

**NASA SPACE OPERATIONS MANAGEMENT OFFICE -- AN AGENCY WIDE APPROACH  
TO REDUCE OPERATIONS COSTS.**

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**Abstract**

NASA has recently changed the operations management processes, transitioning from a discipline and NASA center-based approach to an agency wide approach. Each NASA center over the last 30 years has developed operational approaches and capabilities that have some degree of duplicity and overlap. The newly created Space Operations Management office located at the Johnson Space Center and headed by the NASA Director of Space Operations. This new organization will minimize the duplicity and overlap of functions thus enabling more cost effective mission operations by providing common services to the NASA programs.

Space operations Management is performed in a distributed fashion and place more involvement and responsibility on a contractor than in the past. A single space operations contractor for NASA will be selected as opposed to many contracts with tens of contractors. This contractor will be selected and in place during, fiscal year 1998. The contract will be a service contract and be performance based,

The Space Operations Management Office Organizations will be described along with the responsibilities assigned to this office. The roles for the government and for the contractor will be discussed,

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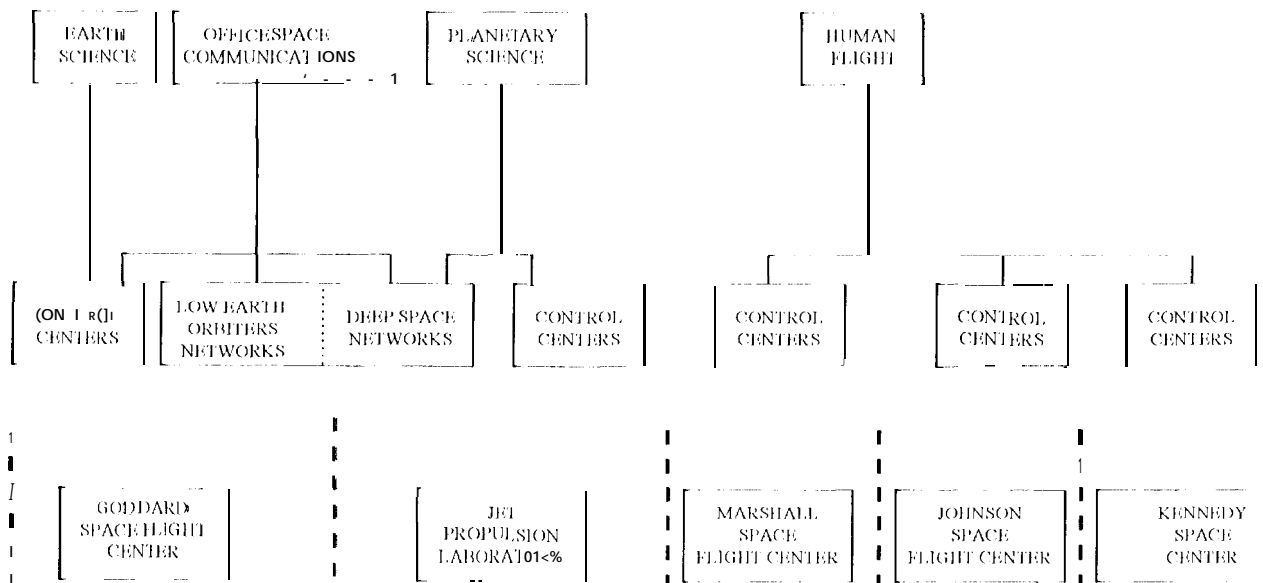
This paper will describe the changes, approach and anticipated benefits of this new approach to operations.

### Background

Organizations and organizational processes are often based on history and past experiences. NASA is no exception. The operational organizations and processes pertaining to operations have not significantly changed during the past 20 years. The introduction of new technology and the development of capability in the commercial sector has not altered NASA's basic approach to operations. This paper describes the NASA operations organization and processes that have recently been put in place. To understand the significance, a few words describing the attributes of the NASA operations

processes and organization that preceded the current approach are necessary.

There has been an alignment between NASA Headquarters and the NASA Centers / Jet Propulsion Laboratory (JPL) which resulted in a Center performing operational functions for primarily one NASA Headquarters office or Discipline. Thus the Office of Space Science that includes the planetary program watches over JPL, the Office of Space Flight watches over both Johnson and Marshall and the Office of Mission to Planet watches over Goddard. The Office of Space Communications funds the Deep Space Network at JPL, the Low Earth Networks at Goddard and the Wide Area Networks at Marshall. In addition the Office of Space Communications funds the Mission Control Centers and capabilities at Goddard while the Office of Space Science funds the same capabilities for planetary exploration at JPL.



**Figure 1 Alignment Between NASA Headquarters and Centers**

These alignments have resulted in similar capabilities being developed and operated at different centers. The very nature of the organizational approach did not foster NASA wide solutions to common

problems. These alignments have resulted in each center having one or more contracts to support the development, sustaining and operations of capabilities to support the NASA missions. This organizational alignment is shown in

Figure 1 NASA Centers, except for Kennedy Space Center are all called Space Flight Centers, indicating a stand alone capability. This is indeed how they were established in the early days of NASA when space flight was not common, nor done commercially.

Each of the four centers is staffed with a combination of Government Employees (Civil Servants) or JPL staff and contractors. Some of the contractors have contracts at more than one center, and in some cases due to center internal organizations, more than one contract at the same center. In 1995 several of the contractors approached NASA and suggested that by consolidating contracts, and changing the contracting approach from support contracts to performance based task contracts, that savings approaching significant savings could be realized. These savings can assist in meeting the budget reduction goals that NASA has accepted in responding to a balanced national budget, and at the same time, attempting to maintain an aggressive space program,

While this discussion was taking place, an Agency wide review had been held by a board of experts both inside and outside NASA. This Board was called the Zero Based Review (ZBR). This review made recommendations relative to reducing the overlap between centers, reducing the size of the agency and focusing the role of each center. The primary recommendation relative to NASA operations was that the Civil Service and JPL staff should not be involved in routine operations. Another recommendation was that the Johnson Space Center (JSC) be designated the lead center for NASA Space Operations. These events;

- => the contractor suggestion that significant savings could be realized by combining, contracts and changing the contract types

- => Phasing Civil Service and JPL staff out of routine operations.
  - => JSC being designated the lead center
- led to NASA assigning to JSC the task of leading a study to evaluate the feasibility of implementing the contractor's suggestions.

#### Study Process And Recommendation

A team composed of members from each of the NASA Centers involved in operations and JPL was formed. This team confirmed that savings could be achieved by consolidating contracts, however, no specific amount of savings could be estimated. The contractors initial suggestion of significant savings, did not specify a baseline to which the savings would be applied. During the same time period, each of the centers had been going through replanning exercises to reduce staff and costs at the centers. NASA operations related budgets were undergoing significant reductions. In many cases, the reductions in out year funding were accepted with only a general plan or approach defined that enabled the operations functions could be performed for the agreed upon budgets.

The team soon found that they could discuss operations in a way that each independent member understood. Common terms were defined as each described what operations and development functions were performed at each center. The team soon understood that there were:

- => Obvious areas of duplication between centers.
  - => Many common approaches
- Several areas where each of the centers was undergoing transitions from mainframe based systems to work station based systems.

The team built up trust in each other, and became convinced that there was some merit in forming a common approach to operations across NASA. Thus, in a few short months, a group of about 15 individuals from GSFC, JPL, JSC and MSFC formed what was to become the nucleus of a new NASA Operations Organization.

The teams' report to the NASA Administrator recommended that:

1. A full time transition team should be established under the leadership of an acting Space Operations Functional Manager. This transition team was challenged to develop methods of streamlining and consolidating operations services across the agency and transition operational functions to private industry wherever appropriate.
2. An implementation team should be established to initiate commercialization of the Wide Area Networks,

#### The Space Operations Management Office

The recommendations made in the study phase resulted in NASA defining a new agency function to oversee and manage all operations activities. (This agency function is the first agency function to be moved from NASA Headquarters in Washington D.C. to a NASA field center.) The Johnson Space Center (JSC) was designated as the space operations lead center. The Space Operations Management Office is the Functional manager for space operations and for space operations facilities and systems that include:

- » World wide space networks
- » Mission and network control facilities

- » Mission control facilities
- » Data processing and planning Systems
- » Telecommunications Systems.

The major near term task for this new organization is to consolidate all of the existing operations contracts at JPL, GSFC, JSC and MSFC relating to robotics and facility operations, into a single Consolidated Space operations Contract (CSOC). In addition, SOMO is required to advise the Headquarters Offices that fund NASA Operations on the acquisition of new space Operations facilities and systems. The JSC approval is required on all major operations related acquisitions.

Guidance to the SOMO is provided by a NASA operations council. This council is chaired by the Associate Deputy Administrator (technical), who reports to the NASA Administrator. The membership of the council is composed of the

- » Five NASA Headquarters Office Associate Administrators,
- » Chief information officer
- » Director, space operations

Starting in September 1997 projects and SOMO will agree on the services and the price for these services that will be provided by SOMO to the project. These agreements are called Project Service Level Agreements. This is a significant change from the current process of providing the services at no cost to the project. The NASA Headquarters Offices will allocate funding for time services to the Director, Space Operations.

#### The Organization

The distributed Space Operations Management Office organization is shown below. The three boxes above the

horizontal line are the functions that are performed by staff members assigned to JSC. Those boxes below the horizontal line are responsive to the SOMO staff but

remain at the Centers and assigned to the centers as shown by the vertical alignments.

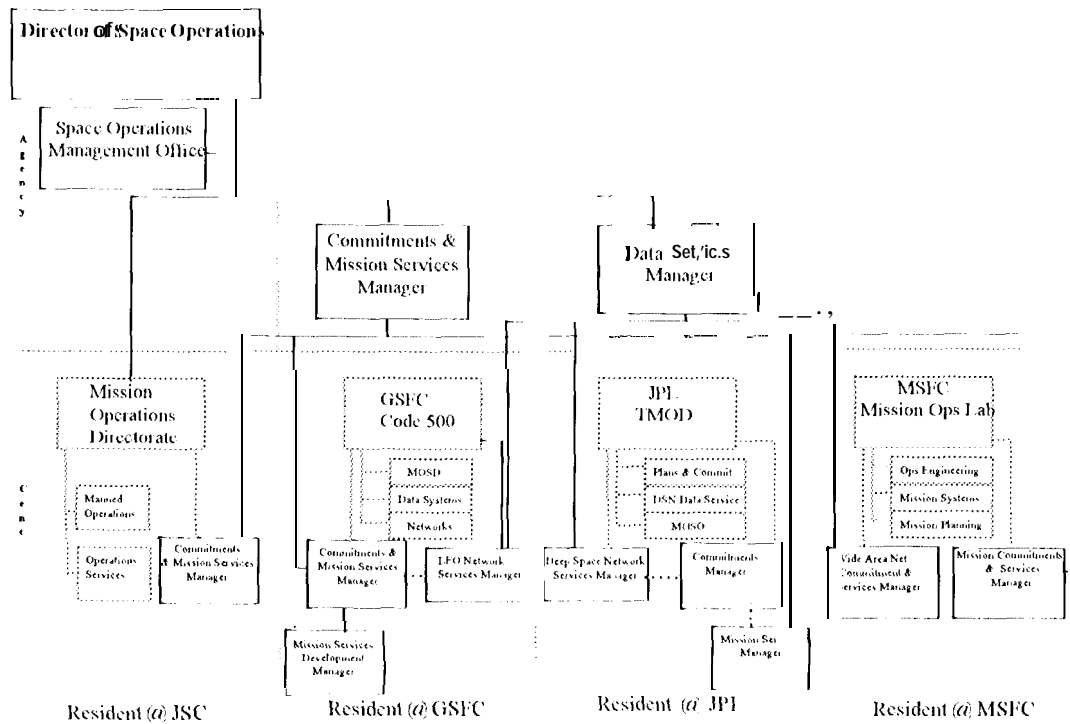


Figure 2

The SOMO staff reporting to JSC have three primary responsibilities.

The Space operations Management Office is responsible for the system engineering of the NASA Operations assets, and the management of the Consolidated Operations Contract (CSOC). This contractor will support each of the four centers and thus one entity will have the visibility of common processes that take place at each of the centers. It is through the combination of the SOMO organization looking across the centers and the CSOC looking across the centers that NASA will change the approach to operations within the Agency,

The Commitments and Mission Services Manager is responsible for the process that results in one or more commitments being made between SOMO and a space project. These commitments will define the total set of services that are to be provided by SOMO to the project. These services include both Mission Services -- value added processing to spacecraft, payload or radiometric data, and Data Services, the delivery of data transmitted between space vehicle and a control center or a user location. The characteristics of these services such as quantity, quality, continuity and latency are specified along with the cost for these services. The added dimension of providing in a commitment document the charge for providing these services is new to the Agency. In the past, many of these

services have been provided to a project "free." The services were funded under a separate budget by the Office of Space Communications. This budget was to provide "necessary services" to the flight projects. As with any commodity, the projects tended to use the "free service" to lower the costs that projects were responsible for such as the design and development of the spacecraft and payload. The Commitments and Data Services Manager (C&MSM) is also responsible for the design, development, sustaining and operation of the Mission Services that include control centers, orbit determination, scheduling, sequencing and planning systems and data processing. Again, for the first time NASA has created a position that looks at these services across the agency as opposed to a center view of these processes.

The Data Services Manager (DSM) is responsible for the reception and delivery of data transmitted from a spacecraft to a control center or a user location. Assets which NASA has for these services include the Deep Space Network (DSN), the Low Earth Orbit (LEO) networks, Data Relay Satellite System (TDRSS) and the Ground Network and the Wide Area Networks. Together these networks receive data from satellites, transmit commands and information to the satellites (DSN and LEO Networks) and deliver the data between the control center or user and the tracking assets (WAN). The Ground Network is used primarily to receive high rate science data (10 to 100's of megabits per second) from LEO satellites. In most cases these LEO satellites use the TDRSS for TT&C.

Both the DSM and the C&MSM have individuals at each of the centers reporting to them. It is this 'team' that will be changing the NASA approach to operations.

The Space operations Management Organization then has the following attributes

1. Johnson Space Center has been delegated the lead center for operations.
2. The Space operations Management Office, at JSC, has been established to administer this responsibility.
3. The office utilizes the expertise of individuals and organizations located at the Centers, it will not become a centralized office that performs all operation functions at Johnson.
4. This organization chart shows this relationship of the center roles with respect to the SOMO.
5. The functions performed by the Headquarters Office of Space Communications will, in a large measure, be re-assigned to GSFC, MSFC, JSC and JPL.
6. The SOMO will be involved in the approving:
  - => New development initiatives
  - = ? The review and approval of new customer agreements
  - = ? The NASA operations architecture
7. The execution of space mission operations will remain the responsibility of the NASA Program and Project Offices. Thus the SOMO will provide services to a project like HST 01- Cassini, but the project will be responsible for the execution and the conduct of the mission.
8. All new operations facilities and capabilities will be reviewed and concurred with by the SOMO. If a capability is needed at JPL, and resources exist at GSFC, then SOMO will recommend to the requesting Headquarters Office that the existing capability be utilized.

### Six Components of the New Approach

For this new concept to work, SOMO must work with the NASA 1 headquarters offices - SOMO is not empowered to dictate what the Offices do in the area of operations. 'T'bus, the Director of Space Operations dots not report to a single NASA Office. The DSO reports to a Space Operations Council.

This Council is chaired by the Assistant Administrator - Technical and is composed of the 5 NASA office Administrators involved with space operations, the NASA Chief Information officer and the DSO. If a NASA 1 headquarters Office wants to support the creation of a new capability or wants to select a costly way of achieving requirements, these recommendations will have to be justified to his peers. It is no longer a unilateral decision.

The second component of the new approach is for the centers and JPL to work together, to identify redundancy and overlap and eliminate duplicative implementations. For example the expertise for the trajectory design and deep space communications, resides at JPL. When NASA sends humans to Mars JSC will rely on this expertise and JPL will be an integral part of this initiative when it takes place. The centers will be changing from inward looking, to looking across NASA, Why does each Center have a scheduling system? Which is the best? Can they be combined? If NASA needs two scheduling systems, SOMO will be able to articulate why there are two. I have seen these types of changes take place during the last year, and predict that in today's budget environment it will continue.

The third component of the new approach is the extensive use of contractors, to provide these operational services. NASA is moving away from the use of Civil Service and JPL staff for the routine provision of operational services. SOMO

is in the process of writing an RFP for what is termed a Consolidated Space Operations Contractor (CSOC). NASA currently has on the order of a dozen or more contractors, at the four Centers, that provide operational support to the centers. Often, a center holds several different contracts, some with the same contractor. The CSOC will be an agency wide contract, that will support Goddard, JPL, Marshall and Johnson. The contract will be administered by Johnson, but each center will have the ability for technical direction and performance assessment. In simple terms SOMO is replacing a dozen or so unique contracts, and the associated RFP generation, SEB selection and Contract Management, with a single RFP, SEB and Contract Administration Process. The Civil Servant and JPL staff will "disengage" from the direction of this contractor. A performance based contract will be issued, where the government will state what is to be done, but not state how to do it. The contractor will be evaluated and rewarded for how well the "what's" are accomplished and for being cost efficient.

The fourth component provides the contractor with incentives to commercialize functions wherever possible. Thus the contractor -- and thus NASA -- is a procurer of commercial services, not the owner of government networks and facilities, where there is commercial viability. An example of this use of commercialized services is the plan to move away from the Government Owned, Government Operated NASCOM network. NASA will transition to an IP network, provided by one or more commercial carriers, enabled through what is called FTS 2000. This transition should be complete by October of 1997. Another example is that SOMO is looking at commercializing the LEO Ground Network and procuring ground network capabilities from industry.

The fifth component is the plan to enter into full cost accounting. This means that a project will have to pay for the services that it requires and negotiates. In the world of operations, this means that SOMO will charge flight projects and programs for tracking time, for the providing of multi-mission services, for the building of control centers, etc. Thus it will finally be possible to make engineering and management decisions, based on life cycle costs. One can determine if it is cost effective to put an on-board solid state recorder onto a spacecraft, rather than require continuous tracking to recover the scientific data. Today, since tracking resources are free to the project, projects often reduce the spacecraft costs by placing significant and costly requirements on the DSN, S/N or GN assets of NASA. Examples of recent spacecraft that have elected to have no on-board storage, thus requiring continuous or nearly continuous tracking are:

- = > A Discovery Class Project called Lunar Prospector
- = > An ESA project, the Infrared Space Observatory (ISO).

The sixth component enables the Space Operations Management Office, to have a voice in the selection of new missions. SOMO will evaluate and provide comments to the NASA Headquarters Offices relative to the operations statements in an Announcement of Opportunity. Then a similar function in providing comments regarding the operability of proposals to responding to the RFP. The intent of this support, is to assist them in knowing, prior to selection, potential cost drivers in the operations area. Thus operations will be evaluated just as scientists evaluate the scientific merit of the proposal, and spacecraft designers, evaluate the feasibility of the technical design of the proposal,

What role will SOMO have with standards? The ability to lower costs of operations is dependent on establishing a suite of standard services that projects can use. The ability to have standard methods of communications, the ability to have standard ways of obtaining cross support are all important for the cost reduction and efficiency goals to be met. The work that the CCSDS and ISO S(113) are doing is essential to our long term success, and SOMO strongly supports these activities. The standards work comes under the purview of the NASA Data Services Manager, and the programmatic responsibility for these activities, across the agency, has been assigned to JPL. This is a specific example of a function moving, from the NASA Headquarters Office of Space Communications to a Center.

#### The Future

Funding for Space Science will continue to be under extreme pressure in the face of high priority national goals such as balancing the budget, providing health care for our retiring individuals, and reducing taxes. The task of restructuring our approach to operations is crucial to enabling a continued aggressive space program. NASA must become more efficient, lower the costs of operations and concentrate our civil service staff on research and development. Through these efforts, NASA will enable more cost effective approaches to exploring the universe while turning over the routine operations to industry.

our challenge is to do this in a way that maintains our current support to flight projects, while changing NASA's approach to Space Operations. Through these efforts NASA will enable new missions to explore the Universe.