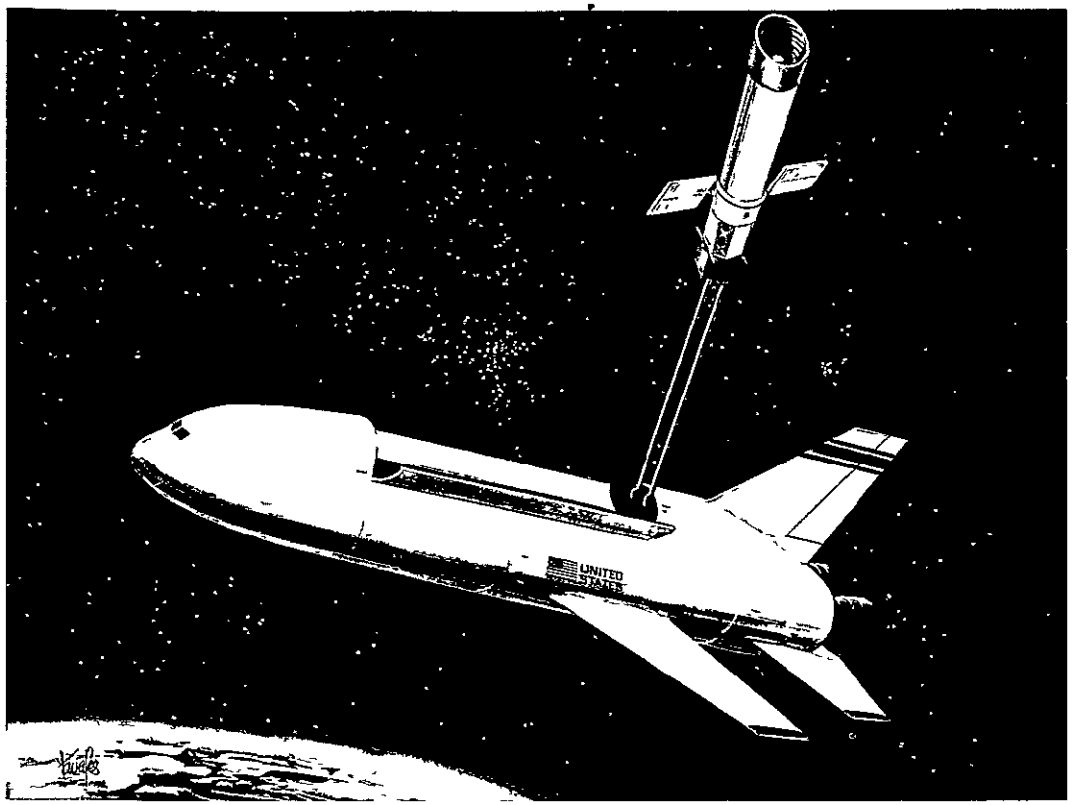


OAO/LST SHUTTLE ECONOMICS STUDY

Prepared for

National Aeronautics and Space Administration
Goddard Space Flight Center

Contract NAS5-17149

October, 1970

by

GRUMMAN AEROSPACE CORPORATION

Volume II

Appendix to

OAO/LST SHUTTLE ECONOMICS STUDY

Prepared by

GRUMMAN AEROSPACE CORPORATION

for

THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

GODDARD SPACE FLIGHT CENTER

CONTRACT NAS 5 17149

October 1, 1970

I

Appendix

TABLE OF CONTENTS

Section No.	Content
1	Index to Documents Generated
2	Proposal for OAO/LST Shuttle Economic Study
3	Reliability/Maintainability Outputs
A	Apportionment Computer Output Summary
B	Multi-state Effectiveness Analytical Technique
C	Multi-state Effectiveness Computer Output Summary
D	Subsystem and Group Reliability Block Diagrams
4	Cost Model/Analysis Computer Outputs

II

Appendix Section 1

Index to Documents Generated

III

OAO/LST SHUTTLE ECONOMICS STUDY

Documents Generated - Des. No. 252E

NUMBER	TITLE - DOCUMENT SUBJECT
IOM-01	Ground Operations - Definition of Major Cost Elements
IOM-02	Quality Control Task Statement
IOM-03	Preliminary Proposed Equipment List for LST
IOM-04	Baseline LST Structure Description
IOM-05	LST Subsystems Description
IOM-06	Baseline LST Experiment Description
IOM-07	Reliability and Maintainability Task Description
IOM-08	Manufacturing Task Description
IOM-09	Inputs Required for Costing OAO/LST Study
IOM-10	Proposal for an OAO/LST Shuttle Economic Study
IOM-11	Reliability and Maintainability Output Format
IOM-12	Addendum to Baseline LST Structure Description (G-4)
IOM-13	Shuttle/LST Cost Factors Presentation
IOM-14	Ground Operations - Detailed Definition of Major Cost Elements
IOM-15	Level of Functional Configuration - LST/Shuttle Ops.
IOM-16	Quality Assurance Assessment - Task Group 2
IOM-17	Definition of OAO/LST Cost Areas
IOM-18	Preliminary Comparison of Titan and Shuttle Design Load Environments for a Titan Booster - LST vs. A Shuttle - LST
IOM-252E-19	Revision to Preliminary Proposed Equipment List For LST (Original Vellum in OAO Log Numbered IOM-3/4-70-330)
IOM-252E-20	Costs of Major LST Components
IOM-252E-21	Interstage Adapter Descriptions, For Titan Launch
IOM-252E-22	OAO/LST Shuttle Economics Study Task Group 1 1.2 Obtain Shuttle Guidelines, Constraints, Interfaces, Capabilities
IOM-252E-23	Updated Baseline LST Experiment Definition
No. 24	Outline of Final Report
No. 25	Input Output Required For Central Pricing
IOM-252E-26	Status of Systems Engineering as of 29 July

OAO/LST SHUTTLE ECONOMICS STUDY (Cont.)

Documents Generated - Des. No. 252E

NUMBER	TITLE - DOCUMENT SUBJECT
IOM-252E-27	Tasks 1.4.1, 1.8.1
IOM-252E-28	Task 1.7.1 - Define Functional, Hardware, and Operation Requirements - Observatory
IOM-252E-29	OAO/LST Radas Support
IOM-252E-30	OAO/LST Pricing For Unit #1 (Prototype)
IOM-252E-31	Q.A. Approach to Inspections, Qual. Eng'g. & Qual. Flow
IOM-252E-32	Payload Impact of Space Shuttle and Tug
IOM-252E-33	LST Task 1.7.3 - Ground Station
IOM-252E-34	Status of OAO/LST Economics Study
IOM-252E-35	Test and Checkout
IOM-252E-36	Updated Experiment and Optics Costs
IOM-252E-37	OAO/LST Shuttle Economic Study
IOM-252E-38	OAO/LST Reliability/Maintainability Status Report
IOM-252E-39	OAO/LST Baseline Costs
IOM-252E-40	Updated Ground Operations - Major Cost Elements
IOM-252E-41	Cost Breakdown of Structure, Flight Article No. 1
IOM-252E-42	Calculation of: No. of Shuttle Revisits, Time Between Revisits, System Uptime and Uptime Ratio
IOM-252E-43	OAO/LST Shuttle Economic Study (Manufacturing Plan & Cost Estimate)
IOM-252E-44	Assumptions in LST Baseline Program Costs
IOM-252E-45	Quality Assurance Cost For Program
IOM-252E-46	Quality Control Summary Report
IOM-252E-47	LST Product Support Report
IOM-252E-48	Reliability & Maintainability - Mission Requirements An Analysis & System Analysis Task Description
IOM-252E-49	Reliability/Maintainability - Subsystem and Subsystem Function Availability Apportionment Task Description
IOM-252E-50	Reliability & Maintainability - LST Observation Time Probability Model
IOM-252E-51	OAO/LST Program Costs
IOM-252E-52	Reliability & Maintainability - Effects of Delay Resupplies on Program Cost
S/CAT-TI-IOM 70-1	OAO/LST Phase "A" Final Report Test and Operations

Appendix Section 2

Proposal for OAO/LST Shuttle Economic Study

VI

PROPOSAL FOR AN

OAO/LST SHUTTLE ECONOMIC STUDY

Submitted

to the

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Goddard Space Flight Center
Greenbelt, Maryland 20771

In Response to

RFP NO. 16067/575

By

GRUMMAN AEROSPACE CORPORATION
Bethpage, New York

VII

TABLE OF CONTENTS

		Page
	Introduction	
Part 1	Study Guidelines and Constraints	1-4
Part 2	Shuttle Interface Considerations	5-15
Part 3	Statement of Work	16-20
Part 4	Task Flow Diagram	21
Part 5	Schedule	22
Part 6	Financial Information	23, 24

INTRODUCTION

The Grumman Aerospace Corporation is pleased to respond to the Goddard Space Flight Center Request for Proposal, N16067/575 dated 30 June 1970 for an OAO/LST Shuttle Economic Study.

The objectives of this study are two fold. The first objective is to determine the effect of utilizing the Space Shuttle upon the cost of the OAO/LST point design spacecraft. The second objective is to determine the effects of utilization of the Space Shuttle upon the mission objectives and operational system of the OAO/LST spacecraft.

Our proposal to undertake this study is based on our unique experience in being able to provide the major program elements involved in this effort in a timely fashion to result in a meaningful output.

This study will involve as one major program element the generation of a complete cost model of an OAO/LST based on the GSFC point design spacecraft and launched in what has been considered until now the convential manner employing an expendable booster, the Titan III-C. Early in the concept development phase of the GSFC Program for the Large Space Telescope Grumman contributed to the structural and thermal configuration of this point design. This baseline cost model will undergo several itterations based on possible changes resulting from the introduction of the concept of an Earth Orbital Shuttle (EOS) available for initial launch, deployment, resupply, and retrieval. The effects of this EOS availability on the design and operation of the OAO/LST spacecraft and the resultant sensitivity to program costs will be presented.

Grumman also has considerable experience in another major study program element - the Earth Orbital Shuttle. We recently competed successfully for a study of several alternate designs after more than 2 years of dedicated effort on the part of several hundred people at Grumman who were involved in the evaluation of Earth Orbital Shuttle Concepts. We propose to draw heavily on this experience for this OAO/LST Economic Study.

Another major program element, which has received little attention in the past, is the Teleoperator device which forms the major interface between the shuttle and spacecraft. Grumman is in a unique position to make a major contribution in this area since it has been involved in the design and evaluation of remote manipulator type devices. These type of devices are employed in the Grumman built deep submersible vehicle, the Ben Franklin. The design experience and actual operational data available from the GAC Ocean Systems Program will be a major source of information for our study team members to draw upon in considering Teleoperator requirements.

An especially significant program element of this study will be credible cost data. To this end Grumman will rely heavily on the cost data available from the present OAO Program which provides a continuous ten year history of cost.

To augment our OAO Program cost history we have also had wide experience in the design, development, and production of large and complex structures, many involving the use of the latest exotic materials technology. This familiarity with requirements and costs will be applied to the cost models in the OAO/LST Economic Study.

An additional interface requirement is the evaluation of the influence of man rated systems on the design of the LST and a comparison of costs associated with man rating on the program. GAC will rely on our LM experience for this area of the study.

In summary, GAC has been familiar with and in many cases a direct participant in the major factors contributing to this OAO/LST Economic Study. Unique experience in these critical areas assures a straightforward approach to the evaluation of the baseline cost model and satisfactory development of interface requirements and definition of the resulting costs for the timely execution of this study.

Part 1 of this proposal is the study guidelines and constraints. Part 2 is the Shuttle Interface considerations with the statement of work and the task Flow Diagram in Parts 3 and 4. Part 5 is the Proposed Schedule. Part 6 contains the cost and pricing summary and financial information.

OAO/LST SHUTTLE ECONOMIC STUDY

PART 1

STUDY GUIDELINES AND CONSTRAINTS

1. GSFC/LST point design to be used as baseline definition of observatory (Space Vehicle) hardware elements. This is defined in the following documentation:

    1. STAR Presentation

    2. Structural Designs for a 120-inch Diameter Advanced Orbiting Telescope
       X-284-70-147
       April 1970

    3. Additional material to be supplied

2. Shuttle launch vehicle capabilities model to be supplied by GAC Shuttle Group (W. Carl is Shuttle interfaces representative on study team) typical shuttle launch and servicing costs to be supplied by GAC Ops Anal.

    Note: The 25,000# LST plus handling, servicing and interface equipment will be assumed to be capable of being inserted into a 400 n.m., nautical mile, 35° inclination orbit as required.

3. GSFC/LST mission model as described in the STAR presentation referenced above will be used.

    Note: The intent of this mission model is to provide up to 90 to 100% observing time availability to orbital astronomy. The actual mission model required to accomplish this goal is to be determined by the GAC Study.

4. The Titan III D (or equivalent Titan Model designation) Expendable Launch Vehicle with a stretched version of the Viking Centaur Shroud (Fairing) will be used as the model for the baseline costing. The Launch environments and payload constraints of this vehicle will be supplied by GAC/GSFC.

5. The LST-peculiar service module for automated resupply of the observatory will be as defined by GAC documentation to be supplied.

    Note: 1) The intent of this mechanism is to minimize the costs of Man Rating Influences on the payload (LST) costs. Maintainability is to be limited to that which can be accomplished with the teleoperation system.

    (See documents 4C and 5 for teleoperator references)

5. Continued

Note 2) EVA maintenance represents a possible alternative to the above service module which, if shown to be feasible, may result in lower LST program costs. Reference 2A, Page 2 states that this should be another study independent of the shuttle. We should consider the possibility of proposing such a study to be done as a follow-on to the present study. Present studies in the Reliab./Maint. section could provide background and justification for such a proposal.

6. Observatory checkout, alignment and calibration will be conducted through the GSFC Ground Station and Observatory Spacecraft telemetry link. No special equipment for this purpose is presently envisioned for the shuttle.

Note: The shuttle launch readiness cycle and payload injection operations may require some kind of payload readiness checkout. This requirement will be supplied by shuttle interface group.

7. The Shuttle launch vehicle environment imposed on the LST, due to reentry and landing from an aborted mission should be considered part of the structural design requirements for the LST and its subsystems. It is intended that additional costs due to this requirement be identified if significant.

8. The Shuttle launch vehicle will be considered to be available for the LST program starting CY 1977 and as required by the STAR mission Workload thereafter.

9. Potential hazards created by the LST spacecraft when on-board the Shuttle should be reduced to a level to be determined by the shuttle interfaces group.

Note: A reference to "Category III b" of Safety Program Directive No. 1, Rev. A (SPD-1A)

- Systems Safety Requirements for Manned Space Flight, has been given as one guideline.

10. Shuttle capabilities for rendezvous, docking, and subsequent attitude stabilization and electrical power support of the docked configuration will be determined by the Shuttle Interfaces group.

11. Availability of a Data Relay Satellite System for continuous real-time communications between the observatory and the ground is not known this time. Advantages of DRSS will be listed but not costed.

12. Spacecraft systems failures should be categorized as: those capable of repair and replacement in orbit through automated procedures, and those requiring retrieval and ground repair. EVA activity will be considered as an alternate to retrieval only.

13. The Level of Modularity for Orbital resupply is assumed to be at the Subsystem Assembly Level as described in the STAR presentation.

14. Experiment Package replacement will be performed for two reasons:

    1) Experiment mission change - typically a one year mission duration is estimated for the particular experiment.

    2) Experiment equipment failure will require package replacement at the next scheduled shuttle visit. Since four independent experiments will be in the observatory payload, the loss of one would not cause loss of scientific mission.

15. The Observatory Spacecraft will be defined for the purposes of this study as being comprised of the following subsystems which include a number of separate modules.

    1) Stabilization and Control
    2) Communications
    3) Data Handling
    4) Electrical Power
    5) Structure
    6) Thermal
    7) Experiment
    8) Primary Optics

16. The shuttle launch mode is defined as including the phases of:

    0) Configure shuttle for dedicated LST mission
    1) Stacking in the shuttle payload bay
    2) Shuttle ground checkout and launch readiness cycle
    3) Shuttle launch
    4) Boost to orbit
    5) Orbital transfer (if required)
    6) Payload deployment including checkout
    7) Payload release

17. The Shuttle instrument update mode is defined as including the phases of:

0) Configure Shuttle for dedicated LST mission
1) Loading replacement experiment packages in the shuttle payload bay
2) As in 16
3) As in 16
4) As in 16
5) As in 16
6) Rendezvous with LST
7) Docking to LST
8) Service module and experiment package deployment
9) Experiment package replacement
10) Service module and old experiment package return and STOW
11) Shuttle return to earth

18. The shuttle refurbish (orbital) mode is defined identically with the instrument update mode with the substitution of "Subsystem Package" for "experiment package".

Note: Both instrument update and subsystem replacement can be performed simultaneously.

19. The shuttle retrieval mode is defined as including the following phases:

1) Shuttle Rendezvous with LST
2) LST Capture
3) LST return to STOW Configuration
4) LST STOW in shuttle
5) Shuttle return to Earth
6) LST unload from shuttle

20. LST has backup S&C System capable of putting LST in safehold mode for shuttle retrieval comprised of sun sensor, gyros and jets.

OAO/LST SHUTTLE ECONOMIC STUDY

PART 2

SHUTTLE INTERFACE CONSIDERATIONS

1. Shuttle guidelines and constraints are: Section A, Baseline System Requirements; Section B, Mission Requirements; and Section C, Desired System Characteristics.

2. Shuttle capabilities with regard to altitude and angle of inclination have been calculated and are compatible with the LST orbital requirements.

3. Interfaces:

   a) Structural

      1. It can be assumed that lateral and longitudinal support can be provided in 2 planes to avoid weight penalty of cantilevered support.

      2. Deployment Retrieval - It can be assumed that EOS will provide deployment. Deployment should be translational until LST is outside cargo bay. Deployment mechanism will include a docking mechanism for capturing LST for servicing, module replacement, or return to earth.

      3. Shrouding - LST can be transported to orbit within a pressurized module with thermal control or simply installed in the unpressurized bay.

   b) Electrical

      1. Electrical Power

         Electrical Interface

         Power available from Shuttle for use by payload:

         Type:

         D.C. 120 Volts (May become 28 volts)
         A.C. 400 Cycles 120 Volts

         Quantity:

         500 watts available. More could be made available, if necessary.

Docking

Accelerations assumed:

CONDITION	N_x(g)	N_y(g)	N_z(g)
Max. Accel	+3.0 -1.30	±1.0	+2.5 -2.7
Entry	-0.13	±0.1	-2.2
Landing	-1.30	±0.1	-2.7
Maneuver	-0.7	±1.0	±2.5
Rebound & Lift Off	+1.45	±0.5	±0.8

PARAMETER	BASELINE DESIGN
Miss Distance Centerline	±15 in
Miss Angle Centerline	±40°
Rotation Angle	±40°
Contact Velocity	0-0.5 ft/sec

SECTION A

BASELINE SYSTEM REQUIREMENTS

The following characteristics shall be considered as baseline system requirements. Variations from these baseline requirements should be identified by the contractor in the event improvements in mission capability and/or reductions in cost could be achieved.

	Systems Requirements	Vehicle (B-Booster) (O-Orbiter)
1.	Fully Reusable Two (2) Stage Vehicle	B, O
2.	Vertical Takeoff; Horizontal Landing	B, O
3.	No propellant cross feed	B, O
4.	Aerodynamic Crossrange: Configuration (s) for low crossrange (approximately 200 n.mi.) and high crossrange (approximately 1500 n.mi.)	O
5.	Gross liftoff weight - 3.5 million pounds	B, O
6.	The cargo bay shall be sized to have a clear volume of 15' diameter X 60' length.	O

	Systems Requirements	Vehicle (B-Booster) (O-Orbiter)
7.	A maximum payload capability shall be provided to the Space Station orbit and return. The vehicle must also be capable of flying up or down with lighter payloads.	O
8.	400,000 pound sea level thrust bell-type engines will be baselined in both the orbiter and booster stages as further defined in CEI Specifications, DCN 1-0-21-00001.	B, O
9.	Sequential Ignition	B, O
10.	Intact abort capability will be provided. This implies the capability of the booster and orbiter to separate and continue flight to a safe landing; the orbiter to land with a full payload.	B, O
11.	A Booster/Orbiter life of 100 missions will be provided with a cost effective level of refurbishment and maintenance.	B, O
12.	The weight of passengers and removable provisions for passengers is charged to the payload.	O
13.	All vehicle stages shall be capable of ferry flights between airports; provisions for strap-on engines and/or auxiliary tankage may be considered.	B, O
14.	The Booster and Orbiter shall be baselined to have go-around capability.	B, O
15.	The Booster shall be capable of returning to the launch site.	B
16.	The Booster and Orbiter shall each have a two (2) man flight crew.	B, O
17.	Propellant shall provide 1500 fps in excess of the amount required to obtain the referenced injection orbit. The tanks shall be sized to provide for a 2000 fps delta V capability.	O
18.	The Orbiter crew and passenger environment shall be shirtsleeve.	O
19.	Systems sensitivity to loading of fluid consumables shall be minimized.	B, O

SECTION B

MISSION REQUIREMENTS

The following mission requirements are presented to provide initial direction for the Phase B Study. Continuous refinement of these requirements may be provided to the contractor by the NASA throughout the duration of the contract. Table B-1 contains a general description of the missions and mission requirements that have been identified as being of major interest in future space program planning.

The following nominal conditions have been selected, from the mission matrix discussed previously, as the shuttle baseline requirements:

1. Mission duration: At least 7 days of self-sustaining lifetime shall be provided for the mission duration. For missions in excess of 7 days the weight of the expendables shall be charged against the payload.

2. Design reference mission: The reference mission to be used in designing the space shuttle is a logistics resupply of a space station or space base.

3. Reference injection orbit. The reference injection orbit shall be 50 x 100 nautical miles.

4. Reference injection orbit ΔV: 1500 fps of usable ΔV capability in excess of the amount required to attain the reference injection orbit shall be provided.

5. Design reference orbit: The reference orbit to be used in designing the space shuttle shall be a 270-nautical mile circular orbit, with a 55° inclination. For purposes of performance calculation the vehicle shall be considered to be launched from a lattitude of 28.5 degrees North.

TABLE B-1

MISSION CHARACTERISTICS

MISSIONS / ORBITAL CHARACTERISTICS	SPACE STATION/ BASE LOGISTICS SUPPORT	PLACEMENT AND RETRIEVAL OF SATELLITES	DELIVERY OF PROPULSIVE STAGES & PAYLOAD	DELIVERY OF PROPELLANTS	SATELLITE SERVICE & MAINTENANCE	SHORT DURATION ORB. MISSION
ALTITUDE (N. MI.)	200 - 300	100 - 800	100 - 200	200 - 300	100 - 800	100 - 300
INCLINATION (DEG.)	28.5-90	28.5-SUN SYN.	28.5-55	28.5-55	28.5-SUN SYN	28.5-90
ON-ORBIT V (1000 FPS)	1 - 2	1 - 5	1 - 1.5	1 - 2	1 - 5	1 - 2
ON-ORBIT STAY TIME (DAYS)	7	7	7	7	7 - 15	7 - 30
CREW	2	2	2	2	2	2
PASSENGERS	ROTATE 50 MEN/QTR	2	2	2	4	12
DISCRETIONARY PAYLOAD						
WEIGHT (1000 LBS.)	* 70/QTR	---------	---------	---------	---------	---------
VOLUME (1000 FT.^{3})		5 - 10	10	10	5 - 10	4 - 6
CRITICAL DIMEN DIA. (FT.)	10 - 15	15	15	15	15	15

* INCLUDE PASSENGERS

SECTION C

DESIRED SYSTEM CHARACTERISTICS

The desired system characteristics listed below are presented to provide initial direction for the Phase B Study. The contractor shall evaluate these desired system characteristics and shall recommend revisions where improvements in cost and effectiveness would result. Continuous refinement of these characteristics will also be provided to the Contractor throughout the duration of this contract. For convenience, the following tabulation of characteristics has been grouped under three headings: Program Characteristics, Vehicle Characteristics, and Operational Characteristics; however, it should be noted that each item applies to the total system.

Program Characteristics

1. Costs will be reported using the design reference mission and should not included payload costs. A communication satellite system is assumed to be available and shall not be costed in the program.

2. The calendar year 1972 will be used as the materials technological base.

3. IOC baseline is the second half of 1977.

4. Flexibility shall be maintained to incorporate technology advancement and alternate missions.

5. Launch rates will vary from a minimum of 25 to a maximum of 75 per year. Cost estimates shall be developed for two launch rates: 25 and 75/year.

Vehicle Characteristics	Vehicle (B-Booster) (O-Orbiter)
1. The vehicle shall have a two-man flight crew and shall be flyable under emergency conditions by a single crewman.	B, O
2. Provisions shall be made for deployment and boarding of a cylindrical payload of the size specified in Appendix A of this document.	O

Vehicle Characteristics (Continued)	Vehicle (B-Booster) (O-Orbiter)
3. The crew environment shall be shirt-sleeve.	B, O
4. The space shuttle shall have an internal sealable tunnel with a standard interface between the crew compartment and unpressurized payload bay.	O
5. The space shuttle crew/passenger compartment atmosphere and total pressure shall be compatible with the space station and space base.	O
6. Systems shall be designed for a minimum of maintenance with ease of removal and replacement; maximum use of aircraft design practice will be used.	B, O
7. In systems where redundancy is needed, the space shuttle systems shall be developed to provide redundant full mission capability and shall avoid minimum-requirement, minimum performance backup system concepts.	B, O
8. The space shuttle system shall provide for safe mission termination in the even major malfunctions occur during prelaunch preparations and subsequent to lift-off. The desired safe-mission-termination capabilities should allow for crew and passenger egress prior to lift-off and for intact separation of orbiter from booster following lift-off.	B, O
9. Multiple redundance system techniques that minimize or eliminate system transients caused by system component failures shall be adopted.	B, O
10. All subsystems shall be designed to fail operational after the failure of the most critical component and to fail safe for crew survival after the second failure. Electronic systems shall be designed to fail operational after failure of the two most critical components and to fail safe for crew survival after the third failure.	B, O

Vehicle Characteristics (Continued)	Vehicle (B-Booster) (O-Orbiter)
11. Boost stages should be designed for manned operations, but capable of operating in an unmanned mode.	B
12. Vehicle preflight and inflight checkout systems should be on-board, consistent with short turn-around and low cost operations.	B, O
13. The vehicle shall be designed for maximum on-board control, using on-board and ground capabilities as appropriate to maximize operational flexibility and minimize ground mission operations consistent with low cost.	B, O
14. Guidance and navigation functions shall be performed on-board, using ground and other navigation aids when appropriate. The guidance and navigation system shall be unrestricted in attitude.	B, O
15. A three-axis translation system and a three-axis attitude control system is required. These systems shall be designed to minimize cross coupling which may result from normal operation and from potential failure modes.	B, O
16. The Booster and Orbiter shall be capable of Pilot Controlled Landing under FAA Category II Conditions. Autopilot Systems similar to Systems used on commercial aircraft shall be included.	B, O
17. The vehicle shall incorporate on-board provisions to quickly and easily place the space shuttle in a safe condition following landing.	B, O
18. Survivability against hazards from radiation as specified in Joint DOD/NASA Survivability Characteristics document (s) dated 16 June 1969.	O
19. Hydrogen will be baselined as fuel for the air breathing engines.	B, O

Operational Characteristics	Vehicle (B-Booster) (O-Orbiter)
1. Space Shuttle launch sites may be located at KSC, Western Test Range, or an in-land site.	B, O
2. All-azimuth launch capability	B, O
3. The vehicle trajectory load factors should be a 3g capability for passenger-carrying missions.	B, O
4. The launch pad, the primary landing site, and the servicing facility shall be in the same general location.	B, O
5. The space shuttle shall have minimal assembly and checkout requirements at the launch pad.	B, O
6. Use of specialized facilities (ie, Clean Room, altitude chambers, etc.) shall be minimized).	B, O
7. Cargo elements containing hazardous material shall have self-contained protective devices or provisions against all hazards.	O
8. A variety of self-sustaining payload types shall be included in the payload integration. Pre-launch payload integration procedures similar to current air-cargo carrier operations are desired. In general, payloads should be loaded prior to moving to the launch pad.	O
9. Limited transfer of cargo shall be possible through the personnel transfer hatch.	O
10. The vehicle shall be docked to the space station or space base, and docking to accommodate personnel and cargo transfer should nominally be accomplished in a single operation.	O
11. Personnel and cargo transfer shall nominally be intravehicular activity.	O
12. For logistics missions, personnel and cargo transfer will be by intravehicular activity. EVA capability should be provided at the expense of the allocated payload weight. The design of the vehicle should not preclude EVA capability.	B, O

Operational Characteristics (Continued)	Vehicle (B-Booster) (O-Orbiter)
13. The space shuttle shall be designed to lift-off within a 60-second launch window for all launch azimuths.	B, O
14. For the design reference mission, the space shuttle shall be capable of launch from a standby status within two hours and nominally would be launched at the next acceptable in-plane opportunity. The vehicle should be capable of staying in a launch status until the second in-plane launch opportunity. The system must be capable of accommodating the time between insertion and rendezvous for a worst case phasing situation. The orbit maneuver sequence should not be constrained by systems limitations.	B, O
15. By using ground facilities and other aids when appropriate, the space shuttle shall be cpable of accomplishing rendezvous with a passive target.	O
16. Systems sensitivity to weather conditions during assembly, checkout, and launch shall be minimized.	B, O
17. The opportunity to return to a pre-selected site shall be available at least once every 24 hours or at more frequent intervals for the high cross-range configuration. By using alternate sites, more frequent emergency returns will be possible.	O
18. Hypersonic lift-drag ratios will be referenced to conditions at a Mach number of 20 and at an altitude of 200,000 feet.	B, O
19. The space shuttle elements shall have the capability to land horizontally on runways no longer than 10,000 feet.	B, O
20. Landing characteristics and handling qualities shall not require skills more demanding than those required foroperational land-based aircraft.	B, O

Operational Characteristics (Continued)	Vehicle (B-Booster) (O-Orbiter)
21. Visibility from the cockpit during landing shall be comparable to high-performance aircraft standards.	B, O
22. Total space shuttle turn-around time from landing to launch readiness should be less than two weeks. The removal and replacement time shall be minimized with on-board checkout and module accessibility.	B, O
23. All-electronic displays and control should be used, wherever practicable, to replace toggle switches and electromechanical gages and motors.	B, O
24. The space shuttle shall be capable of operating within the cargo range from zero to maximum capability.	B, O
25. Service lines at the launch pad should be minimal, preferably only for the main propulsion systems propellants.	B, O
26. Maximum use of existing standards for the selection, design, packaging and integration of hardware should be employed, consistent with program operational requirements.	B, O
27. Any peculiar GSE required to support a remote site landing should be packaged in a manner to be easily flown into the site.	B, O

1.4.3 Expendable Launch Vehicle

Titan III
Vehicle Interface
Shroud

1.4.4 Ground Operations

Ground Control Station/Crew
Manned Operations Control/Crew
Facilities/Test, Handling Crew

1.5 Breakdown Major Cost Elements to Subsystem Hardware Level into:

1.5.1 Direct cost hardware and develop recurring, non-recurring, refurbishment.

1.5.2 Contribution to GSE, spares, major test hardware, final assembly test and checkout.

1.5.3 Pro-rated costs of system engineering support, program management, G&A.

1.6 Establish Detailed Definition of Resupply or Service Modes to Include Launch, Instrument Update, Refurbish (Orbital), Test (Orbital), and Retrieval.

1.7 Define Functional, Hardware, and Operation Requirements Peculiar to OAO/LST Mission for:

1.7.1 Observatory

1.7.2 Shuttle

1.7.3 Ground Station

1.8 Define Subsystem Hardware Level Requirements for Costing and Establish Preliminary Criteria with and without Mainteance and:

1.8.1 Identify development items
Identify state-of-art items
Identify on-shelf items
Identify refurbish design requirements
Establish spares philosophy and identify cost impact

1.8.2 Establish definition of cost validity (average, plus or minus tolerances).

1.8.3 Rank cost factors in order of importance.

1.9 Establish Reliability-Maintainability Model Replaceable Modules using OAO Flight System Experience. Maintainability is Limited to that which can be accomplished with the Teleoperator System.

TASK GROUP 2

DETERMINE MAJOR COST DRIVERS, UTILIZING DEFINITIONS OF TASK 1 AND COST DATE FROM OAO, LM, AND SHUTTLE PROGRAM

2.1 Establish Preliminary Cost Model with and without Shuttle. Quantify and Rank Major Cost Elements for Each Model; Select Principle Cost Drivers.

2.2 Study and Quantify Cost Benefit Effects of Shuttle Serviceability on Hardware Cost Drivers in Each of Following Areas:

2.2.1 Design

- o Lower qualification requirements
- o Lower reliability requirements
- o Lower weight optimization requirements
- o Lower material performance requirements

2.2.2 Test and Checkout (Ground and In-Orbit)

- o Lower acceptance-test requirements
- o Lower test elements
- o Lower number of test articles
- o Determine alignment and calibration trade-offs for telescope

2.3 Study and quantify cost benefit effects of shuttle serviceability on Program Cost Drivers in each of following areas:

2.3.1 Schedules

- o Long lead items
- o Pacing items
- o Repair and turn-around

2.3.2 Facilities

- o Test
- o GSE
- o Shuttle Support Equipment
- o Spares Handling

2.3.3 Services (Manpower)

- o Engineering
- o Manufacture
- o Field Operations
- o Test

2.3.4 Spares

Shelf Life, Complement and Readiness

2.4 Expand Reliability - Maintenance Study

- Identify and rank wear-out items for each subsystem
- Determine expendables schedule
- Determine required reliability functional path (assume maintenance rate)
- Determine Reliability and Maintenance - Cost optimize approach for hardware in critical (costly) areas, e.g. level of redundancy vs. replacement.

2.5 Expand Experiment Package Definition Study for two Cost Categories. The first is the on-axis mission success package. The second is the principle investigators radial packages.

- Estimate replacement cycles rates based on scientific requirements
- Categorize generically physical characteristics for typical experiment types.
- Estimate typical experiment cost; original development and build.
- Estimate typical refurbishment and upgrade package cost
- Estimate special handling, hardware, test, alignment, calibration for orbital servicing

TASK GROUP 3

IDENTIFY AND EVALUATE COMPARITIVE COSTS FOR SELECTED PROGRAM OPTIONS

3.1 Assemble selected program options for cases with and without shuttle resupply

- o Evaluate feasibility of alternatives
- o Evaluate sensitivities of major cost drivers to program alternatives, varying parameters
- o Analyze effects of basic study assumptions on cost results.

3.2 Indicate best Reliability-Maintainability approach for design, manufacture, operation for each selected program - Determine logistics/spares rationale, each case.

3.3 Estimate manpower, materials, facilities, and related costs required to refurbish and recycle observatory.

3.4 Estimate development, build, test, training costs associated with automated servicing module - look at EVA/IVA alternative.

3.5 Summarize comparative costs for selected program options.

TASK GROUP 4

FINAL REPORT

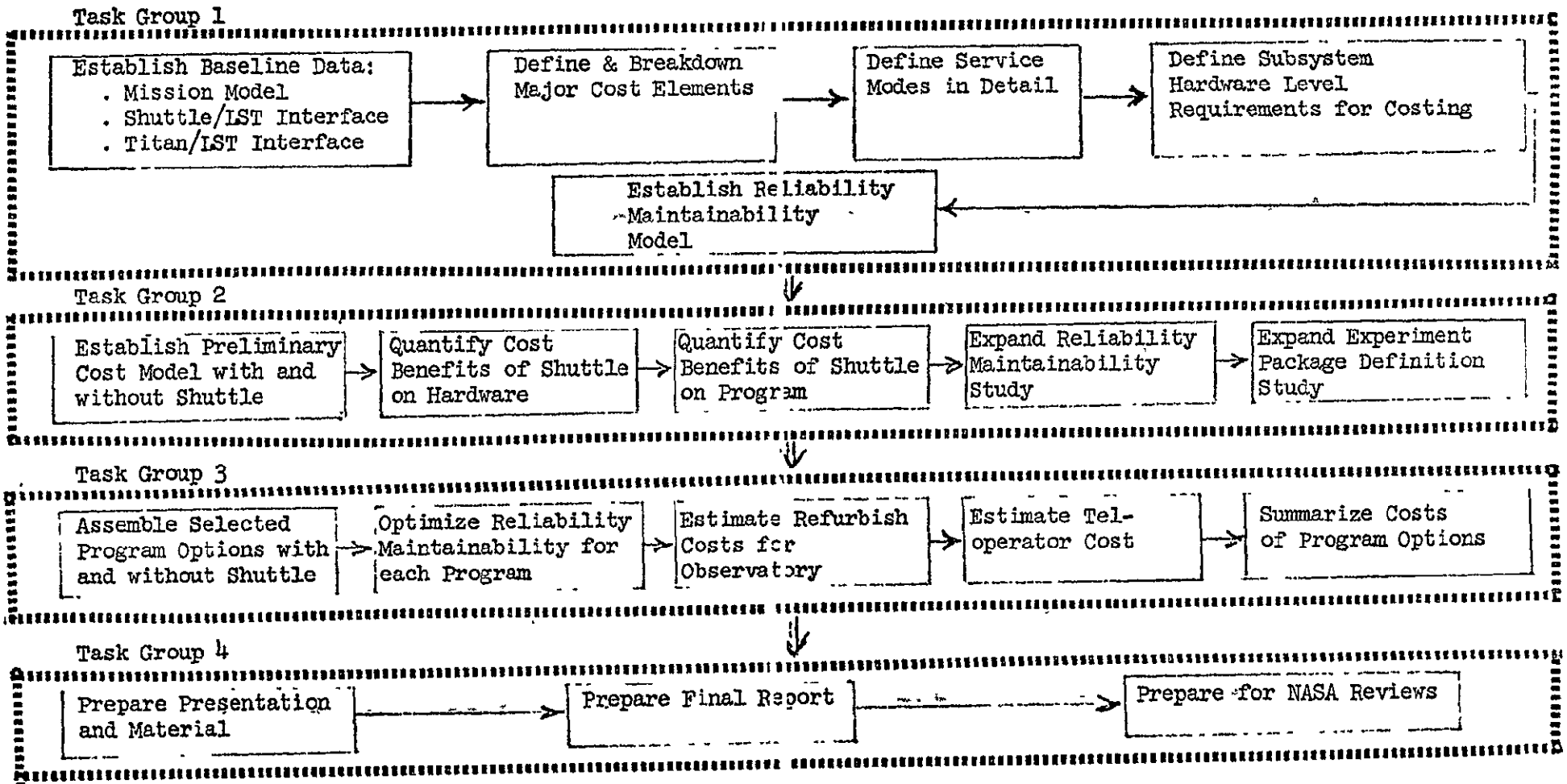
4.1 Presentation of results - generate charts, graphs, etc. - prepare presentation.

4.2 Final Report - OAO/LST Shuttle Economics Study

4.3 NASA Reviews

OAO/LST SHUTTLE ECONOMIC STUDY

TASK FLOW DIAGRAM



Appendix Section 3

Reliability/Maintainability Outputs

Appendix Subsection 3A

Apportionment Computer Output Summary

MTTF	DELAY TIME	NO. FAIL	UPTIME	UPTIME RATIO
3.0	0.5	48.00	144.0	0.79999995
3.0	1.0	42.00	126.0	0.69999999
3.0	1.5	37.33	112.0	0.62222230
3.0	2.0	33.60	100.8	0.56000006
3.0	2.5	30.55	91.6	0.50909108
3.0	3.0	28.00	84.0	0.46666664
3.0	6.0	18.67	56.0	0.31111145
3.0	12.0	11.20	33.6	0.18666667
3.0	24.0	6.22	18.7	0.10370380
6.0	0.5	25.85	155.1	0.86153841
6.0	1.0	24.00	144.0	0.79999995
6.0	1.5	22.40	134.4	0.74666667
6.0	2.0	21.00	126.0	0.69999999
6.0	2.5	19.76	118.6	0.65882373
6.0	3.0	18.67	112.0	0.62222236
6.0	6.0	14.00	84.0	0.46666664
6.0	12.0	9.33	56.0	0.31111115
6.0	24.0	5.60	33.6	0.18666673
9.0	0.5	17.68	159.2	0.88421053
9.0	1.0	16.80	151.2	0.84000003
9.0	1.5	16.00	144.0	0.79999995
9.0	2.0	15.27	137.5	0.76363641
9.0	2.5	14.61	131.5	0.73043483
9.0	3.0	14.00	126.0	0.69999999
9.0	6.0	11.20	100.8	0.56000000
9.0	12.0	8.00	72.0	0.39999998
9.0	24.0	5.09	45.8	0.25454545
12.0	0.5	13.44	161.3	0.89599997
12.0	1.0	12.92	155.1	0.86153841
12.0	1.5	12.44	149.3	0.82962966
12.0	2.0	12.00	144.0	0.79999995
12.0	2.5	11.59	139.0	0.77241379
12.0	3.0	11.20	134.4	0.74666667
12.0	6.0	9.33	112.0	0.62222230
12.0	12.0	7.00	84.0	0.46666664
12.0	24.0	4.67	56.0	0.31111115
15.0	0.5	10.94	162.6	0.90322578
15.0	1.0	10.50	157.5	0.87500000
15.0	1.5	10.18	152.7	0.84848475
15.0	2.0	9.88	148.2	0.82352942
15.0	2.5	9.60	144.0	0.80000007
15.0	3.0	9.33	140.0	0.77777785
15.0	6.0	8.00	120.0	0.66666663
15.0	12.0	6.22	93.3	0.51851857
15.0	24.0	4.31	64.6	0.35897446
18.0	0.5	9.08	163.5	0.90810806
18.0	1.0	8.84	159.2	0.88421041
18.0	1.5	8.62	155.1	0.86153841
18.0	2.0	8.40	151.2	0.84000003
18.0	2.5	8.20	147.5	0.81951225
18.0	3.0	8.00	144.0	0.79999995
18.0	6.0	7.00	126.0	0.69999999
18.0	12.0	5.60	100.8	0.56000006
18.0	24.0	4.00	72.0	0.39999998
21.0	0.5	7.81	164.1	0.91162783
21.0	1.0	7.64	160.4	0.89090902
21.0	1.5	7.47	156.9	0.87111104
21.0	2.0	7.30	153.4	0.85217386
21.0	2.5	7.15	150.1	0.83404261
21.0	3.0	7.00	147.0	0.81666666

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
21.0	24.0	3.73	78.4		0.43[illegible]64
24.0	0.5	6.86	164.6		0.914[illegible]66
24.0	1.0	6.72	161.3		0.89599997
24.0	1.5	6.59	158.1		0.87843132
24.0	2.0	6.46	155.1		0.86153841
24.0	2.5	6.34	152.2		0.84528297
24.0	3.0	6.22	149.3		0.82962966
24.0	6.0	5.60	134.4		0.74666667
24.0	12.0	4.67	112.0		0.62222230
24.0	24.0	3.50	84.0		0.46666664
36.0	0.5	4.60	165.7		0.92054790
36.0	1.0	4.54	163.5		0.90810806
36.0	1.5	4.48	161.3		0.89599997
36.0	2.0	4.42	159.2		0.88421041
36.0	2.5	4.36	157.1		0.87272716
36.0	3.0	4.31	155.1		0.86153841
36.0	6.0	4.00	144.0		0.79999995
36.0	12.0	3.50	126.0		0.69999999
36.0	24.0	2.80	100.8		0.56000006
48.0	0.5	3.46	166.3		0.92371130
48.0	1.0	3.43	164.6		0.91428566
48.0	1.5	3.39	162.9		0.90505046
48.0	2.0	3.36	161.3		0.89599997
48.0	2.5	3.33	159.7		0.88712865
48.0	3.0	3.29	158.1		0.87843132
48.0	6.0	3.11	149.3		0.82962966
48.0	12.0	2.90	134.4		0.74666667
48.0	24.0	2.33	112.0		0.62222230

0.8000000	0.7000000	0.6222223	0.5600001	0.5090911	0.4666666
0.3111115	0.1866667	0.1047038	0.8615384	0.8000000	0.7466667
0.7000000	0.6588237	0.6222224	0.4666666	0.3111112	0.1866667
0.8842105	0.8400000	0.8000000	0.7636364	0.7304348	0.7000000
0.5600000	0.4000000	0.2545455	0.8960000	0.8615384	0.9296297
0.8000000	0.7724138	0.7466667	0.6222223	0.4666666	0.3111112
0.9032258	0.8750000	0.8484848	0.8235294	0.8000001	0.7777779
0.6666666	0.5185186	0.3589745	0.9081081	0.8842104	0.8615384
0.8400000	0.8195122	0.8000000	0.7000000	0.5600001	0.4000000
0.9116278	0.8939090	0.8711110	0.8521739	0.8340426	0.8166667
0.7259259	0.5939394	0.4355556	0.9142857	0.8960000	0.8784313
0.8615384	0.8452830	0.8296297	0.7466667		

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

ITEM NO.	ITEM NAME	ITEM ENGINEERING JUDGMENT FACTORS: CRITICALITY	DESIGN INFLEXIBILITY	DESIGN COMPLEXITY	COST	WEIGHT	ENVIRONMENT	NON-REPLACEABILITY	ITEM POINT TOTAL
ASSIGNED WEIGHTING FACTORS		2.00	3.00	4.00	1.00	6.00	3.00	1.00	
1	EXPERIMENT	10.00	8.00	10.00	10.00	8.00	9.00	0.0	31.00
2	STABIL. & CONTROL	10.00	5.00	10.00	9.00	4.00	7.00	0.0	71.00
3	THERMAL	8.00	7.00	6.00	4.00	6.00	2.00	10.00	83.00
4	STRUCTURE	9.00	5.00	5.00	10.00	10.00	5.00	10.00	52.00
5	ELECTRICAL POWER	10.00	4.00	7.00	5.00	5.00	7.00	5.00	79.00
6	DATA HAND. & COMM.	8.00	1.00	9.00	5.00	1.00	5.00	0.0	119.00
7	PRIMARY OPTICS	10.00	8.00	4.00	10.00	8.00	10.00	10.00	42.00
8	DOCKING MECH.	10.00	5.00	4.00	5.00	7.00	4.00	10.00	80.00
9	PNEUMATICS	10.00	5.00	4.00	4.00	3.00	3.00	0.0	118.00

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

AVAILABILITY GOALS	0.800000	0.700000	0.622222	0.560000	0.509091
NO. ITEM NAME	AVAILABILITY APPORTIONMENTS				
1 EXPERIMENT	0.989804	0.983753	0.978446	0.973723	0.969470
2 STABIL. & CONTROL	0.976802	0.963178	0.951319	0.940834	0.931449
3 THERMAL	0.972935	0.957090	0.943328	0.931186	0.920337
4 STRUCTURE	0.982957	0.972897	0.964109	0.956315	0.949319
5 ELECTRICAL POWER	0.974222	0.959115	0.945984	0.934391	0.924026
6 DATA HAND. & COMM.	0.961424	0.939056	0.919758	0.902831	0.887788
7 PRIMARY OPTICS	0.988211	0.978051	0.970910	0.964565	0.958862
8 DOCKING MECH.	0.973900	0.958608	0.945320	0.933589	0.923102
9 PNEUMATICS	0.961742	0.939552	0.920404	0.903607	0.888676

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

AVAILABILITY GOALS		0.466667	0.311111	0.186667	0.103704	0.861538
NO.	ITEM NAME	AVAILABILITY APPORTIONMENTS				
1	EXPERIMENT	0.965603	0.947789	0.925813	0.901155	0.993179
2	STABIL. & CONTROL	0.922963	0.884428	0.838160	0.787909	0.984446
3	THERMAL	0.910542	0.866258	0.813520	0.756797	0.981841
4	STRUCTURE	0.942977	0.913978	0.878709	0.839808	0.988584
5	ELECTRICAL POWER	0.914664	0.872273	0.821652	0.767029	0.982709
6	DATA HAND. & COMM.	0.874273	0.813960	0.743861	0.670638	0.974068
7	PRIMARY OPTICS	0.953685	0.929925	0.900833	0.868482	0.990770
8	DOCKING MECH.	0.913632	0.870765	0.819611	0.764458	0.982492
9	PNEUMATICS	0.875261	0.815369	0.745713	0.672894	0.974283

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

NO.	ITEM NAME	AVAILABILITY APPORTIONMENTS				
	AVAILABILITY GOALS	0.800000	0.746667	0.700000	0.658824	0.622222
1	EXPERIMENT	0.989804	0.986673	0.983753	0.981018	0.978446
2	STABIL. & CONTROL	0.976802	0.969739	0.963178	0.957056	0.951319
3	THERMAL	0.972935	0.964716	0.957090	0.949982	0.943328
4	STRUCTURE	0.982957	0.977746	0.972897	0.968364	0.964109
5	ELECTRICAL POWER	0.974222	0.966387	0.959115	0.952334	0.945984
6	DATA HAND. & COMM.	0.961424	0.949801	0.939056	0.929073	0.919758
7	PRIMARY OPTICS	0.986211	0.981987	0.978051	0.974369	0.970910
8	DOCKING MECH.	0.973900	0.965969	0.958608	0.951745	0.945320
9	PNEUMATICS	0.961742	0.950212	0.939552	0.929647	0.920404

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

AVAILABILITY GOALS	0.466667	0.311111	0.186667	0.884211	0.840000
NO. ITEM NAME	AVAILABILITY APPORTIONMENTS				
1 EXPERIMENT	0.965603	0.947789	0.925813	0.994364	0.992025
2 STABIL. & CONTROL	0.922963	0.884428	0.839160	0.987139	0.981828
3 THERMAL	0.910542	0.866258	0.813520	0.984982	0.978789
4 STRUCTURE	0.942977	0.913978	0.878709	0.990565	0.986658
5 ELECTRICAL POWER	0.914664	0.872273	0.821652	0.985701	0.979801
6 DATA HAND. & COMM.	0.874273	0.813960	0.743861	0.978539	0.969730
7 PRIMARY OPTICS	0.953685	0.929925	0.900833	0.992372	0.989210
8 DOCKING MECH.	0.913632	0.870765	0.819611	0.985521	0.979548
9 PNEUMATICS	0.875261	0.815369	0.745713	0.978717	0.969980

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

AVAILABILITY GOALS		0.800000	0.761636	0.730435	0.700000	0.560000
NO.	ITEM NAME	AVAILABILITY APPORTIONMENTS				
1	EXPERIMENT	0.989804	0.987692	0.985678	0.983753	0.973723
2	STABIL. & CONTROL	0.976802	0.972034	0.967500	0.963178	0.940834
3	THERMAL	0.972935	0.967385	0.962112	0.957090	0.931186
4	STRUCTURE	0.982957	0.979440	0.976092	0.972897	0.956315
5	ELECTRICAL POWER	0.974222	0.968932	0.963904	0.959115	0.934391
6	DATA HAND. & COMM.	0.961424	0.953572	0.946129	0.939056	0.902831
7	PRIMARY OPTICS	0.986211	0.983361	0.980645	0.978051	0.964565
8	DOCKING MECH.	0.973900	0.968545	0.963456	0.958608	0.933589
9	PNEUMATICS	0.961742	0.953953	0.946568	0.939552	0.903607

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

AVAILABILITY GOALS	0.400000	0.254545	0.896000	0.861538	0.829630
NO.	ITEM NAME	AVAILABILITY APPORTIONMENTS			
1	EXPERIMENT	0.958792	0.939094	0.994969	0.993179	0.991459
2	STABIL. & CONTROL	0.908119	0.865955	0.988516	0.984446	0.980546
3	THERMAL	0.893446	0.845145	0.986588	0.981841	0.977295
4	STRUCTURE	0.931845	0.899957	0.991576	0.988584	0.985714
5	ELECTRICAL POWER	0.898310	0.852025	0.987230	0.982709	0.978378
6	DATA HAND. & COMM.	0.850834	0.785667	0.980826	0.974068	0.967608
7	PRIMARY OPTICS	0.944581	0.918386	0.993190	0.990770	0.988446
8	DOCKING MECH.	0.897092	0.850300	0.987069	0.982492	0.978107
9	PNEUMATICS	0.851989	0.787261	0.980986	0.974283	0.967876

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

AVAILABILITY GOALS	0.800000	0.772414	0.746667	0.622222	0.466667
NO.	ITEM NAME	AVAILABILITY APPORTIONMENTS			
1	EXPERIMENT	0.989804	0.988210	0.986673	0.978446	0.965603
2	STABIL. & CONTROL	0.976802	0.973203	0.969739	0.951319	0.922963
3	THERMAL	0.972935	0.968746	0.964716	0.943328	0.910542
4	STRUCTURE	0.982957	0.980303	0.977746	0.964109	0.942977
5	ELECTRICAL POWER	0.974222	0.970229	0.966387	0.945984	0.914664
6	DATA HAND. & COMM.	0.961424	0.955495	0.949801	0.919758	0.874273
7	PRIMARY OPTICS	0.986211	0.984060	0.981987	0.970910	0.953685
8	DOCKING MECH.	0.973900	0.969858	0.965969	0.945320	0.913632
9	PNEUMATICS	0.961742	0.955861	0.950212	0.920404	0.875261

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

AVAILABILITY GOALS	0.311111	0.903226	0.875000	0.848485	0.823529
NO.	ITEM NAME	AVAILABILITY APPORTIONMENTS			
1	EXPERIMENT	0.947789	0.995336	0.993886	0.992483	0.991123
2	STABIL. & CONTROL	0.884428	0.989351	0.986053	0.982866	0.979785
3	THERMAL	0.866258	0.987562	0.983715	0.980000	0.976409
4	STRUCTURE	0.913978	0.992190	0.989766	0.987422	0.985154
5	ELECTRICAL POWER	0.872273	0.988158	0.984493	0.980954	0.977533
6	DATA HAND. & COMM.	0.813960	0.982216	0.976734	0.971449	0.966350
7	PRIMARY OPTICS	0.929925	0.993687	0.991726	0.989829	0.987992
8	DOCKING MECH.	0.870765	0.988009	0.984299	0.980715	0.977252
9	PNEUMATICS	0.815369	0.982364	0.976927	0.971686	0.966628

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

AVAILABILITY GOALS		0.800000	0.777778	0.666667	0.518519	0.358974
NO.	ITEM NAME	AVAILABILITY APPORTIONMENTS				
1	EXPERIMENT	0.989804	0.988524	0.981551	0.970287	0.954039
2	STABIL. & CONTROL	0.976802	0.973912	0.958248	0.933249	0.897841
3	THERMAL	0.972935	0.969570	0.951365	0.922416	0.881636
4	STRUCTURE	0.982957	0.980826	0.969247	0.950662	0.924110
5	ELECTRICAL POWER	0.974222	0.971015	0.953654	0.926013	0.887005
6	DATA HAND. & COMM.	0.961424	0.956661	0.931013	0.890664	0.834756
7	PRIMARY OPTICS	0.986211	0.984484	0.975087	0.959957	0.938242
8	DOCKING MECH.	0.973900	0.970654	0.953081	0.925112	0.885660
9	PNEUMATICS	0.961742	0.957018	0.931572	0.891531	0.836024

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

AVAILABILITY GOALS	0.908108	0.884210	0.861538	0.840000	0.819512
NO.	ITEM NAME	AVAILABILITY APPORTIONMENTS			
1	EXPERIMENT	0.995583	0.994364	0.993179	0.992025	0.990900
2	STABIL. & CONTROL	0.989912	0.987139	0.984446	0.981828	0.979281
3	THERMAL	0.988217	0.984982	0.981841	0.978789	0.975822
4	STRUCTURE	0.992602	0.990565	0.988584	0.986658	0.984783
5	ELECTRICAL POWER	0.988782	0.985701	0.982709	0.979801	0.976974
6	DATA HAND. & COMM.	0.983150	0.978539	0.974068	0.969730	0.965518
7	PRIMARY OPTICS	0.994020	0.992372	0.990770	0.989210	0.987691
8	DOCKING MECH.	0.988641	0.985521	0.982492	0.979548	0.976685
9	PNEUMATICS	0.983290	0.978717	0.974283	0.969980	0.965802

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

AVAILABILITY GOALS		0.800000	0.700000	0.560000	0.400000	0.911628
NO.	ITEM NAME	AVAILABILITY APPORTIONMENTS				
1	EXPERIMENT	0.989804	0.983753	0.973723	0.958792	0.995760
2	STABIL. & CONTROL	0.976802	0.963178	0.940834	0.908119	0.990315
3	THERMAL	0.972935	0.957090	0.931186	0.893446	0.988688
4	STRUCTURE	0.982957	0.972897	0.956315	0.931845	0.992898
5	ELECTRICAL POWER	0.974222	0.959115	0.934391	0.898310	0.989230
6	DATA HAND. & COMM.	0.961424	0.939056	0.902831	0.850834	0.983821
7	PRIMARY OPTICS	0.986211	0.978051	0.964565	0.944581	0.994260
8	DOCKING MECH.	0.973900	0.958608	0.933589	0.897092	0.989094
9	PNEUMATICS	0.961742	0.939552	0.903607	0.851989	0.983956

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

AVAILABILITY GOALS		0.890909	0.871111	0.852174	0.834043	0.816667
NO.	ITEM NAME	AVAILABILITY APPORTIONMENTS				
1	EXPERIMENT	0.994709	0.993683	0.992680	0.991700	0.990742
2	STABIL. & CONTROL	0.987923	0.985591	0.983315	0.981093	0.978923
3	THERMAL	0.985897	0.983176	0.980522	0.977933	0.975405
4	STRUCTURE	0.991141	0.989426	0.987752	0.986117	0.984519
5	ELECTRICAL POWER	0.986572	0.983980	0.981452	0.978985	0.976576
6	DATA HAND. & COMM.	0.979841	0.975967	0.972193	0.968514	0.964926
7	PRIMARY OPTICS	0.992838	0.991451	0.990096	0.988772	0.987478
8	DOCKING MECH.	0.986403	0.983779	0.981220	0.978722	0.976283
9	PNEUMATICS	0.980009	0.976167	0.972423	0.968774	0.965215

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

NO.	ITEM NAME	AVAILABILITY APPORTIONMENTS				
	AVAILABILITY GOALS	0.725926	0.593939	0.435556	0.914286	0.896000
1	EXPERIMENT	0.985397	0.976358	0.962549	0.995893	0.994969
2	STABIL. & CONTROL	0.966870	0.946675	0.916290	0.990618	0.988516
3	THERMAL	0.961380	0.937948	0.902850	0.989042	0.986588
4	STRUCTURE	0.975626	0.960660	0.937979	0.993120	0.991576
5	ELECTRICAL POWER	0.963206	0.940848	0.907308	0.989567	0.987230
6	DATA HAND. & COMM.	0.945096	0.912245	0.863704	0.984326	0.980826
7	PRIMARY OPTICS	0.980267	0.968103	0.949600	0.994440	0.993190
8	DOCKING MECH.	0.962749	0.940122	0.906192	0.989435	0.987069
9	PNEUMATICS	0.945544	0.912950	0.864768	0.984457	0.980986

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

AVAILABILITY GOALS		0.878431	0.861538	0.845283	0.829630	0.746667
NO.	ITEM NAME	AVAILABILITY APPORTIONMENTS				
1	EXPERIMENT	0.994065	0.993179	0.992310	0.991459	0.986673
2	STABIL. & CONTROL	0.986459	0.984446	0.982475	0.980546	0.969739
3	THERMAL	0.984188	0.981841	0.979544	0.977295	0.964716
4	STRUCTURE	0.990064	0.988584	0.987135	0.985714	0.977746
5	ELECTRICAL POWER	0.984944	0.982709	0.980520	0.978378	0.966387
6	DATA HAND. & COMM.	0.977408	0.974068	0.970802	0.967608	0.949801
7	PRIMARY OPTICS	0.991967	0.990770	0.989596	0.988446	0.981987
8	DOCKING MECH.	0.984755	0.982492	0.980276	0.978107	0.965969
9	PNEUMATICS	0.977596	0.974283	0.971044	0.967876	0.950212

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

AVAILABILITY GOALS	0.622222	0.466667	0.920548	0.908108	0.896000
NO.	ITEM NAME	AVAILABILITY APPORTIONMENTS			
1	EXPERIMENT	0.978446	0.965603	0.996205	0.995583	0.994969
2	STABIL. & CONTROL	0.951319	0.922963	0.991330	0.989912	0.988516
3	THERMAL	0.943328	0.910542	0.989872	0.988217	0.986588
4	STRUCTURE	0.964109	0.942977	0.993643	0.992602	0.991576
5	ELECTRICAL POWER	0.945984	0.914664	0.990358	0.988782	0.987230
6	DATA HAND. & COMM.	0.919758	0.874273	0.985511	0.983150	0.980826
7	PRIMARY OPTICS	0.970910	0.953685	0.994862	0.994020	0.993190
8	DOCKING MECH.	0.945320	0.913632	0.990236	0.988641	0.987069
9	PNEUMATICS	0.920404	0.875261	0.985632	0.983290	0.980986

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

AVAILABILITY GOALS	0.884210	0.872727	0.861538	0.800000	0.700000
NO. ITEM NAME	AVAILABILITY APPORTIONMENTS				
1 EXPERIMENT	0.994364	0.993767	0.993179	0.989804	0.983753
2 STABIL. & CONTROL	0.987139	0.985783	0.984446	0.976802	0.963178
3 THERMAL	0.984982	0.983400	0.981841	0.972935	0.957090
4 STRUCTURE	0.990565	0.989568	0.988584	0.982957	0.972897
5 ELECTRICAL POWER	0.985701	0.984194	0.982709	0.974222	0.959115
6 DATA HAND. & COMM.	0.978539	0.976286	0.974068	0.961424	0.939056
7 PRIMARY OPTICS	0.992372	0.991565	0.990770	0.986211	0.978051
8 DOCKING MECH.	0.985521	0.983995	0.982492	0.973900	0.958608
9 PNEUMATICS	0.978717	0.976483	0.974283	0.961742	0.939552

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

NO.	ITEM NAME	AVAILABILITY APPORTIONMENTS				
	AVAILABILITY GOALS	0.560000	0.923711	0.914286	0.905050	0.896000
1	EXPERIMENT	0.973723	0.996362	0.995893	0.995429	0.994969
2	STABIL. & CONTROL	0.940834	0.991688	0.990618	0.989561	0.988516
3	THERMAL	0.931186	0.990290	0.989042	0.987808	0.986588
4	STRUCTURE	0.956315	0.993905	0.993120	0.992344	0.991576
5	ELECTRICAL POWER	0.934391	0.990755	0.989567	0.988392	0.987230
6	DATA HAND. & COMM.	0.902831	0.986107	0.984326	0.982566	0.980826
7	PRIMARY OPTICS	0.964565	0.995075	0.994440	0.993812	0.993190
8	DOCKING MECH.	0.933589	0.990639	0.989435	0.988246	0.987069
9	PNEUMATICS	0.903607	0.986223	0.984457	0.982711	0.980986

LARGE SPACE TELESCOPE (LST) MISSION SUCCESS APPORTIONMENT

AVAILABILITY GOALS		0.887129	0.878431	0.829630	0.746667	0.622222
NO.	ITEM NAME	AVAILABILITY APPORTIONMENTS				
1	EXPERIMENT	0.994515	0.994065	0.991459	0.986673	0.978446
2	STABIL. & CONTROL	0.987481	0.986459	0.980546	0.969739	0.951319
3	THERMAL	0.985381	0.984188	0.977295	0.964716	0.943328
4	STRUCTURE	0.990816	0.990064	0.985714	0.977746	0.964109
5	ELECTRICAL POWER	0.986081	0.984944	0.978378	0.966387	0.945984
6	DATA HAND. & COMM.	0.979107	0.977408	0.967608	0.949801	0.919758
7	PRIMARY OPTICS	0.992576	0.991967	0.988446	0.981987	0.970910
8	DOCKING MECH.	0.985906	0.984755	0.978107	0.965969	0.945320
9	PNEUMATICS	0.979281	0.977596	0.967876	0.950212	0.920404

OAO/LST/SHUTTLE M T B F APPORTIONMENTS

LST MTTF (MONTHS)	SHUTTLE DELAY (MONTHS)	UPTIME RATIO FOR SYSTEM	SUBSYSTEM MTBF APPORTIONMENTS (IN HOURS) STABIL & CONT	ELECT. POWER	COMM/DATA	HAND PNEUMATICS
3.0	0.5	0.799999952	107364.8	96492.2	64057.9	64600.9
3.0	1.0	0.699999988	76765.4	68991.7	45801.3	46189.3
3.0	1.5	0.622222304	64922.2	58347.8	38735.1	39063.4
3.0	2.0	0.560000062	59027.7	53050.2	35218.2	35516.7
3.0	2.5	0.509091079	55764.0	50117.1	33271.0	33552.9
3.0	3.0	0.466666639	51888.4	48431.3	32151.9	32424.3
3.0	6.0	0.311111450	52762.5	47419.5	31480.1	31746.9
3.0	12.0	0.186666667	61173.8	54979.0	36498.7	36808.0
3.0	24.0	0.103703797	81553.1	73294.5	48657.7	49070.1
6.0	0.5	0.861538410	298539.7	268307.6	178120.0	179629.6
6.0	1.0	0.799999952	214729.6	192984.6	128115.8	129201.7
6.0	1.5	0.746666670	175733.1	157937.4	104849.1	105737.6
6.0	2.0	0.699999988	153530.8	137983.4	91602.5	92378.6
6.0	2.5	0.658823729	139427.7	125308.4	83188.0	83893.0
6.0	3.0	0.622222364	129844.2	116695.5	77470.1	78126.7
6.0	6.0	0.466666639	107776.7	96862.5	64303.7	64848.6
6.0	12.0	0.311111152	105524.8	94838.8	62960.2	63493.8
6.0	24.0	0.186666727	122347.7	109958.1	72997.3	73615.9
9.0	0.5	0.884210527	529427.5	474914.1	315279.8	317951.4
9.0	1.0	0.840000033	392597.3	352841.0	234239.1	236224.2
9.0	1.5	0.799999952	322094.4	289476.9	192173.7	193802.6
9.0	2.0	0.763636410	279221.4	250945.6	166594.1	168006.0
9.0	2.5	0.730434835	250603.3	225225.7	149519.6	150796.6
9.0	3.0	0.699999988	230296.2	206975.1	137403.8	138568.0
9.0	6.0	0.560000002	177083.1	159150.7	105654.7	106550.1
9.0	12.0	0.399999976	156878.7	140992.2	93599.9	94393.1
9.0	24.0	0.254545450	165089.1	148371.2	98498.5	99333.2
12.0	0.5	0.895999969	779160.3	700257.6	464877.3	468816.6
12.0	1.0	0.861538410	597079.4	536615.2	356240.1	359259.2
12.0	1.5	0.829629660	494756.4	444654.6	295190.4	297692.2
12.0	2.0	0.799999952	429459.2	385969.2	256231.6	258403.4
12.0	2.5	0.772413790	384353.9	345431.5	229320.4	231263.8
12.0	3.0	0.746666670	351466.1	315874.9	209699.2	211475.2
12.0	6.0	0.622222304	259648.6	233391.0	154940.3	156253.4
12.0	12.0	0.466666639	215553.4	193725.0	128607.4	129697.2
12.0	24.0	0.311111152	211049.7	189677.6	125920.4	126987.6
15.0	0.5	0.903225780	1042405.0	936845.2	621938.1	627208.4
15.0	1.0	0.875000000	820192.6	737133.6	489357.6	493504.7
15.0	1.5	0.848484755	687410.1	617799.6	410135.1	413611.1
15.0	2.0	0.823529422	599343.6	538651.1	357591.6	360622.7
15.0	2.5	0.800000072	536824.1	482461.5	320299.6	323004.2
15.0	3.0	0.777777851	490268.1	440620.3	292512.7	294991.6
15.0	6.0	0.666666627	354522.6	318621.4	211522.1	213314.3
15.0	12.0	0.518518557	281399.2	252902.8	167893.5	169316.4
15.0	24.0	0.358974457	260572.8	234185.7	155457.8	156785.4
18.0	0.5	0.908108056	1313738.0	1180704.0	783928.6	790472.0
18.0	1.0	0.884210408	1056850.0	949829.1	630558.0	635902.9
18.0	1.5	0.861538410	895619.2	804922.8	534360.1	538889.8
18.0	2.0	0.840000033	785194.7	705782.0	468478.2	472448.4
18.0	2.5	0.819512248	704982.1	633593.1	420620.2	424184.6

18.0	3.0	0.799999952	544188.9	578953.7	384347.5	387605.1
18.0	6.0	0.699999988	460592.6	413950.3	274807.6	277136.0
18.0	12.0	0.560000062	354166.1	318301.5	211309.4	213100.1
18.0	24.0	0.399999976	313757.4	281984.2	187199.8	188786.1
21.0	0.5	0.911627829	1590619.0	1429536.0	949022.4	957063.2
21.0	1.0	0.890909016	1303676.0	1171657.0	777824.9	784415.6
21.0	1.5	0.871111035	1116158.0	1003129.4	665943.2	671587.6
21.0	2.0	0.852173865	984197.4	884529.4	587209.6	592186.0
21.0	2.5	0.834042609	886419.2	796656.7	528871.9	533353.7
21.0	3.0	0.816666663	811171.8	729026.2	483976.1	488077.8
21.0	6.0	0.725925922	576998.6	518568.6	344259.9	347177.4
21.0	12.0	0.593939424	433582.9	389676.1	258692.7	260885.1
21.0	24.0	0.435555637	370612.4	333082.4	221121.7	222995.7
24.0	0.5	0.914285660	1871445.0	1681931.0	1116575.0	1126039.0
24.0	1.0	0.895999968	1558320.0	1400515.0	929754.6	937633.2
24.0	1.5	0.878431320	1346647.0	1210281.0	803463.9	810272.6
24.0	2.0	0.861538410	1194158.0	1073230.0	712480.1	718518.4
24.0	2.5	0.845282972	1079190.0	969907.6	643887.6	649344.2
24.0	3.0	0.829629660	989512.9	889309.1	590380.9	595384.6
24.0	6.0	0.746666670	702932.2	631749.8	419396.4	422950.6
24.0	12.0	0.622222304	519377.2	466782.1	309880.6	312506.8
24.0	24.0	0.466666639	431106.8	387450.1	257214.8	259394.6
36.0	0.5	0.920547903	3017953.0	2712347.0	1800626.0	1815886.0
36.0	1.0	0.908108056	2627476.0	2361408.0	1567657.0	1580944.0
36.0	1.5	0.895999968	2337481.0	2100773.0	1394631.0	1406449.0
36.0	2.0	0.884210408	2113700.0	1899656.0	1261116.0	1271805.0
36.0	2.5	0.872727156	1935875.0	1739839.0	1155020.0	1164805.0
36.0	3.0	0.861538410	1791238.0	1609845.0	1068720.0	1077777.0
36.0	6.0	0.799999952	1288377.0	1157907.0	768695.0	775210.2
36.0	12.0	0.699999988	921185.1	827900.7	549615.3	554272.0
36.0	24.0	0.560000062	708332.3	636603.0	422618.8	426200.2
48.0	0.5	0.923711300	4183527.0	3759870.0	2496048.0	2517200.0
48.0	1.0	0.914285660	3742990.0	3363863.0	2233150.0	2252079.0
48.0	1.5	0.905050457	3396316.0	3052377.0	2026366.0	2043543.0
48.0	2.0	0.895999968	3116641.0	2801030.0	1859509.0	1875266.0
48.0	2.5	0.887128651	2886278.0	2594001.0	1722068.0	1736658.0
48.0	3.0	0.878431320	2693294.0	2420563.0	1606927.0	1620545.0
48.0	6.0	0.829629660	1979025.0	1778618.0	1180761.0	1190769.0
48.0	12.0	0.746666670	1405864.0	1263499.0	838792.7	845901.1
48.0	24.0	0.622222304	1038754.4	933564.1	619761.2	625013.6

Appendix Subsection 3B

Multi-state Effectiveness Analytical Technique

ANALYTICAL TECHNIQUE AND SAMPLE PROBLEM:

In order to aid in the understanding of the analytical approach suggested for this study, the following simple example is presented. Consider a system composed of one vehicle with failure rate (λ); repair rate (μ) and repair percentage (π). The states for this system can be given as:

(1) The vehicle is up.

(2) The vehicle is down with a failure which can be repaired.

(3) The vehicle is down with a failure which cannot be repaired.

It can readily be seen that the vehicle cannot be in more than one of these states at any time (mutually exclusive states) and that there are no other possible states (at least for the present scope of the problem) in which the vehicle can be (mutually exhaustive states). *

The problem can now be represented by the state transition diagram given below (Figure 2). +

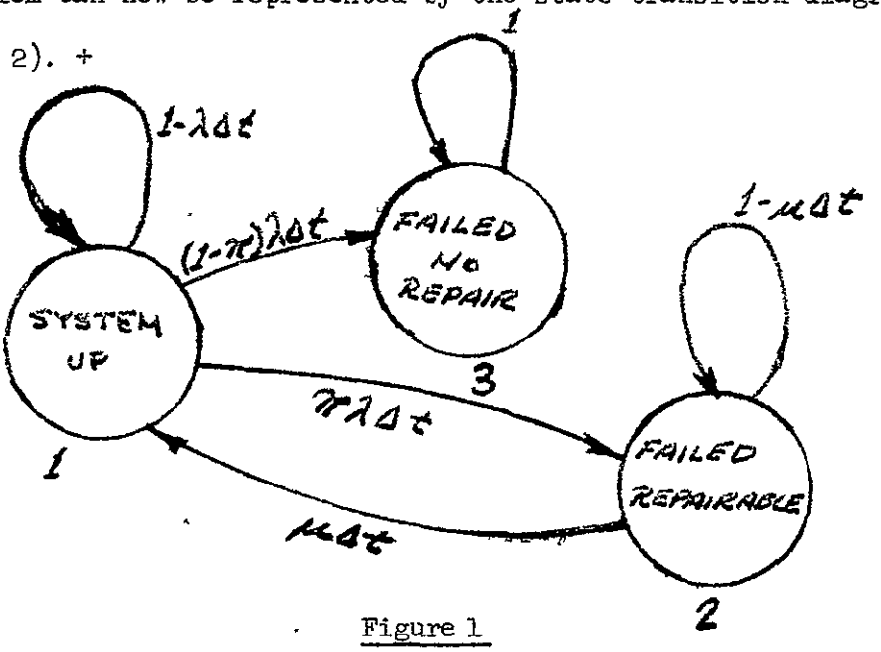


Figure 1

* See Definitions Section for detailed definitions.

\+ In order to simplify the state diagrams utilized in this study the "self loops" and Δt factors were eliminated in the figures for Shuttle via Titan Systems.

The directed edges between states in Figure 1 indicate the approximate probability of making a transition from state "i" to state "j" (e.g., 1→2) in the small time interval Δt given that we start in state "i" at time "t". Thus the probability of being in a specific state at a time "t +Δt" is equal to the probability of being there at time "t" and remaining until "t +Δt"; plus the probability of being in another state at time "t" making a transition in "Δt" and ending there at "t +Δt". Specifically if we can write the probability that we are in state 2 at time "t +Δt" as:

$$P_2(t+\Delta t) = \pi \lambda \Delta t P_1(t) + (1-\mu \Delta t) P_2(t)$$

Rearranging terms we obtain:

$$\frac{P_2(t+\Delta t) - P_2(t)}{\Delta t} = \pi \lambda P_1(t) - \mu P_2(t)$$

Taking the limit on both sides as $\Delta t \to 0$ (and thus replacing our approximation with the exact answer) we obtain:

$$\frac{dP_2(t)}{dt} = \dot{P}_2(t) = \pi \lambda P_1(t) - \mu P_2(t)$$

In a similar manner we obtain the following set of differential equations:

$$\dot{P}_1(t) = -\lambda P_1(t) + \mu P_2(t)$$
$$\dot{P}_2(t) = \pi \lambda P_1(t) - \mu P_2(t)$$
$$\dot{P}_3(t) = (1-\pi) \lambda P_1(t)$$

The above set of differential equations can be written in matrix form as:

$$\begin{bmatrix} \dot{P}_1(t) \\ \dot{P}_2(t) \\ \dot{P}_3(t) \end{bmatrix} = \begin{bmatrix} -\lambda & \mu & 0 \\ \pi\lambda & -\mu & 0 \\ (1-\pi)\lambda & 0 & 0 \end{bmatrix} \begin{bmatrix} P_1(t) \\ P_2(t) \\ P_3(t) \end{bmatrix}$$

or alternately:

$$[\dot{P}(t)] = [A][P(t)]$$

where (P(t)) is the current state vector and (A) is just the transpose of the transition matrix (M). That is:

implying that:

$$[A] = [M]^T$$

$$[M] = \begin{bmatrix} -\lambda & \pi\lambda & (1-\pi)\lambda \\ \mu & -\mu & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

Notice that the matrix (A) is a stocastic matrix, that is the sum of the column elements equals zero. This is true for all matrices involved in problems of this type.

The difficulty now results in solving the matrix equation. One method of solving the problem exactly is to take the Laplace transform of each of the individual equations to yield a set of linear homogenous algebraic equations which are then solved by standard techniques, and then take the inverse transform. This technique is exact, however, the solutions are exceedingly difficult to obtain especially if the number of states is large. (Solving this simple 3 state problem using this technique will show the difficulties involved).

Another technique is to write the matrix equation as a simple differential equation implying solutions of the form:

$$[P(t)] = \exp\{t[A]\}[P(0)]$$

where (P(0)) is the initial condition vector and $e^{t[A]}$ given by:

$$e^{t[A]} = 1 + t[A] + \frac{t^2[A]^2}{2!} + \cdots$$

$$= \sum_{i=0}^{\infty} \frac{\{t[A]\}^i}{i!}$$

Here the answer is approximated by taking a number of terms of the series. This solution, however, converges slowly for large mission times so a large number of terms must be used - thus it is not considered suitable for our application. A third method of solution for the problem is given in Reference (b) and involves the use of a matrix of the form:

$$[N]\Delta t = [A]^T - [I]$$

$$\text{or } [A]^T = [I] + [N]\Delta t$$

$$\text{or } [M] = [I] + [N]\Delta t$$

Where Δt is of the order of 1×10^{-3} and then raising the matrix to a very high power ($\simeq 10^5$) to bring the time within the range of the mission time. This method converges very rapidly and has been programmed and used successfully for problems with as many as 50 states and mission times approaching twenty years. Because of the above attributes, the method explained in Reference (b) was used in this study.

DEFINITIONS:

(a) Multi-State effectiveness Markov Models -

This is the technique suggested to mathematically model the proposed vehicles and missions. These models break down the vehicles' interaction for each phase of the mission into mutually exclusive and mutually exhaustive states. Transitions from individual states to other states in the model are indicated by the product of the failure rate (λ) and the repair percentage (π) for repairable failures, and by the product $(1-\pi)\lambda$ for non-repairable failures (See Figures 2 & 3). Transitions to individual states from other states are indicated by the repair rate (μ).

(b) System State -

A state of a system is a collection of failure and successful events describing a particular system condition. (See Figures 2 & 3).

(c) Mutually Exclusive States -

A set of system states is mutually exclusive if the intersection of each state in the set with all other states is the null set (i.e. $\emptyset$ = set containing no elements). This condition constrains the model so that the system cannot be in more than one state at any time.

(d) Mutually Exhaustive States -

A set of system states is mutually exhaustive if the union of this set with the set of all possible system states is the set itself. This condition constrains the problem so that the system can be in no state other than the set of states given in the model.

DEFINITIONS - (Continued)

(e) Repair Percentage (π) -

The fraction of all possible failures which can occur on the vehicle which can be repaired is the repair percentage. Thus if it is known that on a particular vehicle 9 out of 10 failures which may occur can be repaired, the repair percentage for that particular vehicle is .90.

(f) Initial Condition Vector ($P(t_o)$) -

The vector containing the initial probability of being in each of the "N" states at the start of the problem (i.e. at t = to) as its "N" components is called the initial condition vector. The initial condition vector is usually taken to be, (1,0,0.....,0) implying that the system started in the all up condition.

(g) Current State Vector ($P(t)$) -

The vector containing the probability of being in each of the "N" states at a current time "t" is called the current state vector.

(h) Transition Matrix (M) -

The matrix containing the transition rate from state "i" to state "j" as its $(i\ j)^{th}$ element is called the transition matrix.

Appendix Subsection 3C

Multi-state Effectiveness Computer Output Summary

[redacted] WITH SHUTTLE

THIS IS CASE NUMBER 2

N	MAXRUN	MAXPHS	MAXSUB	NNODE
10	4	12	0	4

THE H VALUES FOR EACH PHASE ARE-
0.10000E-01 0.10000E-01 0.10000E-01 0.10000E-01 0.10000E-01 0.10000E-01 0.10000E-01 0.10000E-01
0.10000E-01 0.10000E-01 0.10000E-01 0.10000E-01

THE INITIAL CONDITION VECTOR IS -

STATE 1 = 1.0000

STATE 2 = 0.0

STATE 3 = 0.0

STATE 4 = 0.0

STATE 5 = 0.0

STATE 6 = 0.0

STATE 7 = 0.0

STATE 8 = 0.0

STATE 9 = 0.0

STATE 10 = 0.0

1	0	0	0
1	0	0	0
1	0	0	0
0	1	0	0
0	1	0	0
0	1	0	0
0	0	1	0
0	0	1	0
0	0	1	0
0	0	0	1

PHASE 1 = 4380.00 HOURS
PHASE 2 = 4380.00 HOURS
PHASE 3 = 4380.00 HOURS
PHASE 4 = 4380.00 HOURS
PHASE 5 = 4380.00 HOURS
PHASE 6 = 4380.00 HOURS
PHASE 7 = 4380.00 HOURS
PHASE 8 = 4380.00 HOURS
PHASE 9 = 4380.00 HOURS
PHASE 10 = 4380.00 HOURS
PHASE 11 = 4380.00 HOURS
PHASE 12 = 4380.00 HOURS

0.0 0.29140E-04

0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

0.0 0.10000E 01

WHEN G IS 1, THE STATE VECTOR IS 0

STATE 1 = 0.9613

STATE 2 = 0.0366

STATE 3 = 0.0007

STATE 4 = 0.0000

STATE 5 = 0.0000

STATE 6 = 0.0000

STATE 7 = 0.0000

STATE 8 = 0.0000

STATE 9 = 0.0000

STATE 10 = 0.0014

THIS IS RUN NUMBER 2

WITHOUT SHUTTLE

LAM LAM1 LAM2 LAMS LAMR LAMA PI PI1 PI2 D MU LAMO

0.50E-05 0.24E-05 0.80E-04 0.31E-04 0.11E-02 0.57E-04 0.75E-00 0.50E-00 0.90E-00 72.00 10.00 0.10E-11

0.0	0.50000E-08	0.0	0.0	0.0	0.10000E-14
0.0	0.0	0.34380E-05	0.0	0.0	0.14151E-06
0.0	0.0	0.0	0.22920E-05	0.0	0.14151E-06
0.0	0.0	0.0	0.0	0.34380E-05	0.14151E-06
0.0	0.0	0.0	0.0	0.0	0.14151E-06
0.0	0.0	0.0	0.0	0.0	0.0

AT TIME IN RUN = 0.0

MODE 1 = 1.00

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.0

0.99950E 00	0.42019E-03	0.70524E-04	0.51767E-05	0.46545E-06	0.35206E-05
0.0	0.69911E-00	0.25467E-00	0.28627E-01	0.35468E-02	0.14051E-01
0.0	0.0	0.78400E 00	0.16978E 00	0.32174E-01	0.14051E-01
0.0	0.0	0.0	0.69911E-00	0.28684E-00	0.14051E-01
0.0	0.0	0.0	0.0	0.98595E 00	0.14052E-01
0.0	0.0	0.0	0.0	0.0	0.10000E-01

WHEN G IS 1, THE STATE VECTOR IS 0

STATE 1 = 0.9995

STATE 2 = 0.0004

STATE 3 = 0.0001

STATE 4 = 0.0000

STATE 5 = 0.0000

STATE 6 = 0.0000

AT TIME = 18000.00 END OF PHASE - TOTAL TIME - 18000.00

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.913930833	1	0.915209174
2	0.001278400	2	0.029327799
3	0.001809807	3	0.0
4	0.001160459	4	0.055461217
5	0.026357535		
6	0.055461217		

WHEN G IS 1, THE STATE VECTOR IS 0

STATE 1 = 0.9950

STATE 2 = 0.0042

STATE 3 = 0.0007

STATE 4 = 0.0000

STATE 5 = 0.0000

STATE 6 = 0.0000

STATE 7 = 0.0000

STATE 8 = 0.0000

STATE 9 = 0.0000

STATE 10 = 0.0000

AT [redacted] = [redacted] [redacted].00 [redacted]D C[redacted]ASE [redacted]T O[redacted] IM[redacted] [redacted] [redacted]0.00[redacted]

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.980198741	1	0.999227703
2	0.016663317	2	0.000075519
3	0.002365684	3	0.000256003
4	0.000014037	4	0.000440733
5	0.000021944		
6	0.000039538		
7	0.000022544		
8	0.000273459		
9	0.000000000		
10	0.000440733		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 4332.01

0.0 0.42500E-07 0.75000E-08 0.0 0.0 0.0 0.0 0.0
0.0 0.10000E-13
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.50000E-07
0.0 0.0 0.0 0.15000E-06 0.0 0.0 0.45000E-07 0.47568E-06
0.0 0.50954E-06
0.0 0.0 0.0 0.0 0.22920E-04 0.0 0.45000E-07 0.0
0.0 0.79552E-07
0.0 0.0 0.0 0.0 0.0 0.11460E-04 0.45000E-07 0.0
0.0 0.79552E-07
0.0 0.0 0.0 0.0 0.0 0.0 0.45000E-07 0.0
0.0 0.79552E-07
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.37441E-68 0.31107E-06
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.37441E-68 0.31107E-06
0.10000E 00 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0

AT TIME IN RUN = 4000.00

MODE 1 = 1.00

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.00

0.99501E 00 0.42208E-02 0.70563E-03 0.28378E-05 0.19020E-05 0.63846E-06 0.16115E-05 0.16949E-04
0.69480E-72 0.29146E-04
0.0 0.99501E 00 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.49875E-02
0.92641E-65 0.13273E-67 0.88868E 00 0.54120E-02 0.57472E-02 0.29000E-02 0.42099E-02 0.44164E-01
0.18110E-68 0.48890E-01
0.82874E-66 0.11772E-68 0.20199E-69 0.99812E-01 0.42832E 00 0.45949E 00 0.44031E-02 0.24066E-71
0.16484E-69 0.79748E-02
0.82874E-66 0.11772E-68 0.20199E-69 0.51148E-72 0.31397E 00 0.67365E 00 0.44031E-02 0.24066E-71
0.16484E-69 0.79748E-02
0.82874E-66 0.11772E-68 0.20199E-69 0.51148E-72 0.20754E-72 0.98762E 00 0.44031E-02 0.24066E-71
0.16484E-69 0.79748E-02
0.36769E-63 0.78465E-66 0.13338E-66 0.41278E-69 0.20766E-69 0.52856E-70 0.96937E 00 0.21252E-68
0.36295E-67 0.30628E-01
0.36769E-63 0.78465E-66 0.13338E-66 0.41278E-69 0.20766E-69 0.52856E-70 0.20180E-69 0.96937E 00
0.36295E-67 0.30628E-01
0.99501E 00 0.42284E-02 0.70556E-03 0.28374E-05 0.19016E-05 0.63824E-06 0.16117E-05 0.16946E-04

AT TIME = 4000.00 END OF PHASE = 2 INITIAL TIME = 8000.00

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.963433385	1	0.998470187
2	0.032711662	2	0.000074227
3	0.002325221	3	0.000251624
4	0.000013797	4	0.001203881
5	0.000021569		
6	0.000038862		
7	0.000022158		
8	0.000229466		
9	0.000000000		
10	0.001203881		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 4329.35

0.0	0.42500E-07	0.75000E-08	0.0	0.0	0.0	0.0	0.0
0.0	0.10000E-13						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.50000E-07						
0.0	0.0	0.0	0.15000E-06	0.0	0.0	0.45000E-07	0.47560E-06
0.0	0.50954E-06						
0.0	0.0	0.0	0.0	0.22920E-04	0.0	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.11460E-04	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.0	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.37441E-68	0.31107E-06						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.37441E-68	0.31107E-06						
0.10000E 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0						

AT TIME IN RUN = 8000.00

MODE 1 = 1.00

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.00

NOT REPRODUCIBLE

0.99501E 00	0.42288E-02	0.70563E-03	0.28378E-05	0.19020E-05	0.63846E-06	0.16115E-05	0.16949E-04
0.69480E-72	0.29146E-04						
0.0	0.99501E 00	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.49875E-02						
0.92641E-65	0.13273E-67	0.88968E 00	0.54120E-02	0.57472E-02	0.29000E-02	0.42099E-02	0.44164E-01
0.18110E-68	0.48890E-01						
0.82874E-66	0.11772E-68	0.20199E-69	0.99812E-01	0.42832E 00	0.45949E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.82874E-66	0.11772E-68	0.20199E-69	0.51148E-72	0.31397E 00	0.67365E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.82874E-66	0.11772E-68	0.20199E-69	0.51148E-72	0.20754E-72	0.96762E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.36769E-63	0.78465E-66	0.13338E-66	0.41278E-69	0.20766E-69	0.52856E-70	0.96937E 00	0.21252E-68
0.36295E-67	0.30628E-01						
0.36769E-63	0.78465E-66	0.13338E-66	0.41278E-69	0.20766E-69	0.52856E-70	0.20180E-69	0.96937E 00
0.36295E-67	0.30628E-01						
0.99501E 00	0.42284E-02	0.70556E-03	0.28374E-05	0.19016E-05	0.63824E-06	0.16113E-05	0.16946E-04

```
 0.0          0.29140E-04
 0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
 0.0          0.10000E 01

 WHEN G IS 1, THE STATE VECTOR IS 0

 STATE  1 = 0.9613

 STATE  2 = 0.0366

 STATE  3 = 0.0007

 STATE  4 = 0.0000

 STATE  5 = 0.0000

 STATE  6 = 0.0000

 STATE  7 = 0.0000

 STATE  8 = 0.0000

 STATE  9 = 0.0000

 STATE 10 = 0.0014
```

AT TIME [redacted] 0.0 [redacted] END [redacted] PHAS [redacted] 3T [redacted] TI [redacted] 00.

STATE NO.	STATE PROB.	MODE NO.	MODE PROP.
1	0.946954787	1	0.997402251
2	0.048162095	2	0.000072958
3	0.002286450	3	0.000247320
4	0.000013561	4	0.002277396
5	0.000021200		
6	0.000038197		
7	0.000021779		
8	0.000225541		
9	0.000000000		
10	0.002277396		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 4325.32

0.0 0.42500E-07 0.75000E-08 0.0 0.0 0.0 0.0 0.0
0.0 0.10000E-13
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.50000E-07
0.0 0.0 0.0 0.15000E-06 0.0 0.0 0.45000E-07 0.47568E-06
0.0 0.50954E-06
0.0 0.0 0.0 0.0 0.22920E-04 0.0 0.45000E-07 0.0
0.0 0.79552E-07
0.0 0.0 0.0 0.0 0.0 0.11460E-04 0.45000E-07 0.0
0.0 0.79552E-07
0.0 0.0 0.0 0.0 0.0 0.0 0.45000E-07 0.0
0.0 0.79552E-07
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.37441E-68 0.31107E-06
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.37441E-68 0.31107E-06
0.10000E 00 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0

AT TIME IN RUN = 12000.00

MODE 1 = 1.00

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.00

0.99501E 00 0.42288E-02 0.70563E-03 0.28378E-05 0.19020E-05 0.63846E-06 0.16115E-05 0.16949E-04
0.69480E-72 0.29146E-04
0.0 0.99501E 00 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.49875E-02
0.92641E-65 0.13273E-67 0.88868E 00 0.54120E-02 0.57472E-02 0.29000E-02 0.42099E-02 0.44164E-01
0.18110E-68 0.48890E-01
0.82874E-66 0.11772E-68 0.20199E-69 0.99812E-01 0.42032E 00 0.45949E 00 0.44031E-02 0.24066E-71
0.16484E-69 0.79748E-02
0.82874E-66 0.11772E-68 0.20199E-69 0.51148E-72 0.31397E 00 0.67365E 00 0.44031E-02 0.24066E-71
0.16484E-69 0.79748E-02
0.82874E-66 0.11772E-68 0.20199E-69 0.51148E-72 0.20754E-72 0.98762E 00 0.44031E-02 0.24066E-71
0.16484E-69 0.79748E-02
0.36769E-63 0.78465E-66 0.13338E-66 0.41278E-69 0.20766E-69 0.52856E-70 0.96937E 00 0.21252E-68
0.36295E-67 0.30628E-01
0.36769E-63 0.78465E-66 0.13338E-66 0.41278E-69 0.20766E-69 0.52856E-70 0.20180E-69 0.96937E 00
0.36295E-67 0.30628E-01
0.99501E 00 0.42284E-02 0.70556E-03 0.28374E-05 0.19016E-05 0.63824E-06 0.16112E-05 0.16946E-04

0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

0.0 0.10000E 01

WHEN G IS 1, THE STATE VECTOR IS 0

STATE 1 = 0.9448

STATE 2 = 0.0519

STATE 3 = 0.0007

STATE 4 = 0.0000

STATE 5 = 0.0000

STATE 6 = 0.0000

STATE 7 = 0.0000

STATE 8 = 0.0000

STATE 9 = 0.0000

STATE 10 = 0.0025

AT TIME = 4000.00 END OF PHASE - 4TOTAL TIME 16000.00

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.930757999	1	0.996035516
2	0.063031197	2	0.000071710
3	0.002246360	3	0.000243090
4	0.000013329	4	0.003649566
5	0.000002837		
6	0.000037544		
7	0.000021407		
8	0.000221683		
9	0.000000000		
10	0.003649566		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 4319.97

0.0	0.42500E-07	0.75000E-08	0.0	0.0	0.0	0.0	0.0
0.0	0.10000E-13						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.50000E-07						
0.0	0.0	0.0	0.15000E-06	0.0	0.0	0.45000E-07	0.47568E-06
0.0	0.50954E-06						
0.0	0.0	0.0	0.0	0.22920E-04	0.0	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.11460E-04	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.0	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.37441E-68	0.31107E-06						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.37441E-68	0.31107E-06						
0.10000E 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0						

AT TIME IN RUN = 16000.00

MODE 1 = 1.00

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.00

0.99501E 00	0.42288E-02	0.70563E-03	0.28378E-05	0.19020E-05	0.63846E-06	0.16115E-05	0.16949E-04
0.69480E-72	0.29146E-04						
0.0	0.99501E 00	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.49876E-02						
0.92041E-65	0.13273E-67	0.89868E 00	0.54120E-02	0.57472E-02	0.29000E-02	0.42099E-02	0.44164E-01
0.18110E-68	0.48890E-01						
0.82874E-66	0.11772E-68	0.20199E-69	0.99812E-01	0.42832E 00	0.45949E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.82874E-66	0.11772E-68	0.20199E-69	0.51148E-72	0.31397E 00	0.67365E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.82374E-66	0.11772E-68	0.20199E-69	0.51148E-72	0.20754E-72	0.98762E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.36769E-63	0.78465E-66	0.13338E-66	0.41278E-69	0.20766E-69	0.52856E-70	0.96937E 00	0.21252E-68
0.36295E-67	0.30621E-						
0.36769E-63	0.78465E-	0.13338E-66	0.41278E-69	0.20766E-69	0.52856E-70	0.20180E-69	0.96937E 00
0.36295E-67	0.30621E-						
0.99501E 00	0.42288E-02	0.70556E-03	0.28374E-05	0.19016E-05	0.63824E-06	0.16112E-05	0.16946E-04

0.0 0.29140E-04
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.10000E 01

WHEN G IS 1, THE STATE VECTOR IS 0

STATE 1 = 0.9287

STATE 2 = 0.0667

STATE 3 = 0.0007

STATE 4 = 0.0000

STATE 5 = 0.0000

STATE 6 = 0.0000

STATE 7 = 0.0000

STATE 8 = 0.0000

STATE 9 = 0.0000

STATE 10 = 0.0040

AT TIME = 4000.00 END OF PHASE - STOTAL TIME 19999.99

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.914838374	1	0.994381368
2	0.077335060	2	0.000070483
3	0.002207938	3	0.000238932
4	0.000013101	4	0.005308997
5	0.000020481		
6	0.000036902		
7	0.000021041		
8	0.000217891		
9	0.000000000		
10	0.005308997		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 4313.36

0.0	0.42500E-07	0.75000E-08	0.0	0.0	0.0	0.0	0.0
0.0	0.10000E-13						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.50000E-07						
0.0	0.0	0.0	0.15000E-06	0.0	0.0	0.45000E-07	0.47568E-06
0.0	0.50954E-06						
0.0	0.0	0.0	0.0	0.22920E-04	0.0	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.11460E-04	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.0	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.37441E-68	0.31107E-06						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.37441E-68	0.31107E-06						
0.10000E 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0						

AT TIME IN RUN = 19999.99

MODE 1 = 0.99

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.01

0.99501E 00	0.42268E-02	0.70563E-03	0.28378E-05	0.19020E-05	0.63846E-06	0.16115E-05	0.16949E-04
0.69480E-72	0.29146E-04						
0.0	0.99501E 00	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.49875E-02						
0.92641E-65	0.13273E-67	0.88968E 00	0.54120E-02	0.57472E-02	0.29000E-02	0.42099E-02	0.44164E-01
0.18110E-68	0.48890E-01						
0.82874E-66	0.11772E-68	0.20199E-69	0.99812E-01	0.42832E 00	0.45949E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.82874E-66	0.11772E-68	0.20199E-69	0.51148E-72	0.31397E 00	0.67365E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.82874E-66	0.11772E-68	0.20199E-69	0.51148E-72	0.20754E-72	0.98762E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.36769E-63	0.78465E-66	0.13338E-66	0.41278E-69	0.20766E-69	0.52856E-70	0.96937E 00	0.21252E-68
0.36295E-67	0.30628E-01						
0.36769E-63	0.78465E-66	0.13338E-66	0.41273E-69	0.20766E-69	0.52856E-70	0.20180E-69	0.96937E 00
0.36295E-67	0.30628E-01						
0.99501E 00	0.42284E-02	0.70556E-03	0.28374E-05	0.19016E-05	0.63824E-06	0.16112E-05	0.16946E-04

```
 0.0          0.29140E-04
 0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
 0.0          0.10000E 01

 WHEN G IS 1, THE STATE VECTOR IS 0

 STATE  1 = 0.9128

 STATE  2 = 0.0808

 STATE  3 = 0.0006

 STATE  4 = 0.0000

 STATE  5 = 0.0000

 STATE  6 = 0.0000

 STATE  7 = 0.0000

 STATE  8 = 0.0000

 STATE  9 = 0.0000

 STATE 10 = 0.0057
```

AT TIME = 4000.00 END OF PHASE - 6TOTAL TIME - 23999.99

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.899191201	1	0.992451012
2	0.091089666	2	0.000069278
3	0.002170174	3	0.000234846
4	0.000012877	4	0.007244628
5	0.000020131		
6	0.000036271		
7	0.000020681		
8	0.000214165		
9	0.000000000		
10	0.007244628		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 4305.53

0.0	0.42500E-07	0.75000E-08	0.0	0.0	0.0	0.0	0.0
0.0	0.10000E-13						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.50000E-07						
0.0	0.0	0.0	0.15000E-06	0.0	0.0	0.45000E-07	0.47568E-06
0.0	0.50954E-06						
0.0	0.0	0.0	0.0	0.22920E-04	0.0	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.11460E-04	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.0	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.37441E-68	0.31107E-06						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.37441E-68	0.31107E-06						
0.10000E 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0						

AT TIME IN RUN = 23999.99

MODE 1 = 0.99

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.01

0.99501E 00	0.42288E-02	0.70563E-03	0.28378E-05	0.19020E-05	0.63846E-06	0.16115E-05	0.16949E-04
0.69480E-72	0.29146E-04						
0.0	0.99501E 00	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.49879E-02						
0.92641E-65	0.13273E-67	0.88868E 00	0.54120E-02	0.57472E-02	0.29000E-02	0.42099E-02	0.44164E-01
0.18110E-68	0.48890E-01						
0.82874E-66	0.11772E-68	0.20199E-69	0.99812E-01	0.42832E 00	0.45949E 00	0.44031E-02	0.24066E-71
0.10484E-69	0.79748E-02						
0.82874E-66	0.11772E-68	0.20199E-69	0.51148E-72	0.31397E 00	0.67365E 00	0.44031E-02	0.24066E-71
0.10484E-69	0.79748E-02						
0.82874E-66	0.11772E-68	0.20199E-69	0.51148E-72	0.20754E-72	0.98762E 00	0.44031E-02	0.24066E-71
0.10484E-69	0.79748E-02						
0.36769E-63	0.78465E-66	0.13338E-66	0.41278E-69	0.20766E-69	0.52856E-70	0.96937E 00	0.21252E-68
0.36295E-67	0.30628E-01						
0.36769E-63	0.78465E-66	0.13338E-66	0.41278E-69	0.20766E-69	0.52856E-70	0.20180E-69	0.96937E 00
0.36295E-67	0.30628E-01						
0.99501E 00	0.42284E-02	0.70556E-03	0.28374E-05	0.19016E-05	0.63824E-06	0.16112E-05	0.16946E-04

```
 0.0          0.29140E-04
 0.0    0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
 0.0          0.10000E 01

 WHEN G IS 1, THE STATE VECTOR IS 0

 STATE  1 = 0.8972

 STATE  2 = 0.0944

 STATE  3 = 0.0006

 STATE  4 = 0.0000

 STATE  5 = 0.0000

 STATE  6 = 0.0000

 STATE  7 = 0.0000

 STATE  8 = 0.0000

 STATE  9 = 0.0000

 STATE 10 = 0.0077
```

AT TIME = 4000.00 END OF PHASE - TOTAL TIME - 27999.99

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.883811593	1	0.990254998
2	0.10431C393	2	0.000068093
3	0.002133056	3	0.000230829
4	0.000012656	4	0.009445701
5	0.000019786		
6	0.000035650		
7	0.000020327		
8	0.000210502		
9	0.000000000		
10	0.009445701		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 4296.52

0.0	C.42500E-07	0.75000F-08	0.0	0.0	0.0	0.0	0.0
0.0	C.10000E-13						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.50000E-07						
0.0	C.0	0.0	0.15000E-06	0.0	0.0	0.45000E-07	0.47568E-06
0.0	C.50954E-06						
0.0	0.0	0.0	0.0	0.22920E-04	0.0	0.45000E-07	0.0
0.0	C.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.11460E-04	0.45000E-07	0.0
0.0	C.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.0	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	C.0	0.0	0.0	0.0	0.0	0.0	0.0
0.37441E-68	0.31107E-06						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.37441E-68	0.31107E-06						
0.10000E 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0						
0.0	C.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	C.0						

AT TIME IN RUN = 27999.99

MODE 1 = 0.99

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.01

0.99501E 00	0.42288E-02	0.70563E-03	0.28378E-05	0.19020E-05	0.63846E-06	0.16115E-05	0.16949E-04
0.69480E-72	0.29146E-04						
0.0	C.99501E 00	0.0	0.0	0.0	0.0	0.0	0.0
0.0	C.49975C-02						
0.92641E-65	0.13273E-67	0.88868E 00	0.54120F-02	0.57472F-02	0.29000E-02	0.42099E-02	0.44164E-01
0.18110E-68	C.46890E-01						
0.82874E-66	C.11772E-68	0.20199E-69	0.99812E-01	0.42832E 00	0.45949E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.82874E-66	0.11772E-68	0.20199E-69	0.51148E-72	0.31397E 00	0.67365E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.82874E-66	0.11772E-68	C.20199E-69	0.51148E-72	0.20754E-72	0.98762E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748F-02						
0.36769E-63	C.78465E-66	0.13338E-66	0.41278E-69	0.20766E-69	0.52856F-70	0.96937F 00	0.21252E-68
0.36295E-67	C.30628F-01						
0.36769E-63	C.78465E-66	0.13338E-66	0.41278E-69	0.20766E-69	0.52856E-70	0.20180E-69	0.96937E 00
0.36295E-67	C.30628F-01						
0.99501E 00	C.42284E-02	0.70556F-03	0.28374E-05	0.19016E-05	0.63824F-06	0.16112E-05	0.16946E-04

0.0 0.29140E-04
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.10000E 01

WHEN G IS 1. THE STATE VECTOR IS 0

STATE 1 = 0.8818

STATE 2 = 0.1075

STATE 3 = 0.0006

STATE 4 = 0.0000

STATE 5 = 0.0000

STATE 6 = 0.0000

STATE 7 = 0.0000

STATE 8 = 0.0000

STATE 9 = 0.0000

STATE 10 = 0.0100

[redacted] AT TIME = 4000.00 END OF PHASE 8 [redacted] TIME = [redacted] 31999.99

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.868695140	1	0.987804115
2	0.117012441	2	0.000066928
3	0.002096573	3	0.000226881
4	0.000012440	4	0.011901762
5	0.000019448		
6	0.000035041		
7	0.000019980		
8	0.000206901		
9	0.000000000		
10	0.011901762		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 4286.39

0.0 0.42500E-07 0.75000E-08 0.0 0.0 0.0 0.0 0.0
0.0 0.10000E-13
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.50000E-07
0.0 0.0 0.0 0.15000E-06 0.0 0.0 0.45000E-07 0.47568E-06
0.0 0.50954E-06
0.0 0.0 0.0 0.0 0.22920E-04 0.0 0.45000E-07 0.0
0.0 0.79652E-07
0.0 0.0 0.0 0.0 0.0 0.11460E-04 0.45000E-07 0.0
0.0 0.79552E-07
0.0 0.0 0.0 0.0 0.0 0.0 0.45000E-07 0.0
0.0 0.79552E-07
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.37441E-68 0.31107E-06
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.37441E-69 0.31107E-06
0.10000E 00 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0

AT TIME IN RUN = 31999.99

MODE 1 = 0.99

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.01

0.99501E 00 0.42288E-02 0.70563E-03 0.28378E-05 0.19020E-05 0.63846E-06 0.16115E-05 0.16949E-04
0.69480E-72 0.29146E-04
0.0 0.99501E 00 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.49875E-02
0.92641E-65 0.13273E-67 0.88868E 00 0.54120E-02 0.57472E-02 0.29000E-02 0.42099E-02 0.44164E-01
0.18110E-68 0.48890E-01
0.82874E-66 0.11772E-69 0.20199E-69 0.99812E-01 0.42832E 00 0.45949E 00 0.44031E-02 0.24066E-71
0.16484E-69 0.79748E-02
0.82874E-66 0.11772E-68 0.20199E-69 0.51148E-72 0.31397E 00 0.67365E 00 0.44031E-02 0.24066E-71
0.16484E-69 0.79748E-02
0.82874E-66 0.11772E-68 0.20199E-69 0.51148E-72 0.20754E-72 0.98762E 00 0.44031E-02 0.24066E-71
0.16484E-69 0.79748E-02
0.36769E-63 0.78465E-66 0.13338E-66 0.41278E-69 0.20766E-69 0.52856E-70 0.96937E 00 0.21252E-68
0.36295E-67 0.30628E-01
0.36769E-63 0.78465E-66 0.13338E-66 0.41278E-69 0.20766E-69 0.52856E-70 0.20180E-69 0.96937E 00
0.36295E-67 0.30628E-01
0.99501E 00 0.42284E-02 0.70556E-03 0.28374E-05 0.19016E-05 0.63824E-06 0.16112E-05 0.16946E-04

0.0 0.29140E-04
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.10000E 01

WHEN C IS 1, THE STATE VECTOR IS 0

STATE 1 = 0.8667

STATE 2 = 0.1201

STATE 3 = 0.0006

STATE 4 = 0.0000

STATE 5 = 0.0000

STATE 6 = 0.0000

STATE 7 = 0.0000

STATE 8 = 0.0000

STATE 9 = 0.0000

STATE 10 = 0.0125

AT TIME = 4000.00 END OF PHASE - 9TOTAL TIME 35999.99

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.853837252	1	0.985108376
2	0.129210413	2	0.000065784
3	0.002060714	3	0.000223000
4	0.000012227	4	0.014602657
5	0.000019115		
6	0.000034441		
7	0.000019638		
8	0.000203363		
9	0.000000000		
10	0.014602657		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 4275.18

0.0	0.42500E-07	0.75000E-08	0.0	0.0	0.0	0.0	0.0
0.0	0.10000E-13						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.50000E-07						
0.0	0.0	0.0	0.15000E-06	0.0	0.0	0.45000E-07	0.47568E-06
0.0	0.50954E-06						
0.0	0.0	0.0	0.0	0.22920E-04	0.0	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.11460E-04	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.0	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.37441E-68	0.31107E-06						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.37441E-68	0.31107E-06						
0.10000E 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0						

AT TIME IN RUN = 35999.99

MODE 1 = 0.99

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.01

0.99501E 00	0.42288E-02	0.70563E-03	0.28378E-05	0.19020E-05	0.63846E-06	0.16115E-05	0.16949E-04
0.69480E-72	0.29146E-04						
0.0	0.99501E 00	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.49875E-02						
0.92641E-65	0.13273E-67	0.88868E 00	0.54120E-02	0.57472E-02	0.29000E-02	0.42099E-02	0.44164E-01
0.18110E-68	0.48890E-01						
0.82874E-66	0.11772E-68	0.20199E-69	0.99812E-01	0.42832E 00	0.45949E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.82874E-66	0.11772E-68	0.20199E-69	0.51148E-72	0.31397E 00	0.67365E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.82874E-66	0.11772E-68	0.20199E-69	0.51148E-72	0.20754E-72	0.98762E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.36769E-63	0.78469E-66	0.13338E-66	0.41278E-69	0.20766E-69	0.52856E-70	0.96937E 00	0.21252E-68
0.36295E-67	0.30628E-01						
0.36769E-63	0.78469E-66	0.13338E-66	0.41278E-69	0.20766E-69	0.52856E-70	0.20180E-69	0.96937E 00
0.36295E-67	0.30628E-01						
0.99501E 00	0.42284E-02	0.70556E-03	0.28374E-05	0.19016E-05	0.63824E-06	0.16112E-05	0.16946E-04

0.0 0.2914CE-04

0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

0.0 0.10000E 01

.WHEN G IS 1, THE STATIC VECTOR IS 0

STATE 1 = 0.8519

STATE 2 = 0.1322

STATE 3 = 0.0006

STATE 4 = 0.0000

STATE 5 = 0.0000

STATE 6 = 0.0000

STATE 7 = 0.0000

STATE 8 = 0.0000

STATE 9 = 0.0000

STATE 10 = 0.0153

[redacted] AT TIME = 4000.00 END OF PHASE - TOTAL TIME = 39999.99

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.839233398	1	0.982177436
2	0.140918612	2	0.000064659
3	0.002028468	3	0.000219186
4	0.000012018	4	0.017538521
5	0.000018788		
6	0.000033852		
7	0.000019302		
8	0.000199884		
9	0.000000000		
10	0.017538521		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 4262.93

0.0	0.42500E-07	0.75000E-08	0.0	0.0	0.0	0.0	0.0
0.0	0.10000E-13						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.50000E-07						
0.0	0.0	0.0	0.15000E-06	0.0	0.0	0.45000E-07	0.47568E-06
0.0	0.50954E-06						
0.0	0.0	0.0	0.0	0.22920E-04	0.0	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.11460E-04	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.0	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.37441E-68	0.31107E-06						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.37441E-68	0.31107E-06						
0.10000E 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0						

AT TIME IN RUN = 39999.99

MODE 1 = 0.98

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.02

0.99501E 00	0.42288E-02	0.70563E-03	0.28378E-05	0.19020E-05	0.63846E-06	0.16115E-05	0.16949E-04
0.69480E-72	0.29146E-04						
0.0	0.99501E 00	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.49875E-02						
0.92641E-65	0.13273E-67	0.98868E 00	0.54120E-02	0.57472E-02	0.29000E-02	0.42099E-02	0.44164E-01
0.18110E-68	0.48890E-01						
0.82874E-66	0.11772E-68	0.20199E-69	0.99812E-01	0.42832E 00	0.45949E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.82874E-66	0.11772E-68	0.20199E-69	0.51148E-72	0.31397E 00	0.67365E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.82874E-66	0.11772E-68	0.20199E-69	0.51148E-72	0.20754E-72	0.98762E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.36769E-63	0.78465E-66	0.13338E-66	0.41278E-69	0.20766E-69	0.52856E-70	0.96937E 00	0.21252E-68
0.36295E-67	0.30628E-01						
0.36769E-63	0.78465E-66	0.13338E-66	0.41278E-69	0.20766E-69	0.52856E-70	0.20180E-69	0.96937E 00
0.36295E-67	0.30628E-01						
0.99501E 00	0.42284E-02	0.70556E-03	0.28374E-05	0.19016E-05	0.63824E-06	0.16112E-05	0.16946E-04

```
 0.0          0.29140E-04
 0.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0
 0.0          0.10000E 01

 WHEN G IS 1, THE STATE VECTOR IS 0

 STATE  1 = 0.8373

 STATE  2 = 0.1438

 STATE  3 = 0.0006

 STATE  4 = 0.0000

 STATE  5 = 0.0000

 STATE  6 = 0.0000

 STATE  7 = 0.0000

 STATE  8 = 0.0000

 STATE  9 = 0.0000

 STATE 10 = 0.0183
```

\ AT TIME = 4000.00 END OF PHASE - 11TOTAL TIM\ 43999.99

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.824879289	1	0.979021072
2	0.152150989	2	0.000063553
3	0.001990824	3	0.000215437
4	0.000011812	4	0.020699769
5	0.000018467		
6	0.000033273		
7	0.000018972		
8	0.000196465		
9	0.000000000		
10	0.020699769		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 4249.68

0.0	0.42500E-07	0.75000E-08	0.0	0.0	0.0	0.0	0.0
0.0	0.10000E-13						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.50000E-07						
0.0	0.0	0.0	0.15000E-06	0.0	0.0	0.45000E-07	0.47568E-06
0.0	0.50954E-06						
0.0	0.0	0.0	0.0	0.22920E-04	0.0	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.11460E-04	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.0	0.45000E-07	0.0
0.0	0.79552E-07						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.37441E-68	0.31107E-06						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.37441E-68	0.31107E-06						
0.10000E 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0						
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0						

AT TIME IN RUN = 43999.99

MODE 1 = 0.98

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.02

0.99501E 00	0.42288E-02	0.70563E-03	0.28378E-05	0.19020E-05	0.63846E-06	0.16115E-05	0.16949E-04
0.69480E-72	0.29146E-04						
0.0	0.99501E 00	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.49875E-02						
0.92641E-65	0.13273E-67	0.88868E 00	0.54120E-02	0.57472E-02	0.29000E-02	0.42099E-02	0.44164E-01
0.13110E-68	0.48890E-01						
0.82874E-66	0.11772E-68	0.20199E-69	0.99812E-01	0.42832E 00	0.45949E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.82874E-66	0.11772E-69	0.20199E-69	0.51148E-72	0.31397E 00	0.67365E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.82874E-66	0.11772E-68	0.20199E-69	0.51148E-72	0.20754E-72	0.98762E 00	0.44031E-02	0.24066E-71
0.16484E-69	0.79748E-02						
0.36769E-63	0.78465E-66	0.13338E-66	0.41278E-69	0.20766E-69	0.52856E-70	0.96937E 00	0.21252E-66
0.36295E-67	0.30628E-01						
0.36769E-63	0.78465E-66	0.13338E-66	0.41278E-69	0.20766E-69	0.52856E-70	0.20180E-69	0.96937E 00
0.36295E-67	0.30628E-01						
0.99501E 00	0.42284E-02	0.70556E-03	0.28374E-05	0.19016E-05	0.63824E-06	0.16112E-05	0.16946E-04

WITHOUT SHUTTLE

THIS IS CASE NUMBER 1

N	MAXRUN	MAXPHS	MAXSUB	NMODE
6	4	6	0	4

THE N VALUES FOR EACH PHASE ARE-
0.10000E-02 0.10000E-02 0.10000E-02 0.10000E-02 0.10000E-02 0.10000E-02

THE INITIAL CONDITION VECTOR IS

STATE 1 = 1.0000

STATE 2 = 0.0

STATE 3 = 0.0

STATE 4 = 0.0

STATE 5 = 0.0

STATE 6 = 0.0

1	0	0	0
1	0	0	0
0	1	0	0
0	1	0	0
0	1	0	0
0	0	0	1

PHASE 1 = 17520.00 HOURS

PHASE 2 = 26280.00 HOURS

PHASE 3 = 26280.00 HOURS

PHASE 4 = 26280.00 HOURS

PHASE 5 = 26280.00 HOURS

PHASE 6 = 26280.00 HOURS

0.0 C.291E-04
0.0 C.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 C.10000E 01

WHEN G IS 1, THE STATE VECTOR IS 0

STATE 1 = 0.8230

STATE 2 = 0.1549

STATE 3 = 0.0006

STATE 4 = 0.0000

STATE 5 = 0.0000

STATE 6 = 0.0000

STATE 7 = 0.0000

STATE 8 = 0.0000

STATE 9 = 0.0000

STATE 10 = 0.0215

AT TIME = 4000.00 END OF PHASE - 12TOTAL TIME - 47999.99

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.81C77C631	1	0.975648463
2	0.162921071	2	0.000062466
3	0.001956774	3	0.000211753
4	0.000011610	4	0.024077088
5	0.000018151		
6	0.000032704		
7	0.000018647		
8	0.0001931C5		
9	0.C00000000		
10	0.024077C88		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 4235.48

THIS IS RUN NUMBER 2

WITHOUT SHUTTLE

LAM	LAM1	LAM2	LAM3	LAM4	LAM5	P1	P11	P12	D	MU	LAM0
0.50E-05	0.24E-05	0.80E-04	0.31E-04	0.11E-02	0.57E-04	0.75E-00	0.50E-00	0.90E-00	72.00	10.00	0.10E-11

0.0	0.50000E-08	0.0	0.0	0.0	0.10000E-14
0.0	0.0	0.34380E-05	0.0	0.0	0.14151E-06
0.0	0.0	0.0	0.22920E-05	0.0	0.14151E-06
0.0	0.0	0.0	0.0	0.34380E-05	0.14151E-06
0.0	0.0	0.0	0.0	0.0	0.14151E-06
0.0	0.0	0.0	0.0	0.0	0.0

AT TIME IN RUN = 0.0

MODE 1 = 1.00

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.0

0.99950E 00	0.42019E-03	0.70524E-04	0.51767E-05	0.46545E-06	0.35206E-05
0.0	0.69911E-00	0.25467E-00	0.28627E-01	0.35468E-02	0.14051E-01
0.0	0.0	0.78400E 00	0.16978E 00	0.32174E-01	0.14051E-01
0.0	0.0	0.0	0.69911E 00	0.28684E 00	0.14051E-01
0.0	0.0	0.0	0.0	0.98595E 00	0.14052E-01
0.0	0.0	0.0	0.0	0.0	0.10000E-01

WHEN G IS 1, THE STATE VECTOR IS 0

STATE 1 = 0.9995

STATE 2 = 0.0004

STATE 3 = 0.0001

STATE 4 = 0.0000

STATE 5 = 0.0000

STATE 6 = 0.0000

AT TIME = 18000.00 END OF PHASE - TOTAL TIME = 18000.00

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.913930933	1	0.915209174
2	0.001278400	2	0.029327799
3	0.001909807	3	0.0
4	0.001160459	4	0.055461217
5	0.026357535		
6	0.055461217		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 17267.82

0.0	0.50000E-08	0.0	0.0	0.0	0.10000E-14
0.0	0.0	0.34380E-05	0.0	0.0	0.14151E-06
0.0	0.0	0.0	0.22920E-05	0.0	0.14151E-06
0.0	0.0	0.0	0.0	0.34380E-05	0.14151E-06
0.0	0.0	0.0	0.0	0.0	0.14151E-06
0.0	0.0	0.0	0.0	0.0	0.0

AT TIME IN RUN = 18000.00

MODE 1 = 1.00

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.0

0.99950E 00	0.42019E-03	0.70524E-04	0.51767E-05	0.46545E-06	0.35206E-05
0.0	0.69911E-00	0.25467E-00	0.28627E-01	0.35468E-02	0.14051E-01
0.0	0.0	0.78400E 00	0.16978E 00	0.32174E-01	0.14051E-01
0.0	0.0	0.0	0.69911E-00	0.28684E 00	0.14051E-01
0.0	0.0	0.0	0.0	0.98595E 00	0.14052E-01
0.0	0.0	0.0	0.0	0.0	0.10000E-01

WHEN G IS=1,-THE-STATE VECTOR IS-0

STATE 1 = 0.9995

STATE 2 = 0.0004

STATE 3 = 0.0001

STATE 4 = 0.0000

STATE 5 = 0.0000

STATE 6 = 0.0000

AT TIME = 26699.99 END OF PHASE 2 TOTAL TIME 44699.99

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.875027001	1	0.876250982
2	0.001223981	2	0.029987842
3	0.001732768	3	0.0
4	0.001111061	4	0.093756557
5	0.027144015		
6	0.093756557		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 25087.29

0.0	0.50000E-08	0.0	0.0	0.0	0.10000E-14
0.0	0.0	0.34380E-05	0.0	0.0	0.14151E-06
0.0	0.0	0.0	0.22920E-05	0.0	0.14151E-06
0.0	0.0	0.0	0.0	0.34380E-05	0.14151E-06
0.0	0.0	0.0	0.0	0.0	0.14151E-06
0.0	0.0	0.0	0.0	0.0	0.0

AT TIME IN RUN = 44699.99

MODE 1 = 1.00

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.0

0.49950E-00	0.42019E-03	0.70524E-04	0.51767E-05	0.46545E-06	0.35206E-05
0.0	0.69911E 00	0.25467E 00	0.28627E-01	0.35468E-02	0.14051E-01
0.0	0.0	0.79400E-00	0.16978E-00	0.32174E-01	0.14051E-01
0.0	0.0	0.0	0.69911E 00	0.28684E 00	0.14051E-01
0.0	0.0	0.0	0.0	0.98595E-00	0.14052E-01
0.0	0.0	0.0	0.0	0.0	0.10000E 01

WHEN G IS 1, THE STATE VECTOR IS 0

STATE 1 = 0.9995

STATE 2 = 0.0004

STATE 3 = 0.0001

STATE 4 = 0.0000

STATE 5 = 0.0000

STATE 6 = 0.0000

AT TIME = 26699.99 END OF PHASE - 3TOTAL TIME - 71399.94

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.875027001	1	0.876250982
2	0.001223981	2	0.029987842
3	0.001732768	3	0.0
4	0.001111061	4	0.093756557
5	0.027144015		
6	0.093756557		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 25087.29

0.0	0.50000E-08	0.0	0.0	0.0	0.10000E-14
0.0	0.0	0.34380E-05	0.0	0.0	0.14151E-06
0.0	0.0	0.0	0.22920E-05	0.0	0.14151E-06
0.0	0.0	0.0	0.0	0.34380E-05	0.14151E-06
0.0	0.0	0.0	0.0	0.0	0.14151E-06
0.0	0.0	0.0	0.0	0.0	0.0

AT TIME IN RUN 71399.94

MODE 1 = 1.00

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.0

0.99950E 00	0.42019E-03	0.70524E-04	0.51767E-05	0.46545E-06	0.35206E-05
0.0	0.69911E-00	0.25467E-00	0.28627E-01	0.35468E-02	0.14051E-01
0.0	0.0	0.78400E 00	0.16978E 00	0.32174E-01	0.14051E-01
0.0	0.0	0.0	0.69911E-00	0.28684E-00	0.14051E-01
0.0	0.0	0.0	0.0	0.98595E 00	0.14052E-01
0.0	0.0	0.0	0.0	0.0	0.10000E-01

WHEN G IS 1, THE STATE VECTOR IS 0 -

STATE 1 = 0.0005

STATE 2 = 0.0004

STATE 3 = 0.0001

STATE 4 = 0.0000

STATE 5 = 0.0000

STATE 6 = 0.0000

AT TIME = 26699.99 END OF PHASE 4 TOTAL TIME = 98099.94

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.875027001	1	0.876250982
2	0.001223981	2	0.029987842
3	0.001732768	3	0.0
4	0.001111061	4	0.093756557
5	0.027144015		
6	0.093756557		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 25087.29

0.0	0.50000E-08	0.0	0.0	0.0	0.10000E-14
0.0	0.0	0.34380E-05	0.0	0.0	0.14151E-06
0.0	0.0	0.0	0.22920E-05	0.0	0.14151E-06
0.0	0.0	0.0	0.0	0.34380E-05	0.14151E-06
0.0	0.0	0.0	0.0	0.0	0.14151E-06
0.0	0.0	0.0	0.0	0.0	0.0

AT TIME IN RUN = 98099.94

MODE 1 = 1.00

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.0

0.99950E-00	0.42019E-03	0.70524E-04	0.51767E-05	0.46545E-06	0.35206E-05
0.0	0.69911E 00	0.25467E 00	0.28627E-01	0.35468E-02	0.14051E-01
0.0	0.0	0.78400E-00	0.16978E-00	0.32174E-01	0.14051E-01
0.0	0.0	0.0	0.69911E 00	0.28684E 00	0.14051E-01
0.0	0.0	0.0	0.0	0.98595E-00	0.14052E-01
0.0	0.0	0.0	0.0	0.0	0.10000E 01

WHEN G IS 1. THE STATE VECTOR IS 0

STATE 1 = 0.9995

STATE 2 = 0.0004

STATE 3 = 0.0001

STATE 4 = 0.0000

STATE 5 = 0.0000

STATE 6 = 0.0000

AT TIME = 26699.99 END OF PHASE - 5TOTAL TIME = 124799.94

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.875027001	1	0.876250982
2	0.001223981	2	0.029987842
3	0.001732768	3	0.0
4	0.001111061	4	0.093756557
5	0.027144015		
6	0.093756557		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 25087.24

0.0	0.50000E-08	0.0	0.0	0.0	0.10000E-14
0.0	0.0	0.34380E-05	0.0	0.0	0.14151E-06
0.0	0.0	0.0	0.22920E-05	0.0	0.14151E-06
0.0	0.0	0.0	0.0	0.34380E-05	0.14151E-06
0.0	0.0	0.0	0.0	0.0	0.14151E-06
0.0	0.0	0.0	0.0	0.0	0.0

AT TIME IN RUN = 124799.94

MODE 1 = 1.00

MODE 2 = 0.0

MODE 3 = 0.0

MODE 4 = 0.0

0.99950E 00	0.42019E-03	0.70524E-04	0.51767E-05	0.46545E-06	0.35206E-05
0.0	0.69911E-00	0.25467E-00	0.28627E-01	0.35468E-02	0.14051E-01
0.0	0.0	0.79400E 00	0.16978E 00	0.32174E-01	0.14051E-01
0.0	0.0	0.0	0.69911E-00	0.28684E-00	0.14051E-01
0.0	0.0	0.0	0.0	0.98595E 00	0.14052E-01
0.0	0.0	0.0	0.0	0.0	0.10000E-01

WHEN G IS 1, THE STATE VECTOR IS 0

STATE 1 = 0.9995

STATE 2 = 0.0004

STATE 3 = 0.0001

STATE 4 = 0.0000

STATE 5 = 0.0000

STATE 6 = 0.0000

AT TIME = 26699.99 END OF PHASE 6TOTAL TIME 151499.94

STATE NO.	STATE PROB.	MODE NO.	MODE PROB.
1	0.875027001	1	0.876250982
2	0.001223981	2	0.029987842
3	0.001732768	3	0.0
4	0.001111061	4	0.093756557
5	0.027144015		
6	0.093756557		

THE EXPECTED TIME IN MODE 1 FOR THIS PHASE = 25087.29

Appendix Subsection 3D

Subsystem and Group Reliability Block Diagrams

GROUP LEVEL FAILURE RATE ANALYSIS

GROUP I

- AIRCRAFT

PNEUMATICS	PRIMARY OPTICS	SPACECRAFT MECHANISMS	THERMAL	ELECTRICAL & WIRING	STRUCTURE
$\lambda = 100$	$\lambda = 1$	$\lambda = 0.01$	$\lambda = 0.1$	$\lambda = 2.00$	$\lambda = 0.01$

$\lambda_{AIRCRAFT} = 301.12$

$MTBF_{AIRCRAFT} = 3,320$ HRS.

- OAO

PNEUMATICS	PRIMARY OPTICS	SPACECRAFT MECHANISMS	THERMAL	ELECTRICAL & WIRING	STRUCTURE
$\lambda = 0.1$	$\lambda = 1$	$\lambda = 0.01$	$\lambda = 0.1$	$\lambda = 0.2$	$\lambda = 0.01$

$\lambda_{OAO} = 1.42$

$MTBF_{OAO} = 704,225$ HRS.

- LM

PNEUMATICS	PRIMARY OPTICS	SPACECRAFT MECHANISMS	THERMAL	ELECTRICAL & WIRING	STRUCTURE
$\lambda = 1$	$\lambda = 1$	$\lambda = 0.01$	$\lambda = 0.1$	$\lambda = 0.2$	$\lambda = 0.01$

$\lambda_{LM} = 2.32$

$MTBF_{LM} = 431,034$ HRS.

NOTE ALL λ ARE IN FAILURES PER 10^6 HRS.

GROUP LEVEL FAILURE RATE ANALYSIS

GROUP 2:

AIRCRAFT

STABILIZATION & CONTROL	PNEUMATICS	THERMAL	COMMUNICATION & DATA HANDLING	POWER SUBSYSTEMS	ON-AXIS EXPERIMENT	SEC OFFSET TRACKER
$\lambda = 3914$	$\lambda = 1946$	$\lambda = 1$	$\lambda = 14950$	$\lambda = 29822$	$\lambda = 57$	$\lambda = 0.64$

$\lambda_{AIRCRAFT} = 50,690.64$

MTBF AIRCRAFT = 19 HRS

OAO

STABILIZATION & CONTROL	PNEUMATICS	THERMAL	COMMUNICATION & DATA HANDLING	POWER SUBSYSTEMS	ON-AXIS EXPERIMENT	SEC OFFSET TRACKER
$\lambda = 27.998$	$\lambda = 0.933$	$\lambda = 1$	$\lambda = 7.725$	$\lambda = 4.507$	$\lambda = 57.1$	$\lambda = 0.64$

$\lambda_{OAO} = 99.327$

MTBF OAO = 10,067 HRS

LM

STABILIZATION & CONTROL	PNEUMATICS	THERMAL	COMMUNICATION & DATA HANDLING	POWER SUBSYSTEMS	ON-AXIS EXPERIMENT	SEC OFFSET TRACKER
$\lambda = 25.319$	$\lambda = 17.233$	$\lambda = 1$	$\lambda = 30.340$	$\lambda = 4.325$	$\lambda = 57.1$	$\lambda = 0.64$

$\lambda_{LM} = 136.452$

MTBF LM = 7328

NOTE: ALL λ ARE IN FAILURES PER 10^6 HRS

GROUP LEVEL FAILURE RATE ANALYSIS

GROUP 3:

AIRCRAFT

SPACECRAFT MECHANISMS
$\lambda = 0.25$

RADIAL EXPERIMENT #1
$\lambda = 114.15$

RADIAL EXPERIMENT #2
$\lambda = 114.15$

RADIAL EXPERIMENT #3
$\lambda = 114.15$

* $\lambda_{AIRCRAFT} = 37.56$

$MTBF_{AIRCRAFT} = 26,624$ HRS

OAO

SPACECRAFT MECHANISMS
$\lambda = 0.25$

RADIAL EXPERIMENT #1
$\lambda = 114.15$

RADIAL EXPERIMENT #2
$\lambda = 114.15$

RADIAL EXPERIMENT #3
$\lambda = 114.15$

$\lambda_{OAO} = 37.56$

$MTBF_{OAO} = 26,624$ HRS

LM

SPACECRAFT MECHANISMS
$\lambda = 0.25$

RADIAL EXPERIMENT #1
$\lambda = 114.15$

RADIAL EXPERIMENT #2
$\lambda = 114.15$

RADIAL EXPERIMENT #3
$\lambda = 114.15$

$\lambda_{LM} = 37.56$

$MTBF_{LM} = 26,624$ HRS

* NOTE: ALL λ ARE IN FAILURES PER 10^6 HRS

PNEUMATICS

EQUIPMENT LEVEL: AIRCRAFT

GAS TANKS
$\lambda = 0.14$

REGULATORS
$\lambda = 0.2$

VALVES (SHUT OFF)
$\lambda = 0.4$

GAS JETS
$\lambda = 0.1$

SOLENOID VALVE & PNEUM. CONN.
$\lambda = 1.43$

GAS TANKS
$\lambda = 0.14$

$\lambda = 0.1$

VALVES (SHUT OFF)
$\lambda = 0.4$

GAS JETS
$\lambda = 0.1$

SOLENOID VALVE & PNEUM. CONN.
$\lambda = 1.43$

$\lambda = 0.047$

REGULATORS
$\lambda = 0.2$

$\lambda = 0.167$

GAS TANKS
$\lambda = 0.14$

VALVES (SHUT OFF)
$\lambda = 0.4$

GAS JETS
$\lambda = 0.1$

SOLENOID VALVE & PNEUM. CONN
$\lambda = 1.43$

$\lambda = 0.383$

GAS JETS
$\lambda = 0.1$

SOLENOID VALVE & PNEUM. CONN
$\lambda = 1.43$

GAS JETS
$\lambda = 0.1$

SOLENOID VALVE & PNEUM. CONN.
$\lambda = 1.43$

GAS JETS
$\lambda = 0.1$

SOLENOID VALVE & PNEUM. CONN.
$\lambda = 1.43$

GAS JETS
$\lambda = 0.1$

SOLENOID VALVE & PNEUM. CONN.
$\lambda = 1.43$

OVER

GAS JETS
$\lambda = 0.1$

SOLENOID VALVE & PNEUM. CONN.
$\lambda = 1.43$

GAS JETS
$\lambda = 0.1$

SOLENOID VALVE & PNEUM. CONN.
$\lambda = 1.43$

$\lambda = 0.383$

$\lambda = 0.383$

GAS JETS
$\lambda = 0.1$

SOLENOID VALVE & PNEUM. CONN.
$\lambda = 1.43$

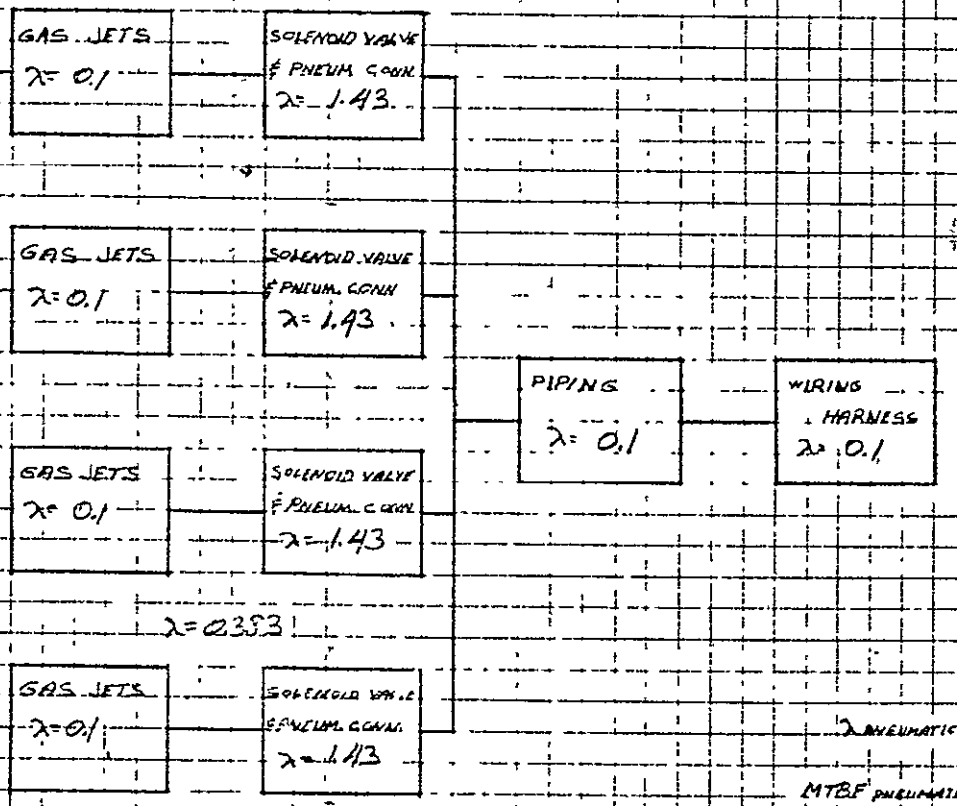
GAS JETS
$\lambda = 0.1$

SOLENOID VALVE & PNEUM. CONN.
$\lambda = 1.43$

ALL λ ARE IN FAILURES PER 10^{+3} HRS.

PNEUMATICS (CONTINUED)

EQUIPMENT LEVEL: AIRCRAFT



$\lambda_{PNEUMATICS} = 2.046$ FAILURES PER 10^6 HRS

$MTBF_{PNEUMATICS} = 488$ HRS

103

COMMUNICATION & DATA HANDLING

EQUIPMENT LEVEL AIRCRAFT

COMMAND RECEIVER
λ = 1.0

NARROW BAND TRANSMITTER
λ = 5.0

NARROW BAND TAPE RECORDER
λ = 5.0

DIPLEXER
λ = 0.01

COMMAND RECEIVER
λ = 1.0

COMMAND DECODER
λ = 4.0

WIDE BAND TRANSMITTER
λ = 10.0

WIDE BAND TAPE RECORDER
λ = 3.3

λ = 0.005

λ = 2.0

DIPLEXER
λ = 0.01

COMMAND RECEIVER
λ = 1.0

λ = 2.5

λ = 1.25

COMMAND DECODER
λ = 4.0

WIDE BAND TRANSMITTER
λ = 10.0

WIDE BAND TAPE RECORDER
λ = 3.3

λ = 0.25

COMMAND RECEIVER
λ = 1.0

TELEMETRY FORMAT CONTR.
λ = 5.0

ON BOARD PROCESSOR
λ = 1.671

COMPUTER OPS. MONITOR
λ = 1.0

COMMAND DETECTOR & DECODE
λ = 5.0

POWER AMP. & RF SW.
λ = 1.0

λ = 2.5

λ = 2.5

λ = 0.5

TELEMETRY FORMAT CONTR.
λ = 5.0

COMMAND DECODER/VERIF
λ = 5.0

POWER AMP. & RF SW.
λ = 1.0

POWER CONVERTER
λ = 1.0

MULTIPLEXER
λ = 0.2

λ = 0.1

POWER CONVERTER
λ = 1.0

TAPE RECORDER INTERFACE
λ = 0.2

WIRING HARNESS
λ = 0.4

MULTIPLEXER
λ = 0.2

λ = 1.0

POWER CONVERTER
λ = 1.0

λ COMM. & DATA HANDLING = 14.5 FAILURES PER 10^6 HRS.

MTBF COMM. & DATA HANDLING = 68 HRS.

ALL λ ARE IN FAILURES PER 10^6 HRS.

EQUIPMENT LEVEL L.M.

COMMAND RECEIVER
$\lambda = 35.0$

NARROW BAND TRANSMITTER
$\lambda = 33.0$

NARROW BAND TAPE RECORDER
$\lambda = 5.0$

DIPLEXER
$\lambda = 1.0$

COMMAND RECEIVER
$\lambda = 35.0$

COMMAND DECODER
$\lambda = 3.75$

WIDE BAND TRANSMITTER
$\lambda = 33.0$

WIDE BAND TAPE RECORDER
$\lambda = 5.0$

$\lambda = 1.0$

$\lambda = 1.875$

DIPLEXER
$\lambda =$

COMMAND RECEIVER
$\lambda = 35.0$

$\lambda = 11.0$

$\lambda = 1.667$

COMMAND DECODER
$\lambda = 3.75$

WIDE BAND TRANSMITTER
$\lambda = 33.0$

WIDE BAND TAPE RECORDER
$\lambda = 5.0$

$\lambda = 8.75$

COMMAND RECEIVER
$\lambda = 35.0$

TELEMETRY FORMAT CONTR.
$\lambda = 0.12$

ON BOARD PROCESSOR
$\lambda = 0.5$

COMPUTER CPS. MONITOR
$\lambda = 3.4$

COMMAND DETECTOR & VERIF.
$\lambda = 1.25$

POWER AMP. ERR. & W.
$\lambda = 1.7$

$\lambda = .06$

$\lambda = 0.625$

$\lambda = 0.85$

TELEMETRY FORMAT CONTR.
$\lambda = 0.12$

COMMAND DETECTOR & VERIF.
$\lambda = 1.25$

POWER AMP. ERR. & W.
$\lambda = 1.7$

POWER CONVERTER
$\lambda = 1.3$

MULTIPLEXER
$\lambda = 1.0$

$\lambda = 0.5$

POWER CONVERTER
$\lambda = 1.3$

TAPE RECORDER INTERFACE
$\lambda = 0.56$

WIRING HARNESS
$\lambda = 0.1$

MULTIPLEXER
$\lambda = 1.0$

$\lambda = 0.433$

POWER CONVERTER
$\lambda = 1.3$

λ COMM. & DATA HANDLING $= 30.840$ FAILURES PER 10^6 HRS

MTBF COMMAND & DATA HANDLING $= 32,425$ HRS

ALL λ ARE IN FAILURES PER 10^{+6} HRS

COMMUNICATION & DATA HANDLING

EQUIPMENT LEVEL OAO

COMMAND RECEIVER λ = 2.4

NARROW BAND TRANSMITTER λ = 1.5

NARROW BAND TAPE RECORDER λ = 0.5

DIPLEXER λ = 0.01

COMMAND RECEIVER λ = 2.4

WIDE BAND TRANSMITTER λ = 4.2

WIDE BAND TAPE RECORDER λ = 0.33

COMMAND DECODER λ = 2.0

λ = 0.005

λ = 1.0

DIPLEXER λ = 0.01

COMMAND RECEIVER λ = 2.4

λ = 0.88

λ = 0.125

COMMAND DECODER λ = 2.0

λ = 0.6

WIDE BAND TRANSMITTER λ = 4.2

WIDE BAND TAPE RECORDER λ = 0.33

COMMAND RECEIVER λ = 2.4

TELEMETRY FORMAT CONTR. λ = 2.0

ON BOARD PROCESSOR λ = 0.25

COMPUTER CRS. MONITOR λ = 0.5

COMMAND DETECTOR & VERIF. λ = 3.0

POWER AMP & RF SW λ = 1.0

λ = 1.0

λ = 1.5

λ = 0.5

TELEMETRY FORMAT CONTR. λ = 2.0

COMMAND DETECTOR & VERIF λ = 3.0

POWER AMP & RF SW λ = 1.0

POWER CONVERTER λ = 1.0

MULTIPLEXER λ = 2.0

λ = 1.0

POWER CONVERTER λ = 1.0

TAPE RECORDER INTERFACE λ = 0.025

WIRING HARNESS λ = 0.01

MULTIPLEXER λ = 2.0

λ = 0.33

POWER CONVERTER λ = 1.0

106

λ COMPLETE DATA HANDLING = 7725 FAILURES PER 10^6 HRS

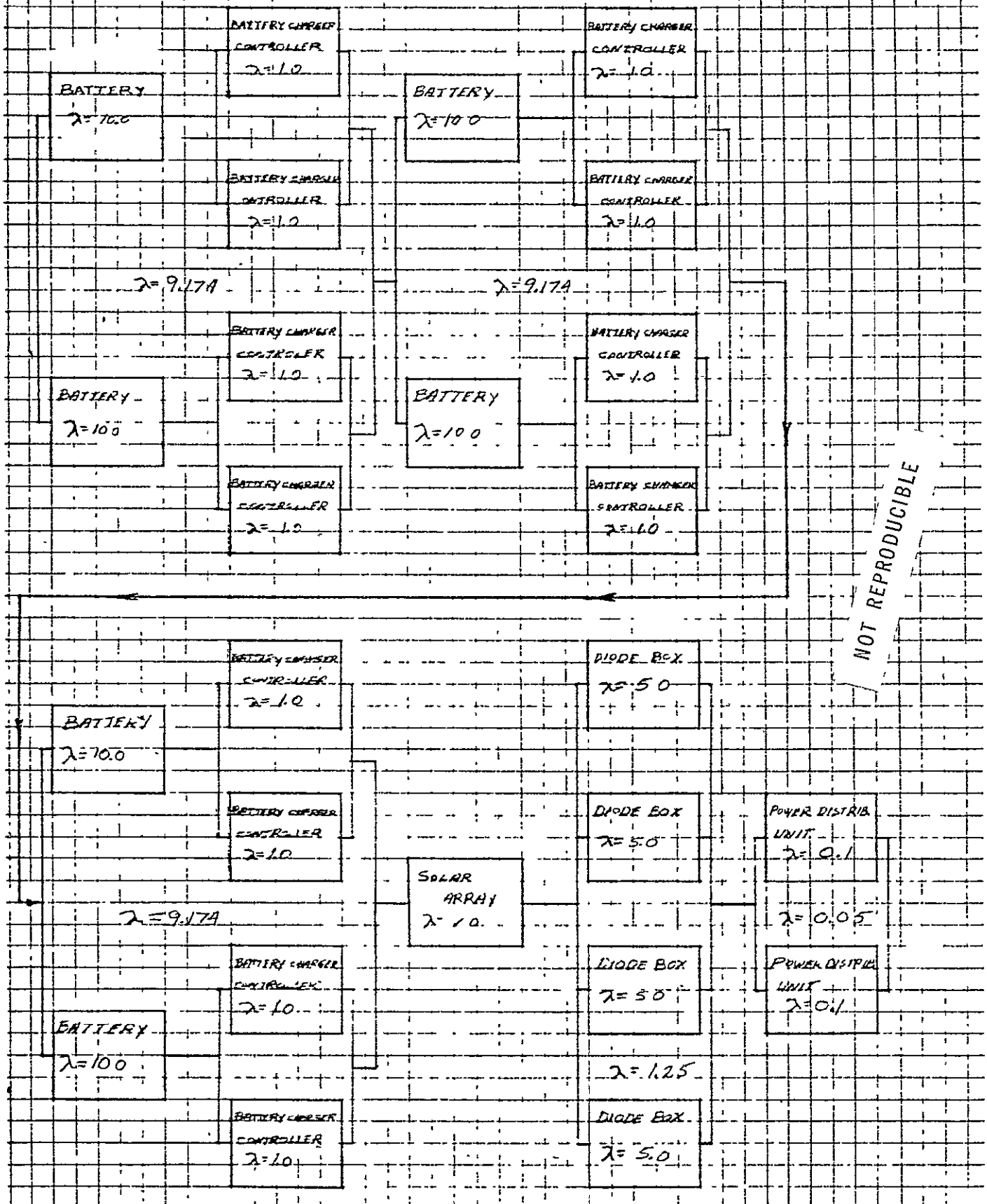
MTBF COMPLETE DATA HANDLING = 129,450 HRS

ALL λ ARE IN FAILURES PER 10^{+6} HRS

PAGE 1 OF 1

ELECTRICAL POWER

EQUIPMENT LEVEL: AIRCRAFT



ALL λ ARE IN FAILURES PER 10^{+3} HRS.

λ ELECT. POWER = 29.822 FAILURES PER 10^{+3} HRS

MTBF ELECT. PWR = 33.5 HRS

ELECTRICAL POWER

EQUIPMENT LEVEL: L.M.

BATTERY
λ = 1.4

BATTERY CHARGER CONTROLLER
λ = 1.0

BATTERY
λ = 1.4

BATTERY CHARGER CONTROLLER
λ = 1.0

BATTERY CHARGER CONTROLLER
λ = 1.0

BATTERY CHARGER CONTROLLER
λ = 1.0

λ = 0.95

λ = 0.95

BATTERY
λ = 1.4

BATTERY CHARGER CONTROLLER
λ = 1.0

BATTERY
λ = 1.4

BATTERY CHARGER CONTROLLER
λ = 1.0

BATTERY CHARGER CONTROLLER
λ = 1.0

BATTERY CHARGER CONTROLLER
λ = 1.0

BATTERY
λ = 1.4

DIODE BOX
λ = 1.3

BATTERY CHARGER CONTROLLER
λ = 1.0

DIODE BOX
λ = 1.3

POWER DISTRIB. UNIT
λ = 1.5

SOLAR ARRAY
λ = 0.4

λ = 0.95

λ = 0.75

BATTERY CHARGER CONTROLLER
λ = 1.0

BATTERY
λ = 1.4

DIODE BOX
λ = 1.3

POWER DISTRIB. UNIT
λ = 1.5

λ = 2.325

BATTERY CHARGER CONTROLLER
λ = 1.0

DIODE BOX
λ = 1.3

ALL λ ARE IN FAILURES PER 10^{+6} HRS

λ ELECT. POWER = 4.325 FAILURES PER 10^{+6} HRS

MTBF ELECT. PWR = 231,213

ELECTRICAL POWER

EQUIPMENT LEVEL: 040

BATTERY
λ=0.337

BATTERY CHARGER CONTROLLER
λ=0.5

BATTERY
λ=0.337

BATTERY CHARGER CONTROLLER
λ=0.5

BATTERY CHARGER CONTROLLER
λ=0.5

BATTERY CHARGER CONTROLLER
λ=0.5

λ=0.294

λ=0.294

BATTERY
λ=0.337

BATTERY CHARGER CONTROLLER
λ=0.5

BATTERY
λ=0.337

BATTERY CHARGER CONTROLLER
λ=0.5

BATTERY CHARGER CONTROLLER
λ=0.5

BATTERY CHARGER CONTROLLER
λ=0.5

BATTERY
λ=0.337

BATTERY CHARGER CONTROLLER
λ=0.5

DIODE B.X.
λ=7.9

BATTERY
λ=0.337

BATTERY CHARGER CONTROLLER
λ=0.5

DIODE BOX
λ=7.9

POWER DISTRIB UNIT
λ=2.5

SOLAR ARRAY
λ=.04

λ=0.294

λ=1.25

BATTERY CHARGER CONTROLLER
λ=0.5

DIODE BOX
λ=7.9

POWER DISTRIB UNIT
λ=2.5

BATTERY
λ=0.337

λ=1.975

BATTERY CHARGER CONTROLLER
λ=0.5

DIODE BOX
λ=7.9

ALL λ ARE IN FAILURES PER 10^6 HRS

$\lambda_{ELECT.\ POWER}$ = 4.507 FAILURES PER 10^6 HRS

MTBF $_{ELECT.\ PWR}$ = 221,877 HRS

3

Appendix Section 4

Cost Model/Analysis Computer Outputs

PERCOM PROGRAM

PROGRAM NO. 1

SHUTTLE SCHEDULE DELAY..... 0.5
TOTAL SYSTEM MTTF..... 3.0
VAR. SUBSYSTEM SLOPE..... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	60862.	1617140.	
4	THERMAL	2120000.	2010971.	
5	S-C MECHANISMS	3520000.	2721481.	
6	ELECTRIC POWER	28892.	729178.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	167969.	1089890.	
9	PNEUMATICS	1214.	235628.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2513000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	113800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	592000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	81105520.	68312656.	
	G & A	10462607.	8812329.	1160999.
	SUBTOTAL	91568112.	77124976.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	105765120.	271988680.	10160999.
	*NO G & A CHARGE			
			TOTAL	387914496.
	COST OF ADD'L SHUTTLE REPAIR FLTS			210000000.
	GRAND TOTAL			597914368.

NO. OF FAILURES..... 48.00
UPTIME (YEARS)..... 12.00
UPTIME RATIO..... 0.80

PERCOM PROGRAM

PROGRAM NO. 2

SHUTTLE SCHEDULE DELAY..... 1.0
TOTAL SYSTEM MTTF..... 3.0
VAR. SUBSYSTEM SLOPE..... 1.25

		SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1		STRUCTURE	20150000.	30649216.	
2		ENGINEERING	17500000.	2250126.	
3		STABILIZATION	60862.	1617140.	
4		THERMAL	2120000.	2910971.	
5		S-C MECHANISMS	3520000.	2721483.	
6		ELECTRIC POWER	28892.	729178.	
7	*	PRIMARY OPTICS	3300000.	8000878.	
8		COMM. & DATA HANDLING	167869.	1089890.	
9		PNEUMATICS	1214.	235628.	
10		TEST & SUPPORT EQUIPMENT	4660540.	2070634.	
11		PROGRAM MANAGEMENT	2533000.	7119000.	
12		SYSTEM INTEGRATION	944000.	2448690.	
13		RELIABILITY	111600.	111800.	
14		QUALITY ACCEPTANCE	1445220.	5820000.	
15		TITAN INTERSTAGE	582000.	670000.	
16	*	TITAN SHROUD	0.0	1000000.	
17		SHUTTLE INTERFACES	20910000.	1997000.	
18		TRAINERS & SIMULATORS	3110400.	100000.	
19	*	EXPERIMENTS A & B	5000000.	39000000.	
20		GROUND STATION	3251000.	800000.	
21	*	NEW COMPUTERS	4550000.	0.0	
		LAUNCH OPERATIONS			
22	*	LV-TITAN	0.0	22500000.	
23	*	LV-SHUTTLE	0.0	10000000.	
24		S-C SUPPORT	0.0	4950000.	
25	*	FACILITIES	1347012.	362826.	
26	*	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	*	EXPERIMENT UPDATE	0.0	39000000.	
28	*	G.S.F.C. & OTHER	0.0	60000000.	
29		ORBITAL OPERATIONS			9000000.
		G & A CHARGEABLE	81105520.	68312656.	
		G & A	10462607.	8812329.	1160999.
		SUBTOTAL	91568112.	77124976.	
		NON-G & A SUBTOTAL	14197012.	194863680.	
		TOTAL	105765120.	271988480.	10160999.
		*NO G & A CHARGE			
				TOTAL	387914496.
		COST OF ADD'L SHUTTLE REPAIR FLTS			180000000.
		GRAND TOTAL			567914496.

NO. OF FAILURES..... 42.00
UPTIME (YEARS)..... 10.50
UPTIME RATIO..... 0.70

PERCOM PROGRAM

PROGRAM NO. 4

SHUTTLE SCHEDULE DELAY.. 2.0
TOTAL SYSTEM MTTF..... 3.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	60862.	1617140.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721493.	
6	ELECTRIC POWER	28892.	729178.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	167869.	1089890.	
9	PNEUMATICS	1214.	215628.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	111800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	81105520.	68312656.	
	G & A	10462607.	8812329.	1160999.
	SUBTOTAL	91568112.	77124976.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	105765120.	271988480.	10160999.
	*NO G & A CHARGE			
			TOTAL	387914496.
	COST OF ADD'L SHUTTLE REPAIR FLTS			137999952.
	GRAND TOTAL			525914368.
	NO. OF FAILURES.... 33.60			
	UPTIME (YEARS)..... 8.40			
	UPTIME RATIO..... 0.56			

PERCOM PROGRAM

PROGRAM NO. 5

SHUTTLE SCHEDULE DELAY..... 2.5
TOTAL SYSTEM MTTF..... 3.0
VAR. SUBSYSTEM SLOPE..... 1.25

		SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1		STRUCTURE	20150000.	30649216.	
2		ENGINEERING	17500000.	2250126.	
3		STABILIZATION	60862.	1617140.	
4		THERMAL	2120000.	2910971.	
5		S-C MECHANISMS	3520000.	2721483.	
6		ELECTRIC POWER	28892.	729178.	
7	*	PRIMARY OPTICS	3300000.	8000978.	
8		COMM. & DATA HANDLING	167969.	1089800.	
9		PNEUMATICS	1214.	235628.	
10		TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11		PROGRAM MANAGEMENT	2533000.	7119000.	
12		SYSTEM INTEGRATION	944000.	2448698.	
13		RELIABILITY	111600.	133800.	
14		QUALITY ACCEPTANCE	1445220.	5820000.	
15		TITAN INTERSTAGE	582000.	670000.	
16	*	TITAN SHROUD	0.0	1000000.	
17		SHUTTLE INTERFACES	20910000.	1997000.	
18		TRAINERS & SIMULATORS	3110400.	100000.	
19	*	EXPERIMENTS A & B	5000000.	39000000.	
20		GROUND STATION	3251000.	800000.	
21	*	NEW COMPUTERS	4550000.	0.0	
		LAUNCH OPERATIONS			
22	*	LV-TITAN	0.0	22500000.	
23	*	LV-SHUTTLE	0.0	10000000.	
24		S-C SUPPORT	0.0	4950000.	
25	*	FACILITIES	1347012.	362826.	
26	*	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	*	EXPERIMENT UPDATE	0.0	39000000.	
28	*	G.S.F.C. & OTHER	0.0	60000000.	
29		ORBITAL OPERATIONS			9000000.
		G & A CHARGEABLE	81105520.	68312656.	
		G & A	10462607.	8812329.	1160999.
		SUBTOTAL	91568112.	77124976.	
		NON-G & A SUBTOTAL	14197012.	194863680.	
		TOTAL	105765120.	271988480.	10160999.
		*NO G & A CHARGE			
				TOTAL	387914496.
		COST OF ADD'L SHUTTLE REPAIR FLTS			122727200.
		GRAND TOTAL			510641664.
		NO. OF FAILURES.....	30.55		
		UPTIME (YEARS).....	7.64		
		UPTIME RATIO.....	0.51		

PERCOM PROGRAM

PROGRAM NO. 6

SHUTTLE SCHEDULE DELAY.. 3.0
TOTAL SYSTEM MTTF..... 3.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	60862.	1617140.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	28892.	729178.	
7	* PRIMARY OPTICS	3300000.	8000478.	
8	COMM. & DATA HANDLING	167869.	1089890.	
9	PNEUMATICS	1214.	235628.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2449698.	
13	RELIABILITY	111600.	133900.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
				9000000.
29	ORBITAL OPERATIONS			
	G & A CHARGEABLE	81105520.	68312656.	1160999.
	G & A	10462607.	8812320.	
	SUBTOTAL	91568112.	77124976.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	105765120.	271988480.	10160999.
	*NO G & A CHARGE		TOTAL	387914496.
	COST OF ADD'L SHUTTLE REPAIR FLTS			110000000.
	GRAND TOTAL			497914368.
	NO. OF FAILURES.... 28.00			
	UPTIME (YEARS)..... 7.00			
	UPTIME RATIO..... 0.47			

PERCOM PROGRAM

PROGRAM NO. 7

SHUTTLE SCHEDULE DELAY.. 6.0
TOTAL SYSTEM MTTF..... 3.0
VAR. SUBSYSTEM SLOPE.... 1.25

			NON-RECURRING	RECURRING	OPERATIONS
	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED				
1		STRUCTURE	20150000.	30649216.	
2		ENGINEERING	17500000.	2250126.	
3		STABILIZATION	60862.	1617140.	
4		THERMAL	2120000.	2910971.	
5		S-C MECHANISMS	3520000.	2721483.	
6		ELECTRIC POWER	20892.	729178.	
7	*	PRIMARY OPTICS	3300000.	8000878.	
8		COMM. & DATA HANDLING	167869.	1089890.	
9		PNEUMATICS	1214.	235628.	
10		TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11		PROGRAM MANAGEMENT	2533000.	7119000.	
12		SYSTEM INTEGRATION	944000.	2449698.	
13		RELIABILITY	111600.	133900.	
14		QUALITY ACCEPTANCE	1445220.	5820000.	
15		TITAN INTERSTAGE	582000.	670000.	
16	*	TITAN SHROUD	0.0	1000000.	
17		SHUTTLE INTERFACES	20910000.	1997000.	
18		TRAINERS & SIMULATORS	3110400.	100000.	
19	*	EXPERIMENTS A & B	5000000.	39000000.	
20		GROUND STATION	3251000.	800000.	
21	*	NEW COMPUTERS	4550000.	0.0	
		LAUNCH OPERATIONS			
22	*	LV-TITAN	0.0	22500000.	
23	*	LV-SHUTTLE	0.0	10000000.	
24		S-C SUPPORT	0.0	4950000.	
25	*	FACILITIES	1347012.	362826.	
26	*	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	*	EXPERIMENT UPDATE	0.0	39000000.	
28	*	G.S.F.C. & OTHER	0.0	60000000.	
29		ORBITAL OPERATIONS			9000000.
		G & A CHARGEABLE	81105520.	68312656.	
		G & A	10462607.	8812329.	1160999.
		SUBTOTAL	91568112.	77124976.	
		NON-G & A SUBTOTAL	14197012.	194863680.	
		TOTAL	105765120.	271988480.	10160999.
		*NO G & A CHARGE			
				TOTAL	387914496.
		COST OF ADD'L SHUTTLE REPAIR FLTS			63333280.
		GRAND TOTAL			451247616.
		NO. OF FAILURES.... 18.67			
		UPTIME (YEARS)..... 4.67			
		UPTIME RATIO..... 0.31			

PERCOM PROGRAM

PROGRAM NO. 8

SHUTTLE SCHEDULE DELAY.. 12.0
TOTAL SYSTEM MTTF..... 3.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	60862.	1617140.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	28892.	729178.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	167869.	1089890.	
9	PNEUMATICS	1214.	235628.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2449695.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	162826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	81105520.	68312656.	
	G & A	10462607.	8812329.	1160999.
	SUBTOTAL	91568112.	77124976.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	105765120.	271988480.	10160999.
	*NO G & A CHARGE		TOTAL	387914496.
	COST OF ADD'L SHUTTLE REPAIR FLTS			25999984.
	GRAND TOTAL			413914368.
	NO. OF FAILURES.... 11.20			
	UPTIME (YEARS)..... 2.80			
	UPTIME RATIO..... 0.19			

PERCON PROGRAM

PROGRAM NO. 9

SHUTTLE SCHEDULE DELAY.. 24.0
TOTAL SYSTEM MTTF..... 3.0
VAR. SUBSYSTEM SLOPE.... 1.25

		SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1		STRUCTURE	20150000.	30649216.	
2		ENGINEERING	17500000.	2250126.	
3		STABILIZATION	60862.	1617140.	
4		THERMAL	2120000.	2910971.	
5		S-C MECHANISMS	3520000.	2721483.	
6		ELECTRIC POWER	28092.	729178.	
7	*	PRIMARY OPTICS	3300000.	8000978.	
8		COMM. & DATA HANDLING	167869.	1089890.	
9		PNEUMATICS	1214.	235628.	
10		TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11		PROGRAM MANAGEMENT	2533000.	7119000.	
12		SYSTEM INTEGRATION	944000.	2448698.	
13		RELIABILITY	111600.	131800.	
14		QUALITY ACCEPTANCE	1445220.	5820000.	
15		TITAN INTERSTAGE	582000.	670000.	
16	*	TITAN SHROUD	0.0	1000000.	
17		SHUTTLE INTERFACES	20910000.	1997000.	
18		TRAINERS & SIMULATORS	3110400.	100000.	
19	*	EXPERIMENTS A & B	5000000.	39000000.	
20		GROUND STATION	3251000.	800000.	
21	*	NEW COMPUTERS	4550000.	0.0	
		LAUNCH OPERATIONS			
22	*	LV-TITAN	0.0	22500000.	
23	*	LV-SHUTTLE	0.0	10000000.	
24		S-C SUPPORT	0.0	4950000.	
25	*	FACILITIES	1347012.	362826.	
26	*	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	*	EXPERIMENT UPDATE	0.0	39000000.	
28	*	G.S.F.C. & OTHER	0.0	60000000.	
29		ORBITAL OPERATIONS			9000000.
		G & A CHARGEABLE	81105520.	68312656.	
		G & A	10462607.	8812329.	1160999.
		SUBTOTAL	91568112.	77124976.	
		NON-G & A SUBTOTAL	14197012.	194863680.	
		TOTAL	105765120.	271988480.	10160999.
		*NO G & A CHARGE			
				TOTAL	387914496.
		COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
		GRAND TOTAL			387914496.
		NO. OF FAILURES.... 6.22			
		UPTIME (YEARS)..... 1.56			
		UPTIME RATIO..... 0.10			

PERCOM PROGRAM

PROGRAM NO.10

SHUTTLE SCHEDULE DELAY.. 0.5
TOTAL SYSTEM MTTF..... 6.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	211309.	5614659.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	100312.	2531682.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	582836.	3784059.	
9	PNEUMATICS	4215.	810092.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	111800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1227000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
				9000000.
29	ORBITAL OPERATIONS			
	G & A CHARGEABLE	81745376.	77389312.	1160999.
	G & A	10545149.	9983217.	
	SUBTOTAL	92290512.	87372528.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	106487520.	282236160.	10160999.
	*NO G & A CHARGE		TOTAL	398884352.
	COST OF ADD'L SHUTTLE REPAIR FLTS			99230720.
	GRAND TOTAL			498115072.
	NO. OF FAILURES....	25.85		
	UPTIME (YEARS).....	12.92		
	UPTIME RATIO.....	0.86		

PERCOM PROGRAM

PROGRAM NO.11

SHUTTLE SCHEDULE DELAY.. 1.0
TOTAL SYSTEM MTTF..... 6.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2260126.	
3	STABILIZATION	211709.	5614659.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	100312.	2531692.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	582836.	3784059.	
9	PNEUMATICS	4215.	818092.	
10	TEST & SUPPORT EQUIPMENT	4660540.	2070634.	
11	PROGRAM MANAGEMENT	2534000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2449698.	
13	RELIABILITY	111600.	137000.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	81745376.	77189312.	
	G & A	10545149.	9983217.	1160999.
	SUBTOTAL	92290512.	87172528.	
	NON-G & A SUBTOTAL	14197012.	194867680.	
	TOTAL	106487520.	282236160.	10160999.
	*NO G & A CHARGE			
			TOTAL	398884352.
	COST OF ADD'L SHUTTLE REPAIR FLTS			90000000.
	GRAND TOTAL			488884224.
	NO. OF FAILURES.... 24.00			
	UPTIME (YEARS)..... 12.00			
	UPTIME RATIO..... 0.80			

PERCOM PROGRAM

PROGRAM NO.12

SHUTTLE SCHEDULE DELAY.. 1.5
TOTAL SYSTEM MTTF..... 6.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	211309.	5614659.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	100312.	2531692.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	582816.	3784050.	
9	PNEUMATICS	4215.	819092.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	762826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	81745376.	77389312.	
	G & A	10545149.	9983217.	1160999.
	SUBTOTAL	92290512.	87372528.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	106487520.	282236160.	10160999.
	*NO G & A CHARGE			
			TOTAL	398884352.
	COST OF ADD'L SHUTTLE REPAIR FLTS			81999968.
	GRAND TOTAL			480884224.
	NO. OF FAILURES....	22.40		
	UPTIME (YEARS).....	11.20		
	UPTIME RATIO.....	0.75		

PERCOM PROGRAM

PROGRAM NO.13

SHUTTLE SCHEDULE DELAY..... 2.0
TOTAL SYSTEM MTTF..... 6.0
VAR. SUBSYSTEM SLOPE..... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	211309.	5614659.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	100312.	2511692.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	582836.	3784059.	
9	PNEUMATICS	4215.	818092.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5920000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	-0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	81745376.	77389312.	
	G & A	10545149.	9983217.	1160999.
	SUBTOTAL	92290512.	87372528.	
	NON-G & A SUBTOTAL	14197012.	19486368O.	
	TOTAL	106487520.	282236160.	10160999.
	*NO G & A CHARGE		TOTAL	398884352.
	COST OF ADD'L SHUTTLE REPAIR FLTS			75000000.
	GRAND TOTAL			473884160.
	NO. OF FAILURES....	21.00		
	UPTIME (YEARS).....	10.50		
	UPTIME RATIO.....	0.70		

PERCOM PROGRAM

PROGRAM NO.14

SHUTTLE SCHEDULE DELAY.. 2.5
TOTAL SYSTEM MTTF..... 6.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	211309.	5614659.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721493.	
6	ELECTRIC POWER	100312.	2511682.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	582836.	3784059.	
9	PNEUMATICS	4215.	818092.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7110000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133900.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	81745376.	77189312.	1160999.
	G & A	10545149.	9981217.	
	SUBTOTAL	92290512.	87172528.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	106487520.	282236160.	10160999.
	*NO G & A CHARGE		TOTAL	398884352.
	COST OF ADD'L SHUTTLE REPAIR FLTS			68823456.
	GRAND TOTAL			467707648.
	NO. OF FAILURES....	19.76		
	UPTIME (YEARS).....	9.88		
	UPTIME RATIO.....	0.66		

PERCOM PROGRAM

PROGRAM NO.15

SHUTTLE SCHEDULE DELAY.... 3.0
TOTAL SYSTEM MTTF..... 6.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	211309.	5614659.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721481.	
6	ELECTRIC POWER	100312.	2531682.	
7	* PRIMARY OPTICS	3100000.	8000979.	
8	COMM. & DATA HANDLING	582836.	3784059.	
9	PNEUMATICS	4215.	818092.	
10	TEST & SUPPORT EQUIPMENT	4660640.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	131800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1147012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	81745376.	77389312.	
	G & A	10545149.	9993217.	1160999.
	SUBTOTAL	92290512.	87372528.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	106487520.	282236160.	10160999.
	*NO G & A CHARGE			
			TOTAL	398884352.
	COST OF ADD'L SHUTTLE REPAIR FLTS			63333280.
	GRAND TOTAL			462217472.
	NO. OF FAILURES.... 18.67			
	UPTIME (YEARS)..... 9.33			
	UPTIME RATIO..... 0.62			

PERCOM PROGRAM

PROGRAM NO.16

SHUTTLE SCHEDULE DELAY.. 6.0
TOTAL SYSTEM MTTF..... 6.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	211309.	5614659.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	100712.	2531662.	
7	* PRIMARY OPTICS	3100000.	8000878.	
8	COMM. & DATA HANDLING	582836.	3784059.	
9	PNEUMATICS	421%.	818092.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	13,3800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1097000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	81745376.	77389312.	
	G & A	10545149.	9983217.	1160999.
	SUBTOTAL	92290512.	87372528.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	106487520.	282236160.	10160999.
	*NO G & A CHARGE		TOTAL	398884352.
	COST OF ADD'L SHUTTLE REPAIR FLTS			40000000.
	GRAND TOTAL			438884352.

NO. OF FAILURES.... 14.00
UPTIME (YEARS)..... 7.00
UPTIME RATIO..... 0.47

PERCOM PROGRAM

PROGRAM NO.17

SHUTTLE SCHEDULE DELAY.. 12.0
TOTAL SYSTEM MTBF..... 6.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	211309.	5614659.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	100312.	2531682.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	582036.	3784059.	
9	PNEUMATICS	4215.	818092.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448693.	
13	RELIABILITY	111600.	133900.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	81745376.	77389112.	
	G & A	10545149.	9983217.	1160999.
	SUBTOTAL	92290512.	87372528.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	106487520.	282236160.	10160999.
	*NO G & A CHARGE			
			TOTAL	398884352.
	COST OF ADD'L SHUTTLE REPAIR FLTS			16666665.
	GRAND TOTAL			415550976.
	NO. OF FAILURES.... 9.33			
	UPTIME (YEARS)..... 4.67			
	UPTIME RATIO..... 0.31			

PERCOM PROGRAM

PROGRAM NO.18

SHUTTLE SCHEDULE DELAY.. 24.0
TOTAL SYSTEM MTTF..... 6.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20160000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	211309.	5614659.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721493.	
6	ELECTRIC POWER	100312.	2531682.	
7	* PRIMARY OPTICS	3300000.	8000870.	
8	COMM. & DATA HANDLING	582836.	3784059.	
9	PNEUMATICS	4215.	818092.	
10	TEST & SUPPORT EQUIPMENT	4660540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	111800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362926.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	81745376.	77389312.	
	G & A	10545149.	9983217.	1160999.
	SUBTOTAL	92290512.	87372528.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	106487520.	282236160.	10160999.
	*NO G & A CHARGE			
			TOTAL	398884352.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			398884352.
	NO. OF FAILURES....	5.60		
	UPTIME (YEARS).....	2.80		
	UPTIME RATIO.....	0.19		

PERCOM PROGRAM

PROGRAM NO.19

SHUTTLE SCHEDULE DELAY..... 0.5
TOTAL SYSTEM MTTF..... 9.0
VAR. SUBSYSTEM SLOPE..... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	450641.	11273900.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	213926.	5399098.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	1242961.	8069922.	
9	PNEUMATICS	8088.	1744672.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	111800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	82763232.	91828800.	
	G & A	10676452.	11845856.	1160999.
	SUBTOTAL	93439680.	103674256.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	107636688.	298537728.	10160999.
	*NO G & A CHARGE			
			TOTAL	416335104.
	COST OF ADD'L SHUTTLE REPAIR FLTS			58421008.
	GRAND TOTAL			474756096.
	NO. OF FAILURES.... 17.68			
	UPTIME (YEARS)..... 13.26			
	UPTIME RATIO..... 0.88			

PFRCOM PROGRAM

PROGRAM NO.20

SHUTTLE SCHEDULE DELAY.. 1.0
TOTAL SYSTEM MTTF..... 9.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	450641.	11973880.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721493.	
6	ELECTRIC POWER	213926.	5390099.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	1242961.	8069922.	
9	PNEUMATICS	8988.	1744672.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2449699.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20010000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	352826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	82763232.	91828400.	
	G & A	10676452.	11845858.	1160999.
	SUBTOTAL	93439680.	103674256.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	10763668B.	208537728.	10160999.
	*NO G & A CHARGE		TOTAL	416335104.
	COST OF ADD'L SHUTTLE REPAIR FLTS			53999936.
	GRAND TOTAL			470334976.
	NO. OF FAILURES.... 16.80			
	UPTIME (YEARS)..... 12.60			
	UPTIME RATIO..... 0.84			

PERCOM PROGRAM

PROGRAM NO.21

SHUTTLE SCHEDULE DELAY..... 1.5
TOTAL SYSTEM MTTF..... 9.0
VAR. SUBSYSTEM SLOPE..... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	450641.	11973980.	
4	THERMAL	2120000.	2810971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	213926.	5499098.	
7	* PRIMARY OPTICS	3300000.	8000078.	
8	COMM. & DATA HANDLING	1242961.	8069022.	
9	PNEUMATICS	8988.	1744672.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2449698.	
13	RELIABILITY	111600.	113800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	82763232.	91828400.	
	G & A	10676452.	11845858.	1160999.
	SUBTOTAL	93439680.	103674256.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	107636688.	298537728.	10160999.
	*NO G & A CHARGE			
			TOTAL	416335104.
	COST OF ADD'L SHUTTLE REPAIR FLTS			50000000.
	GRAND TOTAL			466334976.
	NO. OF FAILURES.... 16.00			
	UPTIME (YEARS)..... 12.00			
	UPTIME RATIO..... 0.80			

PERCOM PROGRAM

PROGRAM NO.22

SHUTTLE SCHEDULE DELAY.. 2.0
TOTAL SYSTEM MTTF..... 9.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	450641.	11973880.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	213926.	5322098.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	1242961.	8069922.	
9	PNEUMATICS	8980.	1744672.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	82763232.	91820400.	
	G & A	10676452.	11845858.	1160999.
	SUBTOTAL	93439680.	103674256.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	107636688.	298537728.	10160999.
	*NO G & A CHARGE		TOTAL	416335104.
	COST OF ADD'L SHUTTLE REPAIR FLTS			46363632.
	GRAND TOTAL			462698496.
	NO. OF FAILURES.... 15.27			
	UPTIME (YEARS)..... 11.45			
	UPTIME RATIO..... 0.76			

NOT REPRODUCIBLE

PERCOM PROGRAM

PROGRAM NO.23

SHUTTLE SCHEDULE DELAY.. 2.5
TOTAL SYSTEM MTTF..... 9.0
VAR. SUBSYSTEM SLOPE.... 1.25

		SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1		STRUCTURE	20150000.	30649216.	
2		ENGINEERING	17500000.	2250126.	
3		STABILIZATION	450641.	11973890.	
4		THERMAL	2120000.	2910971.	
5		S-C MECHANISMS	3520000.	2721483.	
6		ELECTRIC POWER	213926.	5399099.	
7	*	PRIMARY OPTICS	3300000.	8000879.	
8		COMM. & DATA HANDLING	1242961.	8069922.	
9		PNEUMATICS	8988.	1744672.	
10		TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11		PROGRAM MANAGEMENT	2533000.	7119000.	
12		SYSTEM INTEGRATION	944000.	2449698.	
13		RELIABILITY	111600.	133800.	
14		QUALITY ACCEPTANCE	1445220.	5820000.	
15		TITAN INTERSTAGE	582000.	670000.	
16	*	TITAN SHROUD	0.0	1000000.	
17		SHUTTLE INTERFACES	20910000.	1997000.	
18		TRAINERS & SIMULATORS	3110400.	100000.	
19	*	EXPERIMENTS A & B	5000000.	39000000.	
20		GROUND STATION	3251000.	800000.	
21	*	NEW COMPUTERS	4550000.	0.0	
		LAUNCH OPERATIONS			
22	*	LV-TITAN	0.0	22500000.	
23	*	LV-SHUTTLE	0.0	10000000.	
24		S-C SUPPORT	0.0	4950000.	
25	*	FACILITIES	1347012.	462826.	
26	*	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	*	EXPERIMENT UPDATE	0.0	39000000.	
28	*	G.S.F.C. & OTHER	0.0	60000000.	
29		ORBITAL OPERATIONS			9000000.
		G & A CHARGEABLE	82763232.	91829400.	
		G & A	10676452.	11845858.	1160999.
		SUBTOTAL	93439680.	103674256.	
		NON-G & A SUBTOTAL	14197012.	194863680.	
		TOTAL	107636688.	298537728.	10160999.
		*NO G & A CHARGE			
				TOTAL	416335104.
		COST OF ADD'L SHUTTLE REPAIR FLTS			43043432.
		GRAND TOTAL			459378432.
		NO. OF FAILURES.... 14.61			
		UPTIME (YEARS)..... 10.96			
		UPTIME RATIO..... 0.73			

PERCOM PROGRAM

PROGRAM NO.24

SHUTTLE SCHEDULE DELAY.. 3.0
TOTAL SYSTEM MTF..... 0.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	450641.	11973880.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721481.	
6	ELECTRIC POWER	217926.	5399098.	
7	* PRIMARY OPTICS	3100000.	8000878.	
8	COMM. & DATA HANDLING	1242961.	8069022.	
9	PNEUMATICS	8988.	1744672.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2449698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	82763232.	91828400.	
	G & A	10676452.	11845858.	1160999.
	SUBTOTAL	93439680.	103674256.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	107636688.	298537728.	10160999.
	*NO G & A CHARGE			
			TOTAL	416335104.
	COST OF ADD'L SHUTTLE REPAIR FLTS			40000000.
	GRAND TOTAL			456335104.
	NO. OF FAILURES.... 14.00			
	UPTIME (YEARS)..... 10.50			
	UPTIME RATIO..... 0.70			

PERCOM PROGRAM

PROGRAM NO.25

SHUTTLE SCHEDULE DELAY..... 6.0
TOTAL SYSTEM MTTF..... 9.0
VAR. SUBSYSTEM SLOPE..... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30640216.	
2	ENGINEERING	17500000.	2250176.	
3	STABILIZATION	450641.	1197880.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2711481.	
6	ELECTRIC POWER	213926.	5390099.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	1242961.	8069922.	
9	PNEUMATICS	8088.	1744672.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7110000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	162826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	82763232.	91828400.	
	G & A	10676452.	11845858.	1160999.
	SUBTOTAL	93439680.	103674256.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	107636688.	298537728.	10160999.
	*NO G & A CHARGE			
		TOTAL		416335104.
	COST OF ADD'L SHUTTLE REPAIR FLTS			25999984.
	GRAND TOTAL			442334976.
	NO. OF FAILURES..... 11.20			
	UPTIME (YEARS)..... 8.40			
	UPTIME RATIO..... 0.56			

PERCOM PROGRAM

PROGRAM NO.26

SHUTTLE SCHEDULE DELAY.. 12.0
TOTAL SYSTEM MTTF..... 9.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	450641.	11973880.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	213926.	5309098.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	1242961.	8069922.	
9	PNEUMATICS	8988.	1744672.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	113800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	82763232.	91828400.	
	G & A	10676452.	11845858.	1160999.
	SUBTOTAL	93439680.	103674256.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	107636680.	298537728.	10160999.
	#NO G & A CHARGE		TOTAL	416336104.
	COST OF ADD'L SHUTTLE REPAIR FLTS			10000000.
	GRAND TOTAL			426334976.

NO. OF FAILURES.... 8.00
UPTIME (YEARS)..... 6.00
UPTIME RATIO..... 0.40

PERCOM PROGRAM

PROGRAM NO.27

SHUTTLE SCHEDULE DELAY... 24.0
TOTAL SYSTEM MTTF..... 9.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30640216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	450641.	1173880.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	213926.	5390090.	
7	* PRIMARY OPTICS	3100000.	8000878.	
8	COMM. & DATA HANDLING	1242961.	8060922.	
9	PNEUMATICS	8988.	1744672.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7110000.	
12	SYSTEM INTEGRATION	944000.	2440609.	
13	RELIABILITY	111600.	131800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	82763232.	91828400.	
	G & A	10676452.	11845884.	1160999.
	SUBTOTAL	93439680.	103674256.	
	NON-G & A SUBTOTAL	14197012.	19483680.	
	TOTAL	107636688.	200437728.	10160999.
	*NO G & A CHARGE		TOTAL	416335104.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			416335104.
	NO. OF FAILURES....	5.09		
	UPTIME (YEARS).....	3.82		
	UPTIME RATIO.....	0.25		

PERCOM PROGRAM

PROGRAM NO.28

SHUTTLE SCHEDULE DELAY.. 0.5
TOTAL SYSTEM MTTF..... 12.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	770620.	20475984.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	365926.	9212755.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	2125532.	13800008.	
9	PNEUMATICS	15370.	2983483.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	131800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	592000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	84124048.	111131056.	
	G & A	10851997.	14336158.	1160999.
	SUBTOTAL	94976032.	125469200.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	109173040.	320332800.	10160999.
	*NO G & A CHARGE			
			TOTAL	439666688.
	COST OF ADD'L SHUTTLE REPAIR FLTS			37199984.
	GRAND TOTAL			476866560.
	NO. OF FAILURES.... 13.44			
	UPTIME (YEARS)..... 13.44			
	UPTIME RATIO..... 0.90			

PERCOM PROGRAM

PROGRAM NO.29

SHUTTLE SCHEDULE DELAY.. 1.0
TOTAL SYSTEM MTTF..... 12.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	10649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	770620.	20475984.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	*272483.	
6	ELECTRIC POWER	365826.	9242755.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	2125532.	13800008.	
9	PNEUMATICS	15370.	2993483.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7110000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	131800.	
14	QUALITY ACCEPTANCE	1445220.	5830000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	84124048.	111133056.	
	G & A	10851997.	14336158.	1160999.
	SUBTOTAL	94976032.	125469200.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	109173040.	320332800.	10160999.
	*NO G & A CHARGE			
			TOTAL	439666688.
	COST OF ADD'L SHUTTLE REPAIR FLTS			34615376.
	GRAND TOTAL			474281984.
	NO. OF FAILURES.... 12.92			
	UPTIME (YEARS)..... 12.92			
	UPTIME RATIO..... 0.86			

PERCOM PROGRAM

PROGRAM NO.30

SHUTTLE SCHEDULE DELAY.. 1.5
TOTAL SYSTEM MTTF..... 12.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	770620.	20475984.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	365826.	9232755.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	2125532.	13800008.	
9	PNEUMATICS	15370.	2983483.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4050000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	84124048.	111133056.	
	G & A	10851997.	14336158.	1160999.
	SUBTOTAL	94976032.	125469200.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	109173040.	320332800.	10160999.
	*NO G & A CHARGE			
			TOTAL	439666688.
	COST OF ADD'L SHUTTLE REPAIR FLTS			32222208.
	GRAND TOTAL			471888896.
	NO. OF FAILURES.... 12.44			
	UPTIME (YEARS)..... 12.44			
	UPTIME RATIO..... 0.83			

PERCOM PROGRAM

PROGRAM NO.31

SHUTTLE SCHEDULE DELAY.. 2.0
TOTAL SYSTEM MTTF..... 12.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	770620.	2047588.	
4	THERMAL	2120000.	2010971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	365826.	9232755.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	2125532.	13000008.	
9	PNEUMATICS	15370.	2981483.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2449698.	
13	RELIABILITY	111600.	133900.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	8412404.	111133056.	
	G & A	10851997.	14336150.	1160999.
	SUBTOTAL	94976032.	125469200.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	109173040.	320332800.	10160999.
	*NO G & A CHARGE		TOTAL	439666688.
	COST OF ADD'L SHUTTLE REPAIR FLTS			30000000.
	GRAND TOTAL			469666560.
	NO. OF FAILURES.... 12.00			
	UPTIME (YEARS)..... 12.00			
	UPTIME RATIO..... 0.80			

PERCOM PROGRAM

PROGRAM NO.32

SHUTTLE SCHEDULE DELAY.. 2.5
TOTAL SYSTEM MTTF..... 12.0
VAR. SUBSYSTEM SLOPE.... 1.25

		SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1		STRUCTURE	20150000.	30649216.	
2		ENGINEERING	17500000.	2250126.	
3		STABILIZATION	770620.	2047588.	
4		THERMAL	2120000.	2910971.	
5		S-C MECHANISMS	3520000.	2721483.	
6		ELECTRIC POWER	365826.	9232755.	
7	*	PRIMARY OPTICS	3300000.	8000878.	
8		COMM. & DATA HANDLING	2125532.	13800008.	
9		PNEUMATICS	15370.	298348 1.	
10		TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11		PROGRAM MANAGEMENT	2533000.	7119000.	
12		SYSTEM INTEGRATION	944000.	2448698.	
13		RELIABILITY	111600.	134800.	
14		QUALITY ACCEPTANCE	1445220.	5820000.	
15		TITAN INTERSTAGE	582000.	670000.	
16	*	TITAN SHROUD	0.0	1000000.	
17		SHUTTLE INTERFACES	20910000.	1997000.	
18		TRAINERS & SIMULATORS	3110400.	100000.	
19	*	EXPERIMENTS A & B	5000000.	39000000.	
20		GROUND STATION	3251000.	800000.	
21	*	NEW COMPUTERS	4550000.	0.0	
		LAUNCH OPERATIONS			
22	*	LV-TITAN	0.0	22500000.	
23	*	LV-SHUTTLE	0.0	10000000.	
24		S-C SUPPORT	0.0	4950000.	
25	*	FACILITIES	1347012.	362826.	
26	*	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	*	EXPERIMENT UPDATE	0.0	39000000.	
28	*	G.S.F.C. & OTHER	0.0	60000000.	
29		ORBITAL OPERATIONS			9000000.
		G & A CHARGEABLE	84124048.	111137056.	
		G & A	10851997.	14336153.	1160999.
		SUBTOTAL	94976032.	125469200.	
		NON-G & A SUBTOTAL	14197012.	194863680.	
		TOTAL	109173040.	320332800.	10160999.
		*NO G & A CHARGE			
				TOTAL	439666688.
		COST OF ADD'L SHUTTLE REPAIR FLTS			27931024.
		GRAND TOTAL			467597568.
		NO. OF FAILURES.... 11.59			
		UPTIME (YEARS)..... 11.59			
		UPTIME RATIO..... 0.77			

PERCOM PROGRAM

PROGRAM NO.33

SHUTTLE SCHEDULE DELAY... 3.0
TOTAL SYSTEM MTTF..... 12.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	770620.	20475984.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721481.	
6	ELECTRIC POWER	365826.	9212755.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	2125532.	13900008.	
9	PNEUMATICS	15370.	2981491.	
10	TEST & SUPPORT EQUIPMENT	4660540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7110000.	
12	SYSTEM INTEGRATION	944000.	2448699.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5020000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
				9000000.
29	ORBITAL OPERATIONS			
	G & A CHARGEABLE	84124048.	111133056.	
	G & A	10851997.	14336158.	1160999.
	SUBTOTAL	94976032.	125469200.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	109173040.	320332800.	10160999.
	*NO G & A CHARGE		TOTAL	439666688.
	COST OF ADD'L SHUTTLE REPAIR FLTS			25999984.
	GRAND TOTAL			465666560.
	NO. OF FAILURES....	11.20		
	UPTIME (YEARS).....	11.20		
	UPTIME RATIO.....	0.75		

PERCOM PROGRAM

PROGRAM NO.34

SHUTTLE SCHEDULE DELAY.. 6.0
TOTAL SYSTEM MTTF..... 12.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	770620.	20475984.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	369826.	9232755.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	2125532.	13800009.	
9	PNEUMATICS	15370.	2983493.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362026.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	84124048.	111133056.	
	G & A	10851997.	14336158.	1160999.
	SUBTOTAL	94976032.	125469200.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	109173040.	320332800.	10160999.
	*NO G & A CHARGE		TOTAL	439666688.
	COST OF ADD'L SHUTTLE REPAIR FLTS			16666665.
	GRAND TOTAL			456333312.
	NO. OF FAILURES....	9.33		
	UPTIME (YEARS).....	9.33		
	UPTIME RATIO.....	0.62		

PERCOM PROGRAM

PROGRAM NO.35

SHUTTLE SCHEDULE DELAY.. 12.0
TOTAL SYSTEM MTTF..... 12.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649716.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	770620.	20475084.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	365826.	9232755.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	2125532.	11800000.	
9	PNEUMATICS	15370.	2983483.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448628.	
13	RELIABILITY	111600.	111800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	84124048.	111133056.	
	G & A	10851997.	14336158.	1160999.
	SUBTOTAL	94976032.	125469200.	
	NON-G & A SUBTOTAL	14197012.	19863680.	
	TOTAL	109173040.	320332800.	10160999.
	*NO G & A CHARGE			
			TOTAL	439666688.
	COST OF ADD'L SHUTTLE REPAIR FLTS			5000000.
	GRAND TOTAL			444666624.
	NO. OF FAILURES.... 7.00			
	UPTIME (YEARS)..... 7.00			
	UPTIME RATIO..... 0.47			

PERCOM PROGRAM

PROGRAM NO.36

SHUTTLE SCHEDULE DELAY.. 24.0
TOTAL SYSTEM MTTF..... 12.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	770620.	20479084.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721481.	
6	ELECTRIC POWER	365826.	9212765.	
7	* PRIMARY OPTICS	3100000.	8000878.	
8	COMM. & DATA HANDLING	2129532.	14800008.	
9	PNEUMATICS	15370.	2083483.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448699.	
13	RELIABILITY	111600.	137400.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1907000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347017.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	84124048.	111133056.	
	G & A	10851997.	14336158.	1160999.
	SUBTOTAL	94976032.	125469200.	
	NON-G & A SUBTOTAL	14197012.	194867680.	
	TOTAL	109173040.	320332800.	10160999.
	*NO G & A CHARGE			
			TOTAL	439666688.
	COST OF ADD'L SHUTTLE REPAIR FLYS			0.0
	GRAND TOTAL			439666688.
	NO. OF FAILURES....	4.67		
	UPTIME (YEARS).....	4.67		
	UPTIME RATIO.....	0.31		

PERCOM PROGRAM

PROGRAM NO. 17

SHUTTLE SCHEDULE DELAY..... 0.5
TOTAL SYSTEM MTTF..... 15.0
VAR. SUBSYSTEM SLOPE..... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	1162441.	30886976.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	551829.	13927137.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	3206258.	20816609.	
9	PNEUMATICS	23185.	4500433.	
10	TEST & SUPPORT EQUIPMENT	4569540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448699.	
13	RELIABILITY	111600.	133900.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	1110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1147012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	85790412.	134772000.	
	G & A	11066961.	17385568.	1160999.
	SUBTOTAL	96857392.	152157568.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	111054400.	347021056.	10160999.
	*NO G & A CHARGE			
			TOTAL	468236288.
	COST OF ADD'L SHUTTLE REPAIR FLTS			24193536.
	GRAND TOTAL			492429824.
	NO. OF FAILURES.... 10.84			
	UPTIME (YEARS)..... 13.55			
	UPTIME RATIO..... 0.90			

PERCOM PROGRAM

PROGRAM NO.38

SHUTTLE SCHEDULE DELAY.. 1.0
TOTAL SYSTEM MTTF..... 15.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	1162441.	30896976.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	551829.	13927137.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	3206258.	20816608.	
9	PNEUMATICS	23185.	4500413.	
10	TEST & SUPPORT EQUIPMENT	4660540.	2070638.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	153800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	85790432.	134772000.	
	G & A	11066961.	17385568.	1160999.
	SUBTOTAL	96857392.	152157568.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	111054400.	347021056.	10160999.
	*NO G & A CHARGE		TOTAL	468236288.
	COST OF ADD'L SHUTTLE REPAIR FLTS			22500000.
	GRAND TOTAL			490736128.
	NO. OF FAILURES....	10.50		
	UPTIME (YEARS).....	13.12		
	UPTIME RATIO.....	0.88		

GROUP LEVEL FAILURE RATE ANALYSIS

GROUP A:

AIRCRAFT

STABILIZATION & CONTROL	PNEUMATICS	THERMAL	COMMUNICATION	POWER	STRUCTURE
$\lambda = 191$	$\lambda = 544$	$\lambda = 0.05$	$\lambda = 275$	$\lambda = 9,740$	$\lambda = 0.01$

$*\lambda_{AIRCRAFT} = 10,750.$

$MTBF_{AIRCRAFT} = 93$ HRS

OAO

STABILIZATION & CONTROL	PNEUMATICS	THERMAL	COMMUNICATION	POWER	STRUCTURE
$\lambda = 14.102$	$\lambda = 0.385$	$\lambda = 0.05$	$\lambda = 1.48$	$\lambda = 0.294$	$\lambda = 0.01$

$\lambda_{OAO} = 16.321$

$MTBF_{OAO} = 61,279$ HRS

LM

STABILIZATION & CONTROL	PNEUMATICS	THERMAL	COMMUNICATION	POWER	STRUCTURE
$\lambda = 4.214$	$\lambda = 6.133$	$\lambda = 0.05$	$\lambda = 19.75$	$\lambda = 0.95$	$\lambda = 0.01$

$\lambda_{LM} = 31.107$

$MTBF_{LM} = 32,147$ HRS

NOTE: ALL λ ARE IN FAILURES PER 10^6 HRS.

STABILIZATION & CONTROL

EQUIPMENT LEVEL - AIRCRAFT

DIGITAL SUN SENSOR
$\lambda = 0.1$

DIGITAL SUN SENSOR ELECT
$\lambda = 0.39$

DIGITAL SUN SENSOR
$\lambda = 0.1$

DIGITAL SUN SENSOR ELECT
$\lambda = 0.39$

DIGITAL SUN SENSOR
$\lambda = 0.1$

DIGITAL SUN SENSOR ELECT
$\lambda = 0.39$

DIGITAL SUN SENSOR
$\lambda = 0.1$

DIGITAL SUN SENSOR ELECT.
$\lambda = 0.39$

FIXED HEAD TRACKER
$\lambda = 1.5$

$\lambda = 0.88$

FIXED HEAD TRACKER
$\lambda = 1.5$

SOLAR ASPECT SENSOR
$\lambda = 0.1$

$\lambda = 0.078$

SOLAR ASPECT SENSOR
$\lambda = 0.1$

SOLAR ASPECT SENSOR ELECT.
$\lambda = 0.39$

SOLAR ASPECT SENSOR
$\lambda = 0.1$

SOLAR ASPECT SENSOR ELECT.
$\lambda = 0.39$

SOLAR ASPECT SENSOR
$\lambda = 0.1$

INERTIAL REF. UNIT
$\lambda = 0.25$

$\lambda = 0.125$

INERTIAL REF. UNIT
$\lambda = 0.25$

INERTIAL REF. UNIT, ELECT.
$\lambda = 0.75$

$\lambda = 0.375$

INERTIAL REF. UNIT ELECT.
$\lambda = 0.75$

ALL λ IN FAILURES PER 10^{+3} HRS

STABILIZATION & CONTROL (CONTINUED)

EQUIPMENT LEVEL AIRCRAFT

MAG. TORQUER BAR
λ=0.00005

MAG. TORQUER BAR
λ=0.00005

λ=0.00002

MAG. TORQUER BAR
λ=0.00005

MAGNETOMETER
λ= 0.001

λ= 0.0005

MAGNETOMETER
λ= 0.001

MAGNETOMETER ELECTRONICS
λ= 0.39

λ= 0.197

MAGNET METER ELECTRONICS
λ=0.39

INVERTER
λ= 1.0

λ= 0.5

INVERTER
λ= 1.0

MULTIPLEXER
λ= 0.2

MULTIPLEXER
λ= 0.2

MULTIPLEXER
λ= 0.2

λ= 0.1

MULTIPLEXER
λ= 0.2

REMOTE DECODER
λ= 1.0

λ= 2.0

REMOTE DECODER
λ= 1.0

OFFSET TRACKER
λ= 0.02

λ= 0.01

OFFSET TRACKER
λ= 0.02

WHEELS
λ=0.006

λ=0.003

WHEELS
λ=0.006

WHEELS
λ=0.006

λ=0.003

WHEELS
λ=0.006

WHEELS
λ=0.006

λ=0.003

WHEELS
λ=0.006

FINE WHEEL SET CONTROLLER
λ= 0.033

FINE WHEELS SET CONTROLLER
λ=0.033

λ=0.01

FINE WHEELS SET CONTROLLER
λ=0.033

WIRING HARNESS
λ=0.1

λ STAB & CONT = 4.386 FAILURES PER 10^{6} HRS

MTBF S&C = 228 HRS

STABILIZATION & CONTROL

EQUIPMENT LEVEL L. M.

DIGITAL SUN SENSOR λ= 0.1

DIGITAL SUN SENSOR ELECT. λ= 9.0

DIGITAL SUN SENSOR λ=0.1

DIGITAL SUN SENSOR ELECT. λ= 9.0

DIGITAL SUN SENSOR λ=0.1

DIGITAL SUN SENSOR ELECT. λ= 9.0

DIGITAL SUN SENSOR λ= 0.1

DIGITAL SUN SENSOR ELECT. λ= 9.0

FIXED HEAD TRACKER λ= 1.28

λ= 0.64

FIXED HEAD TRACKER λ= 1.28

SOLAR ASPECT SENSOR λ= 6.0

λ= 1.314

SOLAR ASPECT SENSOR λ=6.0

SOLAR ASPECT SENSOR ELECT λ= 18.0

SOLAR ASPECT SENSOR λ= 6.0

SOLAR ASPECT SENSOR ELECT. λ= 18.0

SOLAR ASPECT SENSOR λ=6.0

INERTIAL REF. UNIT λ= 13.0

λ= 6.5

INERTIAL REF. UNIT λ= 13.0

INERTIAL REF UNIT ELECT. λ= 13

λ= 0.65

INERTIAL REF UNIT ELECT. λ= 1.3

ALL λ IN FAILURES PER 10^{+6} HRS.

EQUIPMENT LEVEL LM

MAG. TORQUER BAR λ= 9.0

MAG. TORQUER BAR λ= 9.0

λ= 3.0

MAG. TORQUER BAR λ= 9.0

MAGNETOMETER λ= 0.07

λ= 0.035

MAGNETOMETER λ= 0.07

MAGNETOMETER ELECTRONICS λ= 4.8

λ= 2.4

MAGNET FILTER ELECTRONICS λ= 4.8

INVERTER λ= 7.0

λ= 3.5

INVERTER λ= 7.0

MULTIPLEXER λ= 1.0

MULTIPLEXER λ= 1.0

MULTIPLEXER λ= 1.0

λ= 0.25

MULTIPLEXER λ= 1.0

REMOTE DECODER λ= 3.75

λ= 1.875

REMOTE DECODER λ= 3.75

OFFSET TRACKER λ= 1.28

λ= 0.64

OFFSET TRACKER λ= 1.28

WHEELS λ= 1.5

λ= 0.75

WHEELS λ= 1.5

WHEELS λ= 1.5

λ= 0.75

WHEELS λ= 1.5

WHEELS λ= 1.5

λ= 0.75

WHEELS λ= 1.5

FINE WHEEL & SET CONTROLLER λ= 8.4

FINE WHEEL & SET CONTROLLER λ= 8.4

WIRING HARNESS λ= 10.1

λ= 2.8

FINE WHEEL & SET CONTROLLER λ= 8.4

λ STAB. & CONT. = 25.95 FAILURES/10^6 HRS

MTBF STAB. & CONT. = 38,529

STABILIZATION & CONTROL

EQUIPMENT LEVEL - 0.A.0

DIGITAL SUN SENSOR
λ=0.069

DIGITAL SUN SENSOR ELECT.
λ= 24.861

DIGITAL SUN SENSOR
λ=0.069

DIGITAL SUN SENSOR ELECT.
λ= 24.861

DIGITAL SUN SENSOR
λ= 0.069

DIGITAL SUN SENSOR ELECT
λ= 24.861

DIGITAL SUN SENSOR
λ=0.069

DIGITAL SUN SENSOR ELECT.
λ= 24.861

FIXED HEAD TRACKER
λ= 15.0

λ= 7.5

FIXED HEAD TRACKER
λ= 15.0

SOLAR ASPECT SENSOR
λ=0.092

λ= 2.876

SOLAR ASPECT SENSOR
λ=0.092

SOLAR ASPECT SENSOR ELECT.
λ=10.637

SOLAR ASPECT SENSOR
λ=0.092

SOLAR ASPECT SENSOR ELECT.
λ=10.637

SOLAR ASPECT SENSOR
λ=0.092

INERTIAL REF. UNIT
λ=4.0

λ=2.0

INERTIAL REF UNIT
λ=4.0

INERTIAL REF UNIT ELECT.
λ 1.5

λ=0.75

INERTIAL REF UNIT ELECT.
λ 1.5

ALL λ IN FAILURES PER 10^{+6} HRS.

STABILIZATION & CONTROL (CONTINUED)

EQUIPMENT LEVEL: OFTO

MAG. TORQUER BAR
$\lambda = 0.05$

MAG. TORQUER BAR
$\lambda = 0.05$

$\lambda = 0.017$

MAG. TORQUER BAR
$\lambda = 0.05$

MAGNETOMETER
$\lambda = 1.0$

$\lambda = 0.5$

MAGNETOMETER
$\lambda = 1.0$

MAGNETOMETER ELECTRONICS
$\lambda = 0.5$

$\lambda = 0.25$

MAGNETOMETER ELECTRONICS
$\lambda = 0.5$

INVERTER
$\lambda = 1.0$

$\lambda = 0.5$

INVERTER
$\lambda = 1.0$

MULTIPLEXER
$\lambda = 2.0$

MULTIPLEXER
$\lambda = 2.0$

$\lambda = 0.5$

MULTIPLEXER
$\lambda = 2.0$

MULTIPLEXER
$\lambda = 2.0$

REMOTE DECODER
$\lambda = 2.0$

$\lambda = 1.0$

REMOTE DECODER
$\lambda = 2.0$

OFFSET TRACKER
$\lambda = 1.28$

$\lambda = 0.64$

OFFSET TRACKER
$\lambda = 1.28$

WHEELS
$\lambda = 0.586$

$\lambda = 0.293$

WHEELS
$\lambda = 0.586$

WHEELS
$\lambda = 0.586$

$\lambda = 0.293$

WHEELS
$\lambda = 0.586$

WHEELS
$\lambda = 0.586$

$\lambda = 0.293$

WHEELS
$\lambda = 0.586$

FINE WHEEL & SET CONTROLLER
$\lambda = 33.377$

FINE WHEELS SET CONTROLLER
$\lambda = 33.377$

WIRING HARNESS
$\lambda = 0.1$

$\lambda = 11.126$

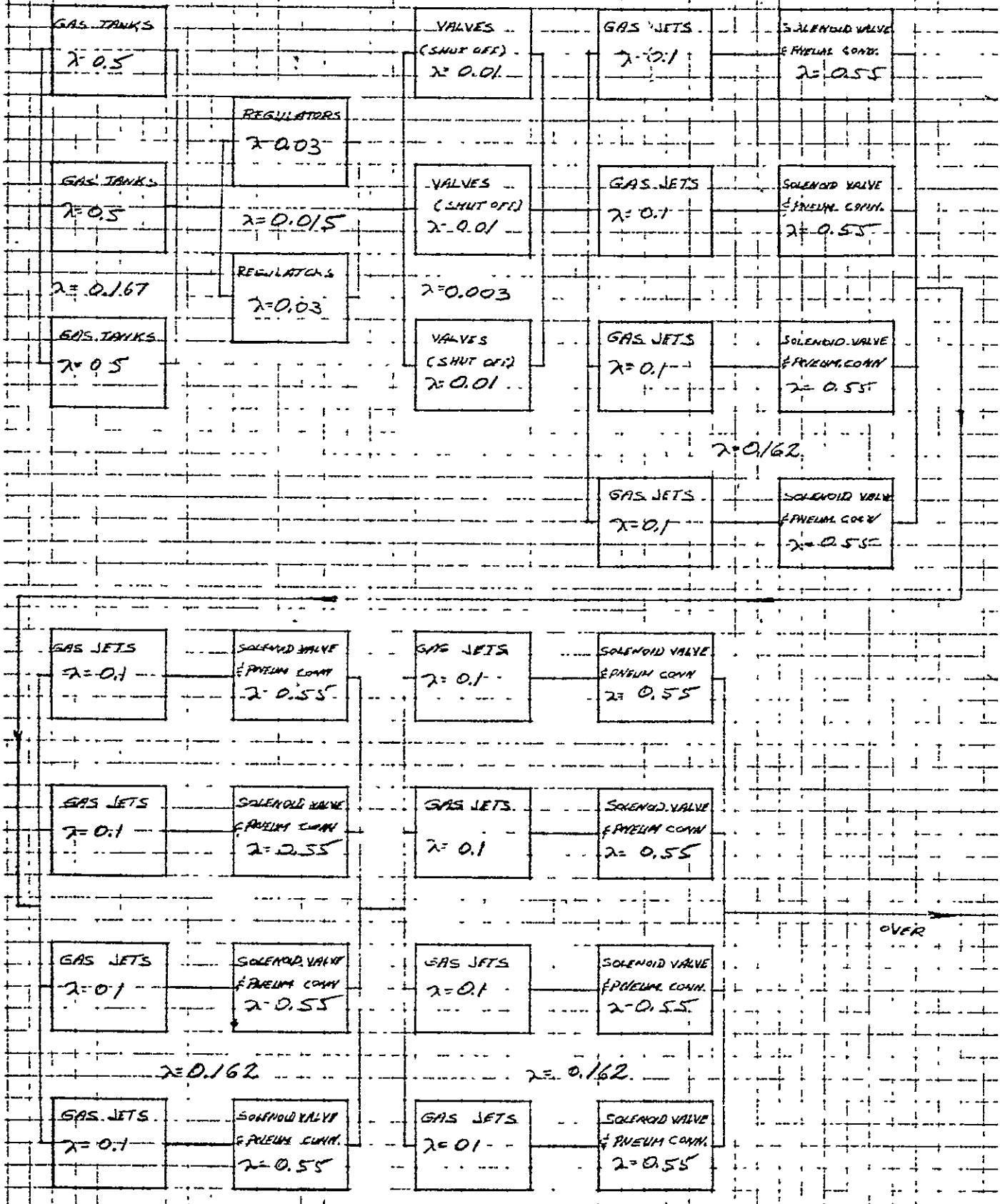
FINE WHEEL & SET CONTROLLER
$\lambda = 33.377$

λ STAB. & CONT. = 28.638 FAILURES PER 10^{+6} HRS

MTBF STAB. & CONT. = 34,918 HRS

PNEUMATICS

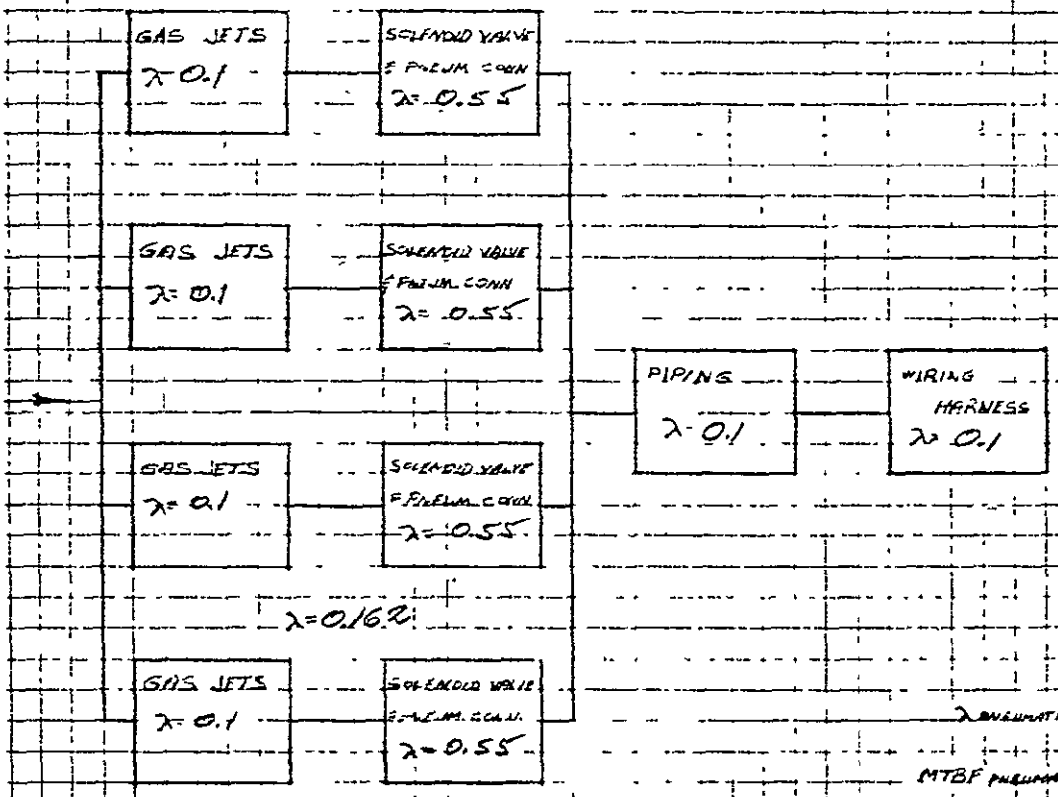
EQUIPMENT LEVEL: O.AD



ALL λ ARE IN FAILURES PER 10^{+6} HRS.

PNEUMATICS (CONTINUED)

EQUIPMENT LEVEL: ORG

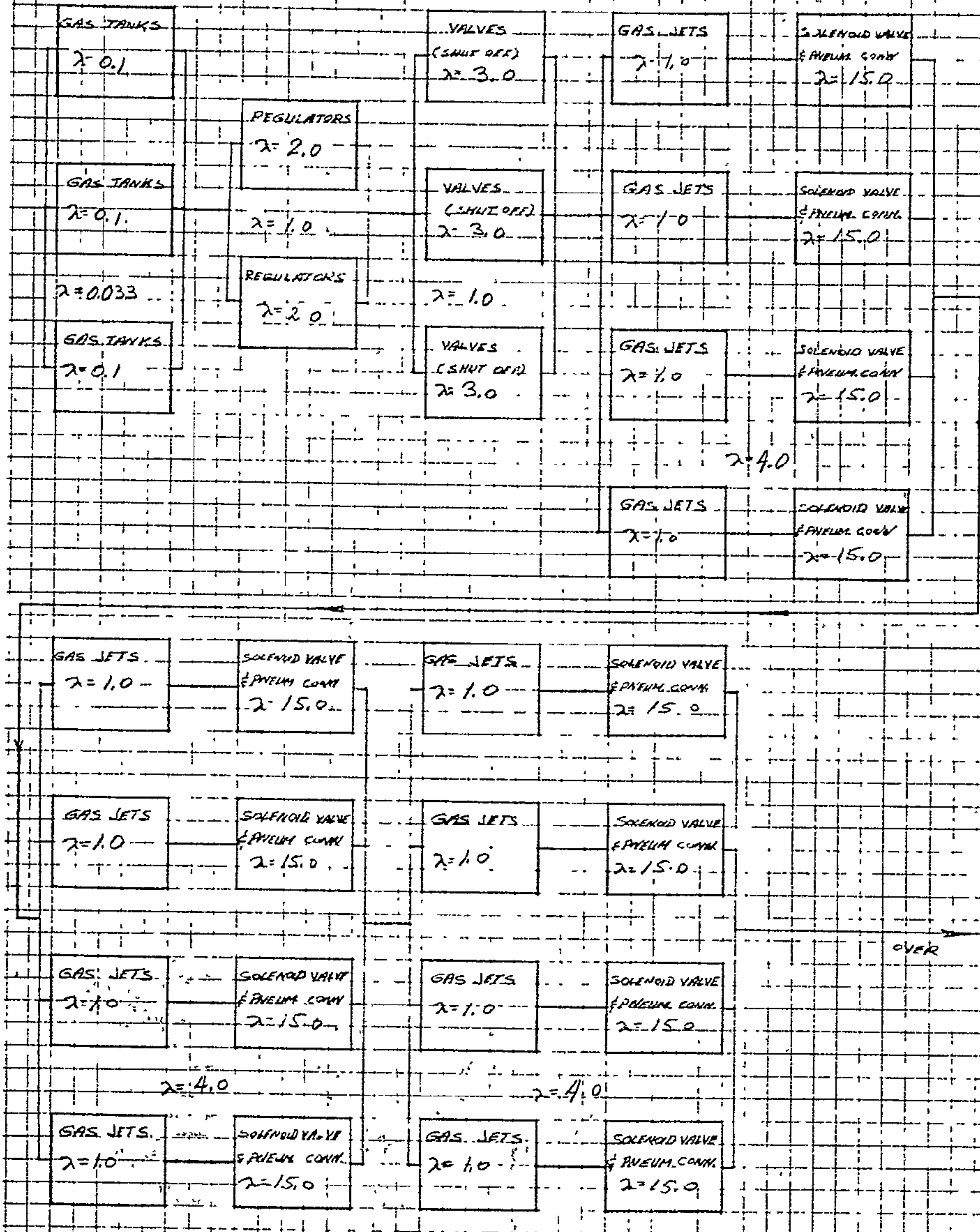


$\lambda_{PNEUMATICS} = 1,233$ FAILURES PER 10^6 HRS.

MTBF PNEUMATICS = 968,254 HRS.

PAGE 2 OF 2

EQUIPMENT LEVEL: L.M.

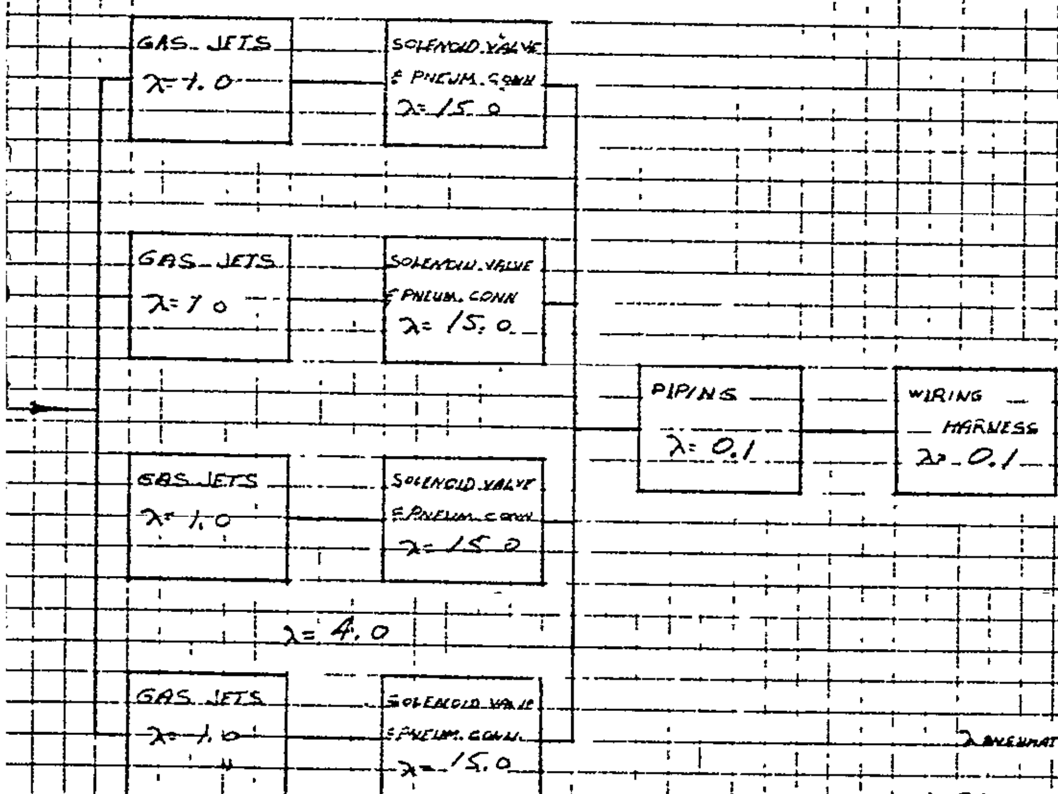


369

ALL λ ARE IN FAILURES PER 10^{+6} HRS.

PNEUMATICS (CONTINUED)

EQUIPMENT LEVEL



$\lambda_{PNEUMATICS}$ = 18.233 FAILURES PER 10^{6} HRS

MTBF PNEUMATICS = 54,845

PERCOM PROGRAM

PROGRAM NO.39

SHUTTLE SCHEDULE DELAY..... 1.5
TOTAL SYSTEM MTTF..... 15.0
VAR. SUBSYSTEM SLOPE..... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	1162441.	30886976.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721493.	
6	ELECTRIC POWER	551829.	13927137.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	3206258.	20916608.	
9	PNEUMATICS	23185.	4500433.	
10	TEST & SUPPORT EQUIPMENT	4660540.	2070614.	
11	PROGRAM MANAGEMENT	2531000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2468698.	
13	RELIABILITY	111600.	111800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	108000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	85790432.	134772000.	
	G & A	11066961.	17385568.	1160999.
	SUBTOTAL	96857392.	152157568.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	111054400.	347021056.	10160999.
	*NO G & A CHARGE			
			TOTAL	468236288.
	COST OF ADD'L SHUTTLE REPAIR FLTS			20909088.
	GRAND TOTAL			489145344.
	NO. OF FAILURES.... 10.18			
	UPTIME (YEARS)..... 12.73			
	UPTIME RATIO..... 0.85			

PERCOM PROGRAM

PROGRAM NO.40

SHUTTLE SCHEDULE DELAY.. 2.0
TOTAL SYSTEM MTTF..... 15.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	1162441.	30886976.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	551829.	13927137.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	3206258.	20816608.	
9	PNEUMATICS	2318%.	4500433.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2573000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	85790432.	134772000.	
	G & A	11066961.	17385568.	1160999.
	SUBTOTAL	96857392.	152157568.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	111054400.	347021056.	10160999.
	*NO G & A CHARGE			
			TOTAL	468236288.
	COST OF ADD'L SHUTTLE REPAIR FLTS			19411760.
	GRAND TOTAL			487648000.
	NO. OF FAILURES.... 9.88			
	UPTIME (YEARS)..... 12.35			
	UPTIME RATIO..... 0.82			

PERCOM PROGRAM

PROGRAM NO.41

SHUTTLE SCHEDULE DELAY.. .25
TOTAL SYSTEM MTTF..... 15.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	1162441.	3088976.	
4	THERMAL	2120000.	2010971.	
5	S-C MECHANISMS	3520000.	2721481.	
6	ELECTRIC POWER	551829.	13927137.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	3206258.	20816608.	
9	PNEUMATICS	23185.	4500433.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448699.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	85790432.	134772000.	
	G & A	11066961.	17385568.	1160999.
	SUBTOTAL	96857392.	152157568.	
	NON-G & A SUBTOTAL	14197012.	19486680.	
	TOTAL	111054400.	347021056.	10160999.
	*NO G & A CHARGE			
			TOTAL	468236288.
	COST OF ADD'L SHUTTLE REPAIR FLTS			17999984.
	GRAND TOTAL			486236160.
	NO. OF FAILURES.... 9.60			
	UPTIME (YEARS)..... 12.00			
	UPTIME RATIO..... 0.80			

PERCOM PROGRAM

PROGRAM NO.42

SHUTTLE SCHEDULE DELAY.. 3.0
TOTAL SYSTEM MTTF..... 15.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	1162441.	30886976.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	551829.	13927137.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	3206258.	20816608.	
9	PNEUMATICS	23185.	4500433.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	85790432.	134772000.	
	G & A	11066961.	17386568.	1160999.
	SUBTOTAL	96857392.	152157568.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	111054400.	347021056.	10160999.
	*NO G & A CHARGE			
			TOTAL	468236288.
	COST OF ADD'L SHUTTLE REPAIR FLTS			16666665.
	GRAND TOTAL			484902912.

NO. OF FAILURES.... 9.33
UPTIME (YEARS)..... 11.67
UPTIME RATIO..... 0.78

PERCOM PROGRAM

PROGRAM NO.43

SHUTTLE SCHEDULE DELAY... 6.0
TOTAL SYSTEM MTTF..... 15.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	1162441.	30886976.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	551829.	13927137.	
7	* PRIMARY OPTICS	3300000.	8000978.	
8	COMM. & DATA HANDLING	3206258.	20816608.	
9	PNEUMATICS	2318S.	4500433.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	502000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	85790432.	134772000.	
	G & A	11066961.	17385568.	1160999.
	SUBTOTAL	96857392.	152157568.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	111054400.	347021056.	10160999.
	*NO G & A CHARGE			
			TOTAL	468236288.
	COST OF ADD'L SHUTTLE REPAIR FLTS			10000000.
	GRAND TOTAL			478236160.
	NO. OF FAILURES....	8.00		
	UPTIME (YEARS).....	10.00		
	UPTIME RATIO.....	0.67		

PERCOM PROGRAM

PROGRAM NO.44

SHUTTLE SCHEDULE DELAY.. 12.0
TOTAL SYSTEM MTTF..... 15.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	1162441.	30886976.	
4	THERMAL	2120000.	2010971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	551829.	13927137.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	3206258.	20816608.	
9	PNEUMATICS	21185.	4500433.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2449698.	
13	RELIABILITY	111600.	133000.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	*. NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	85790432.	134772000.	1160999.
	G & A	11066961.	17385568.	
	SUBTOTAL	96857392.	152157568.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	111054400.	347021056.	10160999.
	*NO G & A CHARGE		TOTAL	468236288.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			468236288.
	NO. OF FAILURES....	6.22		
	UPTIME (YEARS).....	7.78		
	UPTIME RATIO.....	0.52		

PERCON PROGRAM

PROGRAM NO.45

SHUTTLE SCHEDULE DELAY.. 24.0
TOTAL SYSTEM MTTF..... 15.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	1162441.	30896976.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	551829.	13927137.	
7	* PRIMARY OPTICS	3300000.	8000870.	
8	COMM. & DATA HANDLING	3206258.	20816608.	
9	PNEUMATICS	23185.	450043.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448699.	
13	RELIABILITY	111600.	113800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
				9000000.
29	ORBITAL OPERATIONS			
	G & A CHARGEABLE	85790432.	134772000.	1160999.
	G & A	11066961.	17385568.	
	SUBTOTAL	96857392.	152157568.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	111054400.	347021056.	10160999.
	*NO G & A CHARGE		TOTAL	468236288.
				0.0
	COST OF ADD'L SHUTTLE REPAIR FLTS			468236288.
	GRAND TOTAL			
	NO. OF FAILURES....	4.31		
	UPTIME (YEARS).....	5.38		
	UPTIME RATIO.....	0.36		

PERCOM PROGRAM

PROGRAM NO.46

SHUTTLE SCHEDULE DELAY.. 0.5
TOTAL SYSTEM MTTF..... 18.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	1618100.	42994209.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	768138.	19386152.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	4463058.	28976384.	
9	PNEUMATICS	3227[illegible].	6264530.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448699.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	87728288.	162262120.	
	G & A	11316944.	20931824.	1160999.
	SUBTOTAL	99045232.	183194144.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	113242240.	378057729.	10160999.
	*NO G & A CHARGE			
			TOTAL	501460736.
	COST OF ADD'L SHUTTLE REPAIR FLTS			15405402.
	GRAND TOTAL			516866048.

NO. OF FAILURES.... 9.08
UPTIME (YEARS)..... 13.62
UPTIME RATIO..... 0.91

PERCOM PROGRAM

PROGRAM NO.47

SHUTTLE SCHEDULE DELAY.. 1.0
TOTAL SYSTEM MTTF..... 18.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	1618100.	42996209.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721481.	
6	ELECTRIC POWER	768138.	19386352.	
7	* PRIMARY OPTICS	3300000.	8000478.	
8	COMM. & DATA HANDLING	4463058.	28976384.	
9	PNEUMATICS	32273.	6251580.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7110000.	
12	SYSTEM INTEGRATION	944000.	2444698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	87728288.	162262320.	
	G & A	11316944.	20931824.	1160999.
	SUBTOTAL	99045232.	183194144.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	113242240.	378057728.	10160999.
	*NO G & A CHARGE		TOTAL	501460736.
	COST OF ADD'L SHUTTLE REPAIR FLTS			14210524.
	GRAND TOTAL			515671040.

NO. OF FAILURES.... 8.84
UPTIME (YEARS)..... 13.26
UPTIME RATIO..... 0.88

PERCOM PROGRAM

PROGRAM NO.48

SHUTTLE SCHEDULE DELAY.. 1.5
TOTAL SYSTEM MTTF..... 18.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	10649216.	
2	ENGINEERING	17500000.	2258126.	
3	STABILIZATION	1618100.	42994208.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721481.	
6	ELECTRIC POWER *	768138.	19386352.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	4463058.	28976484.	
9	PNEUMATICS	32273.	6264510.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2449698.	
13	RELIABILITY	111600.	133900.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	87728288.	162262320.	
	G & A	11316944.	20931824.	1160999.
	SUBTOTAL	99045232.	183194144.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	113242240.	378057728.	10160999.
	*NO G & A CHARGE			
			TOTAL	501460736.
	COST OF ADD'L SHUTTLE REPAIR FLTS			13076920.
	GRAND TOTAL			514537472.
	NO. OF FAILURES.... 8.62			
	UPTIME (YEARS)..... 12.92			
	UPTIME RATIO..... 0.86			

PERCOM PROGRAM

PROGRAM NO.49

SHUTTLE SCHEDULE DELAY.... 2.0
TOTAL SYSTEM MTTF..... 18.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250125.	
3	STABILIZATION	1618100.	42994208.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	768139.	19386352.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	4463058.	28976384.	
9	PNEUMATICS	32273.	6264530.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	87728288.	162262370.	
	G & A	11316944.	20931824.	1160999.
	SUBTOTAL	99045232.	183194144.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	113242240.	378057728.	10160999.
	*NO G & A CHARGE		TOTAL	501460736.
	COST OF ADD'L SHUTTLE REPAIR FLTS			1199998.
	GRAND TOTAL			513460480.
	NO. OF FAILURES....	8.40		
	UPTIME (YEARS).....	12.60		
	UPTIME RATIO.....	0.84		

PERCOM PROGRAM

PROGRAM NO.50

SHUTTLE SCHEDULE DELAY.. 2.5
TOTAL SYSTEM MTTF..... 10.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	1618100.	42994209.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	768138.	19386352.	
7	* PRIMARY OPTICS	3100000.	8000878.	
8	COMM. & DATA HANDLING	4463058.	28976194.	
9	PNEUMATICS	32274.	6264530.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2449698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4560000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	87728988.	162262320.	
	G & A	11316944.	20931824.	1160999.
	SUBTOTAL	99045232.	183194144.	
	NON-G & A SUBTOTAL	14197012.	19486680.	
	TOTAL	113242240.	378057728.	10160999.
	*NO G & A CHARGE		TOTAL	501460736.
	COST OF ADD'L SHUTTLE REPAIR FLTS			1097560.
	GRAND TOTAL			512436224.
	NO. OF FAILURES.... 8.20			
	UPTIME (YEARS)..... 12.29			
	UPTIME RATIO..... 0.82			

PERCOM PROGRAM

PROGRAM NO.51

SHUTTLE SCHEDULE DELAY.. 3.0
TOTAL SYSTEM MTTF..... 18.0
VAP. SUBSYSTEM SLOPE... 1.25

		SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1		STRUCTURE	20150000.	30649216.	
2		ENGINEERING	17500000.	2250126.	
3		STABILIZATION	1618100.	42994208.	
4		THERMAL	2120000.	2910971.	
5		S-C MECHANISMS	3520000.	2721481.	
6		ELECTRIC POWER	760138.	19186352.	
7	*	PRIMARY OPTICS	3300000.	8000878.	
8		COMM. & DATA HANDLING	4467058.	20076384.	
9		PNEUMATICS	32271.	626540.	
10		TEST & SUPPORT EQUIPMENT	4060540.	2070414.	
11		PROGRAM MANAGEMENT	2533000.	7119000.	
12		SYSTEM INTEGRATION	944000.	2448699.	
13		RELIABILITY	111600.	133000.	
14		QUALITY ACCEPTANCE	1445220.	5820000.	
15		TITAN INTERSTAGE	582000.	670000.	
16	*	TITAN SHROUD	0.0	1000000.	
17		SHUTTLE INTERFACES	20910000.	1997000.	
18		TRAINERS & SIMULATORS	3110400.	100000.	
19	*	EXPERIMENTS A & B	5000000.	39000000.	
20		GROUND STATION	3251000.	800000.	
21	*	NEW COMPUTERS	4550000.	0.0	
		LAUNCH OPERATIONS			
22	*	LV-TITAN	0.0	22500000.	
23	*	LV-SHUTTLE	0.0	10000000.	
24		S-C SUPPORT	0.0	4950000.	
25	*	FACILITIES	1347012.	362826.	
26	*	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	*	EXPERIMENT UPDATE	0.0	39000000.	
28	*	G.S.F.C. & OTHER	0.0	60000000.	
29		ORBITAL OPERATIONS			9000000.
		G & A CHARGEABLE	87728288.	162262320.	
		G & A	11316944.	20931824.	1160999.
		SUBTOTAL	99045232.	183194144.	
		NON-G & A SUBTOTAL	14197012.	194863680.	
		TOTAL	113242240.	378057728.	10160999.
		*NO G & A CHARGE			
				TOTAL	501460736.
		COST OF ADD'L SHUTTLE REPAIR FLTS			10000000.
		GRAND TOTAL			511460608.
		NO. OF FAILURES.... 8.00			
		UPTIME (YEARS)..... 12.00			
		UPTIME RATIO..... 0.80			

PERCOM PROGRAM

PROGRAM NO.52

SHUTTLE SCHEDULE DELAY.. 6.0
TOTAL SYSTEM MTTF..... 18.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	1618100.	4294208.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721481.	
6	ELECTRIC POWER	768138.	19386152.	
7	* PRIMARY OPTICS	3100000.	8000978.	
8	COMM. & DATA HANDLING	4463058.	28976184.	
9	PNEUMATICS	322773.	6266510.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448699.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3261000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4050000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	87728288.	162262320.	
	G & A	11316944.	20931824.	1160999.
	SUBTOTAL	99045232.	183194144.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	113242240.	378057728.	10160999.
	*NO G & A CHARGE		TOTAL	501460736.
	COST OF ADD'L SHUTTLE REPAIR FLTS			5000000.
	GRAND TOTAL			506460672.
	NO. OF FAILURES....	7.00		
	UPTIME (YEARS).....	10.50		
	UPTIME RATIO.....	0.70		

PERCOM PROGRAM

PROGRAM NO.53

SHUTTLE SCHEDULE DELAY.. 12.0
TOTAL SYSTEM MTTF..... 10.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (* SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	1618100.	4299208.	
4	THERMAL	2120000.	2910971.	
5	S/C MECHANISMS	3520000.	4272483.	
6	ELECTRIC POWER	768130.	19386352.	
7	* PRIMARY OPTICS	3300000.	8000870.	
8	COMM. & DATA HANDLING	4463058.	28974184.	
9	PNEUMATICS	32273.	6264530.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	87728288.	162262320.	
	G & A	11316944.	20931824.	1160999.
	SUBTOTAL	99045232.	183194144.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	113242240.	378057728.	10160999.
	*NO G & A CHARGE			
			TOTAL	501460736.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			501460736.
	NO. OF FAILURES.... 5.60			
	UPTIME (YEARS)..... 8.40			
	UPTIME RATIO..... 0.56			

PERCOM PROGRAM

PROGRAM NO.54

SHUTTLE SCHEDULE DELAY.. 24.0
TOTAL SYSTEM MTTF..... 18.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	1618100.	4294208.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	768138.	19386352.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	4463058.	28976394.	
9	PNEUMATICS	32273.	6264530.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4900000.	
25	* FACILITIES	1347012.	3628826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	87728288.	162262320.	
	G & A	11316944.	20931824.	1160999.
	SUBTOTAL	99045232.	183194144.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	113242240.	378057728.	10160999.
	*NO G & A CHARGE		TOTAL	501460736.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			501460736.
	NO. OF FAILURES....	4.00		
	UPTIME (YEARS).....	6.00		
	UPTIME RATIO.....	0.40		

PERCOM PROGRAM

PROGRAM NO.55

SHUTTLE SCHEDULE DELAY.. 0.5
TOTAL SYSTEM MTTF..... 21.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	2130631.	56612560.	
4	THERMAL	2120000.	2910071.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	1011444.	25526944.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	5876740.	38154704.	
9	PNEUMATICS	424[illegible].	8248830.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448690.	
13	RELIABILITY	111600.	111600.	
14	QUALITY ASSURANCE	1445220.	5920000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	89908016.	193183872.	
	G & A	11598129.	24920704.	1160999.
	SUBTOTAL	101506144.	218104576.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	115703152.	412968192.	10160999.
	*NO G & A CHARGE			
			TOTAL	538832128.
	COST OF ADD'L SHUTTLE REPAIR FLTS			9069766.
	GRAND TOTAL			547901696.
	NO. OF FAILURES.... 7.81			
	UPTIME (YEARS)..... 13.67			
	UPTIME RATIO..... 0.91			

PERCOM PROGRAM

PROGRAM NO.56

SHUTTLE SCHEDULE DELAY.. 11.0
TOTAL SYSTEM MTTF..... 21.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30643216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	2130631.	56612560.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	1011444.	25526944.	
7	* PRIMARY OPTICS	3300000.	8000978.	
8	COMM. & DATA HANDLING	5876740.	38154704.	
9	PNEUMATICS	42495.	8248810.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2543000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448690.	
13	RELIABILITY	111600.	111600.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	89908016.	193183972.	
	G & A	11598129.	24920704.	1160999.
	SUBTOTAL	101506144.	218104676.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	115703152.	412968192.	10160999.
	*NO G & A CHARGE			
			TOTAL	538832128.
	COST OF ADD'L SHUTTLE REPAIR FLTS			8181815.
	GRAND TOTAL			547013888.
	NO. OF FAILURES.... 7.64			
	UPTIME (YEARS)..... 13.36			
	UPTIME RATIO..... 0.89			

PERCOM PROGRAM

PROGRAM NO.57

SHUTTLE SCHEDULE DELAY.. 1.5
TOTAL SYSTEM MTTF..... 21.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	2130631.	56612560.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721481.	
6	ELECTRIC POWER	1011444.	25526944.	
7 *	PRIMARY OPTICS	3300000.	8000870.	
8	COMM. & DATA HANDLING	5876740.	38154704.	
9	PNEUMATICS	42495.	8249830.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2513000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	111600.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	89908016.	193183872.	
	G & A	11598129.	24920704.	1160999.
	SUBTOTAL	101506144.	218104576.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	115703152.	412968192.	10160999.
	*NO G & A CHARGE			
			TOTAL	538832128.
	COST OF ADD'L SHUTTLE REPAIR FLTS			7333331.
	GRAND TOTAL			546165248.
	NO. OF FAILURES....	7.47		
	UPTIME (YEARS).....	13.07		
	UPTIME RATIO.....	0.87		

PERCOM PROGRAM

PROGRAM NO.58

SHUTTLE SCHEDULE DELAY.. 2.0
TOTAL SYSTEM MTTF..... 21.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	2130631.	56612560.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721481.	
6	ELECTRIC POWER	1011444.	25526944.	
7	* PRIMARY OPTICS	3100000.	8000978.	
8	COMM. & DATA HANDLING	5876740.	38154704.	
9	PNEUMATICS	42495.	8248830.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070534.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133900.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1907000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	89908016.	193183872.	
	G & A	11598129.	24920704.	1160999.
	SUBTOTAL	101506144.	218104576.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	115703152.	412968192.	10160999.
	*NO G & A CHARGE			
			TOTAL	538832128.
	COST OF ADD'L SHUTTLE REPAIR FLTS			6521735.
	GRAND TOTAL			545353728.
	NO. OF FAILURES.... 7.30			
	UPTIME (YEARS)..... 12.78			
	UPTIME RATIO..... 0.85			

PERCOM PROGRAM

PROGRAM NO.59

SHUTTLE SCHEDULE DELAY.. 2.5
TOTAL SYSTEM MTTF..... 21.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	2130631.	56612560.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	1011444.	25526944.	
7	* PRIMARY OPTICS	3100000.	8000878.	
8	COMM. & DATA HANDLING	5976740.	38154704.	
9	PNEUMATICS	42495.	8248830.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	173800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	89908016.	193183872.	
	G & A	11598129.	24920704.	1160999.
	SUBTOTAL	101506144.	218104576.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	115703152.	412968192.	10160999.
	*NO G & A CHARGE			
			TOTAL	538832128.
	COST OF ADD'L SHUTTLE REPAIR FLTS			5744676.
	GRAND TOTAL			544576768.
	NO. OF FAILURES.... 7.15			
	UPTIME (YEARS)..... 12.51			
	UPTIME RATIO..... 0.83			

PERCOM PROGRAM

PROGRAM NO.60

SHUTTLE SCHEDULE DELAY.. 3.0
TOTAL SYSTEM MTTF..... 21.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	2130631.	56612560.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	1011444.	25526944.	
7 *	PRIMARY OPTICS	3300000.	8000378.	
8	COMM. & DATA HANDLING	5876740.	38154704.	
9	PNEUMATICS	42405.	8248810.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	113800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4050000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	89908016.	193183872.	
	G & A	11598129.	24920704.	1160999.
	SUBTOTAL	101506144.	218104576.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	115703152.	412968192.	10160999.
	*NO G & A CHARGE		TOTAL	538832128.
	COST OF ADD'L SHUTTLE REPAIR FLTS			5000000.
	GRAND TOTAL			543832064.
	NO. OF FAILURES.... 7.00			
	UPTIME (YEARS)..... 12.25			
	UPTIME RATIO..... 0.82			

PERCOM PROGRAM

PROGRAM NO.61

SHUTTLE SCHEDULE DELAY... 6.0
TOTAL SYSTEM MTTF..... 21.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	2130631.	56612560.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721493.	
6	ELECTRIC POWER	1011444.	25526944.	
7 *	PRIMARY OPTICS	3100000.	8000878.	
8	COMM. & DATA HANDLING	5876740.	38154704.	
9	PNEUMATICS	42405.	824830.	
10	TEST & SUPPORT EQUIPMENT	4660540.	2070634.	
11	PROGRAM MANAGEMENT	2513000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	111800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1907000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	89908016.	193183872.	
	G & A	11598129.	24920704.	1160999.
	SUBTOTAL	101506144.	218104576.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	115703152.	412968192.	10160999.
	*NO G & A CHARGE			
			TOTAL	538832128.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			538832128.
	NO. OF FAILURES.... 6.22			
	UPTIME (YEARS)..... 10.89			
	UPTIME RATIO..... 0.73			

PERCON PROGRAM

PROGRAM NO.62

SHUTTLE SCHEDULE DELAY.. 12.0
TOTAL SYSTEM MTTF..... 21.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	2130631.	56612560.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721481.	
6	ELECTRIC POWER	1011444.	25529944.	
7 *	PRIMARY OPTICS	3100000.	8000978.	
8	COMM. & DATA HANDLING	5876740.	38154704.	
9	PNEUMATICS	42495.	8248810.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362926.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	89908016.	193183872.	
	G & A	11598129.	24920704.	1160999.
	SUBTOTAL	101506144.	218104576.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	115703152.	412968192.	10160999.
	*NO G & A CHARGE			
			TOTAL	538832128.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			538832128.
	NO. OF FAILURES.... 5.09			
	UPTIME (YEARS)..... 8.91			
	UPTIME RATIO..... 0.59			

PERCOM PROGRAM

PROGRAM NO.64

SHUTTLE SCHEDULE DELAY..... 0.5
TOTAL SYSTEM MTTF..... 24.0
VAR. SUBSYSTEM SLOPE..... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	2694125.	71585056.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	1278944.	32270160.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	7431007.	48245776.	
9	PNEUMATICS	5373%.	1043045 3.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	113800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	92304512.	227180288.	
	G & A	11907277.	29306240.	1160999.
	SUBTOTAL	104211776.	256486528.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	118408784.	451350016.	10160999.
	*NO G & A CHARGE			
			TOTAL	579919616.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			579919616.

NO. OF FAILURES..... 6.86
UPTIME (YEARS)..... 13.71
UPTIME RATIO..... 0.91

PERCOM PROGRAM

PROGRAM NO.63

SHUTTLE SCHEDULE DELAY.. 24.0
TOTAL SYSTEM MTTF..... 21.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	2130631.	56612560.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	1011444.	25526944.	
7	* PRIMARY OPTICS	3100000.	8000878.	
8	COMM. & DATA HANDLING	5876740.	38154704.	
9	PNEUMATICS	42495.	8248830.	
10	TEST & SUPPORT EQUIPMENT	4669540.	20706614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448699.	
13	RELIABILITY	111600.	111800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	89908016.	193183872.	
	G & A	11598129.	24920704.	1160999.
	SUBTOTAL	101506144.	218104576.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	115703152.	412968192.	10160999.
	*NO G & A CHARGE		TOTAL	538832128.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			538832128.
	NO. OF FAILURES....	3.73		
	UPTIME (YEARS).....	6.53		
	UPTIME RATIO.....	0.44		

PERCOM PROGRAM

PROGRAM NO.65

SHUTTLE SCHEDULE DELAY.. 1.0
TOTAL SYSTEM MTTF..... 24.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	2694125.	71585056.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	1278944.	32278160.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	7411007.	48245776.	
9	PNEUMATICS	53735.	1043053.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2513000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448699.	
13	RELIABILITY	111600.	144900.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	19000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	92304512.	227180288.	
	G & A	11907277.	29306240.	1160999.
	SUBTOTAL	104211776.	256486528.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	118408784.	451350016.	10160999.
	*NO G & A CHARGE			
			TOTAL	579919616.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			579919616.
	NO. OF FAILURES.... 6.72			
	UPTIME (YEARS)..... 13.44			
	UPTIME RATIO..... 0.90			

PERCOM PROGRAM

PROGRAM NO.66

SHUTTLE SCHEDULE DELAY.. 1.5
TOTAL SYSTEM MTTF..... 24.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	2694125.	71585056.	
4	THERMAL	2120000.	2919971.	
5	S-C MECHANISMS	3520000.	2721481.	
6	ELECTRIC POWER	1278944.	32278160.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	7431007.	48245776.	
9	PNEUMATICS	51735.	1041051.	
10	TEST & SUPPORT EQUIPMENT	4659540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	131900.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29.	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	92304512.	227180289.	
	G & A	11907277.	29306240.	-1160999.
	SUBTOTAL	104211776.	256486528.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	118408784.	451350016.	10160999.
	*NO G & A CHARGE			
			TOTAL	579919616.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			579919616.
	NO. OF FAILURES.... 6.59			
	UPTIME (YEARS)..... 13.18			
	UPTIME RATIO..... 0.88			

PERCOM PROGRAM

PROGRAM NO.67

SHUTTLE SCHEDULE DELAY... 2.0
TOTAL SYSTEM MTTF..... 24.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	2694125.	71585056.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	1278944.	32278160.	
7 *	PRIMARY OPTICS	3100000.	8000870.	
8	COMM. & DATA HANDLING	7431007.	48245776.	
9	PNEUMATICS	53735.	10430454.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448699.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362926.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	92304512.	227180288.	
	G & A	11907277.	29106240.	1160999.
	SUBTOTAL	104211776.	256286528.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	118408784.	451350016.	10160999.
	*NO G & A CHARGE		TOTAL	579919616.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			579919616.
	NO. OF FAILURES.... 6.46			
	UPTIME (YEARS)..... 12.92			
	UPTIME RATIO..... 0.86			

PERCOM PROGRAM

PROGRAM NO.68

SHUTTLE SCHEDULE DELAY.. 2.5
TOTAL SYSTEM MTTF..... 24.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	2694125.	71585056.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721493.	
6	ELECTRIC POWER	1278944.	32278160.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	7431007.	48245776.	
9	PNEUMATICS	53715.	1043453.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2449699.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	-FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	92304512.	227180288.	
	G & A	11907277.	29306240.	1160999.
	SUBTOTAL	104211776.	256486528.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	118408784.	451350016.	10160999.
	*NO G & A CHARGE			
			TOTAL	579919616.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			579919616.

NO. OF FAILURES.... 6.34
UPTIME (YEARS)..... 12.68
UPTIME RATIO..... 0.85

PERCOM PROGRAM

PROGRAM NO.69

SHUTTLE SCHEDULE DELAY.. 3.0
TOTAL SYSTEM MTTF..... 24.0
VAR. SUBSYSTEM SLOPE.... 1.25

		SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1		STRUCTURE	20150000.	30649216.	
2		ENGINEERING	17500000.	2250126.	
3		STABILIZATION	2694125.	71585056.	
4		THERMAL	2120000.	2910971.	
5		S-C MECHANISMS	3520000.	2721483.	
6		ELECTRIC POWER	1278944.	32278160.	
7	*	PRIMARY OPTICS	3300000.	8000879.	
8		COMM. & DATA HANDLING	7431007.	48245776.	
9		PNEUMATICS	53735.	1043045.	
10		TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11		PROGRAM MANAGEMENT	2533000.	7119000.	
12		SYSTEM INTEGRATION	944000.	2449699.	
13		RELIABILITY	111600.	133800.	
14		QUALITY ACCEPTANCE	1445220.	5820000.	
15		TITAN INTERSTAGE	582000.	670000.	
16	*	TITAN SHROUD	0.0	1000000.	
17		SHUTTLE INTERFACES	20910000.	1997000.	
18		TRAINERS & SIMULATORS	3110400.	100000.	
19	*	EXPERIMENTS A & B	5000000.	39000000.	
20		GROUND STATION	3251000.	800000.	
21	*	NEW COMPUTERS	4550000.	0.0	
		LAUNCH OPERATIONS			
22	*	LV-TITAN	0.0	22500000.	
23	*	LV-SHUTTLE	0.0	10000000.	
24		S-C SUPPORT	0.0	4950000.	
25	*	FACILITIES	1347012.	362826.	
26	*	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	*	EXPERIMENT UPDATE	0.0	39000000.	
28	*	G.S.F.C. & OTHER	0.0	60000000.	
29		ORBITAL OPERATIONS			9000000.
		G & A CHARGEABLE	92304512.	227180288.	
		G & A	11907277.	29306240.	1160999.
		SUBTOTAL	104211776.	256486528.	
		NON-G & A SUBTOTAL	14197012.	194863680.	
		TOTAL	118408784.	451350016.	10160999.
		*NO G & A CHARGE			
				TOTAL	579919616.
		COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
		GRAND TOTAL			579919616.
		NO. OF FAILURES.... 6.22			
		UPTIME (YEARS)..... 12.44			
		UPTIME RATIO..... 0.83			

PERCOM PROGRAM

PROGRAM NO.73

SHUTTLE SCHEDULE DELAY..... 0.5
TOTAL SYSTEM MTTF..... 36.0
VAR. SUBSYSTEM SLOPE..... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	5367671.	142623296.	
4	THERMAL	2120000.	2010971.	
5	S-C MECHANISMS	3520000.	2721493.	
6	ELECTRIC POWER	2548120.	64309792.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	14805196.	96122672.	
9	PNEUMATICS	107058.	20781104.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2513000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362926.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	30000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
				9000000.
29	ORBITAL OPERATIONS			
	G & A CHARGEABLE	103674752.	388476416.	
	G & A	13374017.	50113424.	1160999.
	SUBTOTAL	117048784.	438589696.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	131245792.	633453312.	10160999.
	*NO G & A CHARGE		TOTAL	774859776.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			774859776.
	NO. OF FAILURES.....	4.60		
	UPTIME (YEARS).....	13.81		
	UPTIME RATIO.....	0.92		

PERCOM PROGRAM

PROGRAM NO.74

SHUTTLE SCHEDULE DELAY.. 1.0
TOTAL SYSTEM MTTF..... 36.0
VAR. SUBSYSTEM SLOPE... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	5367671.	142623296.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	2548120.	64109792.	
7	* PRIMARY OPTICS	3100000.	8000078.	
8	COMM. & DATA HANDLING	14805196.	96122672.	
9	PNEUMATICS	107058.	20781104.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	103674752.	388476416.	
	G & A	13374037.	50113424.	1160999.
	SUBTOTAL	117048784.	438589696.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	131245792.	633453312.	10160999.
	*NO G & A CHARGE		TOTAL	774859776.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			774859776.
	NO. OF FAILURES.... 4.54			
	UPTIME (YEARS)..... 13.62			
	UPTIME RATIO..... 0.91			

PERCOM PROGRAM

PROGRAM NO.75

SHUTTLE SCHEDULE DELAY... 1.5
TOTAL SYSTEM MTTF..... 36.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	5367671.	142623296.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	2548120.	64309792.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	14805196.	96122672.	
9	PNEUMATICS	107058.	20781104.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	131800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	3628826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	103674752.	388476416.	
	G & A	13374037.	50113424.	1160999.
	SUBTOTAL	117048784.	438589696.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	131245792.	633453312.	10160999.
	*NO G & A CHARGE			
			TOTAL	774859776.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			774859776.
	NO. OF FAILURES.... 4.48			
	UPTIME (YEARS)..... 13.44			
	UPTIME RATIO..... 0.90			

PERCOM PROGRAM

PROGRAM NO.76

SHUTTLE SCHEDULE DELAY.. 2.0
TOTAL SYSTEM MTTF..... 36.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	5367671.	14262296.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	2548120.	64309792.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	14805196.	96122672.	
9	PNEUMATICS	107058.	20781104.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	103674752.	388476416.	
	G & A	13374037.	50113424.	1160999.
	SUBTOTAL	117048784.	438589696.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	131245792.	633453312.	10160999.
	*NO G & A CHARGE			
			TOTAL	774859776.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			774859776.

NO. OF FAILURES.... 4.42
UPTIME (YEARS)..... 13.26
UPTIME RATIO..... 0.88

PERCOM PROGRAM

PROGRAM NO.77

SHUTTLE SCHEDULE DELAY.. 2.5
TOTAL SYSTEM MTTF..... 36.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	5167671.	142623296.	
4	THERMAL	2120000.	2910271.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	2548120.	64309792.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	14805196.	96122672.	
9	PNEUMATICS	107058.	20781104.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11	PROGRAM MANAGEMENT	2513000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	137800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	103674752.	388476416.	
	G & A	13374037.	50113424.	1160999.
	SUBTOTAL	117048784.	438589696.	
	NON-G & A SUBTOTAL	14197012.	194863690.	
	TOTAL	131245792.	633453312.	10160999.
	*NO G & A CHARGE			
			TOTAL	774859776.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			774859776.

NO. OF FAILURES.... 4.36
UPTIME (YEARS)..... 13.09
UPTIME RATIO..... 0.87

PERCOM PROGRAM

PROGRAM NO.78

SHUTTLE SCHEDULE DELAY.. 3.0
TOTAL SYSTEM MTTF..... 36.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	5367671.	142623296.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	2548120.	64309792.	
7	* PRIMARY OPTICS	3300000.	8000873.	
8	COMM. & DATA HANDLING	14805196.	96122672.	
9	PNEUMATICS	107058.	20781104.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	113800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	103674752.	388476416.	
	G & A	13374037.	50113424.	1160999.
	SUBTOTAL	117048784.	438589696.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	131245792.	633453312.	10160999.
	*NO G & A CHARGE			
			TOTAL	774859776.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			774859776.
	NO. OF FAILURES.... 4.31			
	UPTIME (YEARS)..... 12.92			
	UPTIME RATIO..... 0.86			

PERCOM PROGRAM

PROGRAM NO.79

SHUTTLE SCHEDULE DELAY..... 6.0
TOTAL SYSTEM MTTF..... 36.0
VAR. SUBSYSTEM SLOPE..... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	5167671.	142623296.	
4	THERMAL	2120000.	2910071.	
5	S-C MECHANISMS	3520000.	2721481.	
6	ELECTRIC POWER	2548120.	64309792.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	14805196.	96122672.	
9	PNEUMATICS	107058.	20781104.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	103674752.	388476416.	
	G & A	13374037.	50113424.	1160999.
	SUBTOTAL	117048784.	438589696.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	131245792.	633453312.	10160999.
	*NO G & A CHARGE			
			TOTAL	774859776.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			774859776.

NO. OF FAILURES..... 4.00
UPTIME (YEARS)..... 12.00
UPTIME RATIO..... 0.80

PERCOM PROGRAM

PROGRAM NO.71

SHUTTLE SCHEDULE DELAY.. 12.0
TOTAL SYSTEM MTTF..... 24.0
VAR. SUBSYSTEM SLOPE.... 1.25

		SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1		STRUCTURE	20150000.	30649716.	
2		ENGINEERING	17500000.	2250126.	
3		STABILIZATION	2604125.	71585056.	
4		THERMAL	2120000.	2910971.	
5		S-C MECHANISMS	3520000.	2721483.	
6		ELECTRIC POWER	1278944.	32278160.	
7	*	PRIMARY OPTICS	3300000.	8000878.	
8		COMM. & DATA HANDLING	7431007.	48245776.	
9		PNEUMATICS	53735.	10430453.	
10		TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11		PROGRAM MANAGEMENT	2513000.	7119000.	
12		SYSTEM INTEGRATION	944000.	2448698.	
13		RELIABILITY	111600.	131800.	
14		QUALITY ACCEPTANCE	1445220.	5820000.	
15		TITAN INTERSTAGE	582000.	670000.	
16	*	TITAN SHROUD	0.0	1000000.	
17		SHUTTLE INTERFACES	20910000.	1997000.	
18		TRAINERS & SIMULATORS	3110400.	100000.	
19	*	EXPERIMENTS A & B	5000000.	39000000.	
20		GROUND STATION	3251000.	800000.	
21	*	NEW COMPUTERS	4550000.	0.0	
		LAUNCH OPERATIONS			
22	*	LV-TITAN	0.0	22500000.	
23	*	LV-SHUTTLE	0.0	10000000.	
24		S-C SUPPORT	0.0	4950000.	
25	*	FACILITIES	1347012.	362826.	
26	*	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	*	EXPERIMENT UPDATE	0.0	39000000.	
28	*	G.S.F.C. & OTHER	0.0	60000000.	
29		ORBITAL OPERATIONS			9000000.
		G & A CHARGEABLE	92304512.	227180288.	
		G & A	11907277.	29306240.	1160999.
		SUBTOTAL	104211776.	256486528.	
		NON-G & A SUBTOTAL	14197012.	194863680.	
		TOTAL	118408784.	451350016.	10160999.
		*NO G & A CHARGE			
				TOTAL	579919616.
		COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
		GRAND TOTAL			579919616.
		NO. OF FAILURES....	4.67		
		UPTIME (YEARS).....	9.33		
		UPTIME RATIO.....	0.62		

PERCOM PROGRAM

PROGRAM NO.72

SHUTTLE SCHEDULE DELAY.. 24.0
TOTAL SYSTEM MTTF..... 24.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	2694125.	71585056.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	1278944.	32278160.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	7431007.	48245776.	
9	PNEUMATICS	53735.	10430453.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	137800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	92304512.	227180288.	
	G & A	11907277.	29306240.	1160999.
	SUBTOTAL	104211776.	256486528.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	118408784.	451350016.	10160999.
	*NO G & A CHARGE			
			TOTAL	579919616.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			579919616.

NO. OF FAILURES.... 3.50
UPTIME (YEARS)..... 7.00
UPTIME RATIO..... 0.47

PERCOM PROGRAM

PROGRAM NO.80

SHUTTLE SCHEDULE DELAY.. 12.0
TOTAL SYSTEM MTTF..... 36.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	5367671.	142623296.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	2548120.	64309792.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	14805196.	96122672.	
9	PNEUMATICS	107058.	20781104.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448699.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	103674752.	388476416.	
	G & A	13374037.	50113424.	1160999.
	SUBTOTAL	117048784.	438589696.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	131245792.	633453312.	10160999.
	*NO G & A CHARGE			
			TOTAL	774859776.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			774859776.

NO. OF FAILURES.... 3.50
UPTIME (YEARS)..... 10.50
UPTIME RATIO..... 0.70

PERCOM PROGRAM

PROGRAM NO.81

SHUTTLE SCHEDULE DELAY.. 24.0
TOTAL SYSTEM MTTF..... 36.0
VAR. SUBSYSTEM SLOPE.... 1.25

		SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1		STRUCTURE	20150000.	30649216.	
2		ENGINEERING	17500000.	2250126.	
3		STABILIZATION	5367671.	142623206.	
4		THERMAL	2120000.	2910971.	
5		S-C MECHANISMS	3520000.	2721483.	
6		ELECTRIC POWER	2548120.	64309792.	
7	*	PRIMARY OPTICS	3300000.	8000878.	
8		COMM. & DATA HANDLING	14805106.	96122672.	
9		PNEUMATICS	107058.	20781104.	
10		TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11		PROGRAM MANAGEMENT	2513000.	7119000.	
12		SYSTEM INTEGRATION	944000.	2448698.	
13		RELIABILITY	111600.	133800.	
14		QUALITY ACCEPTANCE	1445220.	5820000.	
15		TITAN INTERSTAGE	582000.	670000.	
16	*	TITAN SHROUD	0.0	1000000.	
17		SHUTTLE INTERFACES	20910000.	1987000.	
18		TRAINERS & SIMULATORS	3110400.	100000.	
19	*	EXPERIMENTS A & B	5000000.	39000000.	
20		GROUND STATION	3251000.	800000.	
21	*	NEW COMPUTERS	4550000.	0.0	
		LAUNCH OPERATIONS			
22	*	LV-TITAN	0.0	22500000.	
23	*	LV-SHUTTLE	0.0	10000000.	
24		S-C SUPPORT	0.0	4950000.	
25	*	FACILITIES	1347012.	362826.	
26	*	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	*	EXPERIMENT UPDATE	0.0	39000000.	
28	*	G.S.F.C. & OTHER	0.0	60000000.	
29		ORBITAL OPERATIONS			9000000.
		G & A CHARGEABLE	103674752.	388476416.	
		G & A	13374037.	50113424.	1160999.
		SUBTOTAL	117048784.	438589696.	
		NON-G & A SUBTOTAL	14197012.	194863680.	
		TOTAL	131245792.	633453312.	10160999.
		*NO G & A CHARGE			
				TOTAL	774859776.
		COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
		GRAND TOTAL			774859776.
		NO. OF FAILURES.... 2.80			
		UPTIME (YEARS)..... 8.40			
		UPTIME RATIO..... 0.56			

PERCOM PROGRAM

PROGRAM NO.82

SHUTTLE SCHEDULE DELAY.. 0.5
TOTAL SYSTEM MTTF..... 48.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30640216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	8562705.	22751872.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	4064853.	10258312.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	23617648.	15333520.	
9	PNEUMATICS	170783.	3115078.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448699.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	117262704.	581234688.	
	G & A	15126882.	74979232.	1160999.
	SUBTOTAL	132389584.	656213760.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	146586592.	851077376.	10160999.
	*NO G & A CHARGE			
			TOTAL	1007824640.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			1007824640.

NO. OF FAILURES.... 3.46
UPTIME (YEARS)..... 13.86
UPTIME RATIO..... 0.92

PERCOM PROGRAM

PROGRAM NO.83

SHUTTLE SCHEDULE DELAY.. 1.0
TOTAL SYSTEM MTTF..... 48.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30640216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	8562705.	227517872.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721481.	
6	ELECTRIC POWER	4064853.	102599112.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	23617648.	153317520.	
9	PNEUMATICS	170783.	33150784.	
10	TEST & SUPPORT EQUIPMENT	4669540.	20706614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362026.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	117262704.	581234688.	
	G & A	15126882.	74979272.	1160999.
	SUBTOTAL	132389584.	656213760.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	146586592.	851077376.	10160999.
	*NO G & A CHARGE		TOTAL	1007824640.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			1007824640.
	NO. OF FAILURES....	3.43		
	UPTIME (YEARS).....	13.71		
	UPTIME RATIO.....	0.91		

PERCOM PROGRAM

PROGRAM NO.84

SHUTTLE SCHEDULE DELAY.. 1.5
TOTAL SYSTEM MTTF..... 40.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30640216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	8562705.	227517872.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	4064853.	102589312.	
7	* PRIMARY OPTICS	3300000.	8000978.	
8	COMM. & DATA HANDLING	23617648.	153117520.	
9	PNEUMATICS	170783.	33150784.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2440698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5920000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1937000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	117262704.	581234688.	
	G & A	15126882.	74979232.	1160999.
	SUBTOTAL	132389584.	656213760.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	146586592.	851077376.	10160999.
	*NO G & A CHARGE		TOTAL	1007824640.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			1007824640.

NO. OF FAILURES.... 3.39
UPTIME (YEARS)..... 13.58
UPTIME RATIO..... 0.91

PERCOM PROGRAM

PROGRAM NO.85

SHUTTLE SCHEDULE DELAY.. 2.0
TOTAL SYSTEM MTTF..... 48.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30640216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	8562705.	227517872.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	4064853.	102589312.	
7 *	PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	23617648.	153337520.	
9	PNEUMATICS	170783.	33150784.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	143800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16 *	TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19 *	EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21 *	NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22 *	LV-TITAN	0.0	22500000.	
23 *	LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25 *	FACILITIES	1347012.	362826.	
26 *	SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27 *	EXPERIMENT UPDATE	0.0	39000000.	
28 *	G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	117262704.	581234688.	
	G & A	15126882.	74979232.	1160999.
	SUBTOTAL	132389584.	656213760.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	146586592.	851077376.	10160999.
	*NO G & A CHARGE			
			TOTAL	1007824640.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			1007824640.
	NO. OF FAILURES.... 3.36			
	UPTIME (YEARS)..... 13.44			
	UPTIME RATIO..... 0.90			

PERCOM PROGRAM

PROGRAM NO.86

SHUTTLE SCHEDULE DELAY.. 2.5
TOTAL SYSTEM MTTF..... 48.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	8562705.	227517872.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	4064853.	102589112.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	23617648.	151117520.	
9	PNEUMATICS	170783.	31150784.	
10	TEST & SUPPORT EQUIPMENT	4660540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7112000.	
12	SYSTEM INTEGRATION	944000.	2448628.	
13	RELIABILITY	111600.	1113800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	117262704.	581234688.	
	G & A	15126882.	74979232.	1160999.
	SUBTOTAL	132389584.	656213760.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	146586592.	851077376.	10160999.
	*NO G & A CHARGE			
			TOTAL	1007824640.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			1007824640.

NO. OF FAILURES.... 3.33
UPTIME (YEARS)..... 13.31
UPTIME RATIO..... 0.89

PERCOM PROGRAM

PROGRAM NO.87

SHUTTLE SCHEDULE DELAY..... 3.0
TOTAL SYSTEM MTTF..... 48.0
VAR. SUBSYSTEM SLOPE..... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	8562705.	227517872.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721491.	
6	ELECTRIC POWER	4064853.	102589312.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	23617648.	153337520.	
9	PNEUMATICS	170783.	33150784.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	117262704.	581234688.	
	G & A	15126882.	74979232.	1160999.
	SUBTOTAL	132389584.	656213760.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	146586592.	851077376.	10160999.
	*NO G & A CHARGE			
			TOTAL	1007824640.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			1007824640.

NO. OF FAILURES.... 3.29
UPTIME (YEARS)..... 13.18
UPTIME RATIO..... 0.88

PERCOM PROGRAM

PROGRAM NO.88

SHUTTLE SCHEDULE DELAY.. 6.0
TOTAL SYSTEM MTTF..... 48.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	8562705.	227517872.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	4054853.	102689312.	
7	* PRIMARY OPTICS	3300000.	8000878.	
8	COMM. & DATA HANDLING	23617648.	153377520.	
9	PNEUMATICS	170783.	33150784.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448698.	
13	RELIABILITY	111600.	111600.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	117262704.	581234688.	
	G & A	15126882.	74070232.	1160999.
	SUBTOTAL	132389584.	655211760.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	146586592.	851077376.	10160999.
	*NO G & A CHARGE			
			TOTAL	1007824640.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			1007824640.
	NO. OF FAILURES.... 3.11			
	UPTIME (YEARS)..... 12.44			
	UPTIME RATIO..... 0.83			

PERCOM PROGRAM

PROGRAM NO.89

SHUTTLE SCHEDULE DELAY.. 12.0
TOTAL SYSTEM MTTF..... 48.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	8562705.	227517872.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	4004853.	102589312.	
7	* PRIMARY OPTICS	3100000.	8000878.	
8	COMM. & DATA HANDLING	23617648.	151137520.	
9	PNEUMATICS	170783.	31150784.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070614.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2448608.	
13	RELIABILITY	111600.	131900.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	117262704.	581234608.	
	G & A	15126882.	74979232.	1160999.
	SUBTOTAL	132389584.	656213760.	
	NON-G & A SUBTOTAL	14197012.	194863680.	
	TOTAL	146586592.	851077376.	10160999.
	*NO G & A CHARGE			
			TOTAL	1007824640.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			1007824640.
	NO. OF FAILURES.... 2.80			
	UPTIME (YEARS)..... 11.20			
	UPTIME RATIO..... 0.75			

PERCOM PROGRAM

PROGRAM NO.90

SHUTTLE SCHEDULE DELAY.. 24.0
TOTAL SYSTEM MTTF..... 48.0
VAR. SUBSYSTEM SLOPE.... 1.25

	SHUTTLE-MAINTAINED PROGRAM (3 SPACECRAFT)-NOT OPTIMIZED	NON-RECURRING	RECURRING	OPERATIONS
1	STRUCTURE	20150000.	30649216.	
2	ENGINEERING	17500000.	2250126.	
3	STABILIZATION	8562705.	227517872.	
4	THERMAL	2120000.	2910971.	
5	S-C MECHANISMS	3520000.	2721483.	
6	ELECTRIC POWER	40640532.	102589312.	
7	* PRIMARY OPTICS	3100000.	8000878.	
8	COMM. & DATA HANDLING	23617648.	153337520.	
9	PNEUMATICS	170783.	33150784.	
10	TEST & SUPPORT EQUIPMENT	4669540.	2070634.	
11	PROGRAM MANAGEMENT	2533000.	7119000.	
12	SYSTEM INTEGRATION	944000.	2449698.	
13	RELIABILITY	111600.	133800.	
14	QUALITY ACCEPTANCE	1445220.	5820000.	
15	TITAN INTERSTAGE	582000.	670000.	
16	* TITAN SHROUD	0.0	1000000.	
17	SHUTTLE INTERFACES	20910000.	1997000.	
18	TRAINERS & SIMULATORS	3110400.	100000.	
19	* EXPERIMENTS A & B	5000000.	39000000.	
20	GROUND STATION	3251000.	800000.	
21	* NEW COMPUTERS	4550000.	0.0	
	LAUNCH OPERATIONS			
22	* LV-TITAN	0.0	22500000.	
23	* LV-SHUTTLE	0.0	10000000.	
24	S-C SUPPORT	0.0	4950000.	
25	* FACILITIES	1347012.	362826.	
26	* SHUTTLE UPDATE FLIGHT	0.0	15000000.	
27	* EXPERIMENT UPDATE	0.0	39000000.	
28	* G.S.F.C. & OTHER	0.0	60000000.	
29	ORBITAL OPERATIONS			9000000.
	G & A CHARGEABLE	117262704.	581234688.	
	G & A	15126882.	74979232.	1160999.
	SUBTOTAL	132389584.	656211760.	
	NON-G & A SUBTOTAL	14197012.	194861680.	
	TOTAL	146586592.	851077376.	10160999.
	*NO G & A CHARGE			
			TOTAL	1007824640.
	COST OF ADD'L SHUTTLE REPAIR FLTS			0.0
	GRAND TOTAL			1007824640.
	NO. OF FAILURES....	2.33		
	UPTIME (YEARS).....	9.33		
	UPTIME RATIO.....	0.62		