#2

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BREAKDOWN OF RESPONSIBILITIES

WORK PACKAGE DIRECTIVE

This directive is issued to establish work package responsibilities in consideration of changes which have been baselined as a result of recommendations by the Configuration Evaluation Task Force (CETF). All program documentation, planning, and implementation shall be consistent with this directive.

The CETF results included the following significant changes to previous assignment directives which are related to Space Station hardware and functional allocation.: Four "Resource Nodes" were created which are larger, outfitted versions of the replaced 4 nodes and 2 tunnels which, in the baseline configuration, functioned only as passageways connecting the laboratory and habitation modules. The resource nodes add about 4000 cubic feet of usable pressurized volume to the Space Station. This additional volume will house systems and subsystems that were previously located either on the station structure or inside the laboratory or habitation modules. The primary command and

PROCESS DESCRIBED NEEDS A FLOWCHART - DIAGRAM

LOOKS A' -> C

PROVISIONS/USERS ETC

control function moves from the laboratory and habitation modules to the nodes. In addition, major parts of the station's core systems, (i.e. C&T, GN&C, DMS) move from the modules to the resource nodes. This relocation will remove systems requiring substantial amounts of crew activity from the habitation module, thus improving the habitability aspects of the module.

Work Package 1 has been tasked to design, manufacture, and qualify resource primary pressure vessel structures and provide them to Work Package 2. Work Package 2 will specify design requirements for the structure shell to Work Package 1. Any Work Package 1 common system components to be installed in the nodes will be provided to Work Package 2 in accordance with Work Package 2 programmatic requirements. Work Package 2 is responsible for the integration and verification of all subsystems in the nodes.

(1.0) INTEGRATED CONFIGURATION RESPONSIBILITIES

Level A' is responsible for the engineering analyses and design activities needed to generate a full configuration conceptual design of the Space Station and a set of Space Station Program requirements which, when implemented by the various agents of the Program (e.g., Level C Project Managers), will produce the optimum Space Station from a combined initial, life cycle, and user cost and a user performance point of view.

In the execution of this responsibility, Level A' will make appropriate and effective use of the NASA institutions, Work Package contractors, and Program Support Contractor (PSC) in the performance of system level analysis, design, integration, and verification activities. The specific systems level support task responsibilities of the NASA organizations will be defined subsequently as part of the SE&I and Program integration directive. = P/P

(2.0) SPACE STATION SYSTEMS RESPONSIBILITY

Responsibility for each system of the Space Station Program is assigned as follows:

Electric Power System	WP4	**Man Systems	WP1
DMS	WP2	User Servicing (external)	WP3
*Thermal Control System		Assembly & external	WP2
Internal TCS	WP1	Systems Maintenance	
External TCS	WP2		
*C&T	WP2		
except:		Mechanisms/Gimbals	N/A
Internal Audio	WP1	(see additional	
Internal Video	WP1	dispositions)	
GN&C	WP2		
ECLSS	WP1		
EVA Systems	WP2		

*ACD responsibility is WP2. Internal and external refers to pressurized and unpressurized. WP 2's ACD responsibility encompasses all functions and components of the system (inside and outside) with respect to the standard responsibilities of being an ACD agent. The WP 1 responsibility is to DDT&E the assigned system components consistent with the ACD requirements. WP 2 has the end-to-end analysis and verification responsibility. Commonality analysis will be performed by the ACD agent (iterating with WP 1 and Level A') in phase C/D to determine appropriate commonality between inside and outside components. Following the program determination of component commonality (between inside and outside), WP 2 will be assigned the development and verification responsibility of the common components.

**Manned Systems ACD responsibility is assigned to JSC.

The responsibility for the above systems for the Space Station is delegated from Level A'. Both the provider of the system as well as the users of a system have a responsibility for a given system as follows:

(2.1) SYSTEM PROVIDER RESPONSIBILITY: By the above system assignments, the provider of the system has the responsibility to develop, implement and maintain the end-to-end system for the assigned ACD. In the development of the system, the ACD agent is responsible that the system is consistent with the Station level requirements, architecture, functional partitioning, and resource allocation provided by Level A'. The ACD responsibility includes:

A. Integrating the detailed system hardware and software requirements of all "elements" and platforms (as provided by the appropriate Work Packages and International Partners) and performing end-to-end system analysis.

B. Detailing the end-to-end system architecture, topology, and preliminary design, defining overall system design and integration standards, and performing DDT&E (exceptions above) of systems components for all program elements. This task shall include the formal process of defining, partitioning and allocating distributed systems functions, iterating across program elements based on functional requirements inputs of all work packages, under the direction of Level A'.

C. Defining the end-to-end system test and verification requirements and plans, and implementing associated testing and analysis, consistent with the Level A' test and verification concepts and requirements.

D. Defining all system-to-system and system-to-element interface requirements and development, iterating with the Program Office and other associated work package element developers and systems architects.

E. Analyzing and recommending, based on the detailed requirements of all elements (including platforms) the common vs. unique components for the system. The ACD systems provider is responsible for the common component DDT&E and the element developer is responsible for the element unique components DDT&E, subject to ACD requirements and constraints. (Since this process is iterative, and will continue in phase C/D, the Work Packages and Level A' PSC (program support contractor) are required to set up a process that will effectively accommodate a common-to-unique, unique-to-common classification change for system components. For C/D proposal purposes, ACDs shall depict maximum commonality with "zero-based unique" element components. Subsequent identification and assignment of element unique components will occur post-contract award and prior to PDR per the process described above.) The ACD, system architecture and classification of the system components will be baselined and controlled by Level A'.

F. Support to the element developer as required to aid in the installation and integration of the system components into the elements.

The Man Systems development for the Habitation and Laboratory module is a special case, and will be developed and managed by the process defined in the Man Systems MOU which has been jointly baselined by the MSFC, JSC and the office of the AA for Space Station.

The User Servicing ACD and the Station Assembly/External Maintenance ACD agent (assigned as above) have the additional responsibility to work with the program's Canadian International Partner, iterating with Canada on requirements, design and implementation in order to arrive at an integrated solution to the end-to-end system utilizing the resulting U.S. and Canadian supplied elements in an appropriate complementary fashion.

(2.2) SYSTEM USER RESPONSIBILITY: The element developers as users of the above systems have a responsibility to the program as follows:

A. For the above systems, the element developers have a responsibility to conform to the ACD architectural baseline and to utilize ACD common components. To arrive at a baseline understanding of "practical commonality", the element user has a

responsibility to iterate with the system provider and Level A' to arrive at a program baseline for common and unique components during the remainder of phase B and early phase C/D of the program. (For C/D proposal purposes, the ACDs shall depict zero-based-unique element components for the above end-to-end systems except for TCS and C&T. For TCS and C&T systems the proposal strategy should assume "no commonality" between inside and outside and thus WP1 and WP2 should request the bidders to respond accordingly. Actual TCS and C&T inside/outside commonality will be determined in phase C/D according to the above note.)

B. The element users of the system shall establish and provide the detailed requirements (design, performance and verification, including element, unique system-to-system and unique system-to-element requirements) for the system within the element to support the continued ACD architectural development for the system, and support an iterative process with the system provider and Level A' to arrive at a mature program baseline for both the system and elements.

C. Following determination of common and element unique components (approximately PDR time frame), perform the DDT&E on all element unique systems hardware and DDT&E of systems installation hardware.

D. Perform design integration, installation and element-level checkout of all the systems components within the element.

(2.3) LEVEL A' SYSTEMS ACD RESPONSIBILITY: Level A' has the responsibility to define and provide the Station level requirements and functional partitioning, as top level drivers to the ACD (and element) agents for further detailing and implementation by the systems and element agents as described in the above process. In this capacity Level A' has the responsibility to provide the requirements, functional partitioning and resource allocations to the systems and element levels. Level A' has the responsibility to iterate with the system and element agents, performing interface analysis and providing direction and technical guidance where appropriate, on system-to-system and system-to-element interfaces and to baseline and control the resulting ACD's. and to perform independent assessements as necessary to affect and technically manage the overall process.

(3.0) SPACE STATION ELEMENT RESPONSIBILITY

Responsibility for each element of the Space Station Program is assigned as follows:

Truss Element	WP2	LCD Common Module	N/A

Power Modules	WP4	Platforms	WP3
Att Payload Accom (includes Gimbals)	WP3	*Resource Nodes	WP2
		Airlock	WP2
Servicing Facility	WP3	Hab Module	WP1
Telerobotic Servicer	WP3	Lab Module	WP1
MSS Mobile Base	WP2	Log Module(s)	WP1
Propulsion Element	WP2		
Logistics Elements	WP1		

*Unused volume to be held as Program Reserve

The work package which is responsible for a given element is responsible for the following:

A. Design of the element in accordance with the element requirements and conceptual design information in the PDRD's, ACD's and Baseline Configuration Document (BCD) and Element/Element Interface Requirements (IRDs and ICD's)

B. Design, Development, Test, and Engineering/Evaluation of all element-unique equipment (called "Outfitting" in the Phase B RFP) subject to the following restrictions:

- o The Johnson Space Center will provide Technical Direction and Contract Direction (TD/CD) concerning the Man Systems for the Habitat and Lab Module via an Exhibit in the Work Package 1 Contract (process and equipment specified in JSC/MSFC MOU)

- o The Marshall Space Flight Center will provide Technical Direction and Contract Direction (TD/CD) concerning the propulsion system Hydrogen/Oxygen thruster via an Exhibit in the Work Package 2 Contract (equipment and process specified in JSC/MSFC MOU)

C. Production of all element-unique equipment

D. Production of the element structure with the exception of the Resource Node structure (pressure shell) which will be provided by Work Package 1. Node Structure requirements/specifications will be developed by WP2 and provided to WP1.

E. Design of the installation of all system components in the element in accordance with the instructions and constraints in the System Architectural Control Documents and Element/Element Interface Control Documents

F. Development of all required utility runs (cables, lines, pipes, etc.)

G. All "installation hardware" (brackets, mountings, and so forth)

H. Installation of all system components and element-unique equipment in the element

I. Verification of the finished element

(4.0) SPACE STATION SOFTWARE RESPONSIBILITIES

Software responsibility is dispositioned as follows:

A. The applications software for a given system will be designed, developed, produced, and verified by the System Architect in accordance with all requirements detailed in the System Architectural Control Document (ACD).

B. The applications software for each system will handle the functional control of the system components provided by the systems agent.

C. Element-unique software is the responsibility of the element developer.

D. All software (systems and application) is subject to the same commonality considerations as hardware. Where practical the approach to software functionality and design (i.e., building blocks, etc.) will be optimized to support multi-use across the elements and systems. Software commonality will be defined and controlled by the ACD and Program commonality processes.

E. All DMS Systems Level Software (OS, NOS, DBMS, and UIL) is the responsibility of the Data Management System architect (WP2) and shall be common to all elements.

F. The SSE and Software integration function is the responsibility of Level A'.

G. The Station Operations Management Software is defined as part of the Data Management System and, as such, is assigned to the Data Management System architect (WP2) for definition and development regardless of the elements in which it is resident. The Operations Management System's function is to provide accommodations to manage the Space Station systems, resource planning, scheduling, and station operations. The element and systems providers have a responsibility to iterate with the DMS agent (and Level A') to effect a definition of the systems/element operations and OMS software implementation. The elements/systems agents also have a development responsibility to provide any resulting unique local system/element OMS which will function as a part of the DMS-provided total Space Station OMS.

(5.0) MANNED-CORE SPACE STATION RESPONSIBILITY HIERARCHY

Responsibility for the manned-core Space Station is dispositioned as follows:

- o Level A′ is responsible for the overall performance of the Space Station.
- o The System Architect is responsible for the design and functioning of ACD system components throughout the life of the Space Station.
- o The Element Architect is responsible for the design and functioning of element-supplied equipment throughout the life of the Space Station.
- o The Element Architect is responsible for the installation of all of the ACD system components and element-unique equipment within the element and for the integrated performance of the element.

(6.0) SPACE STATION PLATFORMS RESPONSIBILITY

Level A′ has overall responsibility for the top level definition and performance requirements for the platforms and delegates to WP-3 the detailed Systems Engineering and architecture responsibility for platforms, platform systems and operational software. In concert with the Space Station objectives to reduce both initial and life cycle costs, the platform designer should design the platforms and platform systems such that the maximum practical level of commonality is achieved between the platforms and core Space Station (or other programs).

To achieve that end, WP 3 is responsible to insure that the appropriate commonality analyses are conducted and that the components selected to be common meet the performance requirements of the platform. WP 3 is also responsible to iterate with the core station systems ACD agent who also has a responsibility to conduct commonality assessments based on the total set of requirements (station and platform) for the program. This iterative jointly supported process (element and system agent) should be conducted for the balance of phase B as well as continue into phase C/D, and at the appropriate time in the program a mature configuration for commonality will be baselined in the program. After that point, the respective element and systems agent responsibilities will be as described in section 2 and 3 above.

Joint commonality analysis responsibility is assigned as follows:

DISTRIBUTED SYSTEM	WORK PACKAGE RESPONSIBILITY
Electric Power System	WP4/WP3
DMS	WP2/WP3
Thermal Control System	WP2/WP3
C&T	WP2/WP3

Specifically, the platform developer is responsible for the following:

A. Commonality analysis in conjunction with the distributed systems architect to the point in time of a mature baseline

B. Design of the installation of all common components on the platforms in accordance with the instructions and constraints provided by the systems designers

C. Development of all required utility runs

D. All "installation hardware" (brackets, mountings, and so forth)

E. Installation of all system components on the platforms

F. Design, Development, Test, and Engineering/Evaluation of all platform-unique equipment

G. Production of all platform-unique equipment

H. Verification of the finished platforms

(7.0) ADDITIONAL DISPOSITIONS

Additional dispositions are as follows:

(1) Standard equipment racks for pressurized elements: Based on the SSCB definition of standardized racks, WP1 is assigned the responsibility to be the provider of the standard equipment racks (structure only) for use in the pressurized elements of the Space Station. Systems and element agents (and users) as part of outfitting the standard rack must conform to a requirement that all non-anthropomorphic components and equipment are to be designed to fit into these standard equipment racks according to Space Station Program standards. Deviations to this commonality rule will be granted only on a case-by-case basis.

(2) Mechanisms and gimbals are element-supplied equipment unless otherwise specified.

(3) Hab and Lab module-to-node and node-to-airlock berthing equipment is assigned to WP1.

(4) Devices for attaching the pressurized elements to the truss element are the responsibility of WP2.

(5) Space Station-to-NSTS and logistics-to-Station docking and berthing is assigned to WP2 as well as proximity operations provisions for STS, free flyers and OMV.

(6) The power system gimbals are assigned as follows. The Alpha Gimbals responsibility to WP2 and the Beta Gimbals responsibility to WP4. Boom truss structure outboard of the Alpha Gimbal and gimbal transition structure will be developed and supplied by WP2.

(7) Power Module Thermal System: The radiators which are an integral part of the Solar Dynamic System are considered to be part of the Electric Power System and, as such, are the responsibility of WP4. Common Thermal components in the Power Module which are there for the purpose of heat rejection and temperature control of Power Module equipment (excluding the radiators which are part of the Solar Dynamic System above) are considered to be part of the Thermal Control System and, as such, are the responsibility of WP2.

(8) Unpressurized Attached Payload Accommodations Pointing Systems: The attached payload accommodations designer (WP3) is assigned the responsibility for the attached payload accommodations pointing systems with the constraint that commonality with other systems will be maintained to the maximum extent practical. Exceptions to commonality will be granted by SSCB approval only on a case-by-case basis.

(9) Refueling and berthing hardware for the OMV is dispositioned to be part of the Free Flyer refueling responsibility and, as such, is assigned to WP3. OMV refueling is a post-IOC phased capability.

(10) Telerobotic Servicer: the telerobotic servicer (FTS) is assigned to WP3 as part of the responsibility of the Free Flyer/Satellite Servicing function.

(11) Refrigerators and freezers are assigned to WP1 with the assumption that these items will be a common design to the Hab, Lab, and Logistics Elements even though specific sizing requirements may require customized configurations for each application.

(12) ECLSS/EVA System: the overlap between ECLSS and EVA support is dispositioned with the ground rule that equipment required for EVA support is the responsibility of WP2. EVA support is defined as that equipment which would not be there if EVA support were not a requirement. The EVA System shall make use of other work packages' existing systems and resources to the maximum extent practical. In addition, commonality shall be analyzed and maintained, with exceptions granted only on a case-by-case basis.

(13) GSE: It is a Program goal to maximize "common GSE" usage between and across Work Package centers and the launch site(s) for development, verification, and launch site processing. In general, Work Package centers will provide Work Package unique GSE for development, verification and factory checkout. KSC will provide launch site facilities and GSE for launch site processing. Commonality can occur either by Work Package centers providing factory GSE to the launch site, or by KSC providing launch site GSE for factory checkout. In selection of the proper agent to provide "common GSE", center expertise and experience as well as cost to the program will be considered. Selection of the proper source or agent will be determined by the Level A' GSE management integration function responsible for overall program GSE management. KSC is also assigned the responsibility to provide flight hardware "element level" transportation equipment for the program, including work package to launch site transit and between Work Packages.

(14) Launch Site Processing: KSC is assigned responsibility to for launch site processing at both KSC and VAFB. The Payload Ground Operations Contractor (PGOC) will be the launch site hands-on processing contractor. Work Package development Center and contractor engineering personnel will be resident at the launch site to make development engineering decisions required by out-of-spec conditions. In the event that initial IACO-type activities takes place at the launch site vs. equipment arriving in a factory accepted condition, such activity would be conducted by the development contractor with PGOC in a supporting/host role.

(15) FSE/OSE: The program groundrule is to utilize common FSE and OSE where practical in the Space Station Program. Consistent with the responsibilities for the ACD for on-orbit assembly and maintenance, WP-2 is assigned the responsibility of common FSE/OSE. Element unique FSE/OSE will be the responsibility of the element supplier. Scope and common vs. unique will be determined as a part of phase C/D.

(16) Space Station onboard Command and Control accommodations, functions, and related equipment are assigned as follows: Overall Space Station and system-level command and control hardware and

software is assigned to WP-2, with any element-unique command and control software and hardware required for the local operation of an element assigned to the element supplier. WP-2 has the responsibility for the overall command and control architecture (as part of the DMS ACD) to assure a consistent overall approach to command and control, as well as the responsibility for the functional commonality analysis and the development of common hardware and software.

(17) Fluids system: Level A' has the responsibility for the integrated fluids system definition and analysis. The elements and systems Work Package agents have a responsibility to maintain the element and systems definition consistent with the overall program definition and configuration of the fluids systems architecture and commonality definition.

(18) Hatches - Hatch DDT&E and production is initially assigned to the Work Package responsible for developing the pressurized structure. Commonality analysis will be performed in phase C/D for all hatches, and if deemed common across Work Packages, development responsibility for the common hatches will be assigned as part of that commonality decision in phase C/D.

ARTICLE L-25 GENERAL INSTRUCTIONS FOR PROPOSAL PREPARATION

A. INTRODUCTION

It is NASA's intent, by providing the instructions set forth below, to solicit information that will demonstrate the offeror's competence to successfully complete the requirements specified in the SOW and contract schedule and to permit a competitive evaluation of each offeror's proposal.

B. GENERAL

Generally, the proposal should --

1. Demonstrate understanding of the overall and specific requirements of the proposed contract;

2. Convey the company's capabilities for transforming understanding into accomplishment; and

3. Present plans, methods and estimated costs for performing the contract.

The contractor selected as a result of this RFP will be responsible for all contract requirements. The Government will

look to one entity for the responsibility of management and performance of the contract. In the event teaming arrangements are proposed for accomplishing the prescribed work, the organizational relationships of the team members throughout the expected contract duration should be explained, including the proposed contributions of each team member to the overall effort. The offeror shall complete all applicable representations, certifications, and other statements of offerors, in Section K of this RFP and submit them with the Other Factors Proposal.

In order to minimize redundancy in the proposal, the offeror may reference another volume or section in the proposal rather than copy the information in both locations; however, consistency in the logical flow of the subject matter should be maintained.

Areas that represent significant risks or concern to the offeror should be cited clearly and concisely in the appropriate section. The offeror should discuss the proposed approach to solutions of concern or risks in sufficient detail to substantiate the approach.