
Interval	Rating	Interval	Rating	Interval	Rating		
N/A*	--	--	2-Med.	FM=1080 (ea)	1-large		
Notes *unmanned, controller required, IVA or gnd. (1)		Notes		Notes (2) 18 ft. lg. Arms (2 ea)			
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE			
Interval	Rating	Interval	Rating	Interval	Rating		
--	Unknown	--	2-Mod. stab.	--	1-Unlimited		
Notes		Notes		Notes			

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	2	SYSTEM NOMENCLATURE SCHMOO
VISIBILITY		<p style="text-align: center;">NOTES</p> <p>(1) Remotely operated service Module for maintenance</p> <p>(2) 2 each stabilization arms 2 each manipulator arms (18 ft lg)</p> <p>(3) 2 complete TV systems - stereoptical color TV (3d) - Black & White TV (2d)</p> <p>SYSTEM PROPOSED BY LOCKHEED MISSILES & SPACE COMPANY</p>		
Interval	Rating			
--	1-Unobstructed			
Notes (3)				
DEPLOYED VOLUME				
Interval	Rating			
3240 cu. ft. (E)*	1-Large			
Notes *oblated spheroid - 15 ft. W. x 18 ft. Lg. x 12 ft. H.				
TRANSPORT VELOCITY				
Interval	Rating			
--	1-Fast			
Notes				
CARGO MASS LIMIT				
Interval	Rating			
--	1-Large			
Notes				
CARGO STABILIZATION				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
CARGO SIZE				
Interval	Rating			
--	1-Large			
Notes				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
--	2-Mod. Stab.			
Notes				

References: Bib. No. 30, 92 & 93

REV-

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET		DEV LEVEL	2	SYSTEM NOMENCLATURE MODULAR EVA WORK PLATFORM	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)	
Interval	Rating	Interval	Rating	Interval	Rating
--	Unknown	--	2-Integrated*	25 lbs (P)	2-Moderate
Notes		Notes *4 hrs emergency		Notes	
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)	
Interval	Rating	Interval	Rating	Interval	Rating
4 hrs (P)*	3-Limited, Short term	1052 lbs (P)	3-Heavy	--	3-Low
Notes *Plus 4 hrs emergency (P)		Notes (3)		Notes	
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
--	2-Limited*	--	Unknown	--	2-Moderate
Notes *Special interface (1)		Notes		Notes	
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
7000 ft (P)*	2-Limited Med.	216cu.ft.(E)*	2-Moderate	--	2-Moderate
Notes *10000 ft. w/ ext. propul. cap. module		Notes *6 ft x 6 ft x 6 ft		Notes	
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	2-Limited*	15-20 ft/lbs	2-Medium	--	2-Moderate
Notes *Same as suited astronaut		Notes		Notes	
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	Unknown	.5 ft/sec ²	2-Medium	--	2-Moderate
Notes		Notes		Notes	
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE	
Interval	Rating	Interval	Rating	Interval	Rating
1	--	--	2-Mod. Stab.	FM=240 (ea)*	2-Medium
Notes Suited astronaut		Notes		Notes *525 cu ft (P)	
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE	
Interval	Rating	Interval	Rating	Interval	Rating
29 lbs/4 hrs (E)	2-Medium	--	2-Medium	7000 ft	2-Medium
Notes (2)		Notes		Notes See range	

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	2	SYSTEM NOMENCLATURE MODULAR EVA WORK PLATFORM
VISABILITY		<p style="text-align: center;">NOTES</p> <p>(1) Utilizes 3 worksite anchors with adhesive pads.</p> <p>(2) 1551 watt-hrs of electrical energy (P)</p> <p>(3) Optional configurations: -Ext. propulsion capability--180 lbs. -Long range rendezvous module--73 lbs.</p> <p>SYSTEM DEVELOPED BY THE BENDIX CORPORATION</p>		
Interval	Rating			
--	2-Obstructed			
Notes Limited by platform				
DEPLOYED VOLUME				
Interval	Rating			
216 cu ft(E)*	2-Medium			
Notes *Approx. 6ft x 6ft x 6ft				
TRANSPORT VELOCITY				
Interval	Rating			
--	2-Medium			
Notes				
CARGO MASS LIMIT				
Interval	Rating			
--	1-Low			
Notes				
CARGO STABILIZATION				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
CARGO SIZE				
Interval	Rating			
--	2-Medium			
Notes				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
--	2-Mod. Stab.			
Notes				

Reference: Bib. No. 9

REV-

LEGEND: P - Published Data T - Typical
E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET		DEV LEVEL	3	SYSTEM NOMENCLATURE	
				REMOTE MANIPULATOR SPACECRAFT	
OPERATIONAL LIFETIME		EMERGENCY PROVISIONS		ACTUATION FORCE (NORMAL)	
Interval	Rating	Interval	Rating	Interval	Rating
3 Yrs (P)	1-Unlimited			15lbs (P)	3-Low
Notes		Notes N/A		Notes (1)	
ON-SITE TIME LIMIT		MASS		ACTUATION FORCE (ROTATION)	
Interval	Rating	Interval	Rating	Interval	Rating
--	2-Limited Long Term	540lbs (T)	2-Moderate	40in. lbs. (E)	2-Moderate
Notes		Notes		Notes (1)	
WORKSITE FLEXIBILITY		MAINTENANCE TIME REQUIREMENTS		WORKSITE MASS HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
--	1-Unlimited	--	Unknown	--	2-Moderate
Notes		Notes		Notes	
RANGE		STOWED VOLUME		WORKSITE SIZE HANDLING LIMIT	
Interval	Rating	Interval	Rating	Interval	Rating
--	1-Unlimited	24cu. ft. (E)	2-Moderate	--	2-Moderate
Notes		Notes		Notes	
ENVIRONMENTAL FLEXIBILITY		AVERAGE TRANSLATION VELOCITY		ACTUATOR POSITION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
--	1-Unlimited	--	1-Fast	--	2-Moderate
Notes		Notes		Notes	
DEPENDABILITY		TRANSLATION RATE CONTROL		ACTUATOR ORIENTATION ACCURACY	
Interval	Rating	Interval	Rating	Interval	Rating
		--	2-Med.	FM = 200 (E)	2-Moderate
Notes		Notes		Notes 40 in. reach	
CREW REQUIREMENTS		TRANSLATION STABILITY		WORKSITE REACH ENVELOPE	
Interval	Rating	Interval	Rating	Interval	Rating
		--	2 Mod. Stab.	--	2-Med.
Notes N/A Unmanned		Notes		Notes Same as Range	
EXPENDABLE REQUIREMENTS		TRANSLATION MANEUVERABILITY		CARGO TRANSPORT RANGE	
Interval	Rating	Interval	Rating	Interval	Rating
		--	2 - Med.	--	2-Limited Med.
Notes Energy consumption-780 watts (peak), 167 watts (Avg)		Notes		Notes Same as range	

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum

FREE SPACE ACTIVITY SYSTEMS DATA SHEET (Continued)		DEV LEVEL	3	SYSTEM NOMENCLATURE REMOTE MANIPULATOR SPACECRAFT
VISIBILITY		NOTES		
Interval	Rating	(1) Manipulators (2) Electrical bilateral (closed loop position control with force feedback) SYSTEM BEING DEVELOPED BY GENERAL ELECTRIC CO., SPACE SYSTEMS DIVISION		
--	1-Unobstructed			
Notes				
Steroptical TV				
DEPLOYED VOLUME				
Interval	Rating			
24 cu. ft. (E)	2-Med.			
Notes				
TRANSPORT VELOCITY				
Interval	Rating			
--	2-Med.			
Notes				
CARGO MASS LIMIT				
Interval	Rating			
--	2-Moderate			
Notes				
CARGO STABILIZATION				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
CARGO SIZE				
Interval	Rating			
--	2-Med.			
Notes				
WORKSITE STABILITY (NORMAL)				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
WORKSITE STABILITY (ROTATION)				
Interval	Rating			
--	2-Mod. Stab.			
Notes				
Reference Bib. No. 4, 12, 16, 17, 42, 43, 44, 47, 56, 66				
REV -				

LEGEND: P - Published Data T - Typical
 E - Estimate Mx - Maximum
 Mn - Minimum