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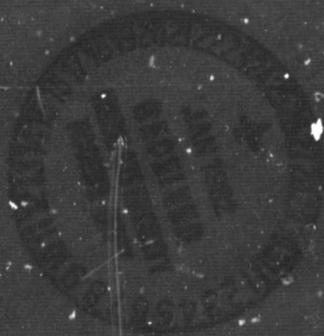
(NASA-TM-84089) PRINCIPLES OF PROJECT  
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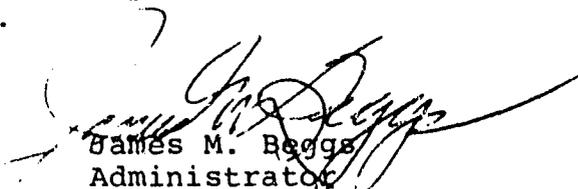
NASA



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FOREWORD

A NASA project is a defined, time-limited activity with clearly established objectives and boundary conditions executed to gain knowledge, create a capability, or provide a service. The basic principles of project management do not change, but it behooves us from time to time to restate these invariants and our adherence to them. I have documented a current version of these principles and am publishing them as my expression of the ground rules and guidelines we should remember as we carry out our research, development, construction, or operational assignments.



James M. Beggs  
Administrator

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## PRINCIPLES OF PROJECT MANAGEMENT

1. NASA welcomes and accepts the high challenge of carrying out projects, expeditiously and at minimum cost, that demand advances in technology.
2. While high risk is inherent in the work done by NASA, every effort will be made to understand and quantify this risk before seeking Office of Management and Budget and Congressional commitment to a project. The desire to obtain project approval or to proceed with project implementation should not be permitted to interfere with the adequate and comprehensive studies and cost analyses necessary to define the risk so as to minimize the potential for cost overruns and schedule slips.
3. The Project Manager is the key individual charged with project execution. After project approval, he or she will have authority and responsibility for all project decisions and will make all recommendations to the management structure required for higher level decisions.
4. The life of a project extends from the earliest possible date during the definition phase until all relevant activities have been completed, including the provision of data in final useful form. The Project Manager will be appointed as early in this cycle as possible and will be expected to remain with the project until its completion. It is intended that the position of Project Manager is at such a level that it will be aspired to as a career goal and that incumbents of these positions will normally remain in them for extended time periods. Project management experience is a key element in career progression in line management.
5. The selection and appointment of a Project Manager are among the most important functions of a Center Director, since the Project Manager will have the authority and responsibility to execute the Center Director's contract with the Program Associate Administrator and higher management. Appointment should be made only after in-depth discussions between the Center Director and the Project Manager, during which they shall establish a clear understanding of the conditions under which the project is to be implemented and the resources that are to be provided.

6. The Program Associate Administrators are accountable to the Office of the Administrator for assuring that new projects have been adequately defined before being included in the Agency's budget submission. Structuring and focusing the definition phase of any project should reduce the total lead time between concept and flight. Major new projects are normally selected by the responsible Program Associate Administrators in consultation with the appropriate Center Directors. Major projects will normally include these three documentation phases:

- A formal "Definition Review" will be conducted by a non-advocate team selected by and reporting to the Program Associate Administrator. The review will be designed to assess the actual stage of project definition in terms of the clarity of the objectives; the completeness of technical specifications; and the range of technical, cost, and schedule risks involved. Results of the Definition Review for major projects are an essential element in the decisions as to the Agency's readiness to provide external commitments on project cost/schedule/performance. The quality of the internal technical and resource commitments remains the responsibility of the Project Management Center Director.
- A signed "Project Initiation Agreement" between the Program Associate Administrator and the involved Center Directors, also required for major projects before inclusion in the Agency budget submission, will outline the management and technical interfaces, the procurement and/or in-house acquisition plans, the schedules, the resource estimates, the uncertainty/contingency/reserve envelope, and all other key ground rules.
- A formal, approved "Project Plan" will be required to reconfirm intra-agency understandings before release of resources by the Program Associate Administrator to the Project Management Center.

7. The Project Manager's authority follows a clear chain of delegation that starts with the Project Approval Document, the agreement between the Administrator and the Program Associate Administrator that reflects the NASA commitment to the Administration. The agreement between the Associate Administrator and

the Center Director is reflected first in the Project Initiation Agreement and later in the Project Plan. The Project Manager is delegated authority to carry out the Center Director's responsibility for project implementation. This authority is further defined by agreements between these two individuals established prior to the appointment of the Project Manager and updated as required.

8. A Project Manager is responsible for a level of understanding of contractor activities and resource use sufficient to control the project activity. The specific approaches to be employed will be individually developed as part of the Definition Phase, the Project Initiation Agreement, the Project Plan, the Request for Proposal, and the ultimate contract.

9. The Project Manager, through the immediately surrounding institution, must have direct control of the systems engineering function and resources. Usually, therefore, a single Center will be selected by the responsible Program Associate Administrator as the Project Management Center, and its major responsibilities and interfaces will be initially defined in the "Project Initiation Agreement"; this will usually include delegation for suballocations of NASA resources to other Centers and instrumentalities. In cases where large and complex programs require the utilization of major resources of multiple centers, the program management and system level requirements and integration responsibilities may be established at the Headquarters level by the Administrator.

10. The selection of a responsible contractor and the management of the efforts to be accomplished are critical to the success of NASA programs and will be guided by the following:

- Project, line, and staff management must take an active role in structuring appropriate individual procurement plans, work statements, and solicitation provisions, especially the formulation of clear evaluation criteria. Vigorous monitoring of procurement structures set in place is mandatory.

- In structuring evaluation criteria for individual procurements, and during the evaluation process, greater consideration must be given to human and material resource proposals in the evaluation of mission suitability elements. Unrealistic resource proposals will be considered to reflect a lack of understanding of the requirement. This will result in a lower mission suitability evaluation.
  
- NASA Source Selection Officials must be attentive to the credibility, or lack thereof, of resource and cost proposals in selecting contractors. Selections should not necessarily be made on the basis of lowest cost when there is reason to believe the resource requirements are understated by the proposer.
  
- Assessment of the experience and past performance of competitors for NASA projects continues to be a significant component part of the proposal evaluation process: in-depth analysis of these elements must be made by NASA evaluators and Source Selection Officials alike. Selection of demonstrated poor prior performers, or those lacking meaningful experience reasonably relatable to particular requirements, is discouraged and not in the overall best interest of the Government in the absence of other compelling reasons.
  
- Contracts awarded to successful competitors should, to the extent feasible, accurately reflect technical and cost baselines representative of the scope of work to be performed free from proposal deficiencies and weaknesses identified during the evaluation process.

11. After contract award, it is essential that the Project Manager develop control of the detailed technical content of the selected contractual approach, together with associated costs, before the contract effort reaches full momentum. To this end, the early part of a contract period of performance shall be devoted to developing such control and assessing whether the project needs to be realigned or whether the project content and estimated costs can be achieved. This post-award activity will usually be funded at a moderately low level prior to a large-scale commitment of funds. Further assessments of technical content and its compatibility to planned resources must be made periodically as the work progresses.

Project Managers are responsible for informing NASA management of the result of these assessments in a timely manner. Center Directors are responsible for the implementation and monitoring of this process.

12. Explicit provision will be made in all new start proposals for development uncertainties and changes in scope that may be required. Development uncertainties will be covered by a "contingency" estimate which should provide for:

- Normal engineering changes
- Cost allowance for impact of schedule slips at the subsystem level
- Anticipated inheritance not realized
- Anticipated increases in technical or management complexity
- Alternate design paths/backup vendors where appropriate to mitigate schedule risk
- Known factors whose cost impact is uncertain (e.g., TBD specifications)

These uncertainties can be assessed by utilizing any one or more of the following approaches:

- Technical and schedule risk assessment (e.g., critical path analysis)
- Parametric cost estimating (using empirical data bases)
- Cost risk analysis
- Engineering judgment
- Analogy with previous programs

In addition to these basic project requirements for a contingency to cover development uncertainties, specific provision should be made in the final estimates for a Headquarters reserve to include funding for significant changes in ground rules and assumptions, additional requirements beyond the original objectives established for the project, and schedule slips outside the influence of the project. An allowance for program adjustment (APA) will be established to fund such changes. The contingency should be allocated to the Project Management Center. APA will be maintained in Headquarters until specific requirements are identified, reviewed, and confirmed when appropriate amounts will be transferred to the Center.