

① CW/IN/81
2002 077 507

2001 NASA/ASEE SUMMER FACULTY FELLOWSHIP PROGRAM

**JOHN F. KENNEDY SPACE CENTER
UNIVERSITY OF CENTRAL FLORIDA**

GUIDELINES FOR PROJECT MANAGEMENT

David Ben-Arieh
Associate Professor
Department of Industrial & Manufacturing Systems Engineering
Kansas State University

And
Kim Jenkins
Process Management Division

ABSTRACT

Project management is an important part of the professional activities at Kennedy Space Center (KSC). Project management is the means by which many of the operations at KSC take shape. Moreover, projects at KSC are implemented in a variety of ways in different organizations. The official guidelines for project management are provided by NASA headquarters and are quite general.

The project reported herein deals with developing practical and detailed project management guidelines in support of the project managers. This report summarizes the current project management effort in the Process Management Division and presents a new modeling approach of project management developed by the author. The report also presents the Project Management Guidelines developed during the summer.

GUIDELINES FOR PROJECT MANAGEMENT

David Ben-Arieh

1. Introduction

Kennedy Space Center has developed the mission of being the Spaceport Center of the nation. As such it is the recognized authority within NASA on Spaceport technologies, which include all the technologies required to prepare and launch space vehicles.

Many of the operations with a focus on Spaceport technologies are project oriented. These operations include developing the ground facilities and infrastructure, and maintaining, modifying, loading and launching the space vehicles. Many of these activities are project oriented in the sense that they are one-time improvement projects, consisting of many activities with a definite start time and due date, and a given budget.

Thus project management becomes a crucial skill in KSC professional activities, essential for on time and on budget delivery of quality projects.

Agency wide guidelines for project management are available in the form of a NASA Procedures and Guidelines (NPG) document developed at the headquarter level. As such it is a high level document covering the broad concept of project and program management within NASA. The document does not provide detailed, implementation-oriented guidelines that can assist the project managers in their task. Thus, this summer project intends to satisfy the need for detailed project management guidelines.

This report presents the current methodology developed in the Process Management Division and then present the author's approach towards modeling the project Management Process and the guidelines developed for that process.

2. Current Modeling Approach

The current modeling approach developed by Kim Jenkins represent the Project Management activities as a process. This process is defined and supported by several NASA documents including the following (the nature and types of NASA documentation is not discussed in this report):

KDP-KSC-P-2754

KDP-KSC-P-2600

KDP-KSC-P-2603

NPG 7120.5A

KDP-KSC-M-1000 (Business Management System Manual)

KSC-SMO Operational Plan (Draft)

KMI 8070.6 (KSC Technical Specs and Standards Manual).

Executive Order EO12862 (Setting Customer Service Standards)

An example for the modeling approach is presented in Figure 1 below. This Figure describes the process of Project Formulation as defined by NPG 7120.5.

Note 11:
Define high level objectives & constraints:
 Identify project objectives
 Defines budget, time and resource constraints
 Define milestones
 Define evaluation metrics

Note: 1
 KSC PMC
 -Assess KSC managed project planning and implementation
 -Provides oversight and direction for projects that are greater than \$5M, high visibility, high risk, and strategic importance
 Line Organization PMC
 -Assess project planning and implementation, provides oversight and direction for projects within the organization that are less than \$5M and strategic importance

Note 12:
 Define work allocation to internal and external resources.
 Define resource profile
 Develop activity precedence
 Develop high level cost profile

Note 2:
 Project Updates include:
 -Budget Modifications
 -Schedule changes
 -Requirement changes
 -New Requirements

Note 13:
 Develop a detailed plan, including detailed milestones, evaluation metrics, inspection points, time management tools, cost management tools, and time/cost tradeoffs.

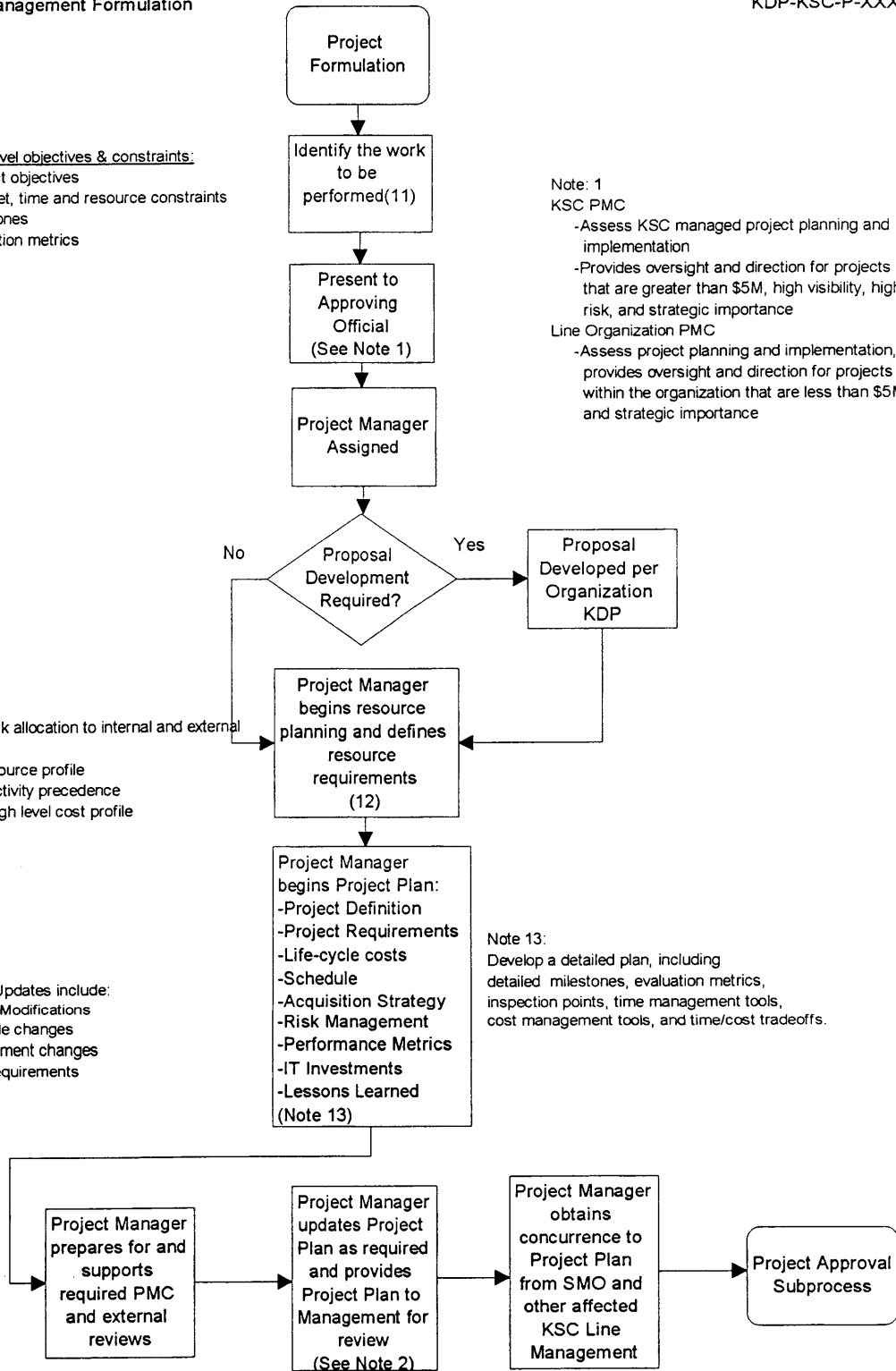


Figure 1: Process Flow Description of the Project Formulation Process

The analysis of the current modeling approach revealed some of its shortcomings in identifying the information required by each activity and the desired output of each such activity. In order to compensate for this handicap, the author with his KSC colleague developed an information based modeling approach for Project Management. This approach is demonstrated in Figure 2.

3. Project Management Guidelines

The next step of this project was to interview project managers within a variety of organizations at KSC, and to try and derive guidelines that are meaningful to the project managers. In order to define these guidelines, the following objectives were identified:

1. Standardization of project planning and management.
By standardization the organization can achieve a uniformly high level of performance, a known set of expectations from project leaders, and a known set of requirements from the support personnel (such as cost estimators, risk analyzers, and forecasters).
2. Capture knowledge from experience project managers.
Some project managers have a vast intangible experience accumulated over many years of practice (with successes as well as failures). This valuable resource can be formulated into the Project Management Guidelines.
3. Provide assistance to project managers.
Many times, project managers are being absorbed by the projects details and may be unable to remove themselves into an objective standpoint. The Project Management Guidelines will help all project managers with all levels of experience to exercise an impartial and professional management of the project. In addition, the guidelines will define a firm set of support activities and documentations that will be prepared by staff functions in support of the project manager.
4. Institutionalize best practices and affect agency culture.
This last objective will help establish highly professional level of performance at NASA. Hopefully, this practice will penetrate all levels and functions of the organization and will improve the overall quality, accountability, and cost and risk management in all avenues of the organization.

The objectives of the Project Management Guidelines led to the development of guidelines for two processes: Project Preparation and Project Planning, but due to space limitations only the Preparation stage is presented in this report. The reader is reminded that the scope of Project Management is much broader, and additional guidelines need to be developed in order to cover the entire process completely. This additional work is planned for the future.

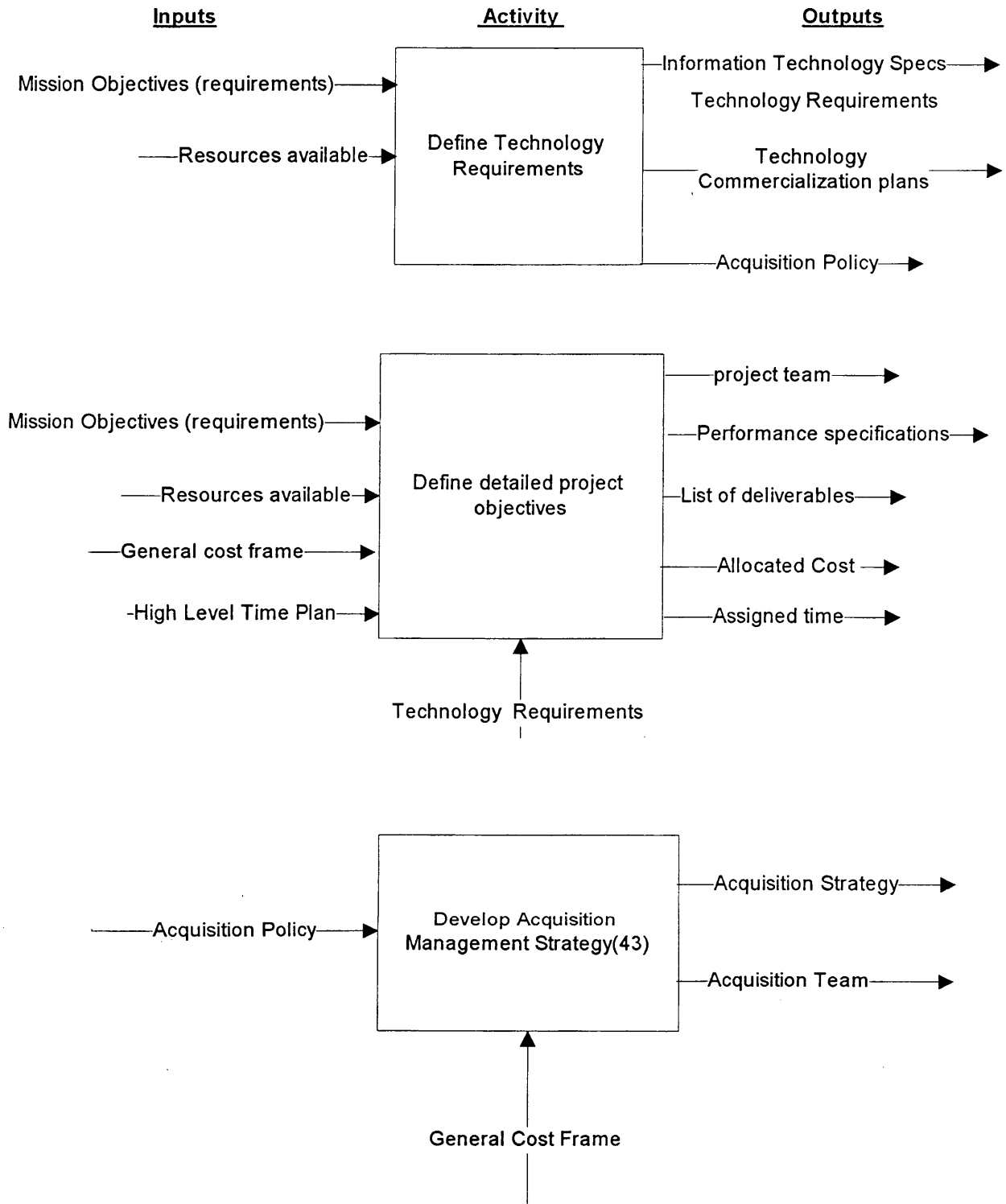


Figure 2: Information Flow Approach to Modeling Project Management

3.1 Guidelines for the Preparatory Stage (Part I of Formulation)

A. Defining Customer Requirements

1. Identify project motivation:
 - Market demand.
 - Business need.
 - Customer request.
 - Technological advance.
 - Legal requirement.
 - Social need. Etc.

2. Identify the customer:
 - The system operators.
 - Maintainers.
 - Sustainers, etc.
 - Resolve *permission* issues.

3. Develop a communication protocol with the customer.
 - Understand who the customer is (the organization, mission, etc.)
 - Develop vocabulary and common terms, units, and modeling approach (if any).

4. Understand the context of the implementation:
 - Define and describe the required behavior and performance.
 - Define the expected project life cycle: *planning, implementation, operation and disposal*.
 - Define the project release mode: *evolutionary, single delivery or incremental delivery*.
 - Identify and manage constraints and assumptions.
 - Identify interfaces with other (existing) systems.
 - Identify existing or planned support systems.
 - For service requirements develop a clear and concise definition.

5. Define high-level requirements and constraints:
 - Review related documentation.
 - Define *essential* and *desired* requirements.
 - Consider *Safety* and *Environmental* issues.
 - Prioritize the requirements.

Methods:

- Interview the customer.
- Create a focus group consisting of customer representatives and project management reps.

Notes:

To minimize requirements changes:

- Document the reqs formally.
 - Develop reqs accountability and traceability.
 - Declare “Time Fences” with customer agreement.
6. Break down the requirements in hierarchical levels.
 - Allow traceability
 - Ensure consistency.
 - Allows complete change impact analysis
 7. Define verification method for each requirement and for the entire project.
 - Interact with requirements when developing the verification methods. Saves time and cost.
 - Organize requirements by verification method. Ensure that all reqs are covered.
 - Communicate with the customer.
 8. Develop evaluation criteria for each requirement.
 - Define the Go/No-Go properties.
 - Defined the desired properties in quantifiable terms (if possible) (this is termed “performance indicators” in 7120.5B (pg. 100)).
 - Define and communicate acceptable and unacceptable levels.
 9. Develop Project Requirements Traceability and Accountability
 - Develop hierarchical breakdown of requirements (from high level to lower levels).
 - Develop a verification plan for these requirements.
 - Identify and manage TBD and TBR requirements.
 10. Develop a Risk Philosophy that will drive the risk management.
 - Identify the risk sources.
 - Identify opportunities.
 11. Develop Project Objectives Document/Agreement (aka "Statement of Work" in NASA) with the customer. Watch for:
 - Mixing tasks, specifications, approvals and special instructions.
 - Imprecise language.
 - No pattern, structure of chronological order.
 - Wide variation of tasks' sizes.
 - Wide variation in how-to description of tasks.
 - Impossible tasks.
 - Missing tasks.
 - Failure to get third party review of customer agreement.

- Client supplied information failure.

12. Develop a candidate physical or logical solution.

Notes:

Requirements mandatory characteristics:

- Needed.
- Verifiable.
- Attainable:
 - Technically.
 - Cost.
 - Schedule.

Other characteristics

- Improve communications:
 - One thought.
 - Concise.
 - Simple.
 - Stated positively.
 - Grammatically correct.
 - Unambiguous – can only be understood one way.

Requirements Should State

- What shall be done.
- Who is responsible: system, software, structure, etc.

All requirements should be accompanied by a rationale:

1. Why is the system needed.
2. What assumptions are made.
3. What design effort is driven by the requirements.
4. Other data that will be needed to maintain the requirement over time.

B. Define the organization that will implement the project

- 1 Choose among the following organization styles: pure support (functional) skill based organization, pure support – product based organization, pure project organization, conventional matrix organization, or compound matrix organization.
- 2 Identify the Management Team.
- 3 Identify support teams (risk, cost, technical assistance, etc.)
- 4 Identify all related offices.
- 5 Identify the main facilities that will be used for the project.

6 Search for partnerships or business opportunities. (7120.5B pg. 42).

C. Identify the project team

1. Define the project manager roles, responsibilities and authority.
2. Select and identify the project team – direct and support staff.
3. Identify and manage the major interfaces and inter-relationships.
4. Develop a common code of conduct.
 - 4.1. Responsibilities, authorities, reporting, behavior, expectations, etc.
 - 4.2. Plan shared reward for project teams.

Tools:

- Task/Responsibility Matrix or Task-Responsibility Identification (cross of org. chart and WBS)
- Linear Responsibility Chart (Matrix of position/titles/people vs. activities – show degree of authority, responsibility, etc).

4. CONCLUSIONS

Project management is an essential part of NASA in general and KSC in particular. Currently, project managers get little assistance from agency documentation, and there are no center-wide recommended practices for project management. This project complemented the work performed in the Process Management Division and developed detailed guidelines for the project managers. The guidelines are accompanied by two main recommendations:

1. Modify the NPG 7120.5 recommendation regarding the structure of a project, and break a project life cycle into the following stages: Preparation, Planning, Approval and Implementation. Project "evaluation" should be exercised as project control activities concurrently with all these four stages.
2. Separate Project Management from Program Management as a distinct and different methodology (even though a program can be viewed as a collection of projects). Program Management should consist of a more strategic approach compared to Project Management that is more tactical in nature.

REFERENCES:

1. NASA's Project Management, March 26 –April 6, 2001, APPL course notes, Management Education Center, Wallops Flight Facility, Wallops Island VA.
2. NASA's Advanced Project Management, June 4-Jun 14, 2001, APPL course notes, Management Education Center, Wallops Flight Facility, Wallops Island VA.
3. *Visualizing Project Management, A Model for Business and technical Success*, 2cd Edition, by Forsberg K., Mooz, H., and Cotterman, H., John Wiley & Sons, 2000.