IG-99-054

AUDIT REPORT

JPL Management of Subcontractor Technical Performance

September 28, 1999

OFFICE OF INSPECTOR GENERAL

National Aeronautics and
Space Administration

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Acronyms

OIG	Office of Inspector General
JPL	Jet Propulsion Laboratory
NMO	NASA Management Office
NEQA	NASA Engineering and Quality Audits
NPG	NASA Procedures and Guidelines
OSS	Office of Space Science
SIRTF	Space Infrared Telescope Facility

W September 28, 1999

TO: SJ/Director, NASA Management Office, Jet Propulsion Laboratory

FROM: W/Assistant Inspector General for Auditing

SUBJECT: Final Report of JPL Management of Subcontractor Technical Performance
Assignment Number A9900400
Report Number IG-99-054

The subject final report is provided for your use and comment. Our evaluation of your response is incorporated into the body of the report. The management response did not provide the specific corrective actions to be taken, the policies and procedures that will be revised, or an estimated completion date for the corrective actions. We request that information by October 28, 1999, in response to the final report. Accordingly, the recommendation will remain open for reporting purposes. Please also notify us when action has been completed on the recommendation, including the extent of testing performed to ensure corrective actions are effective.

If you have questions concerning the report, please contact Mr. Daniel Samoviski, Audit Program Director for Earth and Space Science Audits, at (301) 286-0497, or Mr. James Hoogoian, Auditor-in-Charge, at (818) 354-9754. We appreciate the courtesies extended to the audit staff. The report distribution is in Appendix E.

[original signed by]
Russell A. Rau

Enclosure

cc:
B/Chief Financial Officer
B/Comptroller
BF/Director, Financial Management Division
G/General Counsel
Q/Associate Administrator for Safety and Mission Assurance
S/Associate Administrator for Space Science
JM/Director, Management Assessment Division

NASA Office of Inspector General

IG-99-054 **September 28, 1999**
A9900400

JPL Management of Subcontractor Technical Performance

Introduction

On September 21, 1998, NASA entered into contract NAS7-1407 with the California Institute of Technology to operate the Jet Propulsion Laboratory, a Federally Funded Research and Development Center. The contract is a cost-plus-award-fee contract for which the value is determined by the sum of the estimated costs of taskings issued under the contract. JPL spent about $1.2 billion on task orders in fiscal year 1998. Of that amount, about $754 million was spent on procurements for both project and institutional purposes.[1] The overall audit objective was to determine whether JPL is managing subcontracts effectively and efficiently to ensure that program and/or project objectives are being met. The audit identified a condition related to JPL's controls for managing subcontractor activities. See Appendix A for details on our scope and methodology.

Results in Brief

JPL is generally managing subcontracting in an effective and efficient manner to achieve program and project objectives. JPL's acquisition strategy process adequately addresses project management requirements, and project managers followed the acquisition strategies in executing the resulting subcontracts. However, JPL's most significant subcontracts were not subjected to adequate surveillance. Subcontractor data disclosed problems in the designing, building, and safeguarding of hardware, inadequate application of workforce, and employee noncompliance with quality system procedures. JPL did not act on these problems in a timely manner, in part, due to the lack of surveillance activity to identify and correct problems.

Background

JPL's fiscal year 1999 Implementation Strategy, which describes how JPL will implement NASA's mission, incorporates NASA's emphasis on doing business "faster, better, cheaper." The "faster, better, cheaper" philosophy addresses the National Space Policy, September 19, 1996, which requires NASA to:

[1] JPL's procurement information system does not separately identify subcontracts for project hardware and software.

- Reduce mission costs and development times by implementing innovative procurement practices, validating new technologies, and promoting partnerships between governments, industry, and academia.

- Acquire spacecraft and other capabilities from the private sector where feasible.

To meet these requirements, JPL's fiscal year 1999 Implementation Strategy states that JPL will:

- Use small, frequent, low-cost missions to meet its goals.

- Increase the opportunities for American business to participate in NASA programs.

The introduction of the "faster, better, cheaper" philosophy challenged JPL to change its management practices in two ways. First, JPL is now involved in frequent, low-cost planetary missions. As a result, JPL has had to adapt to more projects with shorter schedules and reduced budgets. For example, five launches occurred from October 1, 1998, to March 31, 1999, as opposed to a previous launch rate of one every 2 years. Second, the increase in projects has resulted in contracting out more spacecraft production. Accordingly, JPL is relying on subcontractor controls more so than in the past.

JPL management has made the following infrastructure investments to provide future missions the means to achieve the goals of the "faster, better, cheaper" philosophy.

- Created a Product Design Center in 1994 to assist in cost and schedule of spacecraft design.
- Identified and proved new technology under separate projects to reduce cost and schedule risks to spacecraft missions starting in 1995.
- Implemented Process Based Management in 1996, which assisted JPL's quality system in becoming International Organization of Standardization (ISO) 9001[2] certified.

Although JPL is changing its ways of doing business, additional improvements are needed.

Subcontractors' Technical Performance

Finding. JPL oversight of subcontractor technical performance needs improvement. JPL does not have adequate policy for monitoring subcontractor performance. For example, JPL has not adopted the practice of performing engineering and quality audits as prescribed in NASA policy. As a result, subcontractors have incurred excessive costs to correct technical problems that could have been prevented or mitigated to some extent.

[2] The ISO 9000 standards represent an international consensus on good management practices with the aim of ensuring that the organization can time and time again deliver the product or services that meet the client's quality requirements.

NASA and JPL Management Controls

The NASA Office of Space Flight recognizes the value of preventing problems in its programs by implementing NASA Engineering and Quality Audits (NEQAs), which are required by NASA Procedures and Guidelines (NPG) 7120.5A, effective April 3, 1998. The JPL contract references NPG 7120.5A.[3] The NEQAs review the accuracy and application of all subcontractor processes involved in the subcontractor operations affecting NASA's projects. The Office of Space Flight implemented these audits at major program contractors because past compliance audits had failed to prevent defects in safety-critical items. The NEQA's verify the accuracy of work documentation and procedures, that operators are rigorously following official procedures and understand them, that operators are adequately trained, and that all supporting systems are in place and functioning as intended.

JPL's current Acquisition Procedure 2-9 identifies controls that address the need to monitor subcontractor performance while recognizing that the level of monitoring should be tailored to the contract scope, type, and nature. However, neither Procedure 2-9 nor any other JPL policy describes how to develop a subcontractor assessment and surveillance plan to proactively verify and ensure that subcontractors strive to prevent technical problems. Some JPL project managers took action in the absence of such guidance. For example, to prevent specific past problems from reoccurring, some JPL project managers have shared lessons learned. In addition, one project manager implemented a documented surveillance plan of subcontractor mission assurance activities. However, the actions did not proactively address the wide range of reasons for technical problems indicated by subcontractor data.

Subcontractor Technical Problems Incurred on JPL Projects

Our review of project data obtained from subcontractors and JPL for five JPL projects[4] (see a glossary of the projects in Appendix B) disclosed the following three areas that resulted in subcontractor technical problems and increased project costs.

- **Hardware Nonconformances.** Subcontractor information systems track hardware nonconformances[5] and what caused them. The subcontractor for the two completed projects, *Stardust* and *Mars 98*, categorized the majority of the causes as poor employee workmanship, inadequate supplier procedures, and ineffective engineering design issues. For example, engineering design issues accounted for 15 percent of the nonconformances on the *Stardust* project and for 17 percent of nonconformances on the *Mars 98* project. This reduces the

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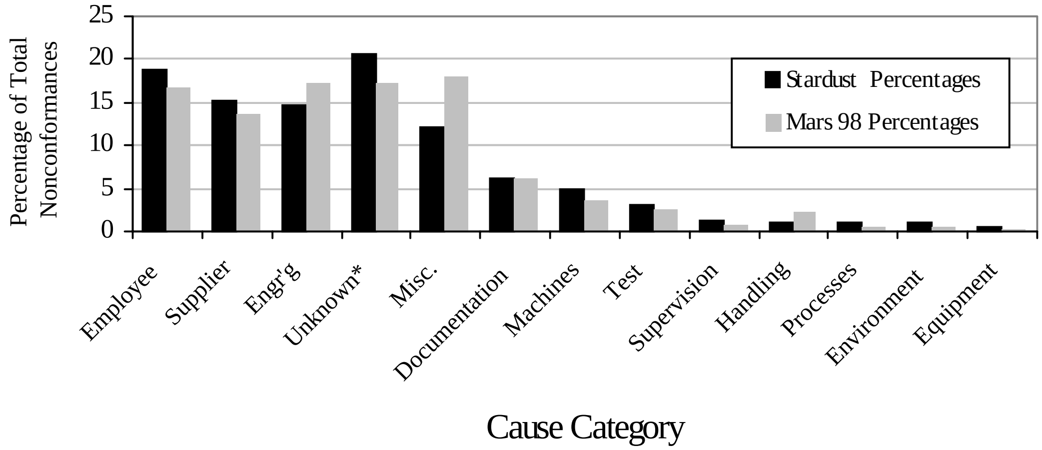
[3] JPL contract Section G-11, "Program and Project Management," requires JPL to manage projects under the direction of NASA Procedures and Guidelines (NPG) 7120.5A, "Program and Project Management Processes and Requirements." Section 4.5.1.2.c of the NPG, "Safety and Mission Success, and Environmental Management," requires the safety and mission success activity to utilize a quality management system governed by the ISO 9000 standard, appropriate surveillance, and NASA Engineering and Quality Audits. The contract allows JPL to tailor this NPG requirement commensurate with risk management, program/project life cycle, and resources.

[4] We selected JPL's *Mars 98, Mars 01, Stardust, Genesis*, and *Space Infrared Telescope Facility (SIRTF)* programs because they had or were expected to have subcontracts with a value of more than $50 million and because they were significant to JPL's mission.

[5] A hardware nonconformance exists when hardware does not meet design requirements.

subcontractor's efficiency since additional resources must be expended to determine the appropriate corrective action. Figure 1 shows the significance of specific cause categories for the two projects.



*Unknowns represent nonconformances for which sufficient information was not available for subcontractors to determine a cause.

Figure 1. Nonconformance Cause Categories for *Stardust* and *Mars 98*

In some cases, subcontractors estimated the cost of addressing nonconformances. For example, subcontractor personnel estimated that the cost of reworking glass body diodes on the *Mars 98* Orbiter and Lander hardware was $800,000, while the cost of reworking supplier-provided solar arrays on the *Stardust* project was $105,000. *Mars 98* project costs were increased by $200,000 when the medium gain antenna was damaged during testing. Appendix C contains other examples of nonconformances that JPL project management considered significant.

JPL project management did not ensure that subcontractors improve practices that cause hardware nonconformances. Further, JPL policy does not include management controls such as NEQAs or the equivalent corrective action to ensure that subcontractors, through follow-up, improve practices that cause technical problems. During project development, JPL project management should have assessed subcontractors' processes for preventing, detecting, and correcting nonconformances and should have improved subcontractor accountability for implementing effective practices.

- **Workforce Levels.** For all five projects reviewed, the actual subcontractor workforce was less than planned early in the project and greater than planned later in the project. For example, *Stardus*t actual workforce was less than planned by as much as 45 percent in the first 6 months and up to 130 percent greater than planned during the later two-thirds of the project. *Genesis*, *Stardust's* follow-on project by the same subcontractor, has been in process for 13 months and is experiencing the same workforce problem. Furthermore, the actual workforce for the remaining two-thirds of the *Mars 98* project averaged 80 percent more than planned. *Mars 01*, the follow-on project for *Mars 98* by the same subcontractor, is also experiencing a similar problem. The *Space Infrared Telescope Facility* (*SIRTF*) project is experiencing the same condition at one of its five hardware providers. Figure 2 shows the actual and planned workforce for the *Stardust* project.

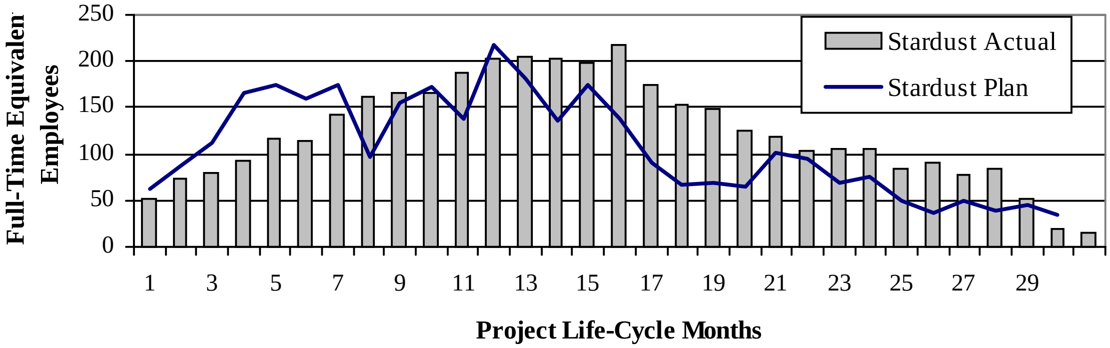


Figure 2. Workforce Variances in the *Stardust* Project Life Cycle

Applying a smaller workforce than planned reduces the ability to accomplish project development milestones. Performance measurement data showed that subcontractors were not meeting milestones early in the project. Subcontractors must expend additional resources to reschedule delayed tasks, develop work-around activities, and meet schedules. The costs of rescheduling and work-around activities add no value to the project. In addition, since engineering design decisions are made early in the project life cycle, not applying workforce when needed could result in ineffective engineering decisions when trying to meet a project milestone.

Applying a larger workforce than planned to meet final spacecraft delivery shows poor subcontractor planning in that the subcontractor did not anticipate normal development problems requiring additional workforce. Since the subcontracts are negotiated based on this planned workforce, significant increases in actual over the planned workforce require changes to subcontracts in order for the subcontractors to be paid for additional workforce costs. For example, *Mars 98* project management negotiated three subcontractor cost growth proposals during the project life-cycle. Preparing, reviewing, negotiating, and incorporating this type of contract change requires additional resources that increase project costs.

JPL project management did not review subcontractor processes for estimating the workforce needed to support their projects, and JPL policy does not specify the management controls to ensure subcontractors propose a more realistic workforce. JPL should have validated the realism of the planned workforce early in the project life cycle, required the subcontractors to propose more realistic estimates where needed, and held subcontractors accountable for applying the needed workforce.

- **Employee Compliance with Procedures.** We obtained statistical information on subcontractor internal audits of company procedures and practices at two subcontractor locations. This information disclosed that 60 percent of the audit findings were attributable to employees not complying with procedures. Subcontractors design the procedures to help ensure efficient and effective accomplishment of project objectives. Subcontractor employee noncompliance with company procedures exposes JPL projects to a greater potential for poor quality and cost increases.

  JPL project management had not reviewed the subcontractors' internal audit processes and audit findings related to their projects. In addition, JPL policy does not identify management controls to ensure that subcontractors implement effective internal audit processes or that project managers are aware of audit findings affecting their project. JPL project management should have assessed the effects of subcontractors' internal audit findings on their projects early in the project life cycle. In addition, JPL should have assessed subcontractor internal audit processes to determine whether audits have or will cover operations affecting JPL projects and whether subcontractors resolve audit findings in a timely manner.

JPL project managers discuss technical problems in weekly and monthly meetings as the problems emerge. JPL managers track the effects and the resolution of problems through disposition. Although this practice corrects the detected problem, it is reactive and more costly than preventing problems. While all technical problems cannot be prevented, proactive intervention increases the likelihood that problems will be detected early and helps minimize the adverse effects on project cost and schedule.

Effects of Technical Problems on Projects

JPL has not applied sufficient resources or ensured that subcontractors implement procedures that resolve ineffective practices. JPL project managers stated that subcontractors are selected on their capabilities to perform and that the managers rely on the subcontractors' processes to prevent technical problems. JPL project managers added that becoming proactively involved in ensuring that subcontractors have implemented effective procedures would consume resources needed to complete the project.

JPL management took some actions to reduce project technical problems, such as studying project software development problems and asking project managers for three completed projects to provide subcontractors the lessons learned to identify common issues. JPL management has also established Design, Verification/Validation and Operations Principles for Flight Systems to avoid design and test deficiencies. These actions are a step in the right direction in reducing project costs; however, additional actions are needed to ensure that subcontractors improve practices that will reduce nonconforming hardware and other project problems. Resources must be expended to analyze the reasons for problems and to take corrective action where needed.

Addressing technical problems after they occur increases project costs. The following table shows the increase in subcontract costs (cost growth) from the initial baseline budget to final cost for the two completed projects we reviewed.

Subcontractor Cost Growth

Completed Project	Initial Baseline (millions)	Final Cost (millions)	Cost Growth (millions)	Cost Growth (% to baseline)
Mars 98	$84.7	$121.3	$37.1	44%
Stardust	$70.4	$ 75.6	$ 5.2	7%

In addition to increasing project costs, subcontractor personnel on the *Mars 98* and *Stardust* projects were required to work 70 hours a week or more to meet the final delivery date. This could have an adverse effect on employee morale and increases the potential for human errors. Rushing to meet milestones could also result in engineering decisions being made based on schedule need instead of the need to reduce risk of failure.

Taking a more proactive approach to problem solving would reduce the cost of correcting problems after they have occurred. As project management increases its use of preventive techniques, it can achieve intended results at a lower cost.

Recommendation, Management's Response, and Evaluation of Response

The Director, NASA Management Office, should direct the JPL Director to revise current project management policies to require project management assessment and monitoring of subcontractor procedures to ensure that they are designed and functioning to prevent, detect, and correct technical problems.

Management's Response. Partially Concur. The NASA Management Office (NMO) and the Office of Space Science (OSS), NASA Headquarters, acknowledge the need for JPL to reduce costs and improve processes. JPL is operating consistent with NPG 7120.5A requirements, its NASA Engineering and Quality Audit requirements through its commitment to ISO, and Process Based Management. JPL was ISO certified in April 1999, and the subcontractor for the *Mars 98* and *Stardust* projects was certified in December 1996. In addition, JPL has developed a set of Design, Verification/Validation and Operations Principles that project managers must follow. JPL is also developing similar principles for software. JPL has also improved communications among projects on lessons learned and process improvements by conducting monthly project managers' meetings. The NMO and OSS believe that the award fee reduction for the *Mars 98* project from $12.5 million to $3.5 million is a strong incentive for the subcontractor to "strive to prevent technical problems."

NASA will advise JPL to continue to improve its project management policies and practices, within the faster, better, cheaper; ISO 9000; and Performance Based Contracting environment, so as to provide an incentive for JPL subcontractors to perform in an efficient and timely fashion.

Evaluation of Management's Response. Management's response does not identify specific corrective actions that will that be taken or the policies that will be revised to require project managers to perform assessments of subcontract monitoring needs and to develop and implement subcontractor monitoring procedures. In addition, management did not provide an estimated completion date for the corrective action. The NMO and OSS are relying on ISO certification, Process Based Management, Performance Based Contracting, and contract incentive fees, along with other principles developed by JPL to ensure subcontractor procedures are designed and functioning to prevent, detect, and correct technical problems. Our report shows that this reliance has not ensured that JPL policies and procedures address significant subcontractor problems that have increased project costs and exposed projects to failure.

The examples of subcontractor problems discussed in this report and the recent loss of a *Mars 98* spacecraft in flight illustrate how ISO certifications, Process Based Management, and Performance Based Contracting alone do not ensure project success. JPL has been operating under Performance Based Management since 1996, well before the launch of the lost spacecraft in January 1999. In addition, the subcontractor who built the lost spacecraft operated under a JPL Performance Based incentive fee contract and was ISO certified in December 1996. The same subcontractor, while ISO certified, was responsible for the loss of four spacecraft from August 1998 through May 1999 as a result failures in its launch vehicle product. Although JPL's principles for flight systems are a step in the right direction, policies and procedures should be revised to require project managers to follow these principles.

We request that management provide specific actions that will be taken, identify the policies and procedures that will be revised, and provide estimated completion dates for the recommended corrective actions. Accordingly, the recommendation is unresolved and will remain undispositioned and open until corrective action is completed.

Appendix A. Objectives, Scope, and Methodology

Objective

The overall objective was to determine whether the JPL is managing subcontracts effectively and efficiently to ensure program and/or project objectives are being met. Specifically, we determined whether JPL:

- developed an acquisition plan that addresses the program and/or project requirements,
- executed subcontract management in accordance with the developed program and/or project acquisition plan, and
- monitored subcontractor performance to ensure that technical requirements are met.

Scope and Methodology

During the audit, we:

- Interviewed JPL project management, Engineering and Mission Assurance, and acquisition personnel to obtain background information and documents.
- Reviewed the JPL contract NAS7-1407, dated September 21, 1998.
- Visited contractors' facilities, and obtained information from the management staff.
- Reviewed JPL's Policy, "Monitoring Performance of Suppliers," May 4, 1999.
- Reviewed JPL's Policy, "Project Planning," March 5, 1999.
- Reviewed JPL's Acquisition Procedure 2-9, "Mission Assurance," January 8, 1997
- Reviewed the "JPL Acquisition Strategy Process Functional Description," September 14, 1997.
- Reviewed JPL's "Project Control Guidebook for Project Managers," December 22, 1998.
- Reviewed JPL's "Process for Tailoring Mission Assurance to Specific Projects," January 1997.
- Reviewed NPG 7120.5A, "Program and Project Management Processes and Requirements," April 3, 1998.
- Reviewed "NASA Marshall Space Flight Center, Marshall Work Instruction – NASA Engineering and Quality Audit," May 14, 1999.
- Reviewed JPL and subcontractor project data related to nonconforming hardware, workforce staffing, and internal audits.
- Consulted NASA Safety and Mission Assurance personnel regarding the NASA Engineering and Quality Assurance Audit process.

Appendix A

To document JPL practices for managing subcontractor technical performance, we selected projects if they had or were expected to have subcontracts with a value of more than $50,000,000 and they were significant to JPL's mission. We selected subcontractor site visits based on the ability of the audit team to obtain adequate information on JPL subcontractor management practices in a timely manner.

Management Controls Reviewed

We reviewed the following management controls:

- NPG 7120.5A, "NASA Program and Project Management Processes and Requirements," April 3, 1998.
- JPL's contract NAS7-1407, dated September 21, 1998.
- JPL Policy, "Monitoring Performance of Suppliers."

We considered JPL controls adequate except they should be strengthened to ensure subcontractor practices associated with engineering, manufacture, assembly, test, and processing of flight hardware and software are effective. Details are in the finding section of the report.

Audit Field Work

We performed the audit field work from November 1998 through July 1999 at JPL and subcontractor locations in Sunnyvale, California, and Denver and Boulder, Colorado. We conducted the audit in accordance with generally accepted government auditing standards.

Appendix B. Project Glossary

***Mars 98*.** The *Mars 98* project consists of an Orbiter and Lander, which were launched on December 11, 1998, and January 3, 1999, respectively. The Orbiter will arrive at Mars in September 1999 and will use a series of aerobraking maneuvers to achieve a stable orbit. Once in orbit, the Orbiter will use atmospheric instruments and cameras to provide detailed information about the surface and climate of Mars. The Lander should land on December 3, 1999, near the southern polar cap of Mars. The Lander is equipped with cameras, a robotic arm, and instruments to measure the Martian soil composition.

Stardust. The *Stardust* spacecraft was launched on February 7, 1999. *Stardust* is on a flight path that will deliver it to a comet (Comet Wild-2) on January 2, 2004. The spacecraft will gather particles flying off the nucleus of the comet. In addition, *Stardust* will attempt to gather samples from a stream of interstellar dust that flows through the solar system. Captured in a glass foam called aerogel, the samples will be enclosed in a clamshell-like device that will be dropped off for reentry into Earth's atmosphere in January 2006. Equipped with parachutes, the capsule will float to a preselected spot in the Utah desert, where it will be retrieved and its contents delivered to scientists for analysis.

Mars 01. The *Mars 01* project also consists of an Orbiter and Lander. The Orbiter is scheduled for launch on March 30, 2001, and should arrive at Mars on October 20, 2001. The Orbiter will carry three instruments, the Thermal Emission Imaging System, the Gamma Ray Spectrometer, and the Mars Radiation Environmental Experiment. The Lander is scheduled for launch on April 10, 2001, and should land on Mars on January 22, 2002. The Lander will carry an imager to take pictures of the surrounding landscape. The Lander will also be a platform for instruments and technology experiments to provide information for future human missions to Mars. Current plans are to send the *Marie Curie* rover to Mars on the Lander.

Genesis. The *Genesis* spacecraft is scheduled for launch January 2001. Genesis will be positioned at a point between Earth and the Sun where the gravity of both bodies is balanced. Once in orbit, Genesis will collect particles of the solar wind in specially designed high purity wafers. After 2 years, the samples will be restowed and returned to Earth where a mid-air recovery of the return capsule will take place over the Utah desert. NASA will make the samples available for scientific study.

Space InfraRed Telescope Facility (SIRTF). *SIRTF* is scheduled for launch in December 2001. SIRTF is the fourth and final element in NASA's family of "Great Observatories" that include the Hubble Space Telescope, the Compton Gamma Ray Observatory and the Advanced Chandra X-Ray Telescope Facility. SIRTF will use infrared telescopes whose unique capability lies in their ability to sense the heat of dark, faint, or hidden objects. *SIRTF* is expected to be operational from 2.5 to 5 years.

Appendix C. Additional Examples of Significant Nonconformances

The examples below address issues associated with hardware provided to subcontractors by suppliers. JPL project management did not review subcontractor practices for ensuring that suppliers provide hardware that meets project requirements. In addition, JPL policy does not specify management controls that would ensure that subcontractors implement effective supplier management processes. During the project development process, JPL project management should have assessed subcontractors' processes for managing suppliers and held subcontractors accountable for implementing effective practices.

Inertial Measurement Unit

Two Inertial Measurement Units (IMU's) purchased from a supplier did not meet requirements. Although the supplier claimed that its new design would meet the subcontractor's requirements, the supplier had not proven the design for the temperature ranges required. Although the subcontractor was aware of potential leakage problems, it took delivery from the supplier. The subcontractor later discovered that the IMU's leakage rates were significantly greater than expected. Although, the supplier absorbed the cost of extensive rework, the subcontractor spent resources assisting in analyzing and tracking the problem.

Field Programming Gate Array (FPGA)

FPGA's were not functioning properly on interface cards between spacecraft and instruments. The FPGA's were radiation hardened as required; however, this hardening process caused some of them to function improperly. The subcontractor did not test the FPGA's to determine whether they met requirements before installation. Additional costs were expended to remove the cards, replace the bad parts, and retest the interface cards.

2N2222 Transistors

A transistor failed during a higher level assembly test. The subcontractor analyzed the transistor that failed and found that they were contaminated. The subcontractor accepted the transistors and installed them without determining whether they met requirements.

Bussman Fuses

A fuse failed during a circuit board test. A wire inside the fuse did not protrude enough to have the desired contact with the end cap. The fuse, as delivered, met inspection criteria; however, the subcontractor did not require an inspection of the wire contact with the cap and a destructive part analysis to determine whether the fuses met requirements. The subcontractor expended additional resources to determine which fuses had to be replaced, performed the replacements, and tested the circuit board again.

Pyro Valve

The valve uses an explosive charge to insert a cylinder in a tube that stops or reduces fuel flow. The supplier discovered that when the valve was fired, the cylinder was not functioning properly. As a result, fuel was continuing to flow. This resulted in significant investigation and system analysis to determine the cause. The subcontractor elected to use the parts in all applications except one. Subcontractor documents show that correcting this problem increased project costs by approximately $200,000.

Appendix D. Management's Response

National Aeronautics and
Space Administration
Jet Propulsion Laboratory
NASA Management Office
4800 Oak Grove Drive
Pasadena, CA 91109-8099

SEP 22 1999

Reply to Attn of: SJ

TO: W/Assistant Inspector General for Auditing

FROM: SJ/Director, NASA Management Office

SUBJECT: Comments on Draft Report of Jet Propulsion Laboratory (JPL) Management of Subcontractor Technical Performance Assignment Number A9900400

Acknowledging a fundamental and continuing responsibility for reducing costs and for improving processes, using all the tools available, the NASA Management Office and the Office of Space Science partially concur with the draft report of Audit # A9900400 on the subject of JPL Management of Subcontractor Technical Performance. We believe that in managing their subcontractors, JPL has been following the lead of NASA Headquarters with the reduced oversight implicit in the approaches of Better, Faster, Cheaper", ISO 9000 and "Performance Based Contracts".

It should be noted that although NPG 7120.5A requires the adoption of NEQA techniques (emphasis added), a review of those techniques reveals that they are entirely consistent with the premise of ISO certification and Process Based Management (PBM). JPL is committed to ISO and PBM and the Laboratory was ISO certified in April 1999. While not required to do so, JPL also makes an effort to obtain ISO certified system subcontractors and the Mars 98 and Stardust subcontractor was in fact ISO certified in December 1996. In addition, JPL benchmarked that ISO system in preparation for their own certification.

To strengthen JPL's insight/oversight process, a set of Design Verification/Validation and Operations Principles have been developed that all projects (including system subcontractors) must address at every review for compliance. If certain principles are not being complied with, the project must provide their rationale and risk assessment for acceptance. The Laboratory is currently developing a similar set of principles for software, which will be released in the future.

To improve communications among the various projects on lessons learned and process improvements, a monthly project managers' meeting has been instituted by JPL. This provides a forum for the project managers to share process issues related to their projects, and serves as a proactive problem avoidance mechanism.

It is true that technical problems have occurred during the development of some JPL projects and by definition, technical problems are almost bound to occur in any cutting-

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edge project. Because of these challenges, JPL sets aside reserves to cover potential technical problems. As a result of setting aside reserves, Mars 98 and Stardust, the only two projects discussed in the draft report, both stayed within their project cost caps even though exceeding the original subcontract prices. Finally, we would point out that, due in large part to the cost growth of the contract, the potential award fee pool for the Mars 98 contract was reduced from approximately $12.5M to approximately $3.5M. We feel that is a strong incentive for the subcontractor to "strive to prevent technical problems".

Considering the challenges of meeting cost, schedule, and performance goals for cutting-edge projects, NASA will advise JPL to continue to improve their project management policies and practices, within the "Faster, Better, Cheaper", ISO 9000 and Performance Based Contracting environment, so as to incentivize JPL subcontractors to perform in an efficient and timely fashion.

Robert A. Parker

Cc:
SJ/R. Svarcas
D. Bromley
IG/J. Hoogoian

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