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ENVIROSAT—2000 Report

Optimum Management Strategies for the NOAA Polar-orbiting Operational Environmental Satellites, 1985-2000

VOLUME 3

April 1985

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Service

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W.H. Eskite, Jr., and W.P. Bishop

Washington, D.C.
April 1985

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PREFACE

This report, Optimum Management Strategies for the NOAA Polar-orbiting Operational Environmental Satellites, 1985 to 2000, is published in three volumes.

Volume I is an independent document, covering the purpose and methods of the analysis and reporting its conclusions. A comprehensive discussion of the analysis process is provided. Sample data sets and summaries of case study results are included. Conclusions are developed in this volume.

Volume II presents a description of the analysis approach. Data collection and data compilation methods are explained and the procedures for comparing and evaluating case studies are examined. Figures and tables are used to illustrate findings.

Volume III provides the time-series graphical representations of the 121 satellite deployment and failure scenarios that were the case studies of the analysis. The statistics and other tabulations that were used in the analysis are included.

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APPENDIX A

PHASES OF THE DATA COLLECTION AND THE PLOTTED SCENARIOS

DESCRIPTION OF THE PHASES OF THE MODELING

A. PHASE A

In this first phase, the basic assumptions usually made in planning and budgeting for the Polar-orbiting Operational Environmental Satellite (POES) are used:

- planned 24-month on-orbit life, and
- regularly scheduled launches at:
  - 18-month intervals for a one-satellite system, and
  - 12-month intervals for a two-satellite system.

Then, in sequential scenarios, launch and premature failures on orbit, both singly and in combinations, are introduced into the modeling. The number of failures of each type is varied from none to a number that we considered most likely, based on the history of the POES program since 1970. (See the discussions of probabilities in Appendix C.) In the case of the one-satellite system, two or three launch failures over a 15-year period, combined with two premature failures on-orbit, are considered about equally likely. For the two-satellite system, three or four launch failures, combined with three premature failures on-orbit in 15 years, are considered most likely. Given the history of the POES since 1970, numbers of failures larger or smaller than these are considered very likely. However, for analytical purposes, fewer failures of both types, as well as the unlikely (but still possible) situations in which two of the launch failures would be consecutive, were modeled in various combinations

The purpose in this phase of the modeling was to assess and quantify the effects of these combinations of failures on system performance [responsiveness to the needs of the National Weather Service (NWS) and other users of POES data], on the number of satellites launched, and on the unit cost to successfully acquire data from space. In this phase, no satellites are assumed to be launched following either type of failure.

Table A-1, shown on pages A-3 and A-4, lists 15 scenarios for a one-satellite system and 24 scenarios for a two-satellite system.

B. PHASE B

In this phase, replacement launches are called for after a launch failure, and changes in the designed on-orbit lifetimes are introduced into the modeling of both Case I and Case II scenarios. Replacement launches following a premature failure on-orbit are introduced in Phase D.

Table A-1

Scenarios in Phase A for the
Case I, one-satellite system

Scenario	Launch Failures	Premature Failures	Page Number in Appendix A
I-1	0	0	A-12
I-2	0	1	A-13
I-3	0	2	A-14
I-4	1	0	A-15
I-5	1	1	A-16
I-6	1	2	A-17
I-7	2	0	A-18
I-8	2	1	A-19
I-9	2	2	A-20
I-10	3	0	A-21
I-11	3	1	A-22
I-12	3	2	A-23
I-13	1+2	0	A-24
I-14	1+2	1	A-25
I-15	1+2	2	A-26

Note that when the numbers 1+2 appear under Launch Failures, the scenarios model the effects if two of the launch failures are consecutive.

Table A-1 (Continued)

Scenarios in Phase A for the
Case II, two-satellite system

Scenario	Launch Failures	Premature Failures	Page Number in Appendix A
II-1	0	0	A-27
II-2	0	1	A-28
II-3	0	2	A-29
II-4	0	3	A-30
II-5	1	0	A-31
II-6	1	1	A-32
II-7	1	2	A-33
II-8	1	3	A-34
II-9	2	0	A-35
II-10	2	1	A-36
II-11	2	2	A-37
II-12	2	3	A-38
II-13	3	0	A-39
II-14	3	1	A-40
II-15	3	2	A-41
II-16	3	3	A-42
II-17	4	0	A-43
II-18	4	1	A-44
II-19	4	2	A-45
II-20	4	3	A-46
II-21	2+2	0	A-47
II-22	2+2	1	A-48
II-23	2+2	2	A-49
II-24	2+2	3	A-50

Note that when the numbers 2+2 appear under Launch Failures, the scenarios model the effects if two of the launch failures are consecutive.

In the first group of scenarios, the on-orbit lifetimes are held at 24 months. The launch schedules are fixed at 18 months for a one-satellite system and 12 months for a two-satellite system. Replacement launches at 9 and 4 months for a one-satellite system, and at 6 and 4 months for a two-satellite system, are modeled.

The second group of scenarios extends the expected on-orbit life by 4 months to 28 months (the approximate average life of the recent POES that successfully achieved orbit is 30.5 months), and similarly extends by 4 months the fixed launch schedules for Case I and Case II scenarios (to 22 or 16 months, respectively). Following a launch failure, replacement launch schedules of 9 and 4, or 6 and 4, months are repeated for direct comparison with the first group of scenarios in this phase.

In Phase B and subsequent phases, only those assumed failures that produce the least negative impact on services to the users (no failures at all) and those combinations of launch and premature failures that appear to be the most likely, based on our analyses of probabilities, are modeled.

As a special Phase B analysis of the two-satellite system, a variation of Scenarios II-1, II-15, and II-16 was introduced in the modeling. A launch strategy was adopted under which the next satellite launched after a launch failure would always be placed in the afternoon orbit, even if the satellite that failed to achieve orbit had been intended for the morning orbit. Such a strategy "protects" the afternoon satellite that provides services most important to the NWS. This strategy, which is the one NOAA program managers would normally adopt, is modeled in Scenarios II-25, II-26, and II-27. The improvement in system performance statistics using this launch strategy was sufficiently great that this strategy was applied to all other Case II scenarios in Phase C and subsequent phases, although there are occasional circumstances in Phases D and E when the wise management of satellite resources will dictate an AM launch after a launch failure.

There are 15 Case I one-satellite scenarios and 18 Case II two-satellite scenarios in Phase B, as shown in Table A-2.

C. PHASE C

The relatively poor program/service performance of those scenarios in Phase B with fixed launch schedules of 22 and 16 months for Case I and Case II, respectively, suggested that the fixed launch schedules in Phase C should be changed to 20 and 14 months.

Table A-2

Scenarios in Phase B for the
Case I, one-satellite system

Scenario	Design Life (Months)	Fixed Launch (Months)	Call-up Launch (Months)	Launch Failures	Premature Failures	Page No. in App. A
I-16	24	18	9	0	0	A-51
I-17	24	18	9	2	2	A-52
I-18	24	18	9	3	2	A-53
I-19	24	18	4	0	0	A-54
I-20	24	18	4	2	2	A-55
I-21	24	18	4	3	2	A-56
I-22	28	22	0	0	0	A-57
I-23	28	22	0	2	2	A-58
I-24	28	22	0	3	2	A-59
I-25	28	22	9	0	0	A-60
I-26	28	22	9	2	2	A-61
I-27	28	22	9	3	2	A-62
I-28	28	22	4	0	0	A-63
I-29	28	22	4	2	2	A-64
I-30	28	22	4	3	2	A-65

Scenarios in Phase B for the
Case II, two-satellite system

Scenario	Design Life (Months)	Fixed Launch (Months)	Call-up Launch (Months)	Launch Failures	Premature Failures	Page No. in App. A
II-25	24	12	0	0	0	A-66
II-26	24	12	0	3	3	A-67
II-27	24	12	0	4	3	A-68
II-28	24	12	6	0	0	A-69
II-29	24	12	6	3	3	A-70
II-30	24	12	6	4	3	A-71
II-31	24	12	4	0	0	A-72
II-32	24	12	4	3	3	A-73
II-33	24	12	4	4	3	A-74
II-34	28	16	0	0	0	A-75
II-35	28	16	0	3	3	A-76
II-36	28	16	0	4	3	A-77
II-37	28	16	6	0	0	A-78
II-38	28	16	6	3	3	A-79
II-39	28	16	6	4	3	A-80
II-40	28	16	4	0	0	A-81
II-41	28	16	4	3	3	A-82
II-42	28	16	4	4	3	A-83

The rationale for this selection is that the increases in the launch intervals are one-half the 4-month extension in on-orbit lifetimes.

The last six Phase B Case I one-satellite scenarios with 9- and 4-month replacement launch schedules (Scenarios I-25 through I-30) were modeled assuming 20-month fixed launch schedules. Similarly, the last six Phase B Case II two-satellite scenarios with 6- and 4-month replacement launch schedules (Scenarios II-37 through II-42) were modeled with 14-month fixed launch schedules.

There are six Phase C scenarios for each case, as can be seen in Table A-3.

Table A-3

Scenarios in Phase C for the Case I, one-satellite system

Scenario	Design Life (Months)	Fixed Launch Schedule (Months)	Call-up Launch Schedule (Months)	Launch Failures	Premature Failures	Page No. in App. A
I-31	28	20	9	0	0	A-84
I-32	28	20	9	2	2	A-85
I-33	28	20	9	3	2	A-86
I-34	28	20	4	0	0	A-87
I-35	28	28	4	2	2	A-88
I-36	28	20	4	3	2	A-89

Scenarios in Phase C for the Case II, two-satellite system

Scenario	Design Life (Months)	Fixed Launch Schedule (Months)	Call-up Launch Schedule (Months)	Launch Failures	Premature Failures	Page No. in App. A
II-43	28	14	6	0	0	A-90
II-44	28	14	6	3	3	A-91
II-45	28	14	6	4	3	A-92
II-46	28	14	4	0	0	A-93
II-47	28	14	4	3	3	A-94
II-48	28	14	4	4	3	A-95

D. PHASE D

The next set of assumptions tested in the modeling relates to the nature of the on-orbit premature failures. In earlier phases we assumed that all premature failures would be sudden, without warning, and catastrophic. This was the nature of the failure of NOAA 8.

Yet, from the perspective of probabilities, it is perhaps more likely that there will be a partial early failure, such as occurred with NOAA 6, the only POES of the current generation of satellites that suffered a partial failure calling for the satellite's replacement before it became totally unusable.

In Phase D it was assumed that the same number of premature failures that were modeled in Phase C would occur, but that the failures would be less than catastrophic, and that there would be some early evidence in the telemetry data that the satellite was doing poorly and that failure was impending. We assumed in our modeling that this early evidence would appear 4 months prior to the satellite's failure to acquire Prime Mission Data (images and soundings). As a result of detecting this early evidence, a replacement satellite would be launched on the same schedule assumed for replacements after a launch failure. In Phase D, all other variables considered in Phase C (design life, fixed launch schedules, replacement launch schedules, etc.) were applied consistently. Therefore, the impact on service statistics and the unit cost to successfully acquire Prime Mission Data can be evaluated if different assumptions are made about the nature of the early failure mechanisms.

In addition to this part of the analysis, three Phase B Case II scenarios (Scenarios II-31, II-32, and II-33, which assumed a 24-month design life and 12-month launch intervals) were modeled again in Phase D Scenarios II-49, II-50, and II-51, applying the assumption of early indications of premature failure. The purpose was to compare directly the performance statistics and the unit cost to acquire data if the satellite program envisioned in conventional budgeting and planning for a two-satellite system was to experience premature failures with early evidence, rather than the sudden failure modeled in Phase B.

The six Case I and nine Case II Phase D scenarios are listed in Table A-4.

Table A-4

Scenarios in Phase D for the
Case I, one-satellite system

Scenario	Design Life (Months)	Fixed Launch Schedule (Months)	Call-up Launch Schedule (Months)	Launch Failures	Premature Failures	Page No. in Appn. A
I-37	28	20	9	0	0	A-96
I-38	28	20	9	2	2	A-97
I-39	28	20	9	3	2	A-98
I-40	28	20	4	0	0	A-99
I-41	28	20	4	2	2	A-100
I-42	28	20	4	3	2	A-101

Scenarios in Phase D for the
Case II, two-satellite system

Scenario	Design Life (Months)	Fixed Launch Schedule (Months)	Call-up Launch Schedule (Months)	Launch Failures	Premature Failures	Page No. in Appn. A
II-49	24	12	4	0	0	A-102
II-50	24	12	4	3	3	A-103
II-51	24	12	4	4	3	A-104
II-52	28	14	6	0	0	A-105
II-53	28	14	6	3	3	A-106
II-54	28	14	6	4	3	A-107
II-55	28	14	4	0	0	A-108
II-56	28	14	4	3	3	A-109
II-57	28	14	4	4	3	A-110

E. PHASE E

Two forms of extended satellite on-orbit lifetimes that exceed the present design lifetimes of 24 months were modeled in Phase E:

- lifetimes of 32 months (the average life of the current POES that were orbited successfully was approximately 30.5 months), examined specifically to determine the impact on performance statistics and costs if improved reliability resulted in reductions in overall long-term system costs, and

- lifetimes that exceed the nominal design life, based on experiences of the current POES satellites, having had on-orbit lifetimes of 29, 41, 37, and 15 months.

For the Case I and Case II systems, both of these on-orbit lifetime assumptions were modeled with a 4-month launch call-up following a launch failure or a premature failure.

The Phase E modeling of satellites with a 32-month design life followed the patterns of failure used in earlier phases. The strategy of launching into the afternoon orbit after a launch failure was not always applied in Phase E. There were several situations, when following the POES history, where a different strategy resulted in better use of the satellites.

Two variations were examined in the modeling of satellite scenarios with 29-41-37-15-month lifetimes (this cycle repeated over the 15 years of the analysis). The first assumed that there would be no early indications of failure on-orbit. The second assumed that telemetry data would provide indications 4 months early that a total failure was likely for satellites with 29-, 41-, or 37-month lifetimes. Omitting early indications of failure of 15-month satellites closely follows history, since NOAA 8 failed without warning.

The final variations modeled for both satellite systems used the exact history of the current POES--satellites with lifetimes of 29-41-0-37-15 months, where the zero represents the launch failure of NOAA B in 1980. Modeling with and without early indications of on-orbit failure, as discussed above, was repeated.

There are 11 Phase E scenarios for each case, as shown in Table A-5.

Table A-5

Scenarios in Phase E for the Case I, one-satellite system

Scenario	Design Life (Months)	Fixed Launch Schedule (Months)	Call-up Launch Schedule (Months)	Launch Failures	Premature Failures	Page No. in Appn. A
I-43	32	22	4	0	0	A-111
I-44	32	22	4	2	2	A-112
I-45	32	22	4	3	2	A-113
I-46	29-33-37-15	On Failure	4	0	N/A*	A-114
I-47	29-33-37-15	On Failure	4	2	N/A*	A-115
I-48	29-33-37-15	On Failure	4	3	N/A*	A-116
I-49	29-33-37-15	On Failure	4	0	N/A**	A-117
I-50	29-33-37-15	On Failure	4	2	N/A**	A-118
I-51	29-33-37-15	On Failure	4	3	N/A**	A-119
I-52	29-33-0-37-15	On Failure	4	N/A	N/A*	A-120
I-53	29-33-0-37-15	On Failure	4	N/A	N/A**	A-121

Scenarios in Phase E for the Case II, two-satellite system

Scenario	Design Life (Months)	Fixed Launch Schedule (Months)	Call-up Launch Schedule (Months)	Launch Failures	Premature Failures	Page No. in Appn. A
II-58	32	16	4	0	0	A-122
II-59	32	16	4	3	3	A-123
II-60	32	16	4	4	3	A-124
II-61	29-33-37-15	On Failure	4	0	N/A*	A-125
II-62	29-33-37-15	On Failure	4	3	N/A*	A-126
II-63	29-33-37-15	On Failure	4	4	N/A*	A-127
II-64	29-33-37-15	On Failure	4	0	N/A**	A-128
II-65	29-33-37-15	On Failure	4	3	N/A**	A-129
II-66	29-33-37-15	On Failure	4	4	N/A**	A-130
II-67	29-33-0-37-15	On Failure	4	N/A	N/A*	A-131
II-68	29-33-0-37-15	On Failure	4	N/A	N/A**	A-132

* No early indications of on-orbit failure.

** Indications 4 months early that an on-orbit satellite is likely to fail.

PLOTTED SCENARIOS

Phase A
Scenario I-1

24-Month Design Life
18-Month Launch Interval
No Replacement Launches

No Random Launch Failures
No Premature Failures

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
Ssssssssssssssssssssss
                 18                    42
2            (2) Sssssssssssssssssssssss
                                36                    60
3                          (3) Sssssssssssssssssssssssss
                                                 54                    78
4                                          (4) Sssssssssssssssssssssssss
                                                                 72                    96
5                                                        (5) Sssssssssssssssssssssssss
                                                                                 90                   114
6                                                                       (6) Sssssssssssssssssssssssss
                                                                                                 108        (120)
7                                                                                          (7) Ssssssssssss
```

```
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                             132
7 continued        sssssssssssss
                       126                   150
8                   (8) Sssssssssssssssssssssssss
                                     144                   168
9                                (9) Sssssssssssssssssssssssss
                                                   162             (180)
10                                            (10) Sssssssssssssssssssss  186
                                                                     180
11                                                              (11) S  204
```

LEGEND

S = Launch of a satellite in a one-satellite system

Phase A
Scenario I-2

```
24-Month Design Life                    |          No Random Launch Failures
18-Month Launch Interval                |              One Premature Failure
No Replacement Launches                 |     (12 Months Before Design Life)
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
Ssssssssssssssssssssss
                18                  42
2           (2) Sssssssssssssssssssssss
                                36        48
3                           (3) Sssssssssss]
                                                54                  78
4                                           (4) Sssssssssssssssssssssss
                                                                72                  96
5                                                       (5) Sssssssssssssssssssssss
                                                                                90                  114
6                                                                       (6) Sssssssssssssssssssssss
                                                                                                108       (120)
7                                                                                                   (7) Sssssssssssss
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                            132
7 continued        sssssssssssss
                      126                 150
8                (8) Sssssssssssssssssssssss
                                144                 168
9                           (9) Sssssssssssssssssssssss
                                                162             (180)
10                                      (10) Sssssssssssssssssss  186
                                                                180
11                                                      (11) S  204
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
] = Premature failure on-orbit

Phase A
Scenario I-3

```
24-Month Design Life                    |          No Random Launch Failures
18-Month Launch Interval                |             Two Premature Failures
No Replacement Launches                 |     (12 Months Before Design Life)
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
Ssssssssssssssssssssss
                18                  42
2            (2) Sssssssssssssssssssssss
                            36                  60
3                        (3) Sssssssssssssssssssssss
                                            54                  78
4                                     (4) Sssssssssssssssssssssss
                                                        72                  96
5                                                (5) Sssssssssssssssssssssss
                                                                    90        102
6                                                            (6) Sssssssssssss]
                                                                                  108       (120)
7                                                                                     (7) Sssssssssssss
-----------------------------------------------------------------------------------------------------------

MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                            132
7 continued       sssssssssssss
                      126       138
8                (8) Sssssssssssss]
                                144                 168
9                            (9) Sssssssssssssssssssssss
                                                162           (180)
10                                        (10) Sssssssssssssssssss  186
                                                              180
11                                                      (11) S  204
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
] = Premature failure on-orbit

Phase A
Scenario I-4

```
24-Month Design Life                    |          One Random Launch Failure
18-Month Launch Interval                |              No Premature Failures
No Replacement Launches                 |
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
SSSSSSSSSSSSSSSSSSSSSS
               18
2           (2) 0
                                36                    60
3                          (3) SSSSSSSSSSSSSSSSSSSSSSS
                                                54                    78
4                                          (4) SSSSSSSSSSSSSSSSSSSSSSS
                                                                72                    96
5                                                       (5) SSSSSSSSSSSSSSSSSSSSSSS
                                                                                  90                    114
6                                                                         (6) SSSSSSSSSSSSSSSSSSSSSSS
                                                                                                108       (120)

7                                                                                                   (7) SSSSSSSSSSS
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
7 continued       SSSSSSSSSSSS
                      126                   150
8                 (8) SSSSSSSSSSSSSSSSSSSSSSS
                                144                   168
9                          (9) SSSSSSSSSSSSSSSSSSSSSSS
                                                162             (180)
10                                        (10) SSSSSSSSSSSSSSSSSS  186
                                                                180
11                                                        (11) S  204
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure

Phase A
Scenario I-5

24-Month Design Life
18-Month Launch Interval
No Replacement Launches

One Random Launch Failure
One Premature Failure
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
Ssssssssssssssssssssss
                18                    42
2           (2) Sssssssssssssssssssssss
                            36                    60
3                       (3) Sssssssssssssssssssssss
                                          54
4                                     (4) O
                                                   72                    96
5                                                (5) Sssssssssssssssssssssss
                                                                 90                    114
6                                                            (6) Sssssssssssssssssssssss
                                                                                 108        120

7                                                                                     (7) Ssssssssssss]
```

```
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
8                 (8) Sssssssssssssssssssssss
                                   144       156
9                                (9) Ssssssssssss]
                                                162            (180)
10                                           (10) Sssssssssssssssssss  186
                                                                180
11                                                          (11) S  204
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
] = Premature failure on-orbit

Phase A
Scenario I-6

```
24-Month Design Life                    |          One Random Launch Failure
18-Month Launch Interval                |             Two Premature Failures
No Replacement Launches                 |     (12 Months Before Design Life)
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                    24
SSSSSSSSSSSSSSSSSSSSSS
               18                   42
2           (2) SSSSSSSSSSSSSSSSSSSSSSS
                            36                   60
3                        (3) SSSSSSSSSSSSSSSSSSSSSSS
                                          54
4                                      (4) O
                                                     72                   96
5                                                (5) SSSSSSSSSSSSSSSSSSSSSSS
                                                                     90        102
6                                                            (6) SSSSSSSSSSSJ
                                                                                   108       (120)
7                                                                                (7) SSSSSSSSSSSS
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                            132
7 continued        SSSSSSSSSSSS
                      126                 150
8                  (8) SSSSSSSSSSSSSSSSSSSSSSS
                                144                 168
9                            (9) SSSSSSSSSSSSSSSSSSSSSSS
                                            162            (180)
10                                     (10) SSSSSSSSSSSSSSSSSS  186
                                                           180
11                                                     (11) S  204
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
J = Premature failure on-orbit

Phase A
Scenario I-7

24-Month Design Life
18-Month Launch Interval
No Replacement Launches

Two Random Launch Failures
No Premature Failures

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
Ssssssssssssssssssssss
                 18
2            (2) 0
                                36                    60
3                          (3) Sssssssssssssssssssssssss
                                                 54
4                                           (4) 0
                                                                 72                    96
5                                                        (5) Sssssssssssssssssssssssss
                                                                                 90                   114
6                                                                        (6) Ssssssssssssssssssssssss
                                                                                                 108        (120)

7                                                                                                     (7) Ssssssssssss
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                                 132
7 continued        sssssssssssss
                      126                 150
8                  (8) Sssssssssssssssssssssssss
                                   144                 168
9                             (9) Sssssssssssssssssssssssss
                                                 162            (180)
10                                         (10) Sssssssssssssssssssss  186
                                                                 180
11                                                          (11) S  204
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure

Phase A
Scenario I-8

24-Month Design Life
18-Month Launch Interval
No Replacement Launches

Two Random Launch Failures
One Premature Failure
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
SSSSSSSSSSSSSSSSSSSSSS
                 18
2            (2) O
                                36                    60
3                          (3) SSSSSSSSSSSSSSSSSSSSSSSS
                                                 54
4                                           (4) O
                                                                 72                    96
5                                                        (5) SSSSSSSSSSSSSSSSSSSSSSSS
                                                                                  90        102
6                                                                          (6) SSSSSSSSSSSS]
                                                                                                 108       (120)
7                                                                                                     (7) SSSSSSSSSSS
```

```
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                                 132
7 continued       SSSSSSSSSSSS
                      126                 150
8                (8) SSSSSSSSSSSSSSSSSSSSSSS
                                144                 168
9                          (9) SSSSSSSSSSSSSSSSSSSSSSS
                                                162            (180)
10                                        (10) SSSSSSSSSSSSSSSSSS  186
                                                                180
11                                                        (11) S  204
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure

Phase A
Scenario I-9

```
24-Month Design Life                    |        Two Random Launch Failures
18-Month Launch Interval                |            Two Premature Failures
No Replacement Launches                 |   (12 Months Before Design Life)
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
Ssssssssssssssssssssss
                 18
2            (2) 0
                                36                  60
3                           (3) Sssssssssssssssssssssss
                                                54
4                                         (4) 0
                                                                  72                  96
5                                                            (5) Sssssssssssssssssssssss
                                                                                 90        102
6                                                                        (6) Sssssssssssss]
                                                                                                 108       (120)
7                                                                                                     (7) Sssssssssss
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
7 continued       sssssssssssss
                      126       138
8                (8) Sssssssssssss]
                                144                 168
9                            (9) Sssssssssssssssssssssss
                                                162            (180)
10                                        (10) Sssssssssssssssssss  186
                                                               180
11                                                        (11) S  204
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
] = Premature failure on-orbit

Phase A
Scenario I-10

24-Month Design Life
18-Month Launch Interval
No Replacement Launches

Three Random Launch Failures
No Premature Failures

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
SSSSSSSSSSSSSSSSSSSSSS
                 18
2            (2) 0
                                 .
                                36                    60
3                          (3) SSSSSSSSSSSSSSSSSSSSSSSSS
                                             54
4                                       (4) 0
                                                   72                    96
5                                                (5) SSSSSSSSSSSSSSSSSSSSSSSSS
                                                                    90                   114
6                                                                (6) SSSSSSSSSSSSSSSSSSSSSSSSS
                                                                                    108        (120)
7                                                                                                (7) SSSSSSSSSSSS
```

```
MONTHS              120       130       140       150       160       170       180
                    |         |         |         |         |         |         |
                                132
7 continued         SSSSSSSSSSSSS
                        126                   150
8                   (8) SSSSSSSSSSSSSSSSSSSSSSSSS
                                     144
9                                (9) 0
                                                162            (180)
10                                           (10) SSSSSSSSSSSSSSSSSS  186
                                                             180
11                                                        (11) S  204
```

LEGEND

S = Launch of a satellite in a one-satellite system
0 = Launch failure

Phase A
Scenario I-11

24-Month Design Life
18-Month Launch Interval
No Replacement Launches

Three Random Launch Failures
One Premature Failure
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
Ssssssssssssssssssssss
                 18
2            (2) 0
                                36                    60
3                          (3) Sssssssssssssssssssssssss
                                                54
4                                           (4) 0
                                                          72                    96
5                                                   (5) Sssssssssssssssssssssssss
                                                                        90        102
6                                                                (6) Ssssssssssss]
                                                                                        108       (120)

7                                                                                   (7) Sssssssssss
```

```
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                            132
7 continued       sssssssssssss
                      126                 150
8                  (8) Ssssssssssssssssssssssss
                                   144
9                             (9) 0
                                                162            (180)
10                                         (10) Sssssssssssssssssssssss  186
                                                                180
11                                                        (11) S  204
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
] = Premature failure on-orbit

Phase A
Scenario I-12

```
24-Month Design Life                      |      Three Random Launch Failures
18-Month Launch Interval                  |          Two Premature Failures
No Replacement Launches                   |   (12 Months Before Design Life)
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
Ssssssssssssssssssssss
                 18
2            (2) 0
                                36                    60
3                          (3) Sssssssssssssssssssssssss
                                                 54
4                                           (4) 0
                                                                 72                    96
5                                                          (5) Sssssssssssssssssssssssss
                                                                                 90        102
6                                                                          (6) Ssssssssssss]
                                                                                                   108       (120)
7                                                                                                (7) Ssssssssssss
-------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
7 continued       sssssssssssss
                      126       138
8                (8) Ssssssssssss]
                                    144
9                                (9) 0
                                                162             (180)
10                                          (10) Sssssssssssssssssss  186
                                                                180
11                                                         (11) S  204
-------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
0 = Launch failure
] = Premature failure on-orbit

Phase A
Scenario I-13

24-Month Design Life
18-Month Launch Interval
No Replacement Launches

Three Launch Failures
(Two Consecutive)
No Premature Failures

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
SSSSSSSSSSSSSSSSSSSSSS
                 18
2            (2) 0
                            36                    60
3                       (3) SSSSSSSSSSSSSSSSSSSSSS
                                          54                    78
4                                    (4) SSSSSSSSSSSSSSSSSSSSSS
                                                     72                    96
5                                              (5) SSSSSSSSSSSSSSSSSSSSSS
                                                                 90                    114
6                                                          (6) SSSSSSSSSSSSSSSSSSSSSS
                                                                                 108        (120)

7                                                                                      (7) SSSSSSSSSSS
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                             132
7 continued       SSSSSSSSSSSSS
                      126                   150
8                (8) SSSSSSSSSSSSSSSSSSSSSSS
                                   144
9                             (9) 0
                                                162
10                                         (10) 0
                                                                180
11                                                        (11) S  204
```

LEGEND

S = Launch of a satellite in a one-satellite system
0 = Launch failure

Phase A
Scenario I-14

24-Month Design Life
18-Month Launch Interval
No Replacement Launches

Three Launch Failures
(Two Consecutive)
One Premature Failure
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
Ssssssssssssssssssssss
                 18
2            (2) 0
                                36                  60
3                          (3) Sssssssssssssssssssssssss
                                          54                  78
4                                   (4) Ssssssssssssssssssssssss
                                                     72                  96
5                                            (5) Sssssssssssssssssssssssss
                                                                 90       102
6                                                         (6) Ssssssssssssl
                                                                                  108       (120)
7                                                                                      (7) Sssssssssssss
```

```
MONTHS            120       130       140       150       160       170       180
                  |         |
                            132
7 continued       sssssssssssss
                      126                 150
8                 (8) Ssssssssssssssssssssssssss
                                144
9                           (9) 0
                                                162
10                                        (10) 0
                                                          180
11                                                   (11) S  204
```

LEGEND

S = Launch of a satellite in a one-satellite system
0 = Launch failure
] = Premature failure on-orbit

Phase A
Scenario I-15

24-Month Design Life
18-Month Launch Interval
No Replacement Launches

Three Launch Failures
(Two Consecutive)
Two Premature Failures
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
SSSSSSSSSSSSSSSSSSSSSS
                 18
2            (2) 0
                                36                  60
3                          (3) SSSSSSSSSSSSSSSSSSSSSSSS
                                          54                  78
4                                    (4) SSSSSSSSSSSSSSSSSSSSSSS
                                                   72                  96
5                                             (5) SSSSSSSSSSSSSSSSSSSSSSS
                                                                  90        102
6                                                          (6) SSSSSSSSSSS]
                                                                                  108       (120)
7                                                                                      (7) SSSSSSSSSSS
```

```
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                             132
7 continued       SSSSSSSSSSSS
                      126       138
8                (8) SSSSSSSSSSS]
                                144
9                          (9) 0
                                        162
10                                (10) 0
                                                  180
11                                            (11) S  204
```

LEGEND

S = Launch of a satellite in a one-satellite system
0 = Launch failure
] = Premature failure on-orbit

Phase A
Scenario II-1

```
24-Month Design Life                    |          No Random Launch Failures
12-Month Launch Interval                |              No Premature Failures
No Replacement Launches                 |
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                   24
Pppppppppppppppppppppp
         12                  36
2     (2) Aaaaaaaaaaaaaaaaaaaaaaaa
                    24                  48
3                (3) Pppppppppppppppppppppppp
                            36                  60
4                        (4) Aaaaaaaaaaaaaaaaaaaaaaaa
                                    48                  72
5                                (5) Pppppppppppppppppppppppp
                                            60                  84
6                                        (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                    72                  96
7                                                (7) Pppppppppppppppppppppppp
                                                                84                  108
8                                                            (8) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                            96                  120

9                                                                        (9) Pppppppppppppppppppppppp
                                                                                        108       (120)
10                                                                                   (10) Aaaaaaaaaaaaa
-------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132.
10 continued      aaaaaaaaaaaaa
                  120                 144
11             (11) Pppppppppppppppppppppppp
                            132                 156
12                     (12) Aaaaaaaaaaaaaaaaaaaaaaaa
                                    144                 168
13                                (13) Pppppppppppppppppppppppp
                                                156                 180
14                                            (14) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                            168       (180)
15                                                       (15) Pppppppppppp 192
                                                                      180
16                                                                (16) A 224
-------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit

Phase A
Scenario II-2

```
24-Month Design Life                    |          No Random Launch Failures
12-Month Launch Interval                |                One Premature Failure
No Replacement Launches                 |     (12 Months Before Design Life)
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                   24
Pppppppppppppppppppppp
         12         24
2     (2) Aaaaaaaaaaa]
                    24                  48
3                (3) Pppppppppppppppppppppppp
                         36                  60
4                        (4) Aaaaaaaaaaaaaaaaaaaaaaaa
                                     48                  72
5                                (5) Pppppppppppppppppppppppp
                                                 60                  84
6                                                (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                             72                  96
7                                                         (7) Pppppppppppppppppppppppp
                                                                         84                  108
8                                                                     (8) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                                     96                  120
9                                                                                 (9) Pppppppppppppppppppppppp
                                                                                                 108       (120)
10                                                                                            (10) Aaaaaaaaaaaaa
-------------------------------------------------------------------------------
MONTHS           120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaaa
                 120                 144
11            (11) Pppppppppppppppppppppppp
                            132                 156
12                       (12) Aaaaaaaaaaaaaaaaaaaaaaaa
                                     144                 168
13                                (13) Pppppppppppppppppppppppp
                                                 156                 180
14                                            (14) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                             168       (180)
15                                                        (15) Pppppppppppp ] 192
                                                                         180
16                                                                   (16) A ] 224
-------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
] = Premature failure on-orbit

Phase A
Scenario II-3

```
24-Month Design Life                    |        No Random Launch Failures
12-Month Launch Interval                |           Two Premature Failures
No Replacement Launches                 |   (12 Months Before Design Life)
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
         12         24
2     (2) Aaaaaaaaaaa]
                      24                  48
3                (3) Pppppppppppppppppppppppp
                              36                  60
4                         (4) Aaaaaaaaaaaaaaaaaaaaaaaa
                                      48                  72
5                                (5) Pppppppppppppppppppppppp
                                                60        72
6                                           (6) Aaaaaaaaaaaa]
                                                      72                  96
7                                                (7) Pppppppppppppppppppppppp
                                                                84                  108
8                                                           (8) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                      96                  120

9                                                                        (9) Pppppppppppppppppppppppp
                                                                                  108       (120)
10                                                                           (10) Aaaaaaaaaaaaa
-------------------------------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaaa
                  120                 144
11           (11) Pppppppppppppppppppppppp
                            132                 156
12                     (12) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                      144                 168
13                                (13) Pppppppppppppppppppppppp
                                                156                 180
14                                           (14) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                            168       (180)
15                                                     (15) Pppppppppppp ] 192
                                                                      180
16                                                            (16) A ] 224
-------------------------------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
] = Premature failure on-orbit

Phase A
Scenario II-4

```
24-Month Design Life                    |          No Random Launch Failures
12-Month Launch Interval                |           Three Premature Failures
No Replacement Launches                 |     (12 Months Before Design Life)
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                   24
Pppppppppppppppppppppp
         12         24
2     (2) Aaaaaaaaaaaa]
                    24                  48
3                (3) Pppppppppppppppppppppppp
                             36                  60
4                         (4) Aaaaaaaaaaaaaaaaaaaaaaaa
                                     48                  72
5                                 (5) Pppppppppppppppppppppppp
                                                 60      72
6                                            (6) Aaaaaaaaaaaa]
                                                         72                  96
7                                                    (7) Pppppppppppppppppppppppp
                                                                     84                  108
8                                                                (8) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                                 96                  120

9                                                                                (9) Pppppppppppppppppppppppp
                                                                                                 108       (120)
10                                                                                           (10) Aaaaaaaaaaaa
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaa
                  120                 144
11             (11) Pppppppppppppppppppppppp
                            132                 156
12                     (12) Aaaaaaaaaaaaaaaaaaaaaaaa
                                    144       156
13                                (13) Pppppppppppp]
                                                156                 180
14                                           (14) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                            168       (180)
15                                                     (15) Pppppppppppp ] 192
                                                                      180
16                                                                (16) A ] 224
-----------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
J = Premature failure on-orbit

Phase A
Scenario II-5

24-Month Design Life
12-Month Launch Interval
No Replacement Launches

One Random Launch Failure
No Premature Failures

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
PPPPPPPPPPPPPPPPPPPPPPP
          12                    36
2      (2) AAAAAAAAAAAAAAAAAAAAAAAAA
                      24
3                (3) 0
                                36                    60
4                           (4) AAAAAAAAAAAAAAAAAAAAAAAAAAAAA
                                          48                    72
5                                     (5) PPPPPPPPPPPPPPPPPPPPPPPPPPP
                                                    60                    84
6                                                (6) AAAAAAAAAAAAAAAAAAAAAAAAAAAAA
                                                                72                    96
7                                                           (7) PPPPPPPPPPPPPPPPPPPPPPPPPPP
                                                                                84                    108
8                                                                          (8) AAAAAAAAAAAAAAAAAAAAAAAAAAAAA
                                                                                                96                    120

9                                                                                        (9) PPPPPPPPPPPPPPPPPPPPPPPPPPP
                                                                                                                108       (120)
10                                                                                                     (10) AAAAAAAAAAAAA
```

```
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                                132
10 continued       AAAAAAAAAAAAA
                  120                   144
11            (11) PPPPPPPPPPPPPPPPPPPPPPPPPP
                            132                   156
12                     (12) AAAAAAAAAAAAAAAAAAAAAAAAAAA
                                        144                   168
13                                (13) PPPPPPPPPPPPPPPPPPPPPPPPPPP
                                                    156                   180
14                                            (14) AAAAAAAAAAAAAAAAAAAAAAAAAAAA
                                                                168       (180)
15                                                        (15) PPPPPPPPPPPPP ] 192
                                                                            180
16                                                                    (16) A ] 224
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure

Phase A
Scenario II-6

```
24-Month Design Life                          |          One Random Launch Failure
12-Month Launch Interval                      |               One Premature Failure
No Replacement Launches                       |     (12 Months Before Design Life)
-----------------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
         12           24
2     (2) Aaaaaaaaaaaa]
                      24
3                (3) 0
                                36                  60
4                           (4) Aaaaaaaaaaaaaaaaaaaaaaaa
                                        48                  72
5                                   (5) Pppppppppppppppppppppppp
                                                60                  84
6                                           (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                        72                  96
7                                                   (7) Pppppppppppppppppppppppp
                                                                84                  108
8                                                           (8) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                        96                  120
9                                                                           (9) Pppppppppppppppppppppppp
                                                                                        108         (120)
10                                                                                  (10) Aaaaaaaaaaaaa
-----------------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaaa
                  120                 144
11           (11) Pppppppppppppppppppppppp
                            132                 156
12                     (12) Aaaaaaaaaaaaaaaaaaaaaaaa
                                    144                 168
13                                (13) Pppppppppppppppppppppppp
                                                156                 180
14                                          (14) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                            168         (180)
15                                                      (15) Pppppppppppp ] 192
                                                                        180
16                                                                (16) A ] 224
-----------------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Premature failure on-orbit

Phase A
Scenario II-7

```
24-Month Design Life                      |          One Random Launch Failure
12-Month Launch Interval                  |              Two Premature Failures
No Replacement Launches                   |     (12 Months Before Design Life)
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                   24
Pppppppppppppppppppppp
         12         24
2      (2) Aaaaaaaaaaaa]
                    24
3                (3) 0
                              36                  60
4                          (4) Aaaaaaaaaaaaaaaaaaaaaaaa
                                        48                  72
5                                   (5) Pppppppppppppppppppppppp
                                                    60                  84
6                                               (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                72          84
7                                                           (7) Pppppppppppp]
                                                                            84                  108
8                                                                       (8) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                                        96                  120

9                                                                                   (9) Pppppppppppppppppppppppp
                                                                                                    108       (120)
10                                                                                            (10) Aaaaaaaaaaaaa
-------------------------------------------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaaa
                 120                 144
11            (11) Pppppppppppppppppppppppp
                            132                 156
12                     (12) Aaaaaaaaaaaaaaaaaaaaaaaa
                                        144                 168
13                                (13) Pppppppppppppppppppppppp
                                                    156                 180
14                                            (14) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                168       (180)
15                                                        (15) Pppppppppppp ] 192
                                                                        180
16                                                                (16) A ] 224
-------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Premature failure on-orbit

Phase A
Scenario II-8

```
24-Month Design Life                    |          One Random Launch Failure
12-Month Launch Interval                |           Three Premature Failures
No Replacement Launches                 |     (12 Months Before Design Life)
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
         12           24
2     (2) Aaaaaaaaaaa]
                      24
3                (3) 0
                            36                    60
4                       (4) Aaaaaaaaaaaaaaaaaaaaaaaa
                                      48                    72
5                                (5) Pppppppppppppppppppppppp
                                                60                    84
6                                           (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                          72         84
7                                                    (7) Pppppppppppp]
                                                                     84                    108
8                                                           (8) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                              96                    120

9                                                                                (9) Pppppppppppppppppppppppp
                                                                                                  108       (120
10                                                                                     (10) Aaaaaaaaaaaaa
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaaa
                  120                 144
11           (11) Pppppppppppppppppppppppp
                            132                 156
12                     (12) Aaaaaaaaaaaaaaaaaaaaaaaa
                                      144                 168
13                                (13) Pppppppppppppppppppppppp
                                                  156       168
14                                           (14) Aaaaaaaaaaaa]
                                                            168       (180)
15                                                     (15) Pppppppppppp ] 192
                                                                     180
16                                                            (16) A ] 224
-----------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Premature failure on-orbit

Phase A
Scenario II-9

```
24-Month Design Life                    |        Two Random Launch Failures
12-Month Launch Interval                |            No Premature Failures
No Replacement Launches                 |
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
         12                      36
2     (2) Aaaaaaaaaaaaaaaaaaaaaaaa
                      24
3                (3) 0
                                36                      60
4                           (4) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                          48
5                                    (5) 0
                                                        60                      84
6                                                  (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                72                      96
7                                                          (7) Pppppppppppppppppppppppp
                                                                                84                      108
8                                                                        (8) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                                96                      120

9                                                                                                   (9) Pppppppppppppppppppppppp
                                                                                                                        108       (120)
10                                                                                                            (10) Aaaaaaaaaaaaa
-------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                            132
10 continued       aaaaaaaaaaaaa
                  120                     144
11           (11) Pppppppppppppppppppppppp
                            132                     156
12                     (12) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                      144                     168
13                                (13) Pppppppppppppppppppppppp
                                                      156                     180
14                                            (14) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                                168       (180)
15                                                      (15) Pppppppppppp ] 192
                                                                          180
16                                                                (16) A ] 224
-------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure

Phase A
Scenario II-10

24-Month Design Life
12-Month Launch Interval
No Replacement Launches

Two Random Launch Failures
One Premature Failure
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
         12           24
2     (2) Aaaaaaaaaaaa]
                      24
3                (3) 0
                                36                    60
4                          (4) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                          48
5                                    (5) 0
                                                      60                    84
6                                                (6) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                                 72                    96
7                                                         (7) Pppppppppppppppppppppppp
                                                                                84                    108
8                                                                      (8) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                      96                    120
9                                                                                          (9) Pppppppppppppppppppppppp
                                                                                                        108       (120)
10                                                                                                (10) Aaaaaaaaaaaaa
MONTHS           120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaaa
                 120                 144
11          (11) Pppppppppppppppppppppppp
                           132                 156
12                    (12) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                     144                 168
13                              (13) Pppppppppppppppppppppppp
                                                156                 180
14                                        (14) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                            168       (180)
15                                                   (15) Pppppppppppppp I 192
                                                                      180
16                                                            (16) A I 224
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
I = Premature failure on-orbit

Phase A
Scenario II-11

```
24-Month Design Life                    |        Two Random Launch Failures
12-Month Launch Interval                |            Two Premature Failures
No Replacement Launches                 |    (12 Months Before Design Life)
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
          12          24
2      (2) Aaaaaaaaaaaa]
                      24
3                (3) 0
                            36                    60
4                       (4) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                     48
5                                (5) 0
                                                  60                    84
6                                             (6) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                            72                    96
7                                                      (7) Pppppppppppppppppppppppp
                                                                          84        96
8                                                                   (8) Aaaaaaaaaaaa]
                                                                                    96                    120

9                                                                                (9) Pppppppppppppppppppppppp
                                                                                              108       (120)
10                                                                                     (10) Aaaaaaaaaaaaa
-------------------------------------------------------------------------------------------------------------------

MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaaa
                 120                 144
11            (11) Pppppppppppppppppppppppp
                            132                 156
12                     (12) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                     144                 168
13                                (13) Pppppppppppppppppppppppp
                                                156                 180
14                                           (14) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                            168       (180)
15                                                     (15) Pppppppppppp ] 192
                                                                     180
16                                                            (16) A ] 224
-------------------------------------------  ---------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Premature failure on-orbit

Phase A
Scenario II-12

```
24-Month Design Life                    |        Two Random Launch Failures
12-Month Launch Interval                |          Three Premature Failures
No Replacement Launches                 |     (12 Months Before Design Life)
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120|
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
         12         24
2     (2) Aaaaaaaaaaa]
                      24
3                (3) 0
                                36                  60
4                           (4) Aaaaaaaaaaaaaaaaaaaaaaaa
                                          48
5                                    (5) 0
                                                    60                  84
6                                              (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                             72                  96
7                                                      (7) Pppppppppppppppppppppp
                                                                         84      96
8                                                                  (8) Aaaaaaaaaaa]
                                                                                96                  120|

9                                                                                    (9) Pppppppppppppppppppppp
                                                                                                   108       (120|
10                                                                                 (10) Aaaaaaaaaaaa
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaa
                  120                 144
11           (11) Pppppppppppppppppppppp
                            132                 156
12                     (12) Aaaaaaaaaaaaaaaaaaaaaaaa
                                      144                 168
13                                (13) Pppppppppppppppppppppp
                                                156                 180
14                                          (14) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                            168       180
15                                                    (15) Pppppppppppp]
                                                                      180
16                                                            (16) A ] 224
-----------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
J = Premature failure on-orbit

Phase A
Scenario II-13

```
24-Month Design Life                    |        Three Random Launch Failures
12-Month Launch Interval                |              No Premature Failures
No Replacement Launches                 |
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
         12                   36
2     (2) Aaaaaaaaaaaaaaaaaaaaaaaa
                      24
3                (3) 0
                              36                  60
4                         (4) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                        48
5                                  (5) 0
                                                  60                  84
6                                            (6) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                            72                  96
7                                                     (7) Pppppppppppppppppppppppp
                                                                        84                  108
8                                                                (8) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                    96                  120

9                                                                                (9) Pppppppppppppppppppppppp
                                                                                                    108       (120)
10                                                                                          (10) Aaaaaaaaaaaaa
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaaa
                  120                 144
11           (11) Pppppppppppppppppppppppp
                            132
12                     (12) 0
                                      144                 168
13                                (13) Pppppppppppppppppppppppp
                                                  156                 180
14                                           (14) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                              168       (180)
15                                                     (15) Pppppppppppppp ] 192
                                                                        180
16                                                                (16) A ] 224
-----------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure

Phase A
Scenario II-14

24-Month Design Life
12-Month Launch Interval
No Replacement Launches

Three Random Launch Failures
One Premature Failure
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
          12          24
2      (2) Aaaaaaaaaaaa]
                      24
3                (3) 0
                                36                    60
4                           (4) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                          48
5                                     (5) 0
                                                      60                    84
6                                                (6) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                                72                    96
7                                                          (7) Pppppppppppppppppppppppp
                                                                          84                    108
8                                                                    (8) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                    96                    120

9                                                                                (9) Pppppppppppppppppppppppp
                                                                                                  108       (120
10                                                                                          (10) Aaaaaaaaaaaaa
```

```
MONTHS            120       130       140       150       160       170       180
                  |         |
                            132
10 continued      aaaaaaaaaaaaa
                  120                 144
11             (11) Pppppppppppppppppppppppp
                            132
12                     (12) 0
                                      144                   168
13                                (13) Pppppppppppppppppppppppp
                                                156                   180
14                                           (14) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                          168       (180)
15                                                   (15) Pppppppppppp ] 192
                                                                    180
16                                                             (16) A ] 224
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Premature failure on-orbit

Phase A
Scenario II-15

```
24-Month Design Life                    |      Three Random Launch Failures
12-Month Launch Interval                |            Two Premature Failures
No Replacement Launches                 |   (12 Months Before Design Life)
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
           12         24
2      (2) Aaaaaaaaaaaa]
                      24
3                (3) 0
                            36                    60
4                       (4) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                     48
5                                (5) 0
                                                  60                    84
6                                             (6) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                            72                    96
7                                                      (7) Pppppppppppppppppppppppp
                                                                        84        96
8                                                                  (8) Aaaaaaaaaaaa]
                                                                                  96                    120

9                                                                          (9) Pppppppppppppppppppppppp
                                                                                           108       (120)
10                                                                                   (10) Aaaaaaaaaaaaa
-----------------------------------------------------------------------------

MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaaa
                  120                 144
11           (11) Pppppppppppppppppppppppp
                            132
12                     (12) 0
                                      144                 168
13                                (13) Pppppppppppppppppppppppp
                                                  156                 180
14                                            (14) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                            168       (180)
15                                                     (15) Pppppppppppp ] 192
                                                                      180
16                                                               (16) A ] 224
-----------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
0 = Launch failure
] = Premature failure on-orbit

Phase A
Scenario II-16

```
24-Month Design Life                    |      Three Random Launch Failures
12-Month Launch Interval                |          Three Premature Failures
No Replacement Launches                 |    (12 Months Before Design Life)
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
          12          24
2     (2) Aaaaaaaaaaaa]
                      24
3                (3) 0
                              36                    60
4                         (4) Aaaaaaaaaaaaaaaaaaaaaaaa
                                        48
5                                   (5) 0
                                                    60                    84
6                                               (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                            72                    96
7                                                       (7) Pppppppppppppppppppppppp
                                                                          84        96
8                                                                   (8) Aaaaaaaaaaaa]
                                                                                  96                    120

9                                                                                     (9) Pppppppppppppppppppppppp
                                                                                                  108       (120)
10                                                                                          (10) Aaaaaaaaaaaaa
-------------------------------------------------------------------------------

MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaaa
                  120                 144
11            (11) Pppppppppppppppppppppppp
                            132
12                    (12) 0
                                      144                 168
13                                (13) Pppppppppppppppppppppppp
                                                  156     168
14                                          (14) Aaaaaaaaaaaa]
                                                          168       (180)
15                                                  (15) Pppppppppppp ] 192
                                                                    180
16                                                            (16) A ] 224
-------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Premature failure on-orbit

Phase A
Scenario II-17

24-Month Design Life
12-Month Launch Interval
No Replacement Launches

Four Random Launch Failures
No Premature Failures

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                   24
Pppppppppppppppppppppp
         12                   36
2     (2) Aaaaaaaaaaaaaaaaaaaaaaaa
                    24
3                (3) 0
                             36                   60
4                         (4) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                       48
5                                   (5) 0
                                                  60                   84
6                                              (6) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                            72                   96
7                                                       (7) Pppppppppppppppppppppppp
                                                                         84                   108
8                                                                   (8) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                   96                   120

9                                                                                (9) Pppppppppppppppppppppppp
                                                                                                 108       (120)
10                                                                                          (10) Aaaaaaaaaaaaa
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaaa
                  120                 144
11           (11) Pppppppppppppppppppppppp
                            132
12                     (12) 0
                                      144                 168
13                                (13) Pppppppppppppppppppppppp
                                                 156
14                                            (14) 0
                                                          168       (180)
15                                                   (15) Pppppppppppp ] 192
                                                                 180
16                                                            (16) A ] 224
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure

Phase A
Scenario II-18

```
24-Month Design Life                          |        Four Random Launch Failures
12-Month Launch Interval                      |                 One Premature Failure
No Replacement Launches                       |     (12 Months Before Design Life)
-----------------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120)|
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
          12          24
2      (2) Aaaaaaaaaaa]
                      24
3                (3) 0
                                36                    60
4                           (4) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                          48
5                                     (5) 0
                                                60                  84
6                                           (6) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                        72                  96
7                                                   (7) Pppppppppppppppppppppppp
                                                                    84                  108
8                                                               (8) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                96                  120)|

9                                                                                   (9) Pppppppppppppppppppppppp
                                                                                                    108       (120)|
10                                                                                              (10) Aaaaaaaaaaaaa
-----------------------------------------------------------------------------------------

MONTHS                120       130       140       150       160       170       180
                      |         |         |         |         |         |         |
                                132
10 continued          aaaaaaaaaaaaa
                      120                 144
11               (11) Pppppppppppppppppppppppp
                                132
12                          (12) 0
                                          144                 168
13                                   (13) Pppppppppppppppppppppppp
                                                      156
14                                              (14) 0
                                                                168       (180)
15                                                        (15) Pppppppppppp ] 192
                                                                        180
16                                                                (16) A ] 224
-----------------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
0 = Launch failure
] = Premature failure on-orbit

Phase A
Scenario II-19

24-Month Design Life
12-Month Launch Interval
No Replacement Launches

Four Random Launch Failures
Two Premature Failures
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
           12         24
2      (2) Aaaaaaaaaaaa]
                      24
3                (3) 0
                              36                    60
4                         (4) Aaaaaaaaaaaaaaaaaaaaaaaa
                                      48
5                                (5) 0
                                                60                    84
6                                           (6) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                        72                    96
7                                                  (7) Pppppppppppppppppppppppp
                                                                   84        96
8                                                        (8) Aaaaaaaaaaaa]
                                                                           96                    120

9                                                                     (9) Pppppppppppppppppppppppp
                                                                                     108       (120)
10                                                                          (10) Aaaaaaaaaaaaa
```

```
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaaa
                  120                 144
11           (11) Pppppppppppppppppppppppp
                            132
12                     (12) 0
                                    144                 168
13                               (13) Pppppppppppppppppppppppp
                                                156
14                                         (14) 0
                                                    168       (180)
15                                                (15) Pppppppppppp ] 192
                                                            180
16                                                     (16) A ] 224
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
0 = Launch failure
] = Premature failure on-orbit

Phase A
Scenario II-20

```
24-Month Design Life                    |        Four Random Launch Failures
12-Month Launch Interval                |           Three Premature Failures
No Replacement Launches                 |     (12 Months Before Design Life)
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
          12          24
2      (2) Aaaaaaaaaaaa]
                      24
3                (3) 0
                            36                    60
4                       (4) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                     48
5                                (5) 0
                                                  60                    84
6                                             (6) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                           72                    96
7                                                     (7) Pppppppppppppppppppppppp
                                                                         84        96
8                                                                  (8) Aaaaaaaaaaaa]
                                                                                   96                   120
9                                                                                     (9) Pppppppppppppppppppppppp
                                                                                                   108        (120)
10                                                                                        (10) Aaaaaaaaaaaaa
-------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaaa
                  120                 144
11            (11) Pppppppppppppppppppppppp
                            132
12                      (12) 0
                                    144       156
13                              (13) Pppppppppppp]
                                                156
14                                        (14) 0
                                                      168       (180)
15                                                (15) Pppppppppppp ] 192
                                                                180
16                                                          (16) A ] 224
-------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Premature failure on-orbit

Phase A
Scenario II-21

```
24-Month Design Life                          |                Four Launch Failures
12-Month Launch Interval                      |                   (Two Consecutive)
No Replacement Launches                       |               No Premature Failures
-----------------------------------------------------------------------------------------
MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                        24
Pppppppppppppppppppppp
         12                       36
2     (2) Aaaaaaaaaaaaaaaaaaaaaaa
                         24
3                (3) 0
                                  36
4                          (4) 0
                                                48                       72
5                                       (5) Pppppppppppppppppppppppp
                                                         60                       84
6                                                  (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                  72                       96
7                                                          (7) Pppppppppppppppppppppppp
                                                                                   84                       108
8                                                                        (8) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                                                96                       120

9                                                                                     (9) Pppppppppppppppppppppppp
                                                                                                                 108       (120)
10                                                                                                     (10) Aaaaaaaaaaaaa
-----------------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                                132
10 continued      aaaaaaaaaaaaa
                  120                       144
11            (11) Pppppppppppppppppppppppp
                                132
12                      (12) 0
                                            144                       168
13                                    (13) Pppppppppppppppppppppppp
                                                         156
14                                                 (14) 0
                                                                  168       (180)
15                                                         (15) Pppppppppppp ] 192
                                                                            180
16                                                                   (16) A ] 224
-----------------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O - Launch failure

Phase A
Scenario II-22

```
24-Month Design Life                          |                Four Launch Failures
12-Month Launch Interval                      |                   (Two Consecutive)
No Replacement Launches                       |               One Premature Failure
                                              |     (12 Months Before Design Life)
-----------------------------------------------------------------------------------------
MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
         12           24
2     (2) Aaaaaaaaaaaa]
                      24
3                (3) 0
                            36
4                        (4) 0
                                     48                   72
5                                (5) Pppppppppppppppppppppppp
                                                60                   84
6                                           (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                         72                   96
7                                                   (7) Pppppppppppppppppppppppp
                                                                   84                   108
8                                                             (8) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                                96                   120

9                                                                        (9) Pppppppppppppppppppppppp
                                                                                             108       (120)
10                                                                                     (10) Aaaaaaaaaaaaa
-----------------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaaa
                  120                 144
11            (11) Pppppppppppppppppppppppp
                            132
12                      (12) 0
                                      144                 168
13                                (13) Pppppppppppppppppppppppp
                                                156
14                                          (14) 0
                                                         168       (180)
15                                                   (15) Pppppppppppp ] 192
                                                                   180
16                                                             (16) A ] 224
-----------------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
0 - Launch failure
] = Premature failure on-orbit

Phase A
Scenario II-23

24-Month Design Life
12-Month Launch Interval
No Replacement Launches

Four Launch Failures
(Two Consecutive)
Two Premature Failures
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                        24
Pppppppppppppppppppppp
         12          24
2     (2) Aaaaaaaaaaa]
                         24
3                (3) 0
                                36
4                         (4) 0
                                        48                      72
5                                 (5) Pppppppppppppppppppppppp
                                                60                      84
6                                        (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                        72                      96
7                                                (7) Pppppppppppppppppppppppp
                                                                84          96
8                                                        (8) Aaaaaaaaaaaa]
                                                                        96                      120

9                                                                                (9) Pppppppppppppppppppppppp
                                                                                                108       (120)
10                                                                                     (10) Aaaaaaaaaaaaa
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaaa
                  120                 144
11           (11) Pppppppppppppppppppppppp
                            132
12                   (12) 0
                                144                 168
13                            (13) Pppppppppppppppppppppppp
                                                156
14                                     (14) 0
                                                    168       (180)
15                                            (15) Pppppppppppp ] 192
                                                            180
16                                                   (16) A ] 224
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O - Launch failure
] = Premature failure on-orbit

Phase A
Scenario II-24

```
24-Month Design Life                          |                Four Launch Failures
12-Month Launch Interval                      |                   (Two Consecutive)
No Replacement Launches                       |            Three Premature Failures
                                              |     (12 Months Before Design Life)
-----------------------------------------------------------------------------------------
MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
          12          24
2      (2) Aaaaaaaaaaaa]
                      24
3                 (3) 0
                                36
4                           (4) 0
                                        48                    72
5                                   (5) Pppppppppppppppppppppppp
                                                60                    84
6                                           (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                        72                    96
7                                                   (7) Pppppppppppppppppppppppp
                                                                      84        96
8                                                               (8) Aaaaaaaaaaaa]
                                                                                96                    120

9                                                                                   (9) Pppppppppppppppppppppppp
                                                                                                  108       (120)
10                                                                                        (10) Aaaaaaaaaaaa
-----------------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
10 continued      aaaaaaaaaaaa
                  120       132
11            (11) Ppppppppppp]
                            132
12                    (12) 0
                                144                   168
13                                  (13) Pppppppppppppppppppppppp
                                                156
14                                          (14) 0
                                                      168       (180)
15                                                (15) Pppppppppppp ] 192
                                                               180
16                                                         (16) A ] 224
-----------------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
0 - Launch failure
] = Premature failure on-orbit

Phase B
Scenario I-16

24-Month Design Life
18-Month Launch Interval
9-Month Call-up
(After a Launch Failure)

No Random Launch Failures
No Premature Failures

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
SSSSSSSSSSSSSSSSSSSSSS
                 18                  42
2            (2) SSSSSSSSSSSSSSSSSSSSSSSS
                              36                  60
3                         (3) SSSSSSSSSSSSSSSSSSSSSSS
                                          54                  78
4                                     (4) SSSSSSSSSSSSSSSSSSSSSSS
                                                   72                  96
5                                                (5) SSSSSSSSSSSSSSSSSSSSSSS
                                                                   90                  114
6                                                             (6) SSSSSSSSSSSSSSSSSSSSSSS
                                                                                  108       (120)
7                                                                                       (7) SSSSSSSSSSS
```

```
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
7 continued       SSSSSSSSSSSS
                     126                 150
8                 (8) SSSSSSSSSSSSSSSSSSSSSSS
                                144                 168
9                           (9) SSSSSSSSSSSSSSSSSSSSSSS
                                            162            (180)
10                                     (10) SSSSSSSSSSSSSSSSSS  186
                                                           180
11                                                     (11) S  204
```

LEGEND

S = Launch of a satellite in a one-satellite system

Phase B
Scenario I-17

24-Month Design Life
18-Month Launch Interval
9-Month Call-up
(After a Launch Failure)

Two Random Launch Failures
Two Premature Failures
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
SSSSSSSSSSSSSSSSSSSSSSS
                 18
2            (2) 0
                     27                    51
3                  (3) SSSSSSSSSSSSSSSSSSSSSSSSS
                                45
4                             (4) 0
                                     54                   78
5                                  (5) SSSSSSSSSSSSSSSSSSSSSSSS
                                                72                   96
6                                            (6) SSSSSSSSSSSSSSSSSSSSSSSS
                                                                90                   114  (120)
7                                                                   (7) SSSSSSSSSSSSSSSSSSSSSSSS
                                                                                     108       (120)
8                                                                                   (8) SSSSSSSSSSSS
```

```
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                            132
8 continued       SSSSSSSSSSSS
                      126       138
9                  (8) SSSSSSSSSSSI
                                144                 168
10                            (10) SSSSSSSSSSSSSSSSSSSSSSSS
                                                162       174
11                                            (11) SSSSSSSSSSSI
                                                           180
12                                                      (12) S  204
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
I = Premature failure on-orbit

Phase B
Scenario I-18

```
24-Month Design Life                    |      Three Random Launch Failures
18-Month Launch Interval                |          Two Premature Failures
9-Month Call-up                         |   (12 Months Before Design Life)
(After a Launch Failure)                |
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
Ssssssssssssssssssssss
                 18
2            (2) 0
                      27                      51
3                  (3) Sssssssssssssssssssssss
                                     45
4                                (4) 0
                                            54                    78
5                                       (5) Sssssssssssssssssssssss
                                                     72                    96
6                                                (6) Sssssssssssssssssssssss
                                                                90                    114  (120)
7                                                                     (7) Sssssssssssssssssssssss
                                                                                   108        120
8                                                                                     (8) Sssssssssssl
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                      126
9                  (9) 0
                            135                 159
10                     (10) Sssssssssssssssssssssss
                                          153       165
11                                   (11) Sssssssssssl
                                                  171     (180)
12                                            (12) Sssssssss  195
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
] = Premature failure on-orbit

Phase B
Scenario I-19

```
24-Month Design Life                    |          No Random Launch Failures
18-Month Launch Interval                |              No Premature Failures
4-Month Call-up                         |
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                   24
Ssssssssssssssssssssss
                 18                    42
2            (2) Sssssssssssssssssssssss
                            36                  60
3                        (3) Sssssssssssssssssssssss
                                          54                  78
4                                     (4) Sssssssssssssssssssssss
                                                   72                  96
5                                                (5) Sssssssssssssssssssssss
                                                                  90                  114
6                                                             (6) Sssssssssssssssssssssss
                                                                                 108       (120
7                                                                                     (7) Ssssssssssss
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                            132
7 continued       ssssssssssss
                      126                 150
8                  (8) Sssssssssssssssssssssss
                                144                 168
9                            (9) Sssssssssssssssssssssss
                                            162            (180)
10                                     (10) Ssssssssssssssssss  186
                                                           180
11                                                     (11) S  204
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system

Phase B
Scenario I-20

```
24-Month Design Life                    |        Two Random Launch Failures
18-Month Launch Interval                |            Two Premature Failures
4-Month Call-up                         |    (12 Months Before Design Life)
(After a Launch Failure)                |
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
Ssssssssssssssssssssss
                 18
2            (2) 0
                 22                    46
3                (3) Sssssssssssssssssssssss
                                   40
4                              (4) 0
                                      44                   68
5                                 (5) Sssssssssssssssssssssss
                                                 62                   90
6                                           (6) Sssssssssssssssssssssss
                                                          80                  104
7                                                    (7) Sssssssssssssssssssssss
                                                                     98        110
8                                                              (8) ssssssssssss]
                                                                                     116(120)
9                                                                                  (9) Sssss
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                                       140
9 continued        ssssssssssssssssssssss
                                  134       146
10                          (10) Sssssssssssss]
                                            152                 176
11                                     (11) Sssssssssssssssssssssssss
                                                        170      (180)
12                                                (12) Ssssssssss
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system

Phase B
Scenario I-21

```
24-Month Design Life                    |      Three Random Launch Failures
18-Month Launch Interval                |            Two Premature Failures
4-Month Call-up                         |     (12 Months Before Design Life)
(After a Launch Failure)                |
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
Ssssssssssssssssssssss
                 18
2            (2) 0
                  22                    46
3                (3) Sssssssssssssssssssssss
                                  40
4                              (4) 0
                                      44                    68
5                                 (5) Sssssssssssssssssssssss
                                                62                        90
6                                          (6) Sssssssssssssssssssssss
                                                          80                    104
7                                                    (7) Sssssssssssssssssssssss
                                                                    98        110
8                                                              (8) Ssssssssssss]
                                                                                116

9                                                                                (9) 0
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                 120                  144
10            (10) Sssssssssssssssssssssss
                                138       150
11                          (11) Ssssssssssss]
                                          156                 180
12                                     (12) Sssssssssssssssssssssss
                                                        174  (180)
13                                                 (13) Ssssss  198
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
0 = Launch failure
] = Premature failure on-orbit

Phase B
Scenario I-22

28-Month Design Life | No Random Launch Failures
22-Month Launch Interval | No Premature Failures
No Replacement Launches |

```
MONTHS  10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                           28
Sssssssssssssssssssssssssssss
                     22                           50
2                (2) Ssssssssssssssssssssssssssssss
                                          44                           72
3                                     (3) Ssssssssssssssssssssssssssssss
                                                              66                           94
4                                                         (4) Ssssssssssssssssssssssssssssss
                                                                                    88                           116
5                                                                               (5) Ssssssssssssssssssssssssssssss
                                                                                                          110         (120)

6                                                                                                     (6) Sssssssssss
----------------------------------------------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                                    138
6 continued       sssssssssssssssssss
                           132                          160
7                      (7) Ssssssssssssssssssssssssssssss
                                                  154                         (180)
8                                             (8) Sssssssssssssssssssssssssss 182
                                                                          176(180)
9                                                                     (9) Sssss  204
```

LEGEND

S = Launch of a satellite in a one-satellite system

Phase B
Scenario I-23

```
28-Month Design Life                    |        Two Random Launch Failures
22-Month Launch Interval                |           Two Premature Failures
No Replacement Launches                 |    (12 Months Before Design Life)
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                            28
Ssssssssssssssssssssssssssss
                   22
2                (2) 0
                                       44                            72
3                                  (3) Sssssssssssssssssssssssssssss
                                                          66
4                                                     (4) S
                                                                                88                          116
5                                                                          (5) Sssssssssssssssssssssssssssss
                                                                                                  110        (120)

6                                                                                                      (6) Sssssssssss
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                        126
6 continued        ssssss]
                            132            148
7                        (7) Sssssssssssssss]
                                     154                    (180)
8                                (8) Sssssssssssssssssssssssssssss  182
                                                        176(180)
9                                                   (9) Ssssss 204
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
0 = Launch failure
] = Premature failure on-orbit

Phase B
Scenario I-24

```
28-Month Design Life                    |      Three Random Launch Failures
22-Month Launch Interval                |            Two Premature Failures
No Replacement Launches                 |    (12 Months Before Design Life)
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                            28
Sssssssssssssssssssssssssss
                        22
2                (2) 0
                                       44                                72
3                                (3) Sssssssssssssssssssssssssssssss
                                                                66
4                                                         (4) S
                                                                                  88                                116
5                                                                         (5) Sssssssssssssssssssssssssssssss
                                                                                                            110       (120)
6                                                                                                                  (6) Sssssssssssss
-----------------------------------------------------------------------------
MONTHS             120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                        126
6 continued        ssssss]
                             132                 148
7                        (7) Sssssssssssssssss]
                                                154
8                                          (8) S
                                                                176(180)
9                                                          (9) Sssss 204
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
] = Premature failure on-orbit

Phase B
Scenario I-25

```
28-Month Design Life                    |          No Random Launch Failures
22-Month Launch Interval                |              No Premature Failures
9-Month Call-up                         |
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                            28
Sssssssssssssssssssssssssss
                       22                     50
2                (2) Sssssssssssssssssssssssssssss
                                   44                        72
3                                  (3) Sssssssssssssssssssssssssssss
                                                   66                        94
4                                                  (4) Sssssssssssssssssssssssssssss
                                                                     88                        116
5                                                                    (5) Sssssssssssssssssssssssssssss
                                                                                           110       (120)

6                                                                                                  (6) Sssssssssss
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                                     138
6 continued       sssssssssssssssssss
                            132                        160
7                     (7) Sssssssssssssssssssssssssssss
                                                154                   (18)
8                                               (8) Sssssssssssssssssssssssssssss  182
                                                                     176(180)
9                                                                    (9) Sssss  204
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system

Phase B
Scenario I-26

```
28-Month Design Life                    |        Two Random Launch Failures
22-Month Launch Interval                |            Two Premature Failures
9-Month Call-up                         |     (12 Months Before Design Life)
(After a Launch Failure)                |
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                            28
Ssssssssssssssssssssssssssss
                   22
2                (2) 0
                             31                        59
3                        (3) Sssssssssssssssssssssssssssss
                                                 53
4                                            (4) 0
                                                      62                        90
5                                                 (5) Sssssssssssssssssssssssssssss
                                                                     84                        112

6                                                                (6) Sssssssssssssssssssssssssssss
                                                                                          106         (120)
7                                                                                     (7) Sssssssssssssss
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                  122
7 continued       ssl
                       128                       156
8                    (7) Sssssssssssssssssssssssssssss
                                            150          166
9                                       (8) Sssssssssssssssl
                                                     172    (180)
10                                                (9) Sssssssss  200
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
I = Premature failure on-orbit

Phase B
Scenario I-27

28-Month Design Life 22-Month Launch Interval 9-Month Call-up (After a Launch Failure)	Three Random Launch Failures Two Premature Failures (12 Months Before Design Life)

```
MONTHS   10       20       30       40       50       60       70       80       90      100      110      120
          :        :        :        :        :        :        :        :        :        :        :        :
1                          28
Ssssssssssssssssssssssssssss
                        22
2                  (2) 0
                             31                            59          72
3                      (3) Sssssssssssssssssssssssssssss
                                                        53
4                                                 (4) 0
                                                              62                        90
5                                                        (5) Sssssssssssssssssssssssssssss
                                                                              84                         112

6                                                                        (6) Sssssssssssssssssssssssssssss
                                                                                                  106        (120)
7                                                                                            (7) Ssssssssssssss
--------------------------------------------------------------------------------------------------------------
MONTHS              120      130      140      150      160      170      180
                     :        :        :        :        :        :        :
                       122
7 continued          ssl
                            128
8                       (7) 0
                                     137            153
9                              (8) Sssssssssssssssl
                                                          159                  (180)
10                                                   (9) Sssssssssssssssssssss 187
--------------------------------------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
] = Premature failure on-orbit

Phase B
Scenario I-28

```
28-Month Design Life                    |        No Random Launch Failures
22-Month Launch Interval                |           No Premature Failures
4-Month Call-up                         |   (12 Months Before Design Life)
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                            28
Ssssssssssssssssssssssssss
                   22                        50
2              (2) Sssssssssssssssssssssssssssss
                                   44                        72
3                              (3) Ssssssssssssssssssssssssssss
                                                   66                        94
4                                             (4) Ssssssssssssssssssssssssssss
                                                                   88                        116
5                                                            (5) Ssssssssssssssssssssssssssss
                                                                                        110       (120)

6                                                                                                   (6) Sssssssssssss
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                                      138
6 continued        sssssssssssssssssss
                            132                        160
7                      (7) Ssssssssssssssssssssssssssssss
                                                154                       (180)
8                                          (8) Ssssssssssssssssssssssssssssss  182
                                                                     176(180)
9                                                             (9) Sssss  204
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system

Phase B
Scenario I-29

```
28-Month Design Life                    |        Two Random Launch Failures
22-Month Launch Interval                |            Two Premature Failures
4-Month Call-up                         |     (12 Months Before Design Life)
(After a Launch Failure)                |
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                            28
Ssssssssssssssssssssssssss
                    22
2                (2) 0
                        26                          54
3                    (3) Sssssssssssssssssssssssssss
                                                48
4                                        (4) 0
                                                52                          80
5                                            (5) Sssssssssssssssssssssssssss
                                                                    74                          102
6                                                               (6) Sssssssssssssssssssssssssss
                                                                                        96            112
7                                                                                   (7) Sssssssssssssssl
                                                                                                          118(120

8                                                                                                        (8) Sss
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                                                146
8 continued       sssssssssssssssssssssssssss
                                        140           156
9                                   (9) Sssssssssssssssl
                                                      162           (180)
10                                                (10) Sssssssssssssssssssssssssss  190
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
I = Premature failure on-orbit

Phase B
Scenario I-30

```
28-Month Design Life                    |      Three Random Launch Failures
22-Month Launch Interval                |            Two Premature Failures
4-Month Call-up                         |     (12 Months Before Design Life)
(After a Launch Failure)                |
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                            28
Sssssssssssssssssssssssssss
                    22
2                (2) 0
                         26                        54
3                    (3) Sssssssssssssssssssssssssssss
                                                48
4                                        (4) 0
                                                52                        80
5                                            (5) Sssssssssssssssssssssssssssss
                                                                  74                        102
6                                                            (6) Sssssssssssssssssssssssssssss
                                                                                        96            112
7                                                                                (7) Sssssssssssssssl
                                                                                                                120
8                                                                                                          (8) 0
-----------------------------------------------------------------------------------------------------------------------
MONTHS             120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                      124                         152
9                  (9) Sssssssssssssssssssssssssssssss
                                             146            162
10                                     (10) Sssssssssssssssl
                                                                 166       (180)
11                                                         (11) Sssssssssssssss  196
-----------------------------------------------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
] = Premature failure on-orbit

Phase B
Scenario II-25

```
24-Month Design Life                    |          No Random Launch Failures
12-Month Launch Schedule                |              No Premature Failures
No Replacement Launches                 |
-------------------------------------------------------------------------------
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                   24
Pppppppppppppppppppppp
         12                 36
2     (2) Aaaaaaaaaaaaaaaaaaaaaaaa
                   24                   48
3                (3) Pppppppppppppppppppppppp
                            36                  60
4                        (4) Aaaaaaaaaaaaaaaaaaaaaaaa
                                     48                  72
5                                 (5) Pppppppppppppppppppppppp
                                                 60                  84
6                                            (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                             72                  96
7                                                       (7) Pppppppppppppppppppppppp
                                                                         84                  108
8                                                                    (8) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                                     96                  120

9                                                                                 (9) Pppppppppppppppppppppppp
                                                                                                     108       (120
10                                                                                              (10) Aaaaaaaaaaaaa
-------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |

                            132
10 continued        aaaaaaaaaaaaa
                  120                 144
11            (11) Pppppppppppppppppppppppp
                            132                 156
12                    (12) Aaaaaaaaaaaaaaaaaaaaaaaa
                                    144                 168
13                            (13) Pppppppppppppppppppppppp
                                                156                 180
14                                        (14) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                            168       (180)
15                                                   (15) Pppppppppppp ] 192
                                                                 18^
16                                                             (16) A ] 224
-------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit

Phase B
Scenario II-26

```
24-Month Design Life                          |      Three Random Launch Failures
12-Month Launch Schedule                      |          Three Premature Failures
No Replacement Launches                       |   (12 Months Before Design Life)
-----------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
          12          24
2      (2) Aaaaaaaaaaa]
                      24
3                 (3) 0
                              36                    60
4                         (4) Pppppppppppppppppppppppp
                                        48
5                                   (5) 0
                                                    60                    84
6                                             (6) Pppppppppppppppppppppppp
                                                            72                    96
7                                                     (7) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                                          84        96
8                                                                   (8) Pppppppppppp]
                                                                                    96                    120

9                                                                                (9) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                                 108       (120)
10                                                                                          (10) Pppppppppppp
-----------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |

                                132
10 continued        pppppppppppp
                  120       132
11            (11) Aaaaaaaaaaa]
                                132
12                      (12) 0
                                      144                   168
13                                (13) Pppppppppppppppppppppppp
                                                156                   180
14                                         (14) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                          168       (180)
15                                                   (15) Pppppppppppp ] 192
                                                                   180
16                                                             (16) A ] 224
-----------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
0 = Launch failure
] = Premature failure on-orbit

Phase B
Scenario II-27

```
24-Month Design Life                    |        Four Random Launch Failures
12-Month Launch Schedule                |           Three Premature Failures
No Replacement Launches                 |     (12 Months Before Design Life)
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
          12          24
2      (2) Aaaaaaaaaaaa]
                      24
3                 (3) 0
                              36                    60
4                         (4) Pppppppppppppppppppppppp
                                        48
5                                   (5) 0
                                                    60                    84
6                                               (6) Pppppppppppppppppppppppp
                                                              72                    96
7                                                       (7) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                                          84        96
8                                                                   (8) Pppppppppppp]
                                                                                    96                    120

9                                                                                (9) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                              108       (120
10                                                                                      (10) Pppppppppppp
-------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |

                                132
10 continued        pppppppppppp
                  120       132
11            (11) Aaaaaaaaaaaa]
                                132
12                      (12) 0
                                    144                   168
13                            (13) Pppppppppppppppppppppppp
                                                156
14                                        (14) 0
                                                      168       (180)
15                                                (15) Pppppppppppp ] 192
                                                                180
16                                                          (16) A ] 224
-------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Premature failure on-orbit

Phase B
Scenario II-28

```
24-Month Design Life                    |        No Random Launch Failures
12-Month Launch Interval                |            No Premature Failures
6-Month Call-up                         |
(After a Launch Failure)                |
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                   24
Pppppppppppppppppppppp
         12                   36
2     (2) Aaaaaaaaaaaaaaaaaaaaaaaa
                    24                   48
3                (3) Pppppppppppppppppppppppp
                             36                   60
4                          (4) Aaaaaaaaaaaaaaaaaaaaaaaa
                                         48                   72
5                                     (5) Pppppppppppppppppppppppp
                                                   60                   84
6                                                (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                             72                   96
7                                                          (7) Pppppppppppppppppppppppp
                                                                         84                  108
8                                                                     (8) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                                     96                  120

9                                                                                 (9) Pppppppppppppppppppppppp
                                                                                                    108       120
10                                                                                                (10) Aaaaaaaaaaaa
-------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |

                            132
10 continued      aaaaaaaaaaaa
                  120                 144
11             (11) Pppppppppppppppppppppppp
                            132                 156
12                      (12) Aaaaaaaaaaaaaaaaaaaaaaaa
                                    144                 168
13                                (13) Pppppppppppppppppppppppp
                                                156                 180
14                                            (14) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                            168       (180)
15                                                        (15) Pppppppppppp 1 132
                                                                      180
16                                                                (16) A 1 224
-------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit

Phase B
Scenario II-29

24-Month Design Life
12-Month Launch Interval
6-Month Call-up
(After a Launch Failure)

Three Random Launch Failures
Three Premature Failures
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                   24
Pppppppppppppppppppppp
         12         24
2     (2) Aaaaaaaaaaa]
                    24
3                (3) 0
                        30                    54
4                    (4) Pppppppppppppppppppppppp
                             42
5                         (5) 0
                                 48                    72
6                                (6) Pppppppppppppppppppppppp
                                          60                    84
7                                      (7) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                   72         84
8                                                (8) Pppppppppppp]
                                                                 84                 108

9                                                                (9) Aaaaaaaaaaaaaaaaaaaa
                                                                           96                 120
10                                                                    (10) Pppppppppppppppppppppp
                                                                                     108       120

11                                                                                   (11) Aaaaaaaaaaa]
MONTHS            120       130       140       150       160       170       180

                  120
12             (12) 0
                        126                   150
13                   (13) Pppppppppppppppppppppp
                                138                   162
14                           (14) Aaaaaaaaaaaaaaaaaaaaaaaa
                                          150                   174
15                                   (15) Pppppppppppppppppppppppp
                                                   162         (180)
16                                            (16) Aaaaaaaaaaaaaaaaaa  174
                                                            174  (120)
17                                                       (17) Pppppp  198
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
0 = Launch failure
] = Premature failure on-orbit

Phase B
Scenario II-30

```
24-Month Design Life                    |        Four Random Launch Failures
12-Month Launch Interval                |           Three Premature Failures
6-Month Call-up                         |     (12 Months Before Design Life)
(After a Launch Failure)                |
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                     24
Pppppppppppppppppppppp
           12         24
2      (2) Aaaaaaaaaaa]
                      24
3                (3) 0
                          30                    54
4                     (4) Pppppppppppppppppppppppp
                                42
5                           (5) 0
                                    48                    72
6                                (6) Pppppppppppppppppppppppp
                                            60                    84
7                                        (7) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                      72        84
8                                                 (8) Pppppppppppp]
                                                                84                108

9                                                            (9) Aaaaaaaaaaaaaaaaaaaa
                                                                     96                  120
10                                                              (10) Pppppppppppppppppppppppp
                                                                                108       120

11                                                                                (11) Aaaaaaaaaaaa]
-------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |

                 120
12            (12) 0
                     126                   150
13                (13) Pppppppppppppppppppppppp
                            138
14                        (14) 0
                                 144                   168
15                            (15) Pppppppppppppppppppppppp
                                            156                   180
16                                       (16) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                      168       (180)
17                                                (17) Pppppppppppp  192
                                                                180
18                                                          (18) A  204
-------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Premature failure on-orbit

Phase B
Scenario II-31

24-Month Design Life
12-Month Launch Interval
4-Month Call-up
(After a Launch Failure)

No Random Launch Failures
No Premature Failures

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                   24
Pppppppppppppppppppppp
         12                  36
2     (2) Aaaaaaaaaaaaaaaaaaaaaaaa
                    24                  48
3                (3) Pppppppppppppppppppppppp
                            36                  60
4                        (4) Aaaaaaaaaaaaaaaaaaaaaaaa
                                    48                  72
5                                (5) Pppppppppppppppppppppppp
                                                60                  84
6                                            (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                            72                  96
7                                                       (7) Pppppppppppppppppppppppp
                                                                        84                  108
8                                                                   (8) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                                    96                  120

9                                                                                (9) Pppppppppppppppppppppppp
                                                                                                    108       (120)
10                                                                                              (10) Aaaaaaaaaaaaa
```

```
MONTHS           120       130       140       150       160       170       180

                            132
10 continued       aaaaaaaaaaaaa
                 120                 144
11            (11) Pppppppppppppppppppppppp
                            132                 156
12                     (12) Aaaaaaaaaaaaaaaaaaaaaaaa
                                    144                 168
13                                (13) Pppppppppppppppppppppppp
                                                156                 180
14                                            (14) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                            168       (180)
15                                                      (15) Pppppppppppp ] 192
                                                                        180
16                                                                  (16) A ] 224
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit

Phase B
Scenario II-32

```
24-Month Design Life                    |      Three Random Launch Failures
12-Month Launch Interval                |          Three Premature Failures
4-Month Call-up                         |   (12 Months Before Design Life)
(After a Launch Failure)                |
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                   24
Pppppppppppppppppppppp
         12         24
2     (2) Aaaaaaaaaaaa]
                    24
3                (3) 0
                        28                  52
4                   (4) Pppppppppppppppppppppp
                            40
5                       (5) 0
                                44                  68
6                           (6) Pppppppppppppppppppppp
                                        56                  80
7                                   (7) Aaaaaaaaaaaaaaaaaaaaaa
                                                68          80
8                                           (8) Pppppppppppp]
                                                            80                  104
9                                                       (9) Aaaaaaaaaaaaaaaaaaaaaa
                                                                        92                  116
10                                                          (10) Pppppppppppppppppppppp
                                                                                104         116

11                                                                                  (11) Aaaaaaaaaaaa]
                                                                                                    116

12                                                                                                  (12) 0
-----------------------------------------------------------------------------
MONTHS           120       130       140       150       160       170       180
                 |         |         |         |         |         |         |

                 120                 144
13           (13) Pppppppppppppppppppppp
                         132                 156
14                   (13) Aaaaaaaaaaaaaaaaaaaaaa
                                 144                 168
15                           (15) Pppppppppppppppppppppp
                                         156                 180
16                                   (16) Aaaaaaaaaaaaaaaaaaaaaa
                                                 168       (180)
17                                           (17) Pppppppppppp  192
                                                          180
18                                                       (18) A  204
-----------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
0 = Launch failure
] = Premature failure on-orbit

Phase B
Scenario II-33

```
24-Month Design Life                    |        Four Random Launch Failures
12-Month Launch Interval                |           Three Premature Failures
4-Month Call-up                         |     (12 Months Before Design Life)
(After a Launch Failure)                |
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                   24
Pppppppppppppppppppppp
         12         24
2     (2) Asssssssssss]
                    24
3                (3) 0
                        28                  52
4                   (4) Pppppppppppppppppppppppp
                                40
5                           (5) 0
                                    44                  68
6                               (6) Pppppppppppppppppppppppp
                                            56                  80
7                                       (7) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                        68      80
8                                                   (8) Pppppppppppp]
                                                                80                  104
9                                                           (9) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                            92                  116
10                                                                  (10) Pppppppppppppppppppppppp
                                                                                        104     116
11                                                                              (11) Aaaaaaaaaaaa]
                                                                                                116
12                                                                                      (12) 0
-----------------------------------------------------------------------------------------------------
MONTHS           120       130       140       150       160       170       180

                 120                 144
13           (13) Pppppppppppppppppppppppp
                         132
14                   (14) 0
                             136                 160
15                       (15) Pppppppppppppppppppppppp
                                     148                 172
16                               (16) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                 160             (180)
17                                           (17) Pppppppppppppppppppp  184
                                                             172     (180)
18                                                       (18) Appppppppp  196
-----------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Premature failure on-orbit

Phase B
Scenario II-34

28-Month Design Life
16-Month Launch Interval
No Replacement Launches

No Random Launch Failures
No Premature Failures

```
MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                                   28
Pppppppppppppppppppppppppp
                 16                                 44
2          (2) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                   32                                60
3                           (3) Pppppppppppppppppppppppppppp
                                                   48                                76
4                                          (4) Appppppppppppppppppppppppppppp
                                                                   64                                  92
5                                                          (5) Pppppppppppppppppppppppppppp
                                                                                   80                                  108
6                                                                          (6) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                                   96                    (120)

7                                                                                                          (7) Pppppppppppppppppppppppp
                                                                                                                      112    (120)

8                                                                                                                   (8) Aaaaaaaaa
```

```
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |

                     124
7 continued          ppppp
                                   140
8 continued          aaaaaaaaaaaaaaaaaaaa
                          128                       156
9                     (9) Pppppppppppppppppppppppppppp
                                             144                       172
10                                     (10) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                        160                 (180)
11                                                (11) Pppppppppppppppppppp  188
                                                                     176(180)
12                                                                (12) Aaaaa  204
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit

Phase B
Scenario II-35

```
28-Month Design Life                    |      Three Random Launch Failures
16-Month Launch Interval                |        Three Premature Failures
No Replacement Launches                 |   (12 Months Before Design Life)
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                            28
PPPPPPPPPPPPPPPPPPPPPPPPPPP
                 16          32
2          (2) AAAAAAAAAAAAAAAA]
                             32
3                        (3) 0
                                      48                        76
4                                (4) APPPPPPPPPPPPPPPPPPPPPPPPPPPP
                                                   64
5                                             (5) 0
                                                                 80             96
6                                                           (6) AAAAAAAAAAAAAAAA]
                                                                               96                  (120)

7                                                                      (7) PPPPPPPPPPPPPPPPPPPPPPPPP
                                                                                          112    (120)

8                                                                                    (8) AAAAAAAAA
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |

                     124
7 continued       PPPPP
                                140
8 continued       AAAAAAAAAAAAAAAAAAAA
                           128
9                    (9) 0
                                    144           160
10                              (10) AAAAAAAAAAAAAAA]
                                                160              (180)
11                                        (11) PPPPPPPPPPPPPPPPPPPP  188
                                                          176(180)
12                                                   (12) AAAAA  204
-----------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
I = Premature failure on-orbit

Phase B
Scenario II-36

```
28-Month Design Life                      |        Four Random Launch Failures
16-Month Launch Interval                  |           Three Premature Failures
No Replacement Launches                   |     (12 Months Before Design Life)
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                            28
Pppppppppppppppppppppppppp
                 16          32
2          (2) Aaaaaaaaaaaaaaa]
                             32
3                        (3) 0
                                       48                        76
4                                (4) Appppppppppppppppppppppppppp
                                                   64
5                                             (5) 0
                                                                 80             96
6                                                          (6) Aaaaaaaaaaaaaaa]
                                                                               96                   (120)

7                                                                     (7) Pppppppppppppppppppppppp
                                                                                          112    (120)

8                                                                                          (8) Aaaaaaaaa
-------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |

                     124
7 continued       ppppp
                                     140
8 continued       aaaaaaaaaaaaaaaaaaaa
                           128
9                     (9) 0
                                 144           160
10                           (10) Aaaaaaaaaaaaaaa]
                                               160            (180)
11                                        (11) 0
                                                        176(180)
12                                                 (12) Ppppp  204
-------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
0 = Launch failure
] = Premature failure on-orbit

Phase B
Scenario II-37

```
28-Month Design Life                    |          No Random Launch Failures
16-Month Launch Interval                |              No Premature Failures
6-Month Call-up                         |
(After a Launch Failure)                |
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                            28
Pppppppppppppppppppppppppp
             16                          44
2         (2) Aaaaaaaaaaaaaaaaaaaaaaaaaaa
                           32                          60
3                      (3) Pppppppppppppppppppppppppppp
                                       48                          76
4                                  (4) Appppppppppppppppppppppppppppp
                                                   64                          92
5                                                (5) Pppppppppppppppppppppppppppp
                                                                   80                         108
6                                                                (6) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                   96                   (120)
7                                                                                (7) Pppppppppppppppppppppppp
                                                                                                   112    (120)
8                                                                                                     (8) Aaaaaaaaa
-------------------------------------------------------------------------------
MONTHS          120       130       140       150       160       170       180
                |         |         |         |         |         |         |

                  124
7 continued     ppppp
                                140
8 continued     aaaaaaaaaaaaaaaaaaaa
                      128                         156
9                  (9) Pppppppppppppppppppppppppppp
                                     144                         172
10                              (10) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                   160                 (180)
11                                              (11) Pppppppppppppppppppp  188
                                                                   176(180)
12                                                               (12) Aaaaa  204
-------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit

Phase B
Scenario II-38

28-Month Design Life
16-Month Launch Interval
6-Month Call-up
(After a Launch Failure)

Three Random Launch Failures
Three Premature Failures
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
          |         |         |         |         |         |         |         |         |         |         |         |

1                            28
Pppppppppppppppppppppppppp
             16          32
2         (2) Aaaaaaaaaaaaaaa]
                         32
3                      (3) 0
                                38                        66
4                            (4) Pppppppppppppppppppppppppppp
                                          54
5                                      (5) 0
                                               60                        88
6                                           (6) Pppppppppppppppppppppppppp
                                                          76                        104
7                                                    (7) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                   92             108
8                                                               (8) Pppppppppppppp]
                                                                                 108
9                                                                             (9) 0
                                                                                        114  (120)
10                                                                                   (10) Pppppp
```

```
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |

                                     142
10 continued      pppppppppppppppppppppp
                            130                       158
11                     (11) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                          146            162
12                                   (12) Pppppppppppppppp]
                                                   162            (180)
13                                              (13) Aaaaaaaaaaaaaaaaaaa  190
                                                                178(180)
14                                                         (14) Ppp  206
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Premature failure on-orbit

Phase B
Scenario II-39

28-Month Design Life
16-Month Launch Interval
6-Month Call-up
(After a Launch Failure)

Four Random Launch Failures
Three Premature Failures
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                            28
Pppppppppppppppppppppppppp
                 16                32
2            (2) Aaaaaaaaaaaaaaaa]
                                   32
3                          (3) 0
                                      38                          66
4                                (4) Pppppppppppppppppppppppppppp
                                                   54
5                                            (5) 0
                                                        60                          88
6                                                  (6) Pppppppppppppppppppppppppppp
                                                                   76                                   104
7                                                             (7) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                   92                108
8                                                                          (8) Pppppppppppppppp]
                                                                                                     108
9                                                                                             (9) 0
                                                                                                                114  (120)
10                                                                                                     (10) Pppppppp
```

```
MONTHS                 120       130       140       150       160       170       180
                        |         |         |         |         |         |         |

                                                142
10 continued           pppppppppppppppppppppppp
                                  130
11                         (11) 0
                                      136                         164
12                                (12) Pppppppppppppppppppppppppppp
                                                        152                 168
13                                              (13) Aaaaaaaaaaaaaaaaa]
                                                                    168         (180)
14                                                            (14) Pppppppppppppp  196
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Premature failure on-orbit

Phase B
Scenario II-40

```
28-Month Design Life                    |        No Random Launch Failures
16-Month Launch Interval                |            No Premature Failures
4-Month Call-up                         |
(After a Launch Failure)                |
-----------------------------------------------------------------------------
MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                            28
Pppppppppppppppppppppppppp
                 16                        44
2          (2) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                            32                        60
3                      (3) Pppppppppppppppppppppppppppp
                                      48                        76
4                                (4) Appppppppppppppppppppppppppp
                                                   64                        92
5                                             (5) Pppppppppppppppppppppppppp
                                                                80                        108
6                                                        (6) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                          96                        (120)

7                                                                                (7) Pppppppppppppppppppppppp
                                                                                                   112       (120)

8                                                                                                     (8) Aaaaaaaaa
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180

                     124
7 continued        pppp
                                140
8 continued        aaaaaaaaaaaaaaaaaaaa
                        128                       156
9                     (9) Pppppppppppppppppppppppppp
                                     144                       172
10                                (10) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                   160                 (180)
11                                            (11) Pppppppppppppppppppp  188
                                                                 176(180)
12                                                          (12) Aaaaa  204
-----------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit

Phase B
Scenario II-41

```
28-Month Design Life                      |      Three Random Launch Failures
16-Month Launch Interval                  |          Three Premature Failures
4-Month Call-up                           |     (12 Months Before Design Life)
(After a Launch Failure)                  |
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                            28
Pppppppppppppppppppppppppp
                 16                32
2          (2) Aaaaaaaaaaaaaaa]
                                  32
3                            (3) 0
                                     36                          64
4                                (4) Pppppppppppppppppppppppppppp
                                                 52
5                                            (5) 0
                                                     56                          84
6                                                (6) Pppppppppppppppppppppppppppp
                                                                 72                          100
7                                                            (7) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                 88                104
8                                                                            (8) Pppppppppppppppp]
                                                                                                   104
9                                                                                              (9) 0
                                                                                                       108       (120)
10                                                                                                (10) Pppppppppppp
-------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |

                                     136
10 continued      pppppppppppppppp
                     124                          152
11                (11) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                140            156
12                           (12) Pppppppppppppppp]
                                                156                   (180)
13                                           (13) Aaaaaaaaaaaaaaaaaaaaaaaaa  184
                                                                172    (180)
14                                                        (14) Pppppppppp  200
-------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Premature failure on-orbit

Phase B
Scenario II-42

28-Month Design Life
16-Month Launch Interval
4-Month Call-up
(After a Launch Failure)

Four Random Launch Failures
Three Premature Failures
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                            28
Pppppppppppppppppppppppppp
                 16          32
2          (2) Aaaaaaaaaaaaaaa]
                             32
3                        (3) 0
                                36                          64
4                            (4) Pppppppppppppppppppppppppppp
                                                52
5                                           (5) 0
                                                    56                          84
6                                               (6) Pppppppppppppppppppppppppppp
                                                                    72                          100
7                                                               (7) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                    88              104
8                                                                               (8) Pppppppppppppppp]
                                                                                                    104
9                                                                                               (9) 0
                                                                                                        108       (120)
10                                                                                                  (10) Pppppppppppp
```

```
MONTHS            120       130       140       150       160       170       180

                                136
10 continued       pppppppppppppppp
                     124
11                (11) 0
                         128                          156
12                   (12) Pppppppppppppppppppppppppppp
                                          144                 160
13                                   (13) Aaaaaaaaaaaaaaaa]
                                                              160                 (180)
14                                                       (14) Pppppppppppppppppppp  188
                                                                            176(180)
15                                                                     (15) Apppp  204
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Premature failure on-orbit

Phase C
Scenario I-31

```
28-Month Design Life                    |          No Random Launch Failures
20-Month Launch Interval                |              No Premature Failures
9-Month Call-up                         |
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                        28
SSSSSSSSSSSSSSSSSSSSSSSSSSS
                   20                       48
2             (2) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                  40                       68
3                            (3) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                                 60                       88
4                                          (4) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                                                 80                       108
5                                                          (5) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                                                                     100                (120)
6                                                                                (6) SSSSSSSSSSSSSSSSSSSSS
-------------------------------------------------------------------------------
MONTHS             120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                            128
6 continued        SSSSSSSSS
                   120                       148
7             (7) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                  140                       168
8                            (8) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                                 160                (180)
9                                          (9) SSSSSSSSSSSSSSSSSSSSS  188
                                                                 180
10                                                         (10) S   208
-------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system

Phase C
Scenario I-32

```
28-Month Design Life                    |        Two Random Launch Failures
20-Month Launch Interval                |            Two Premature Failures
9-Month Call-up                         |    (12 Months Before Design Life)
(After a Launch Failure)                |
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                            28
Ssssssssssssssssssssssssss
                   20
2             (2) 0
                             29                                  57
3                     (3) Sssssssssssssssssssssssssssssss
                                                49
4                                         (4) 0
                                                        58                        86
5                                                 (5) Sssssssssssssssssssssssssssss
                                                                    78                        106
6                                                             (6) Sssssssssssssssssssssssssssssss
                                                                                        98            114
7                                                                                (7) Sssssssssssssssss]
                                                                                                          118(120)

8                                                                                                         (8) sss
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                                                146
8 continued       ssssssssssssssssssssssssssss
                                    138           154
9                             (9) Sssssssssssssssss]
                                                158                   (180)
10                                        (10) Sssssssssssssssssssssssssssssss  186
                                                                    178(180)
11                                                            (11) Sss  206
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
] = Premature failure on-orbit

Phase C
Scenario I-33

```
28-Month Design Life           |     Three Random Launch Failures
20-Month Launch Interval       |         Two Premature Failures
9-Month Call-up                |   (12 Months Before Design Life)
(After a Launch Failure)       |
-----------------------------------------------------------------------

MONTHS  10   20   30   40   50   60   70   80   90   100   110   120
         |    |    |    |    |    |    |    |    |     |     |     |
1                         28
Ssssssssssssssssssssssssssss
                  20
2             (2) 0
                           29                           57
3                      (3) Sssssssssssssssssssssssssssss
                                         49
4                                    (4) 0
                                                 58                           86
5                                            (5) Sssssssssssssssssssssssssssss
                                                                   78                           106
6                                                              (6) Sssssssssssssssssssssssssssss
                                                                                       98              114
7                                                                                  (7) Ssssssssssssssss]
                                                                                                          118

8                                                                                                     (8) 0
-----------------------------------------------------------------------
MONTHS            120  130  140  150  160  170  180
                   |    |    |    |    |    |    |
                      127                           155
9                 (9) Sssssssssssssssssssssssssssss
                                         147             163
10                                  (10) Ssssssssssssssss]
                                                             167          (180)
11                                                      (11) Sssssssssssss 195
-----------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
0 = Launch failure
] = Premature failure on-orbit

Phase C
Scenario I-34

```
28-Month Design Life                         !          No Random Launch Failures
20-Month Launch Interval                     !              No Premature Failures
4-Month Call-up                              !
--------------------------------------------------------------------------------

MONTHS  10     20     30     40     50     60     70     80     90    100    110    120
         !      !      !      !      !      !      !      !      !      !      !      !
1                    28
Ssssssssssssssssssssssssssss
               20                  48
2          (2) Ssssssssssssssssssssssssssss
                          40                  68
3                     (3) Ssssssssssssssssssssssssssss
                                        60                  88
4                                   (4) Ssssssssssssssssssssssssssss
                                                      80                  108
5                                                 (5) Ssssssssssssssssssssssssssss
                                                                 100                (120)
6                                                            (6) Ssssssssssssssssssss
--------------------------------------------------------------------------------
MONTHS         120    130    140    150    160    170    180
                !      !      !      !      !      !      !
                     128
6 continued     ssssssss
               120                 148
7          (7) Ssssssssssssssssssssssssssss
                          140                 168
8                     (8) Ssssssssssssssssssssssssssss
                                        160           (180)
9                                   (9) Ssssssssssssssssssss 188
                                                      180
10                                               (10) S  208
--------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system

Phase C
Scenario I-35

```
28-Month Design Life                    |        Two Random Launch Failures
20-Month Launch Interval                |            Two Premature Failures
4-Month Call-up                         |     (12 Months Before Design Life)
(After a Launch Failure)                |
-----------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                            28
Ssssssssssssssssssssssssssss
                  20
2              (2) 0
                      24                          52
3                  (3) Sssssssssssssssssssssssssssss
                                     44
4                                (4) 0
                                         48                          76
5                                    (5) Sssssssssssssssssssssssssssssss
                                                         68                          96
6                                                   (6) Sssssssssssssssssssssssssssssss
                                                                     88            104
7                                                                          (7) Ssssssssssssssss]
                                                                                          108       (120)
8                                                                                      (8) Sssssssssssss
-----------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                                   136
8 continued       sssssssssssssssss
                           128            144
9                      (9) Ssssssssssssssss]
                                     148                          176
10                               (10) Sssssssssssssssssssssssssssssss
                                                         168       (180)
11                                                   (11) Sssssssssssss  196
-----------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system

Phase C
Scenario I-36

28-Month Design Life
20-Month Launch Interval
4-Month Call-up
(After a Launch Failure)

Three Random Launch Failures
Two Premature Failures
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
          |         |         |         |         |         |         |         |         |         |         |         |
1                                   28
Ssssssssssssssssssssssssss
                   20
2             (2) 0
                      24                        52
3                (3) Sssssssssssssssssssssssssss
                                     44
4                                (4) 0
                                        48                        76
5                                   (5) Sssssssssssssssssssssssssss
                                                     68                        96
6                                                (6) Sssssssssssssssssssssssssss
                                                                   88          104

7                                                                     (7) Ssssssssssssssl
                                                                                        108
8                                                                                  (8) 0
                                                                                             112    (120)

9                                                                                          (9) Ssssssss
```

```
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                                       140
9 continued        sssssssssssssssssss
                             132       148
10                      (10) Sssssssssssssssl
                                    152                       180
11                                (11) Sssssssssssssssssssssssssss
                                                     172    (180)
12                                              (12) Sssssssss  200
```

LEGEND

S = Launch of a satellite in a one-satellite system

Phase C
Scenario II-43

```
28-Month Design Life                    |          No Random Launch Failures
14-Month Launch Interval                |              No Premature Failures
6-Month Call-up                         |
(After a Launch Failure)                |
-------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                        28
Pppppppppppppppppppppppppp
            14                        42
2       (2) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                         28                        56
3                   (3) Pppppppppppppppppppppppppppp
                                  42                        70
4                             (4) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                 56                        84
5                                           (5) Pppppppppppppppppppppppppppp
                                                                   70                        98
6                                                         (6) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                   84                        112
7                                                                           (7) Pppppppppppppppppppppppppppp
                                                                                                   98                  (120
8                                                                                         (8) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                                                                112    (120)

9                                                                                                                 (9) Pppppppp
-------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |

                      126
8 continued       aaaaaaa
                                    140
9 continued       pppppppppppppppppppp
                      126                       154
10                 (10) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                    140                       168
11                            (11) Pppppppppppppppppppppppppppp
                                                 154                       (180)
12                                        (12) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa  182
                                                                168       (180)
13                                                        (13) Pppppppppppp  196
-------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit

Phase C
Scenario II-44

28-Month Design Life
14-Month Launch Interval
6-Month Call-up
(After a Launch Failure)

Three Random Launch Failures
Three Premature Failures
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                            28
Pppppppppppppppppppppppppp
         14                  30
2        (2) Aaaaaaaaaaaaaaa]
                             28
3                   (3) 0
                                 34                          62
4                          (4) Pppppppppppppppppppppppppppp
                                                48
5                                        (5) 0
                                                     54                          82
6                                                (6) Pppppppppppppppppppppppppppp
                                                                     68                          96
7                                                          (7) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                 82                98
8                                                                     (8) Pppppppppppppppp]
                                                                                                   96
9                                                                                        (9) 0
                                                                                                        102             (120)

10                                                                                                   (10) Pppppppppppppppppp
                                                                                                                        116(120)
11                                                                                                                  (11) Aaaaa
MONTHS          120       130       140       150       160       170       180

                          130
10 continued    ppppppppppp
                                    144
11 continued    aaaaaaaaaaaaaaaaaaaaaaaaa
                          130            146
12                   (12) Pppppppppppppppp]
                                    144                         172
13                                (13) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                158                 (180)
14                                        (14) Pppppppppppppppppppppppp  186
                                                                172   (180)
15                                                      (15) Aaaaaaaaa  200
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Premature failure on-orbit

Phase C
Scenario II-45

28-Month Design Life
14-Month Launch Interval
6-Month Call-up
(After a Launch Failure)

Four Random Launch Failures
Three Premature Failures
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                            28
Pppppppppppppppppppppppppp
           14              30
2       (2) Aaaaaaaaaaaaaaa]
                            28
3                   (3) 0
                                34                        62
4                           (4) Pppppppppppppppppppppppppp
                                          48
5                                   (5) 0
                                                54                        82
6                                       (6) Pppppppppppppppppppppppppp
                                                        68                        96
7                                                   (7) Aaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                  82              98
8                                                             (8) Pppppppppppppppp]
                                                                                96
9                                                                         (9) 0
                                                                                     102              (120

10                                                                                (10) Pppppppppppppppppp
                                                                                                   116
11                                                                                            (11) 0
MONTHS          120       130       140       150       160       170       180
                  |         |         |         |         |         |         |

                                130
10 continued      pppppppppp
                   122                        150
12             (12) Pppppppppppppppppppppppppp
                                136            152
13                          (13) Aaaaaaaaaaaaaaa]
                                           150                        178
14                                   (14) Pppppppppppppppppppppppppp
                                                        164           (180)
15                                                (15) Aaaaaaaaaaaaaaaa  192
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Premature failure on-orbit

Phase C
Scenario II-46

28-Month Design Life
14-Month Launch Interval
4-Month Call-up
(After a Launch Failure)

No Random Launch Failures
No Premature Failures

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                            28
Pppppppppppppppppppppppppp
               14                        42
2        (2) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                             28                        56
3                     (3) Pppppppppppppppppppppppppppp
                                       42                        70
4                                (4) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                 56                        84
5                                          (5) Pppppppppppppppppppppppppppp
                                                           70                        98
6                                                  (6) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                     84                        112
7                                                            (7) Pppppppppppppppppppppppppppp
                                                                                   98                        (120)
8                                                                     (8) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                                112    (120)

9                                                                                                   (9) Pppppppp
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |

                      126
8 continued        aaaaaaa
                                   140
9 continued        pppppppppppppppppppp
                      126                        154
10                  (10) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                   140                        168
11                            (11) Pppppppppppppppppppppppppppp
                                                 154                        (180)
12                                        (12) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa  182
                                                           168        (180)
13                                                   (13) Pppppppppppppp  196
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit

Phase C
Scenario II-47

28-Month Design Life
14-Month Launch Interval
4-Month Call-up
(After a Launch Failure)

Three Random Launch Failures
Three Premature Failures
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
          |         |         |         |         |         |         |         |         |         |         |         |

1                            28
Pppppppppppppppppppppppppp
            14            30
2        (2) Aaaaaaaaaaaaaaa]
                         28
3                    (3) 0
                             32                        60
4                        (4) Pppppppppppppppppppppppppppp
                                                46
5                                        (5) 0
                                                    50                        78
6                                            (6) Pppppppppppppppppppppppppppp
                                                                64                        92
7                                                        (7) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                          78            94
8                                                                   (8) Pppppppppppppppp]
                                                                                     92
9                                                                              (9) 0
                                                                                        96                   (120
10                                                                            (10) Pppppppppppppppppppppppppp
                                                                                                   110      (120)

11                                                                                                   (11) Aaaaaaaaaaa
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |

                     124
10 continued       pppppp
                                138
11 continued       aaaaaaaaaaaaaaaaaaa
                     124            140
12               (12) Pppppppppppppppp]
                                138                       166
13                           (13) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                            152                       180
14                                      (14) Pppppppppppppppppppppppppppp
                                                          166         (180)
15                                                   (15) Aaaaaaaaaaaaaaa  194
                                                                       180
16                                                                (16) P  208
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
J = Premature failure on-orbit

Phase C
Scenario II-48

28-Month Design Life
14-Month Launch Interval
4-Month Call-up
(After a Launch Failure)

Four Random Launch Failures
Three Premature Failures
(12 Months Before Design Life)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
          |         |         |         |         |         |         |         |         |         |         |         |

1                            28
Pppppppppppppppppppppppppp
            14          30
2        (2) Aaaaaaaaaaaaaaa]
                         28
3                    (3) 0
                             32                          60
4                        (4) Pppppppppppppppppppppppppppp
                                         46
5                                   (5) 0
                                         50                          78
6                                    (6) Pppppppppppppppppppppppppppp
                                                     64                          92
7                                                (7) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                 78                 94
8                                                          (8) Pppppppppppppppp]
                                                                                92
9                                                                        (9) 0
                                                                                   96                   (120)
10                                                                     (10) Pppppppppppppppppppppppp
                                                                                              110      (120)

11                                                                                                (11) Aaaaaaaaaaa
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |

                     124
10 continued       ppppp
                                 138
11 continued       aaaaaaaaaaaaaaaaaa
                     124
12                (12) 0
                          128            144
13                   (13) Aaaaaaaaaaaaaaaa]
                                 142                         170
14                            (14) Pppppppppppppppppppppppppppp
                                                156                   (180)
15                                        (15) Aaaaaaaaaaaaaaaaaaaaaaaaa  184
                                                            170      (180)
16                                                     (16) Pppppppppppp  198
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
J = Premature failure on-orbit

Phase D
Scenario I-37

```
28-Month Design Life              |          No Random Launch Failures
20-Month Launch Interval          |              No Premature Failures
9-Month Call-up                   |
---------------------------------------------------------------------------

MONTHS  10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                           28
Sssssssssssssssssssssssssss
                   20                           48
2              (2) Sssssssssssssssssssssssssssss
                                       40                            68
3                                  (3) Sssssssssssssssssssssssssssss
                                                           60                            88
4                                                      (4) Sssssssssssssssssssssssssssss
                                                                               80                           108
5                                                                          (5) Sssssssssssssssssssssssssssss
                                                                                                  100                  (120)_
6                                                                                             (6) Sssssssssssssssssssss
---------------------------------------------------------------------------------------------------------------------------
MONTHS             120       130       140       150       160       170       180
                    |         |         |         |         |         |         |
                           128
6 continued        sssssssss
                   120                          148
7              (7) Sssssssssssssssssssssssssssss
                                       140                           168
8                                  (8) Sssssssssssssssssssssssssssss
                                                           160                 180
9                                                      (9) Sssssssssssssssssssss
                                                                               180
10                                                                        (10) S    188
---------------------------------------------------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system

Phase D
Scenario I-38

```
28-Month Design Life                          |        Two Random Launch Failures
20-Month Launch Interval                      |            Two Premature Failures
9-Month Call-up (After a Launch               |   (12 Months Before Design Life,
Failure or Premature Failure)                 |  With Indications 4 Months Early)
-----------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                            28
SSSSSSSSSSSSSSSSSSSSSSSSSSS
                     20
2              (2) 0
                             29                        57
3                    (3) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                           49
4                                     (4) 0
                                                 58                        86
5                                           (5) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                                                   78                        106
6                                                            (6) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                                                                     98        110 114
7                                                                              (7) SSSSSSSSSSSSJSSSJ
                                                                                                          118(120)

8                                                                                                                (8) SSS
-----------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                                                146
8 continued       SSSSSSSSSSSSSSSSSSSSSSSSSSS
                                     138       150 154
9                                (9) SSSSSSSSSSSSJSSSJ
                                                     158                (180)
10                                             (10) SSSSSSSSSSSSSSSSSSSSSSS  186
                                                                   178(180)
11                                                            (11) SSS  206
-----------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
J = Premature failure on-orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase D
Scenario I-39

28-Month Design Life
20-Month Launch Interval
9-Month Call-up (After a Launch Failure or Premature Failure)

Three Random Launch Failures
Two Premature Failures
(12 Months Before Design Life, With Indications 4 Months Early)

```
MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                            28
SSSSSSSSSSSSSSSSSSSSSSSSSSS
                   20
2             (2) 0
                         29                        57
3                    (3) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                        49
4                                   (4) 0
                                                  58                        86
5                                             (5) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                                                   78                        106
6                                                             (6) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                                                                     98        110 114
7                                                                              (7) SSSSSSSSSSSJSSSJ
                                                                                                         118

8                                                                                                     (8) 0
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |
                        127                       155
9                   (9) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                            147       159 163
10                                    (10) SSSSSSSSSSSJSSSJ
                                                        167       (180)
11                                                  (11) SSSSSSSSSSSSSS  195
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
J = Premature failure on-orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase D
Scenario I-40

28-Month Design Life
20-Month Launch Interval
4-Month Call-up (After a Launch Failure or Premature Failure)

No Random Launch Failures
No Premature Failures

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
          |         |         |         |         |         |         |         |         |         |         |         |
1                                   28
SSSSSSSSSSSSSSSSSSSSSSSSSSS
                   20                        48
2             (2) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                  40                        68
3                           (3) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                                60                        88
4                                         (4) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                                                80                        108
5                                                         (5) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                                                                  100                (120)
6                                                                            (6) SSSSSSSSSSSSSSSSSSSSS
```

```
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                                 128
6 continued        SSSSSSSSS
                  120                       148
7             (7) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                  140                       168
8                           (8) SSSSSSSSSSSSSSSSSSSSSSSSSSSSS
                                                160               180
9                                         (9) SSSSSSSSSSSSSSSSSSSSS
                                                                  180
10                                                        (10) S   188
```

LEGEND

S = Launch of a satellite in a one-satellite system

Phase D
Scenario I-41

28-Month Design Life
20-Month Launch Interval
4-Month Call-up (After a Launch Failure or Premature Failure)

Two Random Launch Failures
Two Premature Failures
(12 Months Before Design Life, With Indications 4 Months Early)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                            28
Sssssssssssssssssssssssssss
                  20
2            (2) 0
                     24                          52
3                 (3) Sssssssssssssssssssssssssssss
                                        44
4                                  (4) 0
                                           48                          76
5                                     (5) Sssssssssssssssssssssssssssssss
                                                                68                          96
6                                                        (6) Sssssssssssssssssssssssssssssss
                                                                                 88        100 104
7                                                                          (7) Ssssssssssslsssl
                                                                                            104           (120)

8                                                                                                   (8) Sssssssssssssssss
```

```
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                             132
8 continued        sssssssssssss
                      124        136 140
9                 (9) Ssssssssssslsssl
                                140                         168
10                           (10) Sssssssssssssssssssssssssssss
                                                   160                (180)
11                                            (11) Sssssssssssssssssssss  188
                                                                     180
12                                                              (12) S  208
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
I = Premature failure on-orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase D
Scenario I-42

28-Month Design Life 20-Month Launch Interval 4-Month Call-up (After a Launch Failure or Premature Failure)	Three Random Launch Failures Two Premature Failures (12 Months Before Design Life, With Indications 4 Months Early)

```
------------------------------------------------------------------------------------------
MONTHS  10      20      30      40      50      60      70      80      90     100     110     120
         !       !       !       !       !       !       !       !       !       !       !       !
1                          28
Sssssssssssssssssssssssssss
                        20
2                   (2) 0
                        24                        52
3                  (3) Ssssssssssssssssssssssssssss
                                       44
4                                  (4) 0
                                          48                      76
5                                     (5) Sssssssssssssssssssssssssssss
                                                          68                       96
6                                                     (6) Sssssssssssssssssssssssssssss
                                                                      88       100 104
7                                                                 (7) SsssssssssssJsssJ
                                                                                   104          (120)

8                                                                              (8) Sssssssssssssssss
------------------------------------------------------------------------------------------
MONTHS                  120     130     140     150     160     170     180
                         !       !       !       !       !       !       !
                                   132
8 continued             sssssssssssss
                            124
9                       (9) 0
                                128       140 144
10                         (10) SssssssssssJsssJ
                                            144                       172
11                                    (11) Sssssssssssssssssssssssssssss
                                                         164            (180)
12                                                  (12) Sssssssssssssssss  192
------------------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
0 = Launch failure
J = Premature failure on-orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase D
Scenario II-49

24-Month Design Life
12-Month Launch Interval
4-Month Call-up (After a Launch Failure or Early Signs of Premature Failure)

No Random Launch Failures
No Premature Failures

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
          |         |         |         |         |         |         |         |         |         |         |         |

1                   24                                                                                  *
Pppppppppppppppppppppp
          12                  36
2     (2) Aaaaaaaaaaaaaaaaaaaaaaaa
                    24                  48
3                (3) Pppppppppppppppppppppppp
                          36                  60
4                           (4) Aaaaaaaaaaaaaaaaaaaaaaaa
                                      48                  72
5                                   (5) Pppppppppppppppppppppppp
                                                60                  84
6                                             (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                        72                  96
7                                                     (7) Pppppppppppppppppppppppp
                                                                84                  108
8                                                             (8) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                        96                  120

9                                                                         (9) Pppppppppppppppppppppppp
                                                                                    108       (120)
10                                                                              (10) Aaaaaaaaaaaaa
MONTHS          120       130       140       150       160       170       180
                   |         |
                            132
10 continued       aaaaaaaaaaaaa
                  120                 144
11           (11) Pppppppppppppppppppppppp
                            132                 156
12                     (12) Aaaaaaaaaaaaaaaaaaaaaaaa
                                    144                 168
13                                (13) Pppppppppppppppppppppppp
                                                156                 180
14                                            (14) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                            168       (180)
15                                                      (15) Pppppppppppp ] 192
                                                                      180
16                                                                (16) A ] 224
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit

Phase D
Scenario II-50

24-Month Design Life
12-Month Launch Interval
4-Month Call-up (After a Launch Failure or Early Indications of Premature Failure)

Three Random Launch Failures
Three Premature Failures
(12 Months Before Design Life, With Indications 4 Months Early)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
          |         |         |         |         |         |         |         |         |         |         |         |
1                   24
Pppppppppppppppppppppp
         12       20  24
2     (2) Aaaaaaaalaaa]
                    24
3                (3) 0
                        28                    52
4                   (4) Pppppppppppppppppppppppp
                            32
5                       (5) 0
                                36                    60
6                           (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                          48                  72
7                                     (7) Pppppppppppppppppppppppp
                                                      60     68  72
8                                            (8) Aaaaaaaalaaal
                                                          72                    96
9                                                   (9) Pppppppppppppppppppppppp
                                                            76                  100
10                                                    (10) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                     88     96 100
11                                                            (11) Pppppppp]ppp]
                                                                                100
12                                                                        (12) 0
                                                                                  104           (120)
13                                                                           (13) Pppppppppppppppp
                                                                                     108       (120)
14                                                                             (14) Aaaaaaaaaaaaa
```

```
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                            128
13 continued       pppppppp
                            132
14 continued       aaaaaaaaaaaa
                  120                 144
15            (15) Pppppppppppppppppppppppp
                            132                 156
16                     (16) Aaaaaaaaaaaaaaaaaaaaaaaa
                                  144                 168
17                            (17) Pppppppppppppppppppppppp
                                                156                 180
18                                     (18) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                        168       (180)
19                                                (19) Pppppppppppp  ] 192
                                                                   180
20                                                          (20) A  ] 204
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
] = Premature failure on orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase D
Scenario II-51

24-Month Design Life
12-Month Launch Interval
4-Month Call-up (After a Launch Failure or Early Indications of Premature Failure)

Four Random Launch Failures
Three Premature Failures
(12 Months Before Design Life, With Indications 4 Months Early)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                     24
Pppppppppppppppppppppp
            12      20  24
2      (2) Aaaaaaaalaaa]
                      24
3                 (3) 0
                         28                      52
4                     (4) Pppppppppppppppppppppppp
                            32
5                         (5) 0
                                36                      60
6                               (6) Aaaaaaaaaaaaaaaaaaaaaaaa
                                            48                      72
7                                       (7) Pppppppppppppppppppppppp
                                                        60      68  72
8                                                   (8) Aaaaaaaalaaa]
                                                                    72                      96
9                                                               (9) Pppppppppppppppppppppppp
                                                                        76                      100
10                                                                  (10) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                                    88      96 100
11                                                                          (11) Pppppppp]ppp]
                                                                                            100
12                                                                                      (12) 0
                                                                                                 104            (120)
13                                                                                          (13) Pppppppppppppppp
                                                                                                     108
14                                                                                               (14) 0
                                                                                                          112    (120)
15                                                                                                        (15) Aaaaaaaa
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                            128
13 continued       pppppppp
                                 136
15 continued       aaaaaaaaaaaaaaaa
                     124                 148
16                (16) Pppppppppppppppppppppppp
                                 136                 160
17                          (17) Aaaaaaaaaaaaaaaaaaaaaaaa
                                            148                 172
18                                      (18) Pppppppppppppppppppppppp
                                                        160             (180)
19                                                  (19) Aaaaaaaaaaaaaaaaaaaaa  ] 184
                                                                    172   (180)
20                                                              (20) Pppppppp  ] 196
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
] = Premature failure on orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase D
Scenario II-52

28-Month Design Life
14-Month Launch Interval
6-Month Call-up (After a Launch Failure or Early Indications of Premature Failure)

No Random Launch Failures
No Premature Failures

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                            28
Pppppppppppppppppppppppppp
            14                        42
2        (2) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                             28                        56
3                     (3) Pppppppppppppppppppppppppppp
                                      42                        70
4                                (4) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                  56                        84
5                                            (5) Pppppppppppppppppppppppppppp
                                                                70                        98
6                                                        (6) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                  84                        112
7                                                                          (7) Pppppppppppppppppppppppppppp
                                                                                                98                        (120)
8                                                                                     (8) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                                                                112    (120)

9                                                                                                                   (9) Pppppppp
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |

                      126
8 continued        aaaaaaa
                                   140
9 continued        pppppppppppppppppppp
                      126                        154
10                 (10) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                   140                        168
11                            (11) Pppppppppppppppppppppppppppp
                                                  154                        (180)
12                                          (12) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa  182
                                                                168        (180)
13                                                       (13) Pppppppppppppp  196
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit

Phase D
Scenario II-53

28-Month Design Life
14-Month Launch Interval
6-Month Call-up (After a Launch Failure or Early Indications of Premature Failure)

Three Random Launch Failures
Three Premature Failures
(12 Months Before Design Life, With Indications 4 Months Early)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                            28
Pppppppppppppppppppppppppp
             14        26  30
2        (2) Aaaaaaaaaaaalaaal
                          28
3                     (3) 0
                                34                          62
4                          (4) Pppppppppppppppppppppppppp
                                     40
5                                (5) 0
                                         46                          74
6                                     (6) Aaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                  60                          88
7                                              (7) Pppppppppppppppppppppppppp
                                                                 74        86  90
8                                                           (8) Aaaaaaaaaaaalaaal
                                                                                88                          116
9                                                                        (9) Pppppppppppppppppppppppppp
                                                                                   94                          (120)
10                                                                          (10) Aaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                                108       (120)
11                                                                                                   (11) Ppppppppppp
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                  122
10 continued      aaa
                 120 124
11 continted      Ippp]
                  122
12             (12) 0
                      128                         156
13                (13) Pppppppppppppppppppppppppp
                           134                         162
14                     (14) Aaaaaaaaaaaaaaaaaaaaaaaaaaa
                                     148                         176
15                                (15) Pppppppppppppppppppppppppp
                                                 162         (180)
16                                            (16) Aaaaaaaaaaaaaaaaaaa  190
                                                            176(180)
17                                                       (17) Ppppp  204
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
I = Premature failure on orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase D
Scenario II-54

28-Month Design Life
14-Month Launch Interval
6-Month Call-up (After a Launch Failure or Early Indications of Premature Failure)

Four Random Launch Failures
Three Premature Failures
(12 Months Before Design Life, With Indications 4 Months Early)

```
MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                            28
Pppppppppppppppppppppppppp
             14         26  30
2        (2) Aaaaaaaaaaa]aaa]
                         28
3                    (3) 0
                             34                        62
4                            (4) Pppppppppppppppppppppppppp
                                 40
5                                (5) 0
                                     46                        74
6                                    (6) Aaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                   60                        88
7                                                  (7) Pppppppppppppppppppppppppp
                                                                 74        86  90
8                                                                (8) Aaaaaaaaaaa]aaa]
                                                                                   88                        116
9                                                                                  (9) Pppppppppppppppppppppppppp
                                                                                          94                        (120)
10                                                                                         (10) Aaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                                   108       (120)
11                                                                                                       (11) Pppppppppppp]
```

```
MONTHS                 120       130       140       150       160       170       180
                       |         |         |         |         |         |         |
                        122
10 continued           aaa
                      120 124
11 continued           ]ppp]
                        122
12                (12) 0
                           128                       156
13                     (13) Pppppppppppppppppppppppppp
                                134
14                              (14) 0
                                     140                       168
15                                   (15) Aaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                  154                       (180)
16                                                (16) Pppppppppppppppppppppppppp  182
                                                                 168       (180)
17                                                               (17) Aaaaaaaaaaaaa  196
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
] = Premature failure on orbit - if two symbols, the first represents early indications that a failure will occur in 4 months

Phase D
Scenario II-55

28-Month Design Life
14-Month Launch Intervals
4-Month Call-up (After a Launch Failure or Early Indications of Premature Failure)

No Random Launch Failures
No Premature Failures

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                            28
Pppppppppppppppppppppppppp
            14                        42
2       (2) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                             28                        56
3                     (3) Pppppppppppppppppppppppppppp
                                      42                        70
4                                (4) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                  56                        84
5                                           (5) Pppppppppppppppppppppppppp
                                                                70                        98
6                                                        (6) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                  84                        112
7                                                                          (7) Pppppppppppppppppppppppppppp
                                                                                                98                  (120)
8                                                                                     (8) Aaaaaaaaaaaaaaaaaaaaaaaa
                                                                                                                  112   (120)

9                                                                                                          (9) Pppppppp
```

```
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |

                      126
8 continued        aaaaaaa
                                   140
9 continued        pppppppppppppppppppp
                      126                        154
10                  (10) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                   140                        168
11                            (11) Pppppppppppppppppppppppppppp
                                                154                        (180)
12                                        (12) Aaaaaaaaaaaaaaaaaaaaaaaaaaaa  182
                                                                168        (180)
13                                                     (13) Pppppppppppppp  196
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit

Phase D
Scenario II-56

28-Month Design Life
14-Month Launch Intervals
4-Month Call-up (After a Launch Failure or Early Indications of Premature Failure)

Three Random Launch Failures
Three Premature Failures
(12 Months Before Design Life, With Indications 4 Months Early)

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                            28
Pppppppppppppppppppppppppp
             14          26  30
2        (2) Aaaaaaaaaaaa]aaa]
                             28
3                      (3) 0
                                32                        60
4                            (4) Pppppppppppppppppppppppppp
                                 36
5                               (5) 0
                                        40                        68
6                                  (6) Aaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                  54                        82
7                                            (7) Pppppppppppppppppppppppppp
                                                                68        80  84
8                                                        (8) Aaaaaaaaaaaa]aaa]
                                                                          82                        110
9                                                                  (9) Pppppppppppppppppppppppppp
                                                                             86                        114
10                                                                    (10) Aaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                   100        112 116

11                                                                                  (11) Pppppppppppp]ppp]
                                                                                                     114
12                                                                                            (12) 0
                                                                                                        118(120)
13                                                                                                   (13) Ppp
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                                                146
13 continued       pppppppppppppppppppppppppp
                                     132                       160
14                           (14) Aaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                146                       174
15                                     (15) Pppppppppppppppppppppppppp
                                                          160                   (180)
16                                                 (16) Aaaaaaaaaaaaaaaaaaaaa  188
                                                                    174  (180)
17                                                            (17) Pppppp  202
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
] = Premature failure on orbit - if two symbols, the first represents early indications that a failure will occur in 4 months

Phase D
Scenario II-57

```
28-Month Design Life                          |        Four Random Launch Failures
14-Month Launch Intervals                     |           Three Premature Failures
4-Month Call-up (After a Launch               |     (12 Months Before Design Life,
Failure or Early Indications of               |   With Indications 4 Months Early)
Premature Failure)                            |
-------------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                            28
Ppppppppppppppppppppppppp
         14        26  30
2        (2) Aaaaaaaaaaa]aaa]
                     28
3                (3) 0
                     32                        60
4                    (4) Pppppppppppppppppppppppppp
                         36
5                        (5) 0
                             40                        68
6                            (6) Aaaaaaaaaaaaaaaaaaaaaaaaaaa
                                         54                        92
7                                    (7) Pppppppppppppppppppppppppp
                                                   68        80  84
8                                                (8) Aaaaaaaaaaa]aaa]
                                                                82                        110
9                                                             (9) Pppppppppppppppppppppppppp
                                                                    86                        114
10                                                              (10) Aaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                100       112 116
11                                                                          (11) Pppppppppppp]ppp]
                                                                                                114
12                                                                                        (12) 0
                                                                                                  118(120)
13                                                                                              (13) Ppp
-------------------------------------------------------------------------------------
MONTHS           120       130       140       150       160       170       180
                 |         |         |         |         |         |         |
                                               146
13 continued     pppppppppppppppppppppppppp
                           132
14                   (14) 0
                             136                       164
15                           (15) Aaaaaaaaaaaaaaaaaaaaaaaaaaa
                                           150                       178
16                                         (16) Pppppppppppppppppppppppppp
                                                     164         (180)
17                                                 (17) Aaaaaaaaaaaaaaaaa  192
                                                                178(180)
18                                                           (18) Ppp  206
-------------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
] = Premature failure on orbit - if two symbols, the first represents early indications that a failure will occur in 4 months

Phase E
Scenario I-43

```
32-Month Design Life                         No Random Launch Failures
22-Month Launch Interval                        No Premature Failures
4-Month Call-up
------------------------------------------------------------------------------------------------------------------------
MONTHS  10         20         30         40         50         60         70         80         90        100        110        120
         |          |          |          |          |          |          |          |          |          |          |          |
1                                32
Sssssssssssssssssssssssssssssssss
                      22                                 54
2                 (2) Ssssssssssssssssssssssssssssssss
                                            44                                 76
3                                       (3) Ssssssssssssssssssssssssssssssss
                                                              66                                 98
4                                                         (4) Ssssssssssssssssssssssssssssssss
                                                                                88                              120
5                                                                           (5) Ssssssssssssssssssssssssssssssss
                                                                                                          110      (120)
6                                                                                                     (6) Ssssssssss
------------------------------------------------------------------------------------------------------------------------
MONTHS                120        130        140        150        160        170        180
                       |          |          |          |          |          |          |
                                              142
6 continued            ssssssssssssssssssssss
                                 132                             164
7                            (7) Ssssssssssssssssssssssssssssssss
                                           154                    (180)
8                                      (8) Ssssssssssssssssssssssssss 186
                                                              176(180)
9                                                         (9) Sssss  218
------------------------------------------------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system

Phase E
Scenario I-44

```
32-Month Design Life                          |        Two Random Launch Failures
22-Month Launch Interval                      |            Two Premature Failures
4-Month Call-up (After a Launch               |     (14 Months Before Design Life,
Failure or Premature Failure)                 |  With Indications 4 Months Early)
-----------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                            32
Sssssssssssssssssssssssssssss
                   22
2               (2) 0
                       26                          58
3                  (3) Sssssssssssssssssssssssssssssss
                                        48
4                                  (4) 0
                                           52                          84
5                                      (5) Sssssssssssssssssssssssssssssss
                                                                74                        106
6                                                         (6) Sssssssssssssssssssssssssssssss
                                                                                   96          110 114
7                                                                          (7) Ssssssssssssssl sssl
                                                                                                  114  (120)

8                                                                                                   (8) Sssssss
-----------------------------------------------------------------------------------------------------------------

MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |
                                                146
8 continued        sssssssssssssssssssssssssssss
                                     136        150 154
9                             (9) Ssssssssssssssl sssl
                                                154                   (180)
10                                        (10) Sssssssssssssssssssssssssssss  186
                                                                176(180)
11                                                            (11) Sssss  208
-----------------------------------------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
0 = Launch failure
l = Premature failure on-orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase E
Scenario I-45

32-Month Design Life 22-Month Launch Interval 4-Month Call-up (After a Launch Failure or Premature Failure)	Three Random Launch Failures Two Premature Failures (14 Months Before Design Life, With Indications 4 Months Early)

```
MONTHS  10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                              132
Ssssssssssssssssssssssssssssssss
                    22
2               (2) 0
                        26                              58
3                   (3) Ssssssssssssssssssssssssssssssss
                                              48
4                                         (4) 0
                                                  52                              84
5                                             (5) Ssssssssssssssssssssssssssssssss
                                                                        74                              106
6                                                                   (6) Ssssssssssssssssssssssssssssssss
                                                                                              96            110 114
7                                                                                         (7) Sssssssssssss]sss]
                                                                                                                114  (120)

8                                                                                                               (8) Ssssss
------------------------------------------------------------------------------------------------------------------------
MONTHS              120       130       140       150       160       170       180
                     |         |         |         |         |         |         |
                                                  146
8 continued         ssssssssssssssssssssssssss
                                    136
9                               (9) 0
                                        140           154 158
10                                 (10) Sssssssssssss]sss]
                                                          158                 (180)
11                                                  (11) Sssssssssssssssssssss  190
------------------------------------------------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
] = Premature failure on-orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase E
Scenario I-46

```
POES On-orbit History                          |          No Random Launch Failures |
(29-41-37-15-Month Cycle)                      |           No Early Indications of  |
4-Month Call-up (After a Launch                |                On-orbit Failure    |
Failure or Failure On-orbit)                   |
-------------------------------------------------------------------------------------

MONTHS  10     20     30     40     50     60     70     80     90     100    110    120
        |      |      |      |      |      |      |      |      |      |      |      |

1                    29
Ssssssssssssssssssssssssssss]  (29 months)
                        33                           74
2                   (2) Ssssssssssssssssssssssssssssssssssssssss]  (41 months)
                                                        78                       115
3                                                  (3) Ssssssssssssssssssssssssssssssssssss]
                                                                            (37 months)
                                                                                  119(120)

4                                                                                 (4) Ss
-------------------------------------------------------------------------------------
MONTHS         120    130    140    150    160    170    180
               |      |      |      |      |      |      |

                         134
4 continued    ssssssssssssss]  (15 months)
                            138                    167
5                       (5) Ssssssssssssssssssssssssssss]  (29 months)
                                                       171    (180)
6                                                 (6) Sssssssss  ] 212  (41 months)
-------------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
] = Failure on-orbit

Phase E
Scenario I-47

```
POES On-orbit History                    |          Two Random Launch Failures
(29-41-37-15-Month Cycle)                |             No Early Indications of
4-Month Call-up (After a Launch          |                   On-orbit Failure
Failure or Failure On-orbit)             |
------------------------------------------------------------------------------------

MONTHS  10     20     30     40     50     60     70     80     90     100    110    120
        |      |      |      |      |      |      |      |      |      |      |      |

1                     29
Ssssssssssssssssssssssssssssss]  (29 months)
                        33
2                    (2) 0
                           37                          78
3                     (3) Sssssssssssssssssssssssssssssssssssssssssss]  (41 months)
                                                          82
4                                                      (4) 0
                                                             86                     (120)

5                                                         (5) Ssssssssssssssssssssssssssssssssssss
------------------------------------------------------------------------------------
MONTHS         120    130    140    150    160    170    180
               |      |      |      |      |      |      |

                123
5 continued    ssss  (37 months)
                   127          142
6               (6) Sssssssssssssss]  (15 months)
                               146                  175
7                          (7) Sssssssssssssssssssssssssssss]  (29 months)
                                                    179(180)
8                                               (8) Ss ] 220  (41 months)
------------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
] = Failure on-orbit

Phase E
Scenario I-48

```
POES On-orbit History                      |        Three Random Launch Failures
(29-41-37-15-Month Cycle)                  |              No Early Indications of
4-Month Call-up (After a Launch            |                    On-orbit Failure
Failure or Failure On-orbit)               |
-------------------------------------------------------------------------------------------

MONTHS  10      20      30      40      50      60      70      80      90      100     110     120
         |       |       |       |       |       |       |       |       |       |       |       |

1                           29
Sssssssssssssssssssssssssss]  (29 months)
                               33
2                          (2) 0
                                    37                                    78
3                              (3) Sssssssssssssssssssssssssssssssssssssssss]  (41 months)
                                                                            82
4                                                                      (4) 0
                                                                               86                                   (120)

5                                                                         (5) Sssssssssssssssssssssssssssssssssss
-------------------------------------------------------------------------------------------
MONTHS                  120     130     140     150     160     170     180
                         |       |       |       |       |       |       |

                          123
5 continued             sss]  (37 months)
                             127          142
6                         (6) Sssssssssssssss]  (15 months)
                                            146                         175
7                                       (7) Sssssssssssssssssssssssssssss]  (29 months)
                                                                          179
8                                                                     (8) 0
-------------------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
] = Failure on-orbit

Phase E
Scenario I-49

POES On-orbit History (29-41-37-15-Month Cycle) 4-Month Call-up (After a Launch Failure or Failure On-orbit)	No Random Launch Failures With Indications of On-orbit Failure 4 Months Early for Satellites With 29-, 41-, or 37-Month Lifetimes

```
MONTHS  10         20         30         40         50         60         70         80         90        100        110        120
         :          :          :          :          :          :          :          :          :          :          :          :

1                        25  29
Sssssssssssssssssssssssss]sss]  (29 months)
                             29                                      66  70
2                       (2) Sssssssssssssssssssssssssssssssssssssss]sss]  (41 months)
                                                                         70                                   103 107
3                                                                   (3) Sssssssssssssssssssssssssssssssssss]sss]  (37 months)
                                                                                                                  107          (120)
4                                                                                                            (4) Sssssssssssss
---------------------------------------------------------------------------------------------------------------------------------
MONTHS              120        130        140        150        160        170        180
                     :          :          :          :          :          :          :

                      122
4 continued         ss]  (15 months)
                         126                          151 155
5                      (5) Sssssssssssssssssssssssss]sss]  (29 months)
                                                          155                        (180)
6                                                    (6) Ssssssssssssssssssssssssss  ] 196  (41 months)
---------------------------------------------------------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
] = Failure on-orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase E
Scenario I-50

POES On-orbit History (29-41-37-15-Month Cycle) 4-Month Call-up (After a Launch Failure or Failure On-orbit)

Two Random Launch Failures With Indications of On-orbit Failure 4 Months Early for Satellites With 29-, 41-, or 37-Month Lifetimes

```
---------------------------------------------------------------------------------------------
MONTHS   10      20      30      40      50      60      70      80      90     100     110     120
          :       :       :       :       :       :       :       :       :       :       :       :

1                     25  29
Sssssssssssssssssssssss]sss]  (29 months)
                          29
2                     (2) 0
                             33                                   70  74
3                        (3) Sssssssssssssssssssssssssssssssssssss]sss]  (41 months)
                                                                      74
4                                                                (4) 0
                                                                         78                              111 115
5                                                                   (5) Ssssssssssssssssssssssssssssssssss]sss]
                                                                                                     (37 months)
                                                                                                          115 (120)
6                                                                                                       (6) Sssss
---------------------------------------------------------------------------------------------
MONTHS           120     130     140     150     160     170     180
                  :       :       :       :       :       :       :

                          130
6 continued      ssssssssss]  (15 months)
                             134                       159 163
7                        (7) Sssssssssssssssssssssssss]sss]  (29 months)
                                                           163         (180)
8                                                      (8) Sssssssssssssssss  ] 204  (41 months)
---------------------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
] = Failure on-orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase E
Scenario I-51

POES On-orbit History (29-41-37-15-Month Cycle) 4-Month Call-up (After a Launch Failure or Failure On-orbit)	Three Random Launch Failures With Indications of On-orbit Failure 4 Months Early for Satellites With 29-, 41-, or 37-Month Lifetimes

```
MONTHS    10        20        30        40        50        60        70        80        90        100       110       120
          ¦         ¦         ¦         ¦         ¦         ¦         ¦         ¦         ¦         ¦         ¦         ¦

1                        25  29
Ssssssssssssssssssssssss]sss]  (29 months)
                             29
2                        (2) 0
                                 33                                   70  74
3                            (3) Ssssssssssssssssssssssssssssssssssss]sss]  (41 months)
                                                                          74
4                                                                     (4) 0
                                                                              78                               111 115
5                                                                         (5) Ssssssssssssssssssssssssssssssss]sss]
                                                                                                         (37 months)
                                                                                                                 115 (120)

6                                                                                                              (6) Ssssss
---------------------------------------------------------------------------------------------------------------------------
MONTHS              120       130       140       150       160       170       180
                    ¦         ¦         ¦         ¦         ¦         ¦         ¦

                            130
6 continued         ssssssssss]  (15 months)
                                134                      159 163
7                             (7) Ssssssssssssssssssssssss]sss]  (29 months)
                                                             163
8                                                         (8) 0
                                                                 167         (180)
9                                                             (9) Sssssssssssss  ] 208  (41 months)
---------------------------------------------------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
O = Launch failure
] = Failure on-orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase E
Scenario I-52

Exact History of the Current POES - Satellite Lifetimes on a 29-41-0-37-15-Month Cycle, Where the Zero Represents a Launch Failure

4-Month Call-up (After a Launch Failure or the Failure of an On-orbit Satellite)	No Early Indications of an On-orbit Failure

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         ¦         ¦         ¦         ¦         ¦         ¦         ¦         ¦         ¦         ¦         ¦         ¦

1                           29
Sssssssssssssssssssssssssss]  (29 months)
                                 33                                       74
2                           (2) Sssssssssssssssssssssssssssssssssssssssss]  (41 months)
                                                                              78
3                                                                         (3) 0
                                                                                  82                                  119
4                                                                             (4) Sssssssssssssssssssssssssssssssssss]
                                                                                                          (37 months)
-------------------------------------------------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                   ¦         ¦         ¦         ¦         ¦         ¦         ¦

                      123            138
5                 (5) Sssssssssssssss]  (15 months)
                                         142                          171
6                                    (6) Sssssssssssssssssssssssssssss]  (29 months)
                                                                         175 (180)
7                                                                     (7) Sssss  ] 216  (41 Months)
-------------------------------------------------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
] = Failure on-orbit

Phase E
Scenario I-53

Exact History of the Current POES - Satellite Lifetimes on a 29-41-0-37-15-Month Cycle, Where the Zero Represents a Launch Failure

4-Month Call-up (After a Launch Failure or the Failure of an On-orbit Satellite)	With Early Indications of Failure of Satellites With 29-, 41-, or 37-Month Lifetimes

```
------------------------------------------------------------------------------------------------------------------------
MONTHS  10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                      25  29
Ssssssssssssssssssssssss]sss]  (29 months)
                           29                                   66  70
2                       (2) Sssssssssssssssssssssssssssssssssssss]sss]  (41 months)
                                                                    70
3                                                                (3) 0
                                                                        74                              107 111
4                                                                    (4) Ssssssssssssssssssssssssssssssssss]sss]
                                                                                                    (37 months)
                                                                                                            111    (120)

5                                                                                                         (5) Sssssssss
------------------------------------------------------------------------------------------------------------------------
MONTHS           120       130       140       150       160       170       180
                   |         |         |         |         |         |         |

                       126
5 continued        ssssss]  (15 months)
                           130                    155 159
6                        (6) Sssssssssssssssssssssssss]sss]  (29 months)
                                                        159                (180)
7                                                   (7) Ssssssssssssssssssss  ] 200  (41 Months)
------------------------------------------------------------------------------------------------------------------------
```

LEGEND

S = Launch of a satellite in a one-satellite system
] = Failure on-orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase E
Scenario II-58

32-Month Design Life
16-Month Launch Interval
4-Month Call-up (After a Launch Failure or Premature Failure)

No Random Launch Failures
No Premature Failures

```
MONTHS   10        20        30        40        50        60        70        80        90       100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                            32
Pppppppppppppppppppppppppppppp
             16                          48
2         (2) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                             32                          64
3                      (3) Pppppppppppppppppppppppppppppppp
                                         48                          80
4                                   (4) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                     64                          96
5                                                (5) Pppppppppppppppppppppppppppppppp
                                                                     80                          112
6                                                                (6) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                         96                  (120)

7                                                                                    (7) Pppppppppppppppppppppppp
                                                                                                        112   (120)
8                                                                                                   (8) Aaaaaaaaa
```

```
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |

                        128
7 continued       ppppppppp
                                    144
8 continued       aaaaaaaaaaaaaaaaaaaaaaaa
                        128                         160
9                    (9) Pppppppppppppppppppppppppppppp
                                    144                         176
10                              (10) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                    160                 (180)
11                                              (11) Pppppppppppppppppppp  192
                                                                    176(180)
12                                                              (12) Aaaaa  208
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit

Phase E
Scenario II-59

```
32-Month Design Life                          |      Three Random Launch Failures
16-Month Launch Interval                      |          Three Premature Failures
4-Month Call-up (After a Launch               |    (14 Months Before Design Life)
Failure or Premature Failure)                 |
-----------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |

1                            32
Pppppppppppppppppppppppppppp
                16
                          34          48
2          (2) Aaaaaaaaaaaaaaaaa]
                          32
3                      (3) 0
                             36                          68
4                         (4) Pppppppppppppppppppppppppppppp
                                 40
5                            (5) 0
                                     44                          76
6                                (6) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                 60                          92
7                                            (7) Pppppppppppppppppppppppppppppp
                                                                 76          94
8                                                         (8) Aaaaaaaaaaaaaaaaa]
                                                                             92                        (120)

9                                                                     (9) Pppppppppppppppppppppppppppp
                                                                                 98                  (120)

10                                                                       (10) Aaaaaaaaaaaaaaaaaaaaaaa
                                                                                                114  (120)
11                                                                                     (11) Pppppppp
-----------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                  |         |         |         |         |         |         |

                     124
9 continued       ppppp
                          130
10 continued      aaaaaaaaaaa
                             132
11 continued      ppppppppppp]
                          130
12                    (12) 0
                               134                         166
13                        (13) Pppppppppppppppppppppppppppppp
                                   138                         170
14                            (14) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                154                         (180)
15                                        (15) Pppppppppppppppppppppppppp  186
                                                                170       (180)
16                                                        (16) Aaaaaaaaaaa  202
-----------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
] = Premature failure on-orbit

Phase E
Scenario II-60

```
32-Month Design Life                          |        Four Random Launch Failures
16-Month Launch Interval                      |           Three Premature Failures
4-Month Call-up (After a Launch               |     (14 Months Before Design Life)
Failure or Premature Failure)                 |
-------------------------------------------------------------------------------------

MONTHS   10        20        30        40        50        60        70        80        90       100       110       120!
         |         |         |         |         |         |         |         |         |         |         |         |

1                            32
Pppppppppppppppppppppppppppppp
                 16
2          (2) Aaaaaaaaaaaaaaaaa]
                             32
3                       (3) 0
                                36
4                            (4) Pppppppppppppppppppppppppppppppp
                                   40
5                               (5) 0
                                       44                          76
6                                  (6) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                 60                          92
7                                            (7) Pppppppppppppppppppppppppppppppp
                                                                76              94
8                                                          (8) Aaaaaaaaaaaaaaaaa]
                                                                                92                        (120)
9                                                                        (9) Pppppppppppppppppppppppppppp
                                                                                 98                  (120)
10                                                                          (10) Aaaaaaaaaaaaaaaaaaaaaaa
                                                                                                   114  (120)
11                                                                                          (11) Pppppp
-------------------------------------------------------------------------------------
MONTHS            120       130       140       150       160       170       180
                   |         |         |         |         |         |         |

                     124
9 continued        ppppp
                            130
10 continued       aaaaaaaaaaa
                              132
11 continued       pppppppppppp]
                            130
12                     (12) 0
                                134                         166
13                         (13) Pppppppppppppppppppppppppppppppp
                                   138
14                             (14) 0
                                       142                         174
15                                 (15) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                   158                 (180)
16                                            (16) Pppppppppppppppppppppp  190
                                                                   174  (180)
17                                                            (17) Aaaaaaa  206
-------------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
] = Premature failure on-orbit

Phase E
Scenario II-61

POES On-orbit History (29-41-37-15-Month Cycle) 4-Month Call-up (After a Failure On-orbit) | No Random Launch Failures No Early Indications of On-orbit Failure

```
MONTHS  10      20      30      40      50      60      70      80      90      100     110     120
        |       |       |       |       |       |       |       |       |       |       |       |

1                    29
Ppppppppppppppppppppppppppppp]  (29 months)
          12                                        53
2   (2) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa]  (41 months)
                          33                            70
3                   (3) Ppppppppppppppppppppppppppppppppppppp]  (37 months)
                                              57           72
4                                         (4) Aaaaaaaaaaaaaaa]  (15 months)
                                                             74                         103
5                                                        (5) Ppppppppppppppppppppppppppppp]  (29 months)
                                                                78                                 119
6                                                           (6) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa]
                                                                                             (41 months)
                                                                                       107         (120)
7                                                                                  (7) Ppppppppppppp

MONTHS          120     130     140     150     160     170     180
                |       |       |       |       |       |       |

                                  144
7 continued     pppppppppppppppppppppppp]  (37 months)
                   123          138
8               (8) Aaaaaaaaaaaaaaa]  (15 months)
                                142                         171
9                           (9) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaa]  (29 months)
                                      148                       (180)
10                               (10) Ppppppppppppppppppppppppppppppppp  ] 189  (41 months)
                                                                  175  (180)
11                                                           (11) Aaaaaa  ] 212  (37 months)
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
] = Failure on-orbit

Phase E
Scenario II-62

POES On-orbit History
(29-41-37-15-Month Cycle)
4-Month Call-up (After a Launch
Failure or Failure On-orbit)

Three Random Launch Failures
No Early Indications of
On-orbit Failure

```
MONTHS    10        20        30        40        50        60        70        80        90       100       110       120
           !         !         !         !         !         !         !         !         !         !         !         !

1                             29
Ppppppppppppppppppppppppppppppl  (29 months)
          12                                      53
2      (2) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaal  (41 months)
                                33
3                            (3) 0
                                   37                                    74
4                              (4)  Ppppppppppppppppppppppppppppppppppppppl  (37 months)
                                                      57
5                                                 (5) 0
                                                          61              76
6                                                     (6) Aaaaaaaaaaaaaaal  (15 months)
                                                                            78                              107
7                                                                       (7) Ppppppppppppppppppppppppppppppl  (29 months)
                                                                                82
8                                                                           (8)  0
                                                                                    86                                (120)
9                                                                               (9)  Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                                             111      (120)

10                                                                                                          (10) Ppppppppp
-------------------------------------------------------------------------------------------------------------------------
MONTHS              120       130       140       150       160       170       180
                     !         !         !         !         !         !         !

                         127
9 continued         aaaaaaal  (41 months)
                                         148                           175
10 continued        pppppppppppppppppppppppppppppl  (37 months)
                              131            146
11                       (11) Aaaaaaaaaaaaaaal  (15 months)
                                                  150                          179
12                                           (12) Pppppppppppppppppppppppppppppl  (29 months)
                                                     154                      (180)
13                                               (13) Aaaaaaaaaaaaaaaaaaaaaaaaaaa ] 195  (41 months)
-------------------------------------------------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Failure on-orbit

Phase E
Scenario II-63

POES On-orbit History (29-41-37-15-Month Cycle) 4-Month Call-up (After a Launch Failure or Failure On-orbit)	Four Random Launch Failures No Early Indications of On-orbit Failure

```
MONTHS    10        20        30        40        50        60        70        80        90        100       110       120

1                            29
Ppppppppppppppppppppppppppppp]  (29 months)
          12                                       53
2     (2) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa]  (41 months)
                               33
3                          (3) 0
                                   37                                   74
4                             (4)  Ppppppppppppppppppppppppppppppppppppp]  (37 months)
                                                         57
5                                                    (5) 0
                                                             61             76
6                                                       (6)  Aaaaaaaaaaaaaaa]  (15 months)
                                                                              78                           107
7                                                                         (7) Pppppppppppppppppppppppppppppp]  (29 months)
                                                                                  82
8                                                                             (8) 0
                                                                                      86                             (120)
9                                                                                 (9) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                                              111    (120)
10                                                                                                       (10) Ppppppppp
---------------------------------------------------------------------------------------------------------------------------
MONTHS             120       130       140       150       160       170       180

                          127
9 continued        aaaaaaa]  (41 months)
                                            148                             175
10 continued       ppppppppppppppppppppppppppppp]  (37 months)
                            131
11                     (11) 0
                                 135            150
12                          (12) Aaaaaaaaaaaaaaa]  (15 months)
                                                    152                        (180)
13                                         (13) Ppppppppppppppppppppppppppppp ]  181  (29 months)
                                                        156                    (180)
14                                             (14) Aaaaaaaaaaaaaaaaaaaaaaaaa  ] 197  (41 months)
---------------------------------------------------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Failure on-orbit

Phase E
Scenario II-64

```
POES On-orbit History                   |        No Random Launch Failures
(29-41-37-15-Month Cycle)               |     With Indications of On-orbit
4-Month Call-up (After a Launch         |       Failure 4 Months Early for
Failure or Early Indications of         |     Satellites With 29-, 41-, or
Failure of an On-orbit Satellite)       |               37-Month Lifetimes
--------------------------------------------------------------------------------

MONTHS  10      20      30      40      50      60      70      80      90      100     110     120
         |       |       |       |       |       |       |       |       |       |       |       |

1                        25  29
Pppppppppppppppppppppppp]ppp]  (29 months)
           12                                  49  53
2     (2) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa]aaa]  (41 months)
                            29                                 62  66
3                      (3) Ppppppppppppppppppppppppppppppppp]ppp]  (37 months)
                                                   53              68
4                                              (4) Aaaaaaaaaaaaaaa]  (15 months)
                                                             66                        91  95
5                                                        (5) Ppppppppppppppppppppppppp]ppp]  (29 months)
                                                                   72                                    109 113
6                                                              (6) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa]aaa]  (41 months)

                                                                                          95               (120)
7                                                                                     (7) Pppppppppppppppppppppppppp
                                                                                                     113   (120)
8                                                                                                (8) Aaaaaaaa
--------------------------------------------------------------------------------
MONTHS                  120     130     140     150     160     170     180
                         |       |       |       |       |       |       |

                                128 132
7 continued             ppppppp]ppp]  (37 months)
                                128
8 continued             aaaaaaa]  (15 months)
                                 132                     157 161
9                            (9) Ppppppppppppppppppppppppp]ppp]  (29 months)
                                     136                                 173 177
10                              (10) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa]aaa]  (41 months)
                                                         161                (180)
11                                                  (11) Pppppppppppppppppppp  ] 198  (37 months)
                                                                         177(180)
12                                                                  (12) Aaaa  ] 192  (15 months)
--------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
] = Failure on-orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase E
Scenario II-65

POES On-orbit History (29-41-37-15-Month Cycle) 4-Month Call-up (After a Launch Failure or Early Indications of Failure of an On-orbit Satellite) | Three Random Launch Failures With Indications of On-orbit Failure 4-Months Early for Satellites With 29-, 41-, or 37-Month Lifetimes

```
MONTHS  10        20        30        40        50        60        70        80        90        100       110       120
        |         |         |         |         |         |         |         |         |         |         |         |

1                       25  29
Pppppppppppppppppppppppp]ppp]  (29 months)
           12                                    49  53
2      (2) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa]aaa]  (41 months)
                            29
3                       (3) 0
                                33                                66  70
4                           (4) Ppppppppppppppppppppppppppppppppp]ppp]  (37 months)
                                                    53
5                                               (5) 0
                                                        57             72
6                                                   (6) Aaaaaaaaaaaaaaa]  (15 months)
                                                                     70                       95  99
7                                                                (7) Ppppppppppppppppppppppppp]ppp]  (29 months)
                                                                           76
8                                                                      (8) 0
                                                                               80                                   117(120)
9                                                                          (9) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa]aaa
                                                                                                  99                (120)
10                                                                                           (10) Pppppppppppppppppppppp
------------------------------------------------------------------------------------------------------------------------
MONTHS              120       130       140       150       160       170       180
                    |         |         |         |         |         |         |

                    121
9 continued         a]  (41 months)
                               132 136
10 continued        ppppppppppp]ppp]  (37 months)
                    121            136
11              (11) Aaaaaaaaaaaaaaa]  (15 months)
                                   136                      161 165
12                             (12) Ppppppppppppppppppppppppp]ppp]  (29 months)
                                       140                                  177(180)
13                                 (13) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa]aaa ] 181  (41 months)
                                                                165            180
14                                                         (14) Ppppppppppppppp]  ] 202  (37 months)
------------------------------------------------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch Failure
] = Failure on-orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase E
Scenario II-66

POES On-orbit History (29-41-37-15-Month Cycle) 4-Month Call-up (After a Launch Failure or Early Indications of Failure of an On-orbit Satellite) | Four Random Launch Failures With Indications of On-orbit Failure 4 Months Early for Satellites With 29-, 41-, or 37-Month Lifetimes

```
MONTHS  10        20        30        40        50        60        70        80        90        100       110       120
         |         |         |         |         |         |         |         |         |         |         |         |
1                      25  29
Pppppppppppppppppppppppppppp]ppp]  (29 months)
           12                                         49  53
2      (2) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa]aaa]  (41 months)
                            29
3                      (3) 0
                                33                                66  70
4                          (4) Pppppppppppppppppppppppppppppppppp]ppp]  (37 months)
                                                  53
5                                            (5) 0
                                                      57              72
6                                                (6) Aaaaaaaaaaaaaaa]  (15 months)
                                                                   70                       95  99
7                                                              (7) Ppppppppppppppppppppppppppp]ppp]  (29 months)
                                                                        76
8                                                                   (8) 0
                                                                             80                                      117(120)
9                                                                        (9) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa]aaa
                                                                                                   99                   (120)
10                                                                                             (10) Ppppppppppppppppppppp
-----------------------------------------------------------------------------------------------------------------------------
MONTHS                   120       130       140       150       160       170       180
                          |         |         |         |         |         |         |

                         121
9 continued              a]  (41 months)
                                    132 136
10 continued             ppppppppppppp]ppp]  (37 months)
                         121
11                  (11) 0
                              125          140
12                       (12) Aaaaaaaaaaaaaaa]  (15 months)
                                       136                    161 165
13                                (13) Pppppppppppppppppppppppppp]ppp]  (29 months)
                                             144                               (180)
14                                      (14) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa  ] 185  (41 months)
                                                                    165
15                                                       (15) Pppppppppppppppp ]] 202  (37 months)
-----------------------------------------------------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
O = Launch failure
] = Failure on-orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase E
Scenario II-67

Exact History of the Current POES - Satellite Lifetimes on a 29-41-0-37-15-Month Cycle, Where the Zero Represents a Launch Failure

```
4-Month Call-up (After a Launch        |        No Early Indications of an
Failure or the Failure of an           |                On-orbit Failure
On-orbit Satellite)                    |
--------------------------------------------------------------------------------

MONTHS   10     20     30     40     50     60     70     80     90    100    110    120
          |      |      |      |      |      |      |      |      |      |      |      |

1                      29
Pppppppppppppppppppppppppppppl  (29 months)
             12                                53
2       (2) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaal  (41 months)
                          33
3                      (3) 0
                            37                                     74
4                        (4) Pppppppppppppppppppppppppppppppppppppppl  (37 months)
                                              57          72
5                                         (5) Aaaaaaaaaaaaaaal  (15 months)
                                                             76                     105
6                                                        (6) Ppppppppppppppppppppppppppppppl  (29 months)
                                                                80                          (120)
7                                                           (7) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa
                                                                                        109
8                                                                                   (8) 0
                                                                                          113   (120)
9                                                                                       (9) Ppppppp
--------------------------------------------------------------------------------
MONTHS            120    130    140    150    160    170    180
                   |      |      |      |      |      |      |

                  121
7 continued       al  (41 months)
                                          150
9 continued       ppppppppppppppppppppppppppppppl  (37 months)
                     125       140
10                (10) Aaaaaaaaaaaaaaal  (15 months)
                                144                  173
11                         (11) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaal  (29 months)
                                       154                 (180)
12                                (12) Ppppppppppppppppppppppppppp  ] 195  (41 months)
                                                             177
13                                                      (13) 0
--------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
] = Failure on-orbit - if two symbols, the first represents early indications that a failure will likely occur in 4 months

Phase E
Scenario II-68

Exact History of the Current POES – Satellite Lifetimes on a 29-41-0-37-15-Month Cycle, Where the Zero Represents a Launch Failure

```
4-Month Call-up (After a Launch        |        With Early Indications of
Failure or Early Indications           |         Failure of Satellites With
of an On-orbit Failure)                |   29-, 41-, or 37-Month Lifetimes
-------------------------------------------------------------------------------

MONTHS  10      20      30      40      50      60      70      80      90      100     110     120
        |       |       |       |       |       |       |       |       |       |       |       |

1                  25 29
Pppppppppppppppppppppppppp]ppp]  (29 months)
          12                    49  53
2    (2) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa]aaa]  (41 months)
                   29
3               (3) 0
                     33                         66  70
4                (4) Pppppppppppppppppppppppppppppppppp]ppp]  (37 months)
                                      53          68
5                               (5) Aaaaaaaaaaaaaa]  (15 months)
                                                  70                    95  99
6                                             (6) Pppppppppppppppppppppppppp]ppp]  (29 months)
                                                     74                              111 115
7                                                 (7) Aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa]aaa]
                                                                               (41 months)
                                                                          99
8                                                                    (8) 0
                                                                            103          (120)
9                                                                        (9) Ppppppppppppppppp
                                                                                       115 (120)
10                                                                                (10) Aaaaaa
---------------------------------------------------------------------------------------------
MONTHS           120     130     140     150     160     170     180
                  |       |       |       |       |       |       |

                             136 140
9 continued      ppppppppppppppppp]ppp]  (37 months)
                         130
10 continued     aaaaaaaaaa]  (15 months)
                          134                    159 163
11                     (11) Aaaaaaaaaaaaaaaaaaaaaaaaa]aaa]  (29 months)
                             140                                 177(180)
12                          (12) Ppppppppppppppppppppppppppppppppppppppp]ppp  ] 181  (41 months)
                                                   163
13                                           (13) 0
                                                     167        (180)
14                                               (14) Aaaaaaaaaaaaa  ] 192  (37 months)
---------------------------------------------------------------------------------------------
```

LEGEND

P = Launch of a satellite into the afternoon orbit
A = Launch of a satellite into the morning orbit
] = Failure on-orbit – if two symbols, the first represents early indications that a failure will likely occur in 4 months

APPENDIX B

COST CALCULATIONS FOR THE SCENARIOS

DESCRIPTION OF THE METHODS USED

The cost in today's dollars for a single satellite launched into orbit was set at $C million. A constant inflation rate was applied over the 15 years of 6 percent per year (0.5 percent per month), and the inflation was applied to each satellite from the start of the 15-year period to the month in which a particular satellite is launched.

To simplify cost calculations, it was assumed that when one or more additional satellites are required to replace satellites after a launch or premature failure, the satellite(s) will be purchased for delivery in year one at a cost of $0.75 C million and held in storage, with inflation applied only to the launch costs ($0.25 C million) to the month in which the satellite is launched. These launch costs were inflated as if a replacement satellite was the last to be launched in the 15-year period. This method of inflating satellite and launch costs for replacement satellites is not exact, but cost errors are so small that they will not significantly distort the estimated monthly cost to acquire data successfully, particularly when these costs to acquire data are normalized in the comparison and evaluation parts of this analysis.

This simplified method of cost calculation was used for all scenarios except those in Phase E, which models extended life using the exact history of the current POES satellites to select future launch dates. In these extended-life scenarios, launch costs were calculated for each satellite using the date shown on the plotted charts.

Costs for each launched satellite are calculated using the formula:

Unit Cost = $C million + ($C million x months to launch x 0.005).

TABLES OF CALCULATIONS

Case I

One-satellite system
with satellites launched at
18-month intervals

Satellite	Months to Launch	Cost in $C million	
		Unit	Cumulative
All scenarios involving the launch of 11 satellites			
1	0	1.00	1.00
2	18	1.09	2.09
3	36	1.18	3.27
4	54	1.27	4.54
5	72	1.36	5.90
6	90	1.45	7.35
7	108	1.54	8.89
8	126	1.63	10.52
9	144	1.72	12.24
10	162	1.81	13.42
11	180	1.90	15.95
All scenarios following the above, but which require the launch of a 12th satellite			
Base cost from above			15.95
An additional satellite		0.75	
Launch costs inflated for 180 months		0.48	
Total for 12 satellites			17.18
All scenarios following the above, but which require 13 satellites			
Base cost for 12 satellites			17.18
An additional satellite		0.75	
Launch costs inflated for 180 months		0.48	
Total for 13 satellites			18.41

Case I

One-satellite system
with satellites launched at
20-month intervals

Satellite	Months to Launch	Cost in $C million	
		Unit	Cumulative
All scenarios involving the launch of 10 satellites			
1	0	1.00	1.00
2	20	1.10	2.10
3	40	1.20	3.20
4	60	1.30	4.60
5	80	1.40	6.00
6	100	1.50	7.50
7	120	1.60	9.10
8	140	1.70	10.80
9	160	1.80	12.60
10	180	1.90	14.40
Same as above, but requiring the launch of 11 satellites			
Cost of 10 satellites			14.40
An additional satellite		0.75	
Launch costs inflated for 180 months		0.46	
Total cost for 11 satellites			15.61
Same as above, but requiring 12 satellites			
Cost of 11 satellites			14.40
An additional satellite		0.75	
Launch costs inflated for 180 months		0.46	
Total cost for 12 satellites			16.82

Case I

One-satellite system
with satellites launched at
22-month intervals

Satellite	Months to Launch	Cost in $C million	
		Unit	Cumulative
All scenarios involving the launch of 9 satellites			
1	0	1.00	1.00
2	22	1.11	2.11
3	44	1.22	3.33
4	66	1.33	4.66
5	88	1.44	6.10
6	110	1.55	7.65
7	132	1.66	9.31
8	154	1.77	11.08
9	176	1.88	12.96
Same as above, but requiring the launch of a 10th satellite			
	Cost of 9 satellites		12.96
	An additional satellite	0.75	
	Launch costs inflated for 176 months	0.47	
	Total for 10 satellites		14.18
Same as above, but requiring the launch of an 11th satellite			
	Cost of 10 satellites		14.18
	An additional satellite	0.75	
	Launch costs inflated for 176 months	0.47	
	Total for 11 satellites		15.40
Same as above, but requiring the launch of a 12th satellite			
	Cost of 11 satellites		15.40
	An additional satellite	0.75	
	Launch costs inflated for 176 months	0.47	
	Total for 12 satellites		16.62

Case I

One-satellite system (Phase E)
with satellites launched at irregular intervals
following recent POES history

Satellite	Months to Launch	Cost in $C million	
		Unit	Cumulative
Scenario I-46			
1	0	1.00	1.00
2	33	1.16	2.16
3	78	1.39	3.55
4	119	1.60	5.15
5	138	1.69	6.84
6	171	1.85	8.69
Scenarios I-47 and I-48			
1	0	1.00	1.00
2	33	1.16	2.16
3	37	1.19	3.35
4	82	1.41	4.76
5	86	1.43	6.19
6	127	1.64	7.83
7	146	1.73	9.56
8	179	1.89	11.45
Scenario I-49			
1	0	1.00	1.00
2	29	1.14	2.14
3	70	1.35	3.49
4	107	1.52	5.02
5	126	1.63	6.65
6	155	1.78	8.43
Scenario I-50			
1	0	1.00	1.00
2	29	1.15	2.15
3	33	1.16	3.31
4	74	1.37	4.68
5	78	1.39	6.07
6	115	1.58	7.65
7	134	1.67	9.32
8	163	1.81	11.13

Case I

One-satellite system (Phase E)
with satellites launched at irregular intervals
following recent POES history
(continued)

Satellite	Months to Launch	Cost in $C million	
		Unit	Cumulative
Scenario I-51			
1	0	1.00	1.00
2	29	1.15	2.15
3	33	1.16	3.31
4	74	1.37	4.68
5	78	1.39	6.07
6	115	1.58	7.65
7	134	1.67	9.32
8	163	1.81	11.13
9	167	1.84	12.97
Scenario I-52			
1	0	1.00	1.00
2	33	1.17	2.17
3	78	1.39	3.56
4	82	1.41	4.97
5	123	1.62	6.59
6	142	1.71	8.30
7	175	1.87	10.17
Scenario I-53			
1	0	1.00	1.00
2	29	1.15	2.15
3	70	1.35	3.50
4	74	1.37	4.87
5	111	1.55	6.42
6	130	1.65	8.07
7	159	1.80	9.87

Case-II

Two-satellite system
with satellites launched at
12-month intervals

Satellite	Months to Launch	Cost in $C million	
		Unit	Cumulative
All scenarios requiring the launch of 16 satellites			
1	0	1.00	1.00
2	12	1.06	2.06
3	24	1.12	3.18
4	36	1.18	4.36
5	48	1.24	5.60
6	60	1.30	6.90
7	72	1.36	8.26
8	84	1.42	9.68
9	96	1.48	11.16
10	108	1.54	12.70
11	120	1.60	14.30
12	132	1.66	15.96
13	144	1.72	17.68
14	156	1.78	19.46
15	168	1.84	21.30
16	180	1.90	23.20
All scenarios requiring the launch of 17 satellites			
Cost of 16 satellites			23.20
An additional satellite		0.75	
Launch cost inflated for 180 months		0.47	
Total cost for 17 satellites			24.42
All scenarios requiring the launch of 18 satellites			
Cost of 17 satellites			24.42
An additional satellite		0.75	
Launch cost inflated for 180 months		0.47	
Total cost for 18 satellites			25.64
All scenarios requiring the launch of 20 satellites			
Cost of 18 satellites			25.64
Two additional satellites		1.50	
Two launch costs inflated for 180 months			0.94
Total cost for 20 satellites			28.08

Case II

Two-satellite system
with satellites launched at
14-month intervals

Satellite	Months to Launch	Cost in $C million	
		Unit	Cumulative
All scenarios requiring the launch of 13 satellites			
1	0	1.00	1.00
2	14	1.07	2.07
3	28	1.14	3.21
4	42	1.21	4.42
5	56	1.28	5.70
6	70	1.35	7.05
7	84	1.42	8.47
8	98	1.49	9.96
9	112	1.56	11.52
10	126	1.63	13.15
11	140	1.70	14.85
12	154	1.77	16.62
13	168	1.84	18.46
Scenarios requiring the launch of 15 satellites			
	Cost of 13 satellites		18.46
	Two additional satellites	1.50	
	Two launch costs inflated for 168 months	0.96	
	Total cost for 15 satellites		20.92
Scenarios requiring the launch of 16 satellites			
	Cost of 15 satellites		20.92
	An additional satellite	0.75	
	Launch cost inflated for 168 months	0.48	
	Total cost for 16 satellites		22.15

Case II

Two-satellite system
with satellites launched at
16-month intervals

Satellite	Months to Launch	Cost in $C million	
		Unit	Cumulative
All scenarios requiring the launch of 12 satellites			
1	0	1.00	1.00
2	16	1.08	2.08
3	32	1.16	3.24
4	48	1.24	4.48
5	64	1.32	5.80
6	80	1.40	7.20
7	96	1.48	8.68
8	112	1.56	10.24
9	128	1.64	11.88
10	144	1.72	13.60
11	160	1.80	15.40
12	176	1.88	17.28
Scenarios requiring the launch of 13 satellites			
Cost of 12 satellites			17.28
Another satellite		0.75	
Launch costs inflated for 176 months		0.48	
Total cost for 13 satellites			18.51
Scenarios requiring the launch of 14 satellites			
Cost of 13 satellites			18.51
Another satellite		0.75	
Launch costs inflated for 176 months		0.96	
Total cost for 14 satellites			19.74
Scenarios requiring the launch of 16 satellites			
Cost of 14 satellites			19.74
Two additional satellites		1.50	
Launches (2) inflated for 176 months		0.96	
Total cost for 16 satellites			22.20
Scenarios requiring the launch of 17 satellites			
Cost of 16 satellites			22.20
Another satellite		0.75	
Launch costs inflated for 176 months		0.48	
Total cost for 17 satellites			23.43

Case II

Two-satellite system (Phase E)
with satellites launched at irregular intervals
following recent POES history

Satellite	Months to Launch	Cost in $C million	
		Unit	Cumulative
Scenario II-61			
1	0	1.00	1.00
2	12	1.06	2.06
3	33	1.15	3.21
4	57	1.29	4.50
5	74	1.37	5.87
6	78	1.39	7.26
7	107	1.54	8.80
8	123	1.62	10.42
9	142	1.71	12.13
10	148	1.74	13.87
11	175	1.88	15.75
Scenario II-62			
1	0	1.00	1.00
2	12	1.06	2.06
3	33	1.15	3.21
4	37	1.18	4.39
5	57	1.28	5.67
6	61	1.31	6.98
7	78	1.39	8.37
8	82	1.41	9.78
9	86	1.43	11.21
10	111	1.55	12.76
11	131	1.66	14.42
12	150	1.75	16.17
13	154	1.77	17.94

Case II

Two-satellite system (Phase E)
with satellites launched at irregular intervals
following recent POES history
(continued)

Satellite	Months to Launch	Cost in $C million	
		Unit	Cumulative
Scenario II-63			
1	0	1.00	1.00
2	12	1.06	2.06
3	33	1.15	3.21
4	37	1.18	4.39
5	57	1.28	5.67
6	61	1.31	6.98
7	78	1.39	8.37
8	82	1.41	9.78
9	86	1.43	11.21
10	111	1.55	12.76
11	131	1.66	14.42
12	135	1.67	16.09
13	152	1.76	17.85
14	156	1.78	19.63
Scenario II-64			
1	0	1.00	1.00
2	12	1.06	2.06
3	29	1.15	3.21
4	53	1.26	4.47
5	66	1.33	5.80
6	72	1.36	7.16
7	95	1.48	8.64
8	113	1.56	10.20
9	132	1.66	11.86
10	136	1.68	13.54
11	161	1.80	15.34
12	177	1.89	17.23

Case II

Two-satellite system (Phase E)
with satellites launched at irregular intervals
following recent POES history
(continued)

Satellite	Months to Launch	Cost in $C million	
		Unit	Cumulative
Scenario II-65			
1	0	1.00	1.00
2	12	1.06	2.06
3	29	1.14	3.20
4	33	1.17	4.37
5	53	1.26	5.63
6	57	1.29	6.92
7	70	1.35	8.27
8	76	1.38	9.65
9	80	1.40	11.05
10	99	1.49	12.54
11	121	1.61	14.15
12	136	1.68	15.83
13	140	1.70	17.53
14	165	1.82	19.35
Scenario II-66			
1	0	1.00	1.00
2	12	1.06	2.06
3	29	1.14	3.20
4	33	1.17	4.37
5	53	1.26	5.63
6	57	1.29	6.92
7	70	1.35	8.27
8	76	1.38	9.65
9	80	1.40	11.05
10	99	1.49	12.54
11	121	1.61	14.15
12	125	1.62	15.77
13	136	1.68	17.45
14	144	1.72	19.17
15	165	1.83	21.00

Case II

Two-satellite system (Phase E)
with satellites launched at irregular intervals
following recent POES history
(continued)

Satellite	Months to Launch	Cost in $C million	
		Unit	Cumulative
Scenario II-67			
1	0	1.00	1.00
2	12	1.06	2.06
3	33	1.16	3.22
4	37	1.19	4.41
5	57	1.28	5.69
6	76	1.38	7.07
7	80	1.40	8.47
8	109	1.55	10.02
9	113	1.56	11.58
10	125	1.63	13.21
11	144	1.72	14.93
12	154	1.77	16.70
13	177	1.88	18.58
Scenario II-68			
1	0	1.00	1.00
2	12	1.06	2.06
3	33	1.16	3.22
4	37	1.19	4.41
5	53	1.26	5.67
6	70	1.35	7.02
7	74	1.37	8.38
8	99	1.50	9.89
9	103	1.51	11.40
10	115	1.58	12.98
11	134	1.67	14.65
12	140	1.70	16.35
13	163	1.82	18.17
14	167	1.83	20.00

APPENDIX C

PROBABILITIES OF LAUNCH OR PREMATURE FAILURES

A. OBJECTIVE

This appendix reports on the analyses of the probabilities of failures in future satellites deployed under a wide range of planning assumptions about the POES. The period of analysis is 15 years. Both the one-satellite and the two-satellite systems are considered. Analysis of probabilities allows the selection of those scenarios with the highest probabilities of success for further analysis.

B. TYPES OF SATELLITE FAILURES CONSIDERED

The failures this study is concerned with are mission failures: satellites that do not, for any reason, deliver Primary Mission Data (images and soundings) over their full projected lifetimes on-orbit. For this analysis, two types of failures were considered:

- launch failures--a useful orbit is not achieved because of a failure of the launch vehicle, the orbit insertion system on the satellite, or the satellite subsystem designed to establish a stable, acceptable orbit after launch, and

- premature failures--an on-orbit satellite does not achieve its expected lifetime because of the failure of the imager, the sounder, or spacecraft systems such as power supplies, communication links, orbit maintenance capabilities, or other capabilities needed to assure successful operations, even though the satellite may continue to provide services other than collecting Prime Mission Data.

COMPUTATIONAL APPROACH

It is possible to use the probability of failure of individual components to forecast the performance of a satellite series over an extended period of time. This approach recognizes a wide spectrum of possible failure conditions, from trivial to catastrophic, and leads to conclusions about satellites falling short of or exceeding expected lifetimes. The USAF General Availability Program (GAP) uses such an approach.

Another approach is to use information gained while operating previous, similar spacecraft to determine the relative frequencies with which failures, extended or shortened lifetimes, and other events of importance will occur in the future. In this approach, historical frequencies are used as predictors of future performance.

This second approach was selected, using the past as prologue, for use in this analysis because:

- extensive experience with modern NOAA-series satellites provides a significant data base, since additional satellites of the present design are on order, and there is as yet no compelling reason to believe that the next generation of polar-orbiting satellites will be significantly different from these;

- results of this analysis are to be used to study program and management models, not technical designs of sensors and spacecraft; and

- the history of mission failures of the recent POES and of corrective actions taken shows that the problem of the failure of a critical component or subsystem can be solved if a satellite series remains in use for an extended period of time, but the generic problem of random component failures, which may terminate a satellite mission, remains.

D. COMPUTATIONAL METHOD

The relative frequencies of failures of recent and current satellites were used as the probability coefficients for future POES spacecraft. Launch failure experience from Television and Infrared Observation Satellite (TIROS) M (1970) through NOAA 8 (1984)* is that 3 of 13 satellites failed to achieve useful orbits, a relative frequency of 0.231. Experience with spacecraft that have met design lifetimes indicates a relative frequency of 0.182 for premature failures (2 of 11).

From these values, the probabilities for a launch attempt resulting in a fully successful satellite launch or a premature failure on-orbit were calculated using the notation:

Pr = probability
S = outcome is success
B = outcome is failure to boost the satellite into orbit (launch failure)
R = outcome is premature failure.

The probabilities (Pr) assigned to these outcomes are: Pr(S) = 0.587, Pr(B) = 0.231, and Pr(R) = 0.182.

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* NOAA 9 was finally launched successfully after this portion of the POES analysis was completed.

Letting N be the number of spacecraft in a series and s, b, and r be the numbers of spacecraft in that series that are successful, fail on launch, or fail prematurely, respectively, then, N = s+b+r for a series involving N launch attempts.

Using the notation Pr(s,b,r) to indicate the probability that a series of N = s+b+r launch attempts results in exactly s successes, b launch failures, and r premature failures, the value can be determined by the standard methods for calculating probabilities for independent events. This value is arrived at by computing

$$Pr(s,b,r) = \binom{N}{s,b,r} [Pr(S)]^{s} [Pr(B)]^{b} [Pr(R)]^{r};$$

where $\binom{N}{s,b,r} = \frac{N!}{s!b!r!}$.

For example, if N = 6, s = 3, b = 1, r = 2, and Pr(S), Pr(B), and Pr(R) are as shown above, then

$$Pr(3,1,2) = \binom{6}{3,2,1} (0.587)^{3} (0.231) (0.182)^{2} = 0.09286,$$ to four significant figures.

It should be noted that this expression does not evaluate the probability of any particular sequence of events in a series. It provides a measure of the probability that exactly the specified number of outcomes of each type will occur, regardless of their order. Thus, the sequence in which events will occur was established when the assumptions in the several phases of the analysis discussed in Appendix A were specified.

E. APPLICATION OF THIS METHOD

For this analysis of probabilities, N was allowed to vary from 9 to 20 and s, b, and r to take on all possible values under the condition that the sum of these values equals the number of satellite launches attempted (N = s+b+r). Results were tabulated. For each value of N, peak probability values [Pr(s,b,r)] were identified. Values were considered "peak" under the condition that larger numerical values are selected first and the sum of peak values exceeds 0.50.

F. SAMPLE TABULATIONS

Some abbreviated tabulations are shown in Table C-1 for reference. In this table, the convention Pr(s,b,r) indicates the mix of events for the number of launches (N) under consideration.

Table C-1

Sample tabulations of
computation of probabilities

FOR 11 SATELLITES (N=11)	FOR 16 SATELLITES (N=16)
Pr(11,0,0) = 0.003	Pr(16,0,0) = 0.0002
Pr(10,1,0) = 0.013	Pr(15,1,0) = 0.001
Pr(10,0,1) = 0.010	Pr(15,0,1) = 0.001
Pr(9,2,0) = 0.025	Pr(14,2,0) = 0.004
Pr(8,2,1) = 0.069	Pr(13,2,1) = 0.017
Pr(7,2,2) = 0.084	Pr(12,2,2) = 0.033
Pr(6,2,3) = 0.060	Pr(11,2,3) = 0.041
Pr(8,3,0) = 0.029	Pr(13,3,0) = 0.007
Pr(7,3,1) = 0.072	Pr(12,3,1) = 0.028
Pr(6,3,2) = 0.077	Pr(11,3,2) = 0.052
Pr(5,3,3) = 0.047	Pr(10,3,3) = 0.058
Pr(9,0,2) = 0.015	Pr(14,0,2) = 0.002
Pr(8,0,3) = 0.014	Pr(13,0,3) = 0.003
Pr(9,1,1) = 0.039	Pr(14,1,1) = 0.006
Pr(8,1,2) = 0.054	Pr(13,1,2) = 0.013
Pr(7,1,3) = 0.044	Pr(12,1,3) = 0.017
Pr(7,4,0) = 0.023	Pr(12,4,0) = 0.009
Pr(6,4,1) = 0.049	Pr(11,4,1) = 0.003
Pr(5,4,2) = 0.045	Pr(10,4,2) = 0.056
	Pr(9,4,3) = 0.057
	Pr(8,4,4) = 0.039

G. SEQUENTIAL LAUNCH FAILURES

There is a finite probability for sequential launch failures in a series of POES satellites. To assess this risk, the most likely cases of multiple launch failures in a series of fixed length were examined This led to the question:

> What are the probabilities of experiencing two launch failures in a row in a future series of N satellites, given that three launch failures occur and 0, 1, or 2 premature failures also occur?

To answer this question, a decision had to be made about handling cases in which there is a possibility that all three launch failures could occur in a row. For example, in a series of nine satellites in which one fails on orbit prematurely and three

fail on launch, there are 504 distinguishable combinations of successes and failures. Of these, 336 reflect two or three launch failures in a row, and only 42 reflect all three in a row. Should these 42 count as single events of sequential launch failures, or as 84 events of two launch failures in a row (42 sequences where the first two of the three fail in a row, and 42 occurrences where the second two of the three fail in a row)?

In the context of this study, the objective is to assess the program impacts of sequential launch failures. From this point of view, the harm is done when the first two of three sequential launch failures occur. This outlook led to a decision to treat these 42 cases of three launch failures in a row as if they were 42 cases of two sequential launch failures.

With this ground rule in place, the ratios of arrangements of two or three launch failures in a row to other events for N = 9,10,11...,18; r = 0,1,or 2; and b = 3 were computed.

Multiplication of these computed values by the appropriate probability for a case yields the probability of sequential launch failures for that case. Table C-2 shows the results of some of these computations.

Table C-2

Probabilities of at least two launch failures in a row, given that there are three launch failures (b = 3)

Number of Premature Failures (r)	N = 9	N = 11	N = 13	N = 15	N = 17
0	0.029	0.016	0.008	0.004	0.002
1	0.053	0.040	0.025	0.015	0.008
2	0.040	0.042	0.035	0.024	0.015

APPENDIX D

TABULAR RESULTS OF DATA COLLECTION AND COMPUTATION

EXPLANATION OF THE COLUMN HEADINGS

The quantitative data used in this analysis of the long-term Polar-orbiting Operational Environmental Satellite (POES) was developed from inspection of the plotted scenarios in Appendix A, from the system costs calculated in Appendix B, from the probability assessments discussed in Appendix C, and from the calculation of various measures of systems performance and cost efficiency as described in Volume 2, Chapter III.

These data are tabulated on the 10 tables in this appendix. To facilitate review of these tables, which provide the data base for the analyses and comparisons in Volume 1, Chapter IV, the source of the entries in each of the columns of the tables is discussed briefly below:

Table Title - Case I scenarios are for the one-satellite system, and Case II scenarios are for the two-satellite system - the phases (A through E) are as discussed in Appendix A;

Column 1 - Scenario - a sequential number for each scenario plotted and analyzed - the 53 one-satellite scenarios are numbered sequentially, as are the 68 two-satellite scenarios;

Column 2 - Design Life - shows the assumed design life on orbit for each plotted scenario - assumed design lifetimes either range from 24 to 32 months or assume lifetimes that match the POES history for some of the Phase E scenarios for both the one-satellite and the two-satellite systems;

Column 3 - Satellites - the first entry in this column represents the number of attempted satellite launches, and the second figure represents the number of satellites that are assumed to have reached orbit successfully (determined by deducting the number of assumed launch failures from the number of launch attempts);

Column 4 - Launch Schedule - the first entry is the assumed fixed launch interval for each scenario (these figures range from 12 to 22 months), and the second entry represents the call-up schedule for launching replacement satellites after a launch failure or a premature failure on orbit (figures range from 0 when it is assumed there will be no replacement launches to 9 months);

Column 5 - Launch Failures - represents the number of assumed random launch failures for each plotted scenario - values range from 0 to 4 - when figures appear in the second part of this column (labeled Conseq) they represent the special cases where two of the three or four assumed launch failures are consecutive;

Column 6 - Premature Failures On-Orbit - listed for each scenario are the number of assumed failures that occur 12 months (or more as specified for some scenarios) before the end of the assumed design life - entries vary from 0 to 3;

Column 7 - Prime Mission Data - entries are derived from inspection of the plotted scenarios in Appendix A - Loss represents the number of months in which there would be no Prime Mission Data (images and soundings) - Degraded represents the number of months under a two-satellite system during which data would be available only from satellites in the morning orbit - Dual represents the number of months in the two-satellite system during which Prime Mission Data would be available from satellites in both the morning and the afternoon orbits; since the one-satellite system has no satellites in the morning orbit, these last two entries in Column 7 are not applicable (N/A);

Column 8 - Index of Program Performance - entries were calculated from the formula:

IPP = 180 - (A x Loss) - (B x Degraded) + (C x Dual), where A = 2.5, B = 1.25, and C = 1.25 - see Volume 2, Chapter III, for further discussion of this calculation;

Column 9 - Probability - entries were derived from the types of calculations discussed in Appendix C;

Column 10 - Total Program Cost - entries were taken from the cost calculations reported in Appendix B - note that the cost is reported in terms of "C" million dollars, where "C" represents the cost to fabricate, test, and launch a single satellite, whether the launch was successful or not;

Column 11 - Months of Mission Data - entries were calculated from the formula:

MMD = 180 - (D x Loss) - (E x Degraded) + (F x Dual), where D = 1.0, E = 0.5, and F = 0.5 - see Volume 2, Chapter III, for further discussion of these calculations;

Column 12 - Index of Service Efficiency - entries were determined by first multiplying the Index of Program Performance

of each scenario by its probability, and then normalizing the individual results by dividing each scenario's value by the highest figure so determined (22.875) so that all calculated ISEs range from 0 to 1.000;

Column 13 - Index of Cost Efficiency - entries for each scenario were determined through a sequence of calculations as discussed in Volume 2, Chapter II - first, the Total Program Cost was divided by the Months of Mission Data to determine the monthly cost to acquire data successfully - next, to present these figures so that scenarios with the lowest monthly cost would have the highest relative index value, the monthly cost figure was subtracted from 1.000 - next, to weight the calculated values so that scenarios with the lowest total costs would have the highest relative index, the cost of the most expensive scenario ($28.08 C million) was divided by the total cost for the scenario being evaluated and this result multiplied by the value determined in the previous calculation - finally, all index values so determined were normalized by dividing all individual values by the highest calculated value, resulting in ISE values that range from 0 to 1.000.

TABULAR RESULTS

Phase A
Case 1

One-Satellite Configuration

1 Scenario	2 Design Life (months)	3 Satellites		4 Launch Schedule (in months)		5 Launch Failures		6 Premature Failures in-orbit	7 Prime Mission Data (months)			8 Index of Program Performance	9 Prob-ability	10 Total Program Cost ($ C M)	11 Months of Mission Data	12 Index of Service Efficiency	13 Index of Cost Efficiency	NOTES
		Launch	Orbit	Fixed	Relaunch	Random	Con eq		Lost	Degraded	Dual							
1	24	11	11	18						N/A	N/A	180	0.003	15.95	180	0.0236	0.7933	
2	24	11	11	18				1	6	N/A	N/A	165	0.010	15.95	174	0.0721	0.7906	
3	24	11	11	18				2	12	N/A	N/A	150	0.015	15.95	168	0.0984	0.7881	
4	24	11	10	18		1			12	N/A	N/A	150	0.013	15.95	168	0.0852	0.7878	
5	24	11	10	18		1		1	18	N/A	N/A	135	0.039	15.95	162	0.2302	0.7847	
6	24	11	10	18		1		2	24	N/A	N/A	120	0.054	15.95	156	0.2833	0.7815	
7	24	11	9	18		2			24	N/A	N/A	120	0.025	15.95	156	0.1311	0.7815	
8	24	11	9	18		2		1	30	N/A	N/A	105	0.069	15.95	150	0.3167	0.7779	
9	24	11	9	18		2		2	36	N/A	N/A	90	0.084	15.95	144	0.3505	0.7740	
10	24	11	8	18		3			36	N/A	N/A	90	0.029	15.95	144	0.1141	0.7740	
11	24	11	8	18		3		1	42	N/A	N/A	75	0.072	15.95	138	0.2361	0.7698	
12	24	11	8	18		3		2	54	N/A	N/A	45	0.077	15.95	126	0.1515	0.7602	
13	24	11	8	18		1	2		42	N/A	N/A	75	.014	15.95	138	0.0459	0.7689	
14	24	11	8	18		1	2	1	48	N/A	N/A	60	.035	15.95	132	0.0918	0.7653	
15	24	11	8	18		1	2	2	60	N/A	N/A	30	.038	15.95	120	0.0498	0.7547	

Phase B
Case I
One-Satellite Configuration

1 Scenario	2 Design Life (months)	3 Satellites		4 Launch Schedule (in months)		5 Launch Failures		6 Premature Failures in-orbit	7 Prime Mission Data (months)			8 Index of Program Performance	9 Prob-ability	10 Total Program Cost ($ C M)	11 Months of Mission Data	12 Index of Service Efficiency	13 Index of Cost Efficiency	NOTES
		Launch	Orbit	Fixed	Relaunch	Random	Conseq		Lost	Degraded	Dual							
16	24	11	11	18	9					N/A	N/A	180	0.003	15.95	180	0.0236	0.5059	
17	24	12	10	18	9	2		2	18	N/A	N/A	135	0.075	17.18	162	0.4426	0.4607	
18	24	12	9	18	9	3		2	27	N/A	N/A	112	0.078	17.18	153	0.3836	0.4575	
19	24	11	11	18	4					N/A	N/A	180	0.003	15.95	180	0.0236	0.5059	
20	24	12	10	18	4	2		2	12	N/A	N/A	150	0.084	17.18	168	0.5508	0.4627	
21	24	13	10	18	4	3		2	16	N/A	N/A	140	0.075	18.41	164	0.4590	0.4269	
22	28	9	9	22						N/A	N/A	180	0.009	12.96	180	0.0708	0.6340	
23	28	9	7	22		2		2	44	N/A	N/A	70	0.093	12.96	136	0.2846	0.6181	
24	28	9	6	22		3		2	66	N/A	N/A	15	0.060	12.96	114	0.0393	0.6033	
25	28	9	9	22	9					N/A	N/A	180	0.009	12.96	180	0.0708	0.6340	
26	28	10	8	22	9	2		2	18	N/A	N/A	135	0.091	14.18	162	0.5370	0.5693	
27	28	10	7	22	9	3		2	27	N/A	N/A	113	0.077	14.18	153	0.3804	0.5663	
28	28	9	9	22	4					N/A	N/A	180	0.009	12.96	180	0.0708	0.6340	
29	28	10	8	22	4	2		2	12	N/A	N/A	150	0.084	14.18	168	0.5508	0.5717	
30	28	11	8	22	4	3		2	16	N/A	N/A	140	0.077	15.40	164	0.4713	0.5210	

Phase C
Case 1

One-Satellite Configuration

1 Scenario	2 Design Life (months)	3 Satellites		4 Launch Schedule (in months)		5 Launch Failures		6 Premature Failures in-orbit	7 Prime Mission Data (months)			8 Index of Program Performance	9 Prob-ability	10 Total Program Cost ($ C M)	11 Months of Mission Data	12 Index of Service Efficiency	13 Index of Cost Efficiency	NOTES
		Launch	Orbit	Fixed	Relaunch	Random	Conseq		Lost	Degraded	Dual							
31	28	10	10	20						N/A	N/A	180	0.005	14.40	180	0.0393	0.5657	
32	28	11	9	20	9	2		2	10	N/A	N/A	155	0.084	15.61	170	0.5692	0.5151	
33	28	11	8	20	9	3		2	19	N/A	N/A	132	0.077	15.61	161	0.4443	0.5122	
34	28	10	10	20						N/A	N/A	180	0.005	14.40	180	0.0393	0.5515	
35	28	11	9	20	4	2		2	8	N/A	N/A	160	0.084	15.61	172	0.5875	0.5116	
36	28	12	9	20	4	3		2	12	N/A	N/A	150	0.078	16.82	168	0.5115	0.4737	

Phase D
Case I

One-Satellite Configuration

1 Scenario	2 Design Life (months)	3 Satellites		4 Launch Schedule (in months)		5 Launch Failures		6 Premature Failures in-orbit	7 Prime Mission Data (months)			8 Index of Program Performance	9 Prob-ability	10 Total Program Cost ($ C M)	11 Months of Mission Data	12 Index of Service Efficiency	13 Index of Cost Efficiency	NOTES
		Launch	Orbit	Fixed	Relaunch	Random	Conseq		Lost	Degraded	Dual							
37	28	10	10	20						N/A	N/A	180	0.005	14.40	180	0.0393	0.5657	
38	28	11	9	20	9	2		2	10	N/A	N/A	150	0.084	15.61	168	0.3508	0.5171	
39	28	11	8	20	9	3		2	19	N/A	N/A	130	0.077	15.61	160	0.4375	0.5108	
40	28	10	10	20						N/A	N/A	180	0.005	14.40	180	0.0393	0.5657	
41	28	12	10	20	4	2		2		N/A	N/A	180	0.075	16.82	180	0.5902	0.4796	
42	28	12	9	20	4	3		2		N/A	N/A	180	0.078	16.82	180	0.6138	0.4796	

Phase E
Case 1

One-Satellite Configuration

1 Scenario	2 Design Life (months)	3 Satellites		4 Launch Schedule (in months)		5 Launch Failures		6 Premature Failures In-orbit	7 Prime Mission Data (months)			8 Index of Program Performance	9 Prob-ability	10 Total Program Cost ($ C M)	11 Months of Mission Data	12 Index of Service Efficiency	13 Index of Cost Efficiency	NOTES
		Launch	Orbit	Fixed	Relaunch	Random	Conseq		Lost	Degraded	Dual							
43	32	9	9	22	4					N/A	N/A	180	0.009	12.96	180	0.0708	0.6359	
44	32	11	9	22	4	2		2		N/A	N/A	180	0.084	15.40	180	0.6610	0.5244	
45	33	11	8	22	4	3		2		N/A	N/A	180	0.077	15.40	180	0.6059	0.5244	
46	Cycle 1	6	6		4			In Cycle	20	N/A	N/A	150	0.006	8.69	160	0.0340	0.9635	
47	Cycle 1	8	6		4	2		In Cycle	28	N/A	N/A	110	0.060	11.45	152	0.2885	0.7150	
48	Cycle 1	8	5		4	3		In Cycle	29	N/A	N/A	107	0.055	11.45	151	0.2533	0.7143	
49	Cycle 2	6	6		4			In Cycle	4	N/A	N/A	170	0.006	8.43	176	0.0446	1.0000	
50	Cycle 2	8	6		4	2		In Cycle	12	N/A	N/A	150	0.060	11.13	168	0.3934	0.7429	
51	Cycle 2	9	6		4	3		In Cycle	16	N/A	N/A	140	0.060	12.97	164	0.3672	0.6286	
52	Cycle 3	7	6		4	In Cyc		In Cycle	20	N/A	N/A	130	0.070	10.17	160	0.3978	0.8137	
53	Cycle 4	7	6		4	In Cyc		In Cycle	8	N/A	N/A	150	0.070	9.87	172	0.4590	0.8456	

Cycle 1 29-41-37-15 months on-orbit life with no early indications of on-orbit failure - relaunch 4 months after a failure
Cycle 2 29-41-37-15 months on-orbit life with early indications of on-orbit failure for all but 15 month satellites - relaunch 4 months after a failure
Cycle 3 29-41-0-37-15 months on-orbit with no early indications of on-orbit failure - relaunch 4 months after a failure
Cycle 4 29-41-0-37-15 months on-orbit with early indications of on-orbit failure for all but 15 month satellites - relaunch 4 months after a failure

Phase A
Case II
Two-Satellite Configuration

1 Scenario	2 Design Life (months)	3 Satellites		4 Launch Schedule (in months)		5 Launch Failures		6 Premature Failures In-orbit	7 Prime Mission Data (months)			8 Index of Program Performance	9 Probability	10 Total Program Cost ($ C M)	11 Months of Mission Data	12 Index of Service Efficiency	13 Index of Cost Efficiency	NOTES
		Launch	Orbit	Fixed	Relaunch	Random	Conseq		Lost	Degraded	Dual							
1	24	16	16	12							168	390	0.0002	23.20	264	0.0034	0.3481	
2	24	16	16	12				1			156	375	0.001	23.20	258	0.0164	0.3438	
3	24	16	16	12				2			144	360	0.002	23.20	252	0.0315	0.3465	
4	24	16	16	12				3		12	132	350	0.003	23.20	240	0.0433	0.3447	
5	24	16	15	12		1				24	144	350	0.001	23.20	240	0.0144	0.3447	
6	24	16	15	12		1		1	12	12	144	315	0.006	23.20	234	0.0826	0.3438	
7	24	16	15	12		1		2	12	24	132	285	0.013	23.20	222	0.1620	0.3418	
8	24	16	15	12		1		3	12	24	120	270	0.017	23.20	216	0.2007	0.3407	
9	24	16	14	12		2				36	120	285	0.004	23.20	222	0.0498	0.3418	
10	24	16	14	12		2		1	12	36	120	255	0.017	23.20	210	0.1895	0.3416	
11	24	16	14	12		2		2	12	36	108	240	0.033	23.20	204	0.3462	0.3382	
12	24	16	14	12		2		3	12	36	108	240	0.041	23.20	204	0.4302	0.3382	
13	24	16	13	12		3				48	96	240	0.007	23.20	204	0.0734	0.3382	
14	24	16	13	12		3		1	12	36	96	225	0.028	23.20	198	0.2734	0.3369	
15	24	16	13	12		3		2	12	36	84	210	0.052	23.20	192	0.4774	0.3355	
16	24	16	13	12		3		3	12	36	72	195	0.058	23.20	198	0.4944	0.3369	
17	24	16	12	12		4				48	72	210	0.009	23.20	192	0.0826	0.3355	
18	24	16	12	12		4		1	12	36	72	195	0.033	23.20	186	0.2813	0.3340	
19	24	16	12	12		4		2	12	36	60	180	0.056	23.20	180	0.4407	0.3322	
20	24	16	12	12		4		3	24	36	60	175	0.057	23.20	168	0.4361	0.3299	
21	24	16	12	12		2	2		12	12	84	240	0.002	23.20	204	0.0210	0.3382	
22	24	16	12	12		2	2	1	24		84	225	0.008	23.20	198	0.0787	0.3369	
23	24	16	12	12		2	2	2	24		72	210	0.015	23.20	192	0.1377	0.3355	
24	24	16	12	12		2	2	3	36		72	180	0.020	23.20	180	0.1574	0.3322	

Phase B
Case II
Two-Satellite Configuration

1 Scenario	2 Design Life (months)	3 Satellites		4 Launch Schedule (in months)		5 Launch Failures		6 Premature Failures in-orbit	7 Prime Mission Data (months)			8 Index of Program Performance	9 Prob-ability	10 Total Program Cost ($ C M)	11 Months of Mission Data	12 Index of Service Efficiency	13 Index of Cost Efficiency	NOTES
		Launch	Orbit	Fixed	Relaunch	Random	Conseq		Lost	Degraded	Duet							
25	24	16	16	12							168	390	0.0002	23.20	264	0.0003	0.3631	
26	24	16	13	12		3		3	24	12	84	210	0.058	23.20	192	0.5325	0.3500	
27	24	16	12	12		4		3	24	12	60	180	0.053	23.20	180	0.4171	0.3468	
28	24	16	16	12	6						168	390	0.0002	23.20	264	0.0003	0.3631	
29	24	17	14	12	6	3		3	12	12	102	263	0.053	24.42	213	0.6082	0.3231	
30	24	18	14	12	6	4		3	12	12	84	240	0.055	25.64	204	0.5770	0.3000	
31	24	16	16	12	4						168	390	0.0002	23.20	264	0.0003	0.3631	
32	24	18	15	12	4	3		3	8	12	108	280	0.047	25.64	220	0.5753	0.3034	
33	24	18	14	12	4	4		3	8	12	92	260	0.055	25.64	211	0.6251	0.3034	
34	28	12	12	16						20	124	310	0.002	17.28	232	0.0271	0.7938	
35	28	12	9	16		3		3	24	36	28	130	0.055	17.28	152	0.3126	0.7602	
36	28	12	8	16		4		3	40	20	24	85	0.032	17.28	142	0.1889	0.7533	
37	28	12	12	16	6					20	124	310	0.002	17.28	232	0.0271	0.7938	
38	28	14	11	16	6	3		3	12	28	62	193	0.061	19.74	185	0.5134	0.3499	
39	28	14	10	16	6	4		3	12	12	48	195	0.045	19.74	186	0.3836	0.3501	
40	28	12	12	16	4					20	124	310	0.002	17.28	232	0.0271	0.7938	
41	28	14	11	16	4	3		3	8	28	68	210	0.063	19.74	192	0.5784	0.3514	
42	28	14	10	16	4	4		3	8	12	52	210	0.045	19.74	192	0.4131	0.3514	

Phase C
Case II

Two-Satellite Configuration

1 Scenario	2 Design Life (months)	3 Satellites		4 Launch Schedule (in months)		5 Launch Failures		6 Premature Failures in-orbit	7 Prime Mission Data (months)			8 Index of Program Performance	9 Prob-ability	10 Total Program Cost ($ C M)	11 Months of Mission Data	12 Index of Service Efficiency	13 Index of Cost Efficiency	NOTES
		Launch	Orbit	Fixed	Relaunch	Random	Conseq		Lost	Degraded	Dual							
43	28	13	13	14							166	388	0.001	18.46	263	0.0170	0.3604	
44	28	15	12	14	6	3		3	8	16	92	255	0.062	20.92	210	0.6911	0.3811	
45	28	15	11	14	6	4		3	8	2	72	248	0.053	20.92	207	0.5746	0.3803	
46	28	13	13	14							166	388	0.001	18.46	263	0.0170	0.4460	
47	28	16	13	14	4	3		3	4	14	98	275	0.058	22.15	218	0.6973	0.3591	
48	28	16	12	14	4	4		3	4	18	90	280	0.053	22.15	212	0.6000	0.3579	

Phase D
Case II

Two-Satellite Configuration

1 Scenario	2 Design Life (months)	3 Satellites		4 Launch Schedule (in months)		5 Launch Failures		6 Premature Failures in-orbit	7 Prime Mission Data (months)			8 Index of Program Performance	9 Prob-ability	10 Total Program Cost ($ C M)	11 Months of Mission Data	12 Index of Service Efficiency	13 Index of Cost Efficiency	NOTES
		Launch	Orbit	Fixed	Relaunch	Random	Conseq		Lost	Degraded	Dual							
49	24	16	16	12							168	390	0.0002	23.20	264	0.0030	0.3481	
50	24	20	17	12	4	3		3	8		144	350	0.058	28.08	244	0.7994	0.2790	
51	24	20	16	12	4	4		3	8		140	345	0.057	28.08	242	0.7902	0.2787	
52	28	13	13	14							166	388	0.001	18.46	263	0.0149	0.4455	
53	28	17	14	14	6	3		3	8	2	132	322	0.058	24.42	237	0.7170	0.3252	
54	28	17	13	14	6	4		3	8	2	126	315	0.057	24.42	234	0.6409	0.3247	
55	28	13	13	14							166	388	0.001	18.46	263	0.0149	0.4455	
56	28	17	14	14	4	3		3	4	2	134	335	0.058	24.42	242	0.7460	0.3260	
57	28	18	14	14	4	4		3	4	6	126	320	0.057	25.64	236	0.7003	0.3078	

Phase E
Case II

Two-Satellite Configuration

1 Scenario	2 Design Life (months)	3 Satellites		4 Launch Schedule (in months)		5 Launch Failures		6 Premature Failures in-orbit	7 Prime Mission Data (months)			8 Index of Program Performance	9 Prob-ability	10 Total Program Cost ($ C M)	11 Months of Mission Data	12 Index of Service Efficiency	13 Index of Cost Efficiency	NOTES
		Launch	Orbit	Fixed	Relaunch	Random	Conseq		Lost	Degraded	Dual							
58	32	12	12	16	4						164	385	0.002	17.28	262	0.0337	0.4786	
59	32	16	13	16	4	3		3	4	2	140	342	0.063	22.20	245	0.9419	0.3627	
60	32	17	13	16	4	4		3	4	2	136	337	0.053	23.43	243	0.7808	0.3415	
61	Cycle 1	11	11		4			In Cycle	2	14	133	323	0.003	15.75	238	0.0424	0.5250	
62	Cycle 1	13	10		4	3		In Cycle	4	15	123	305	0.075	17.94	230	1.0000	0.4550	
63	Cycle 1	14	10		4	4		In Cycle	4	16	120	300	0.055	19.63	228	0.7214	0.4122	
64	Cycle 2	12	12		4			In Cycle			156	375	0.002	17.23	258	0.0328	0.4796	
65	Cycle 2	14	11		4	3		In Cycle		4	148	360	0.063	19.35	252	0.9915	0.4224	
66	Cycle 2	15	11		4	4		In Cycle		4	142	353	0.055	21.00	249	0.8487	0.3861	
67	Cycle 3	13	10		4	In Cyc		In Cycle	2	20	121	301	0.075	18.58	231	0.9869	0.4382	
68	Cycle 4	14	11		4	In Cyc		In Cycle		8	146	373	0.061	20.00	249	0.9947	0.4071	

Cycle 1 29-41-37-15 months on-orbit life with no early indications of on-orbit failure - relaunch 4 months after a failure
Cycle 2 29-41-37-15 months on-orbit life with early indications of on-orbit failure for all but 15 month satellites - relaunch 4 months after a failure
Cycle 3 29-41-0-37-15 months on-orbit life with no early indications of on-orbit failure - relaunch 4 months after a failure
Cycle 4 29-41-0-37-15 months on-orbit life with early indications for all but 15 month satellites - relaunch 4 months after a failure

APPENDIX E

GLOSSARY OF ACRONYMS

ELV	Expendable Launch Vehicle
GAP	General Availability Program
NESDIS	National Environmental Satellite, Data, and Information Service
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
POES	Polar-orbiting Operational Environmental Satellite
STS	Space Transportation System
TIROS	Television and Infrared Observation Satellite