IG-97-003

AUDIT REPORT

INACTIVE OR EXCESS PROPERTY AT SELECTED CONTRACTORS

JET PROPULSION LABORATORY

October 25, 1996

National Aeronautics and Space Administration

OFFICE OF INSPECTOR GENERAL

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National Aeronautics and
Space Administration

Headquarters
Washington, DC 20546-0001

Reply to Attn of: W

OCT 25 1996

TO: Marshall Space Flight Center
DA01/Director

FROM: W/Assistant Inspector General for Auditing

SUBJECT: Survey Report on Inactive or Excess Property
at Selected Contractors
Assignment Number A-JP-96-002
Report Number IG-97-003

The Office of Inspector General has completed a survey of inactive or excess property at Thiokol Corporation, Space Operations, Brigham City, Utah, and Rocketdyne, Canoga Park, California. Our survey was issued based on limited audit work to determine whether the contractors' reported inactive or excess property should be disposed. Overall, we determined that NASA-owned property at Thiokol and Rocketdyne was inactive or excess and should be disposed, and that NASA management and the contractors were actively reviewing such property. We found that Rocketdyne had 30 inactive controllers, valued at $111 million, and NASA management initiated action during our survey to dispose of the controllers. However, NASA management had not yet decided how to dispose of an estimated $69 million of Filament Wound Cases and pre-51L steel case motor segments at Thiokol. Consequently, we recommended that the NASA MSFC Center Director direct the project office to expedite its evaluation of the best disposal method.

We received a written response from your office on October 8, 1996. The comments were incorporated into the report to outline the action planned in response to the recommendation. The complete response is included as Appendix 1. The recommendation is considered closed.

The NASA Office of Inspector General staff members associated with this audit express their appreciation to the NASA MSFC teams, and the Space Shuttle Main Engine and Reusable Solid Rocket Motor project office personnel, for their courtesy, assistance, and cooperation.

If you have any questions or need additional information, please call Robert Wesolowski, Director, Division-A, or me at (202) 358-1232.

Debra A. Guentzel

Enclosure

cc:
HK/A. Guenther
L. Pendleton
HC/J. Horvath
J. Balinskas
JLG/P. Brunner
JM/P. Chait

INACTIVE OR EXCESS PROPERTY AT SELECTED CONTRACTORS

JET PROPULSION LABORATORY
PASADENA, CALIFORNIA

INTRODUCTION

The NASA Office of Inspector General (OIG) has completed a survey of inactive or excess property at Thiokol Corporation, Space Operations, Brigham City, Utah, (Thiokol) and Rocketdyne, Canoga Park, California (Rocketdyne). The survey was conducted because significant inactive or excess property were found at both contractor locations during a Chief Financial Officer (CFO) audit. Following is the inactive or excess property found during the fiscal year (FY) 1995 CFO audit:

- Seven controllers (space hardware used in the Space Shuttle Main Engine program), valued at $26 million, were reported by Rocketdyne as inactive for at least four years;

- An estimated $38 million of work-in-process (i.e., facilities type property, special test equipment, special tooling, agency peculiar property, material) was reported by Rocketdyne as excess;

- Twelve Filament Wound Case (FWC) and 4 pre-51L steel case motor segments (space hardware used in the Reusable Solid Rocket Motor program), valued at $69 million, were reported by Thiokol as inactive; and

- An estimated $16 million of inactive inventory (i.e., special test equipment, special tooling, jigs, space shuttle parts, nozzles, and other types of materials and space hardware) that had been reported by Thiokol, had no present or immediate future use.

NASA MSFC OVERSIGHT AND REVIEWS

NASA Marshall Space Flight Center (MSFC) provides management oversight at both contractors, Thiokol and Rocketdyne. On March 19, 1996, the NASA Associate Administrator for Procurement initiated a review of NASA property held by 13 contractors, including Thiokol and Rocketdyne (Appendix A-1). NASA MSFC was responsible for the Thiokol and Rocketdyne reviews. The objective of the NASA review, entitled "Validating and Reducing NASA Property Being Used by Contractors," was to identify property in the possession of contractors that was inactive, underutilized, or had been provided (by NASA) without careful consideration of the need for the property. NASA would then make the decisions to dispose of it, use it to better advantage elsewhere, or leave it in place, while also considering contractual obligations.

OBJECTIVE, SCOPE, AND METHODOLOGY

OBJECTIVE

The overall survey objective was to determine whether NASA-owned property was inactive or excess and should be disposed. Specifically, we determined whether the inactive or excess property reported by Thiokol and Rocketdyne should be disposed.

SCOPE AND METHODOLOGY

The survey was accomplished through interviews with key NASA MSFC, Defense Plant Representative Office (DPRO) and contractor personnel; these included the Space Shuttle Main Engine (SSME) and Reusable Solid Rocket Motor (RSRM) project office personnel, contracting personnel, property administrators, and plant clearance officers. During our survey, we also met with the NASA MSFC team leaders to coordinate our audit efforts and ensure that we did not duplicate NASA efforts at validating and reducing property being used by contractors. We limited our scope to the findings identified during our FY 1995 CFO audit, which included the controllers and excess inventory at Rocketdyne and the FWC and pre-51L steel case motor segments and excess inventory at Thiokol. The estimated costs associated with our FY 1995 CFO audit findings were based on the NASA Form 1018, Report of Government-Owned/Contractor-Held Property. To minimize the contractors' efforts and provide real time input, we timed our visits to match the NASA MSFC review teams. We verbally provided the team leaders with our observations at the contractors' locations and the initial results of our validation of the disposition of the inactive or excess property.

INTERNAL CONTROLS REVIEWED

Significant internal controls were identified and tested for compliance. We reviewed the contractors' policies and procedures to ensure that they are in accordance with Federal Acquisition Regulations (FAR) 45.6 and NASA FAR Supplement 18-45.6, both entitled "Reporting, Redistribution, and Disposal of Contractor Inventory." We also tested the contractors' current dispositions to determine whether they were following their own policies, and that the dispositions were done in a timely manner. Nothing was observed that indicated the contractors' controls were not effective.

AUDIT FIELD WORK

Survey field work was conducted from May 1996 through July 1996 at Thiokol and Rocketdyne. The survey was performed in accordance with generally accepted government auditing standards.

OBSERVATIONS AND RECOMMENDATION

OVERALL EVALUATION

Overall, we determined that NASA-owned property at Thiokol and Rocketdyne was inactive or excess and should be disposed, and that NASA management and the contractors were actively reviewing such property. We determined that Rocketdyne had 30 inactive controllers, not just the 7 controllers found during our FY 1995 CFO review. NASA management took prompt action during our survey to initiate the disposal of the 30 controllers, valued at approximately $111 million. NASA management and the contractors were also taking aggressive action to reduce the other inactive or excess inventories at both Thiokol and Rocketdyne. However, NASA management had not yet decided how to dispose of the estimated $69 million FWC and pre-51L steel case motor segments at Thiokol.

INACTIVE CONTROLLERS AT ROCKETDYNE

During our survey, we determined that a total of 30 Block I controllers were currently inactive at Rocketdyne, not just the 7 controllers found during our FY 1995 CFO review. Rocketdyne has stored the controllers, valued at $111 million ($3.7 million each), for at least four years. Upon our inquiry, the SSME project manager at NASA MSFC reviewed the requirements for retaining the controllers as backup to the SSME flight program and determined there was no further need for them. NASA MSFC procurement office immediately issued instructions to Rocketdyne requesting the contractor to proceed with the excessing of the controllers (Appendix A-2). Consequently, no further recommendation is needed.

EXCESS INVENTORY AT ROCKETDYNE

We reviewed the contractor's disposition process and determined that the contractor exhibited a very aggressive attitude toward disposition of excess inventory. As of May 31, 1996, only $1 million of the reported $38 million excess inventory remained to be disposed. Test stands valued at about $25 million, which the contractor originally reported as excess, were requested by Stennis Space Center, and are being transferred to that center for reutilization. Therefore, we have no further recommendation with respect to the excess inventory reported by Rocketdyne.

EXCESS INVENTORY AT THIOKOL

During our review, we determined that $4 million of the $16 million inactive inventory reported was disposed. Thiokol had disposed of about $44.5 million of excess inventory over the past two years. In addition, another $78.4 million of NASA property was being reviewed for potential disposal. About $14 million of that property was already declared excess by the contractor and will be recommended to the Defense Contract Management Command Plant Clearance Officer and the NASA MSFC contracting officer for disposal. Consequently, no further recommendation is needed.

FWC AND PRE-51L STEEL CASE MOTOR SEGMENTS

The survey disclosed that NASA at present has no plans to use any of the FWC and pre-51L steel case motor segments at Thiokol for either flight or ground tests. The RSRM project office considered two different alternatives, water washout and open air burn, to dispose of the motor segments (Appendix A-3).

WATER WASHOUT

This approach involves water washout of motor propellant and sale of the slurried propellant as mining explosive. There are no regulatory restrictions involved with this alternative. NASA management estimated the potential salvage value of the reusable metal components of the motors at $12 million. However, the NASA project office is not yet confident the metal parts can be salvaged because of potential contamination of the components by ammonium perchlorate-contaminated water. No estimated disposal cost was available by the time we completed our survey.

OPEN AIR BURN

This alternative is subject to regulations and permission must be granted by the State of Utah. With this alternative, the FWC and pre-51L steel case motor segments would only have value as scrap metal. However, according to the RSRM project office at MSFC, the open air burn alternative, which is estimated to cost about $7.7 million, is the least expensive disposal option and preferred by Thiokol and the Space Transportation Systems Chief Engineer's Office.

At the time of this report, NASA management had not decided which alternative to use to dispose of the excess FWC and pre-51L steel case motor segments. These motor segments have been stored by Thiokol for at least 10 years at an annual cost of approximately $23,000. In addition, environmental issues exist with the motor segments' slurried propellant (equivalent to a mining explosive), and the asbestos enclosed in the case insulation. Environmental risks also exist with the ammonium perchlorate-contaminated water if NASA decides to opt for the Water Washout method to dispose of the motor segments.

RECOMMENDATION	We recommend NASA MSFC Center Director direct the project office to expedite its evaluation of the best disposal method.
MANAGEMENT'S RESPONSE	"Concur. The MSFC Reusable Solid Rocket Motor (RSRM) Project Office has issued a technical directive to Thiokol to develop and evaluate all potential options for disposing of the Filament Wound Cases and pre-51L steel case motor segments. The RSRM Project Office plans to assess Thiokol's recommendation and determine an implementation schedule by November 15, 1996."
EVALUATION OF MANAGEMENT'S RESPONSE	The action planned by the NASA MSFC Center Director is responsive to our recommendation.
GENERAL COMMENTS	We appreciated the cooperation and assistance extended to us by the NASA MSFC teams, and the SSME and RSRM project office personnel.

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MAJOR CONTRIBUTORS TO THIS AUDIT

JET PROPULSION LABORATORY	Lorne A. Dear, Program Director, Infrastructure and Support Anh Doan, Auditor-in-Charge
AMES RESEARCH CENTER	Robert Powell, Auditor

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National Aeronautics and
Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812

Reply to Attn of: DE01

OCT 8 1996

TO: Office of Inspector General
Attn: W/Debra A. Guentzel

FROM: DE01/Susan McGuire Smith

SUBJECT: OIG Draft Audit Report on Audit of Inactive or Excess Property at Selected Contractors, JPL, Assignment No. A-JP-96-002

We have reviewed the subject report, and our comments are shown below.

OIG Recommendation: We recommend NASA MSFC Center Director direct the project office to expedite its evaluation of the best disposal method.

MSFC's Response: Concur. The MSFC Reusable Solid Rocket Motor (RSRM) Project Office has issued a technical directive to Thiokol to develop and evaluate all potential options for disposing of the Filament Wound Cases and pre-51L steel case motor segments. The RSRM Project Office plans to assess Thiokol's recommendation and determine an implementation schedule by November 15, 1996.

If you have any questions or need additional information concerning our comments, please contact BE01/Lana Cucarola at (205) 544-0096.

Susan McGuire Smith
Associate Director

cc:
M-DI/Mr. Echerd

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National Aeronautics and
Space Administration
Headquarters
Washington, DC 20546-0001

APPENDIX A-1

MAR 19 1996

Reply to Attn of: HK

TO: Distribution

FROM: H/Associate Administrator for Procurement

SUBJECT: Validating and Reducing NASA Property Being Used by Contractors

Top management at NASA has been concerned for some time about the amount of property we have been providing to our contractors. While we must provide a certain amount of property, where it is unique to NASA programs, or unavailable elsewhere, we have far too many of our scarce budget dollars invested in property to assist contractors in doing NASA work.

NASA has provided property, valued at over $16 billion in 1995, to our contractors. The term "providing property" means either directly furnished to the contractor by NASA, or acquired/fabricated by the contractor for NASA. While most of this dollar value (over $10 billion) consists of space hardware, over $2 billion represents plant equipment, much of which is general purpose in nature and commercially available. The plant equipment amount is not a prudent investment for a research and development agency that has far more relevant uses for such funds. Even in the space hardware category, we could have significant amounts of property that are no longer needed for any foreseeable purpose. Of primary importance, however, is to reduce our recurring costs of continuing to own, maintain, and store property that is not being fully utilized.

It is essential that we periodically revalidate the need for this property by our contractors, and determine whether providing the property continues to conform to policy and NASA interests. To provide a focus for this revalidation process, we have identified our largest contractor recipients of NASA property at each Center from annual property reports submitted by contractors. Those that should be reviewed are listed in enclosure 1. Each of these contracts must be carefully examined to identify idle or otherwise inappropriate property. To be effective, program or project personnel at each Center should lead the teams formed to conduct this review, assisted by procurement, financial management, and property personnel.

What we hope to accomplish is identification of property in the possession of contractors that is inactive, underutilized, or has been provided without careful consideration of the need for the property. Once such property is identified, decisions can be made on whether to dispose of it, use it to better advantage elsewhere, or leave it in place. We should be particularly interested in property which is not in active use, and no clear alternative use is apparent. At the same time, we should be aware of our contractual obligations. If we have furnished property that is

needed for the work to be performed, removing that property from an existing contract could incur an obligation to make an equitable adjustment in the contract. In other words, it could involve a cost to NASA. Situations such as these will need to be carefully handled by each review team. Enclosure 2 is a plan outlining the common methodology to be used in the review, including the schedule, review steps, and overall objectives. General Dailey has asked me to keep him informed of each Center's progress and results. For this purpose, each Center involved in the review should designate a point of contact and provide the name to the Office of Procurement, Code HK, Attn: Mr. Larry Pendleton (202-358-0487).

This is an opportunity for us to make substantial reductions in our property inventory and in the associated costs of ownership. I encourage you to support this review and communicate with those directly involved.

Deidre A. Lee

2 Enclosures

Distribution:
M/Mr. Truflon (Acting)
O/Mr. Force
R/Dr. Whitehead
S/Dr. Huntress
U/Dr. Holloway
X/Dr. Mansfield
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Ms. Stone
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Mr. Sauret
JPL/Dr. Stone

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National Aeronautics and
Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812

Reply to Attn of

GP42-054G-96

APPENDIX A-2

June 17, 1996

Rockwell International Corporation
Rocketdyne Division
Attn: Fred Dunn
6633 Canoga Avenue
P.O. Box 7922
Canoga Park, CA 91309-7922

SUBJECT: Excess Block I Controllers

Rocketdyne is hereby instructed to excess Block I controllers (dash numbers 1 through 30). Due to the development of the Block II controllers, the Block I controllers are no longer used in the SSME Program.

If further information is required, please contact the undersigned or Ketela White at (205)544-7179.

R. Dale McElyea
Contracting Officer

005236 RC

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National Aeronautics and
Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812

APPENDIX A-3

Reply to Attn of GP46D-042-96

May 30, 1996

National Aeronautics and Space Administration
Office of Inspector General
Attn: W/Robert Powell
Ames Research Center
Moffett Field, CA 94035-1000

Subject: Request for Information in Support of OIG Survey of NASA Excess Property

Re: NASA/Ames Letter 9901.2 dated April 24, 1996

In response to the referenced letter, subject as above, enclosed please find requested information concerning obsolete solid rocket motor segments in storage at Thiokol. As previously discussed, disposition of the Filament-Wound Case (FWC) segments has been a concern for some time. Both the MSFC Reusable Solid Rocket Motor (RSRM) Project Office and Thiokol have been evaluating methods for disposing of some or all of the obsolete segments. Current plans are to select a disposal method early in FY97 that will schedule the disposal of all 16 segments over a multi-year period.

As you are aware, NASA Headquarters has currently tasked the various field centers to review NASA property currently in the hands of our prime contractors in order to determine whether or not any such property can be excessed and placed in the disposal process. Cognizant MSFC personnel will be making a site visit at Thiokol in the near future to accomplish this task.

Efforts are being taken, to the extent resources will allow, to ensure that only property necessary for program requirements is being carried on contractor accounts and that all property excess to program needs is excessed in accordance with established regulations. It is trusted that the information provided is sufficient to support the subject review. We are continuing to search the official files for supporting documentation and will forward under separate cover. Should additional information be required, please contact David Morgan at (205) 544-0410.

Kim E. Whitson
Contracting Officer

Enclosure

Obsolete Solid Rocket Motor Segments Stored at Thiokol/Space Operations

Responses to Questions

In response to the information requested by the NASA Office of Inspector General (reference File No. 9901.2, dated April 24, 1996) the following material was collected regarding the 16 excess segments presently in storage at Thiokol/Space Operations. To assist in understanding the makeup of the Solid Rocket Motor segments discussed in this letter, several illustrations are provided as attachments. Attachment 2, "RSRM Propellant Configuration", illustrates the four casting segments (Forward, Center-Fwd, Center-Aft, and Aft). The same casting segment designations were used for the pre-51L and FWC (filament wound case) designs. Attachment 3, "Case Segments", depicts the names of the case segments and the tang/clevis joints employed to attach the various case segments together. Attachment 4, "FWC - SRM Configuration" illustrates the combination of steel and FWC components that were used to assemble the four casting segments. To eliminate attach problems with the SRB forward and aft skirts and the ET, the forward dome, aft dome and ET attach segments were identical to those used on the all steel case segment SRM.

The remainder of this report will now address the following information as requested in the reference letter concerning the 16 excess segments.

- Manufacturer
- When purchased
- Cost
- Reason not used
- Plans for use or disposal including storage and holding costs
- Problems affecting or precluding use/disposal
- Estimated costs of disposal
- Any salvage or residual value
- Test requirements
- Use by other agencies

- Manufacturer and When Purchased

12 FWC Segments

- Manufacturer - Thiokol (Filament wound case components supplied by Hercules)
- Description/manufacture date

	Casting Date
VLS - 1A (Vandenburg Launch System)	
Aft	February 14, 1985
Center - Aft	March 20, 1985
Center - Forward	May 2, 1985
Forward	January 15, 1985
VLS - 1B	
Aft	January 22, 1985
Center - Aft	March 20, 1985
Center - Forward	April 15, 1985
Forward	February 19, 1985
QM-5 (Qualification Test Motor)	
Forward	May 29, 1985
Center - Forward	May 31, 1985
Center - Aft	June 8, 1985
Aft	June 19, 1985

Four Steel Case Segments

- Manufacturer - Thiokol
- Description/Manufacture Date

	Casting Date
• Pre 51-L Design (two segments)	
• SRM-30 (Modified to install experimental field joint U-seal)	
Center-Forward	November 22, 1985
Center-Aft	December 6, 1985
• RSRM Design (two segments)	
• ATA (Assembly Test Article for KSC pathfinder tests)	
Aft	October 30, 1987
• RSRM 38A	
Aft (rubber strip reported to be cast in propellant)	January 19, 1993

- Reason not used

  - FWC Segments (12)

    Following the 51-L failure, the decision was made to discontinue the FWC development program and return all FWC segments to Utah for storage and disposition at some later date. At that time the belief was that the three complete motors could be used as full scale test articles at some future time.

  - SRM-30 segments (aft and aft-center) are the pre-51L design and were modified with an experimental U-seal design for joint protection during the RSRM development program and thus were rendered unusable for static test purposes.

  - ATA segments (aft and aft-center) were manufactured during the RSRM program and shipped to KSC for pathfinder tests involving the assembly and disassembly of the J-seal field joint. As a result of this testing the aft segment was rendered unusable for either flight or ground testing.

  - RSRM 38A aft segment propellant is believed to contain a strip of rubber 1 inch by 8 inches, and about 0.1 inch thick that was discovered missing from the process tooling after completing casting operations. The presence or location of the rubber strip using all available inspection techniques (including X-ray, N-ray, and ultrasonics) was never confirmed. Due to this uncertainty the segment has been identified as unsafe to fly, but could be used in a ground test motor. At present there are no requirements to use the segment in any of the three remaining ground test motors scheduled for testing during the remainder of the Buy III production contract out through the year 2000. Thus the segment is presently considered as a candidate for scrap. This is the only segment of the 251 segments manufactured during the RSRM program through the end of April 1996 that has had a condition potentially unsafe enough not to release it for flight.

Cost

Segment Description	Estimated Value Each Item ($M)
VLS (1A and 1B) - 2 each	
Forward	2.3[1]
Center - Forward	1.9[1]
Center - Aft	1.9[1]
Aft	3.0[1]
QM-5	
Forward	2.3[2]
Center - Forward	1.9[2]
Center - Aft	1.9[2]
Aft	3.0[2]
SRM-30 (Pre 51-L)	
Center - Forward	3.2[2]
Center - Aft	3.2[2]
ATA	
AFT	3.2[2]
RSRM 38A Aft (without nozzle)	5.8[2]

Notes:

(1) Based on value stated on DD-250 at the time of shipment
(2) Estimate based on value of similar segments shipped off plant

- Plans for use or disposal including storage and holding costs

  - As outlined in the previous section entitled "Reason not used" at preser there are no plans to use any of the 18 segments for either flight or groun tests.

  - At present the 18 segments are stored in temperature controlled buildings capable of housing four segments each. The buildings are in a comple located in a remote area at our facility, that is readily accessible by ou motorized transporters. The storage building complex presently consists of a total of 15 buildings, most of which are presently fully depreciated. The annual cost for utilities, maintenance, and segment surveillance is estimated to be about $5,700 per building amounting to a total of $22,800 to store the 18 segments.

- Problems affecting or precluding use/disposal

  - The FWC Segments are presently over ten years old and thus have exceeded the required maximum storage period of five years by a factor of two. As a result there is little support either at NASA or Thiokol to assemble these segments into complete motors and static test them. In addition, the igniters and nozzles originally fabricated for these motors have been removed and used on other motors. The cost to fabricate igniters and nozzles that could be used to static fire these motors would be about $3 million for each motor. This cost when added to the cost to assemble the segments in a test stand would total about $5 million for each motor test. This high cost and the questionable condition of the aging FWC segments has resulted in the program position that static testing is not a viable method for disposing of the FWC segments and recovering the usable metal case parts.

  - The four steel case segments consist of two center and two aft segments and thus cannot be assembled into a single test motor configuration. In addition, the field joint design for the RSRM was modified to include a capture feature to reduce joint rotation during motor operation, thus preventing it from being mated with the pre-51L SRM design.

- Problems affecting or precluding use/disposal (cont)

  - A problem affecting disposal at other locations is the size and weight of the segments. Each segment is about 12 feet in diameter with lengths varying from about 27 to 32 feet depending upon the configuration. Although size does pose a problem during transportation the major concern is the weight of the segments that ranges from about 300,000 to 335,000 pounds. This weight requires the use of specially designed multi-wheeled transporters for travel on roadways and special modified railcars for shipment by rail.

  - Open air burning of the propellant in the segments is subject to regulation. This type of burning of propellant deemed as scrap is regulated by permit and permission must be granted by the State of Utah to allow this type of disposal. In addition, if the segments were burned out, the reusable steel case components would be damaged and only have value as scrap metal.

- Disposal alternatives and estimate costs

  - At present there are two approaches receiving consideration for disposal of the excessed FWC and steel case segments: Water washout and open air burn. Available options and conclusions are being developed which include price estimates, and results can be anticipated by the end of GFY98.

    - <u>WATER WASHOUT ALTERNATIVE</u> - This approach involves water washout and sale of the slurried propellant as a mining explosive. DynaNobel (a mining explosive manufacturer) has advised Thiokol that they will not accept any amount of asbestos in the slurry from the case insulation. This has caused refinement of the slurried propellant approach to involve water washout and a slurry for approximately 75% of the propellant in each segment, with a second process involving AP separation for the 25% of the propellant in the area closest to the liner. This second step drives the recovery cost higher than originally envisioned.

WATER WASHOUT ALTERNATIVE (cont)

To help mitigate recovery costs, yet another alternative has been identified wherein segments are washed out, then AP separated via leaching and centrifuge resulting in "AP water" collection. The "AP water" would then be utilized by DynaNobel as feed stock for mining explosive slurries. This appears to be a lower cost environmentally friendly approach. Rather than a propellant slurry being purchased by mining explosives companies (less than $.05 per pound), we will have to pay DynaNobel some amount (as yet undetermined) to take the "AP water."

DynaNobel has no interest in paying meaningful sums for explosive material, as ammonium nitrate is readily available at very low cost (<$.10 per pound).

Water washout avoids the regulatory restrictions of open air burning and could potentially save the reusable metal components which have a substantial replacement cost. Recovery of the metal components could avoid future program costs. Each of the above approaches involves water washout with potential exposure of the case components to AP-containing water over a lengthy (two to three week) period. Various rust inhibitor alternatives have been evaluated, but we are not yet confident that the metal parts can be salvaged.

OPEN AIR BURN ALTERNATIVE - Air permit limitations have been evaluated and current assessment indicates we may be allowed to burn four segments per year under our existing permits. This indicates a burn approach would require a four year period to dispose of the 16 segments. While involving a longer than anticipated time period, this option eliminates the need for special air permits and may be the least expensive option if replacement value of the metal components is not considered. Suitable burn locations have been located that require very little modification. Process assumptions have been completed and cost estimates associated with this alternative are being finalized.

Estimate costs of disposal

- Currently estimated as open air burn in Program Operating Plan (POP)
  - Total of $7.7M (50% each during GFY97 and 98)

- Salvage or residual value

The primary residual value from the segments is the reusable steel case components as identified for each of the 16 segments:

Segment Description	Reusable Case Component
VLS - 1A	
Aft	Aft dome and ET attach
Center - Aft	none
Center - Forward	none
Forward	Forward dome
(Same for VLS-1B and QM-5)	
SRM-30	
Center - Forward	Cylinders (2)
Center - Aft	Cylinders (2)
ATA	
Aft	Aft dome and ET attach (neither considered usable in RSRM Program)
RSRM 38A	
Aft	Aft dome, two stiffeners, and ET attach

Total Potential Residual Value

Case Component	Quantity	Unit Price ($K)[1]	Total Per Component ($K)
Forward Dome	3	770 [2]	2,310
Cylinder (LW)	4	620	2,480
ET Attach	4	710	2,840
Stiffener	2	700	1,400
Aft Dome	4	770	3,080
		Total	12,110

A-3-11

(1) Based on current contract to procure 33 replacement case components over the period from GFY96 through GFY01

(2) Assumed equivalent in price to the aft dome

- Test requirements

  At present there are no plans to test these segments as assembled motors individually with specially designed closures and nozzles.

- Use by other agencies

  Thiokol is presently not aware of any request from any other government agen to use one or more of these segments for research or testing purposes.

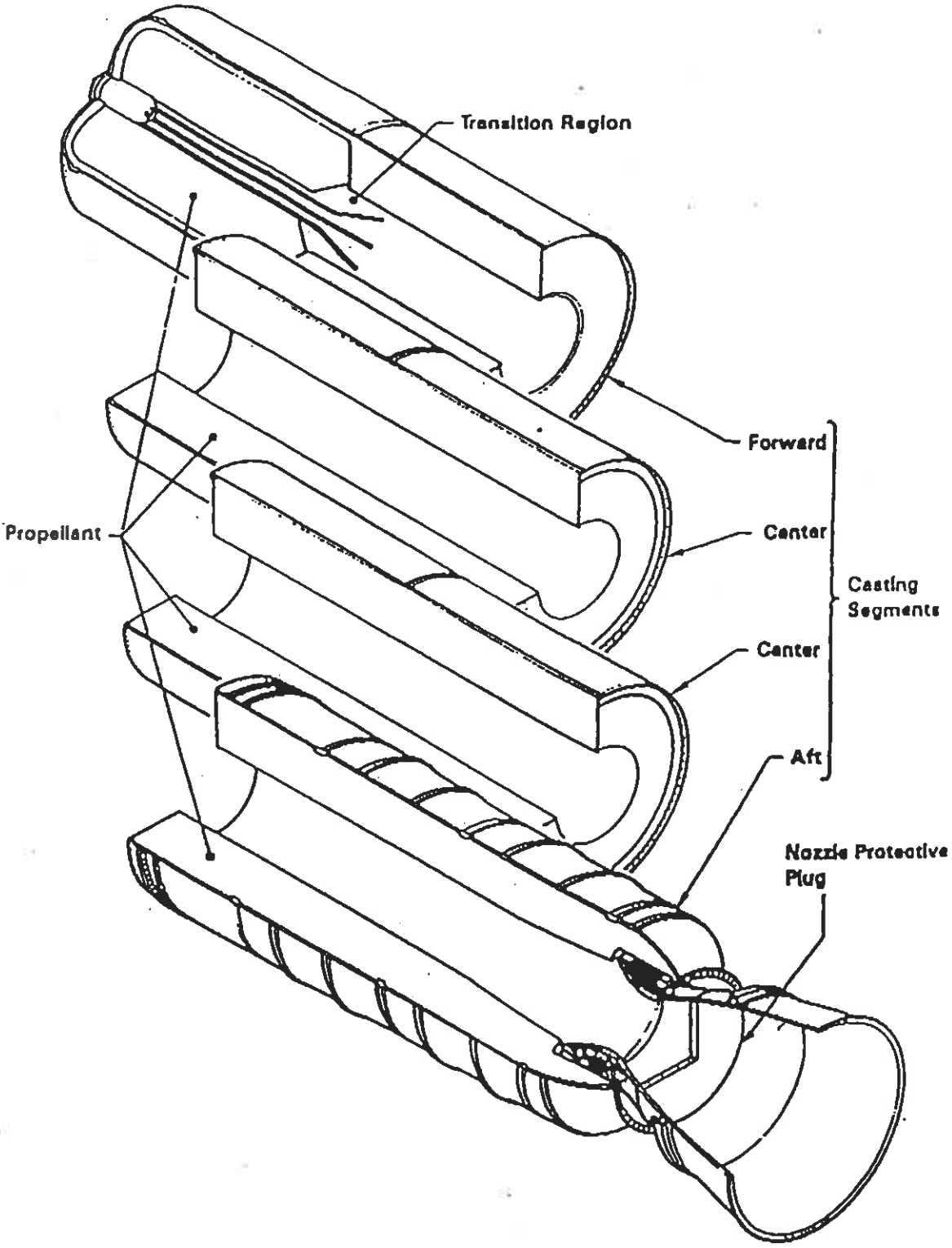

Figure 4.3-1. RSRM Propellant Configuration

A0006740 RJ

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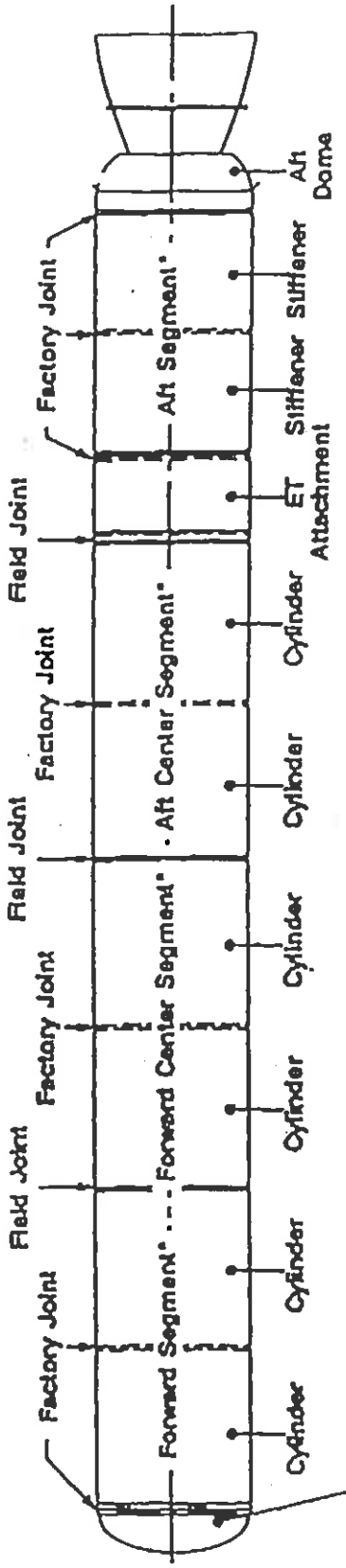

Figure 4.1-1. Case Segments

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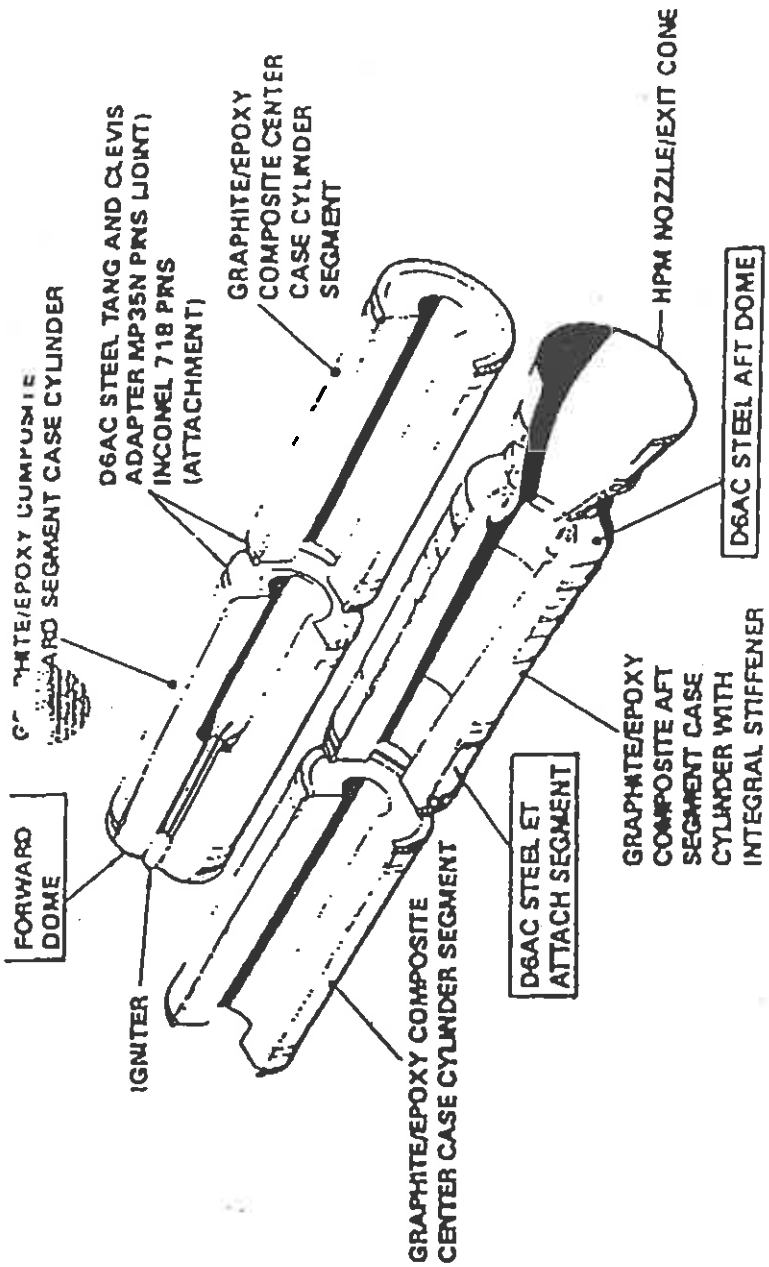

Figure 1. PMC-SRM Configuration

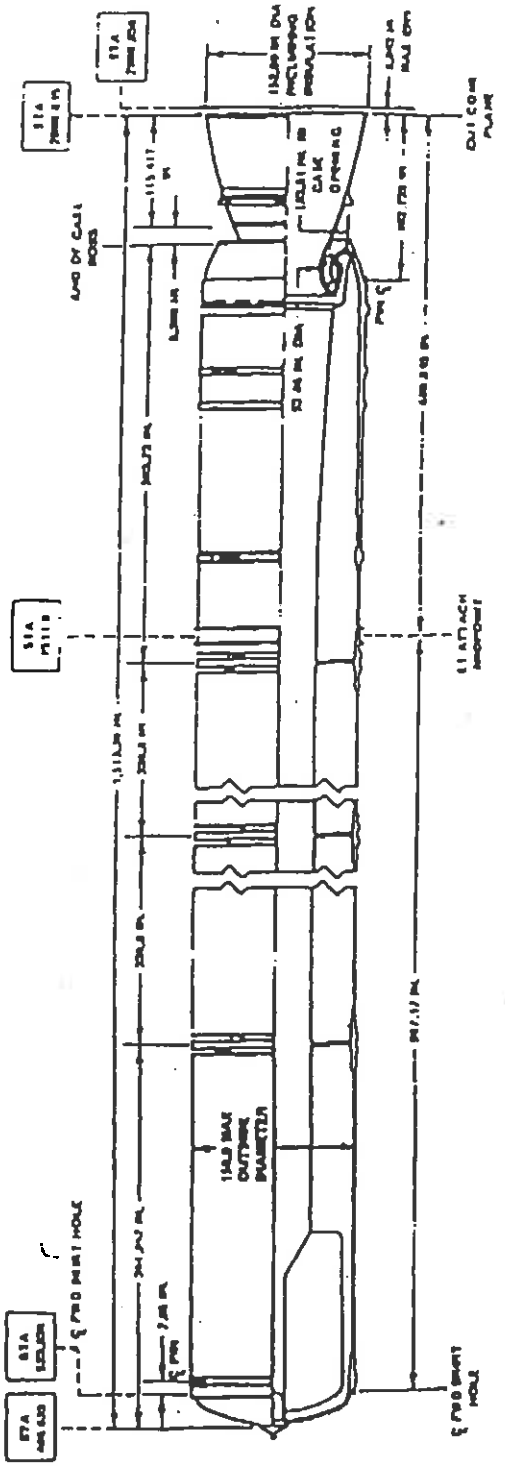

Figure 2. PMC-SRM Design Configuration

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