Surveyor Project Status Report

As of 27 November 1964

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FOREWORD

The biweekly Surveyor Project Status Report presents, in one document, a summary of schedule, manpower, and cost status information for the Surveyor Project and its associated systems.

All schedule information is correlated and reviewed by the Project Office on a biweekly basis. Cost and manpower information is correlated from monthly financial reports maintained by the Jet Propulsion Laboratory.

Jet Propulsion Laboratory
California Institute of Technology

Prepared under Contract No. NAS 7-100
National Aeronautics and Space Administration

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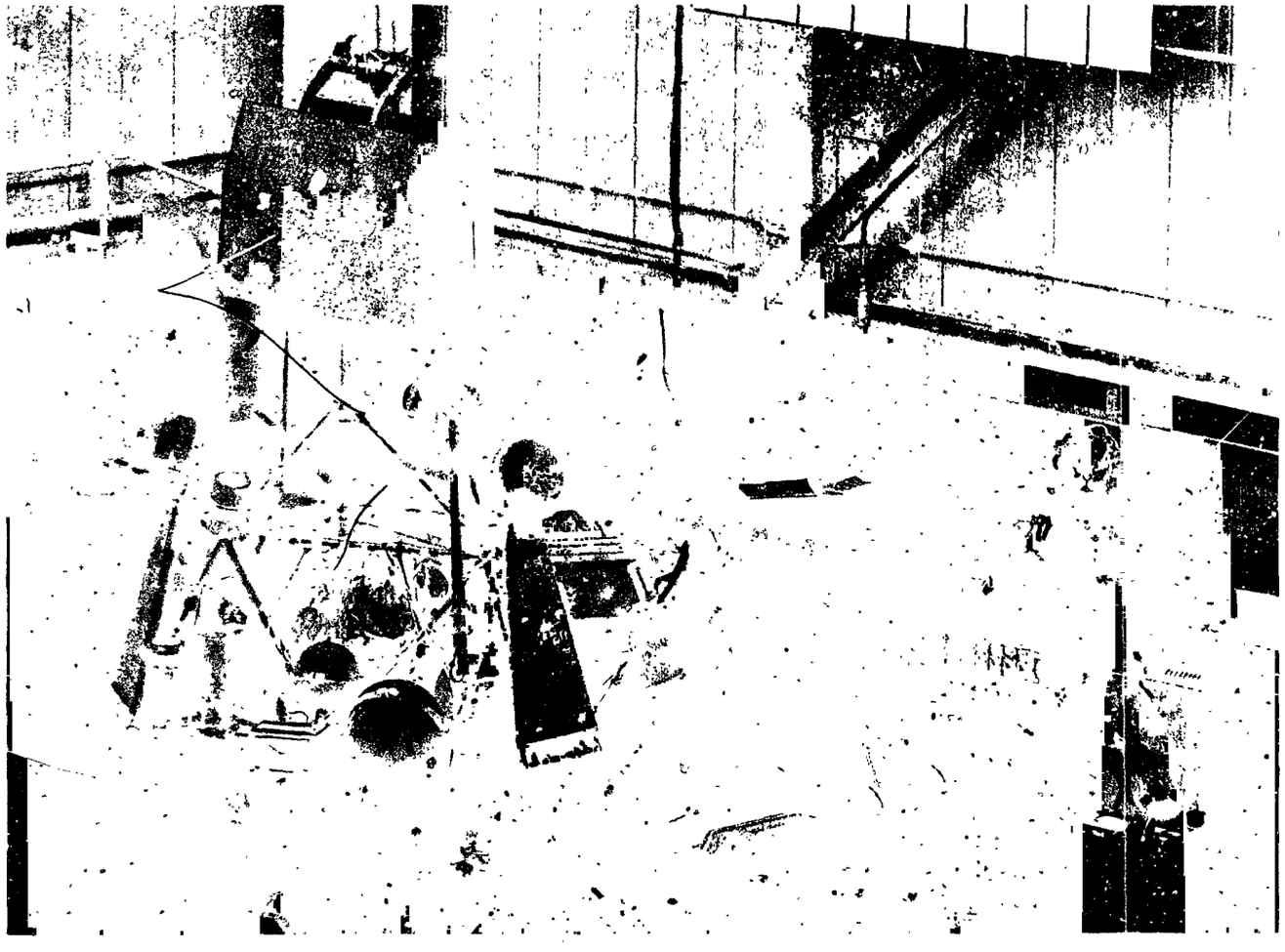


S-2 VEHICLE UNDERGOING TYPE APPROVAL VIBRATION TESTING

PROJECT SUMMARY

Note: Surveyor program planning associated with proposed launch vehicle schedule revisions is continuing as a top priority effort. Plans and schedules relative to spacecraft, launch vehicle, and deep space network support are being subjected to thorough evaluation prior to re-establishment of integrated schedules. Information contained in this report should, therefore, be interpreted as status of the ongoing effort relative to near term development and test objectives.

Current Events

1.0 T-21 Proof Test Vehicle
The T-21 spacecraft continues to undergo checkout prior to the start of thermal-vacuum testing. The TV Telecommunications tests have been completed. The Flight Control Sensor Group which was out for repair has been returned and retest has begun. Because of this rework, the completion of checkout of T-21 will be delayed to 7 December. The T-21 System Functional Test phase will continue, with the Flight Control Group test and the Flight Control/AMR/RADVS integration tests planned for the next reporting period. Upon completion of these tests, the vehicle will enter the solar thermal-vacuum test phase which is scheduled for completion by mid-February 1965.

2.0 SC-1 First Flight Spacecraft
The SC-1 vehicle was taken out of Systems Test on 17 November and returned to the assembly area for upgrade. The required modifications to the spacecraft and assemblies indicate that the upgrade period will be completed by 28 December. Following this upgrade period, the vehicle will undergo system, flight control, and integrated system checkout.

3.0 T-2S Dynamic Descent Vehicle
A formal HAC appointed Review Board is studying the results of the last drop. Future T-2 plans are dependent on Review Board findings. These findings are expected to be published on 4 December.

4.0 S-2A Structural Test Vehicle
On 18 November, the vehicle completed a portion of the type approval vibration testing. With increased strut loading, the vehicle was vibrated through a 5 to 50 cps range. The overall motion of the antenna/solar panel positioner appeared greatly reduced. The vehicle is presently undergoing Structural Approval tests.

5.0 Vernier Thrust Chamber Assembly (TCA)
During the past reporting period, five additional margin limit tests were performed. With the results from a total of sixteen of these tests, operating margin envelopes will be established. Contractual negotiations have been completed on the Development and Pre-Qualification Programs. Negotiations for the Qualification Program are scheduled for early December.

6.0 Vernier Propulsion Feed System
Six new propellant tanks were received at AFMDC to prepare the S-6 vehicle for future expulsion testing. At present a laboratory checkout is being conducted of the load cells and suspension system at HAC El Segundo. Upon completion, expulsion unbalance testing will resume at AFMDC during the second week of December. The S-7 test vehicle was returned to HAC El Segundo from AFMDC on 10 November. The vehicle was disassembled and inspected following the 32 day storage test. First reviews indicate no major problem areas resulting from storage tests. The vehicle is presently undergoing upgrade in preparation for the

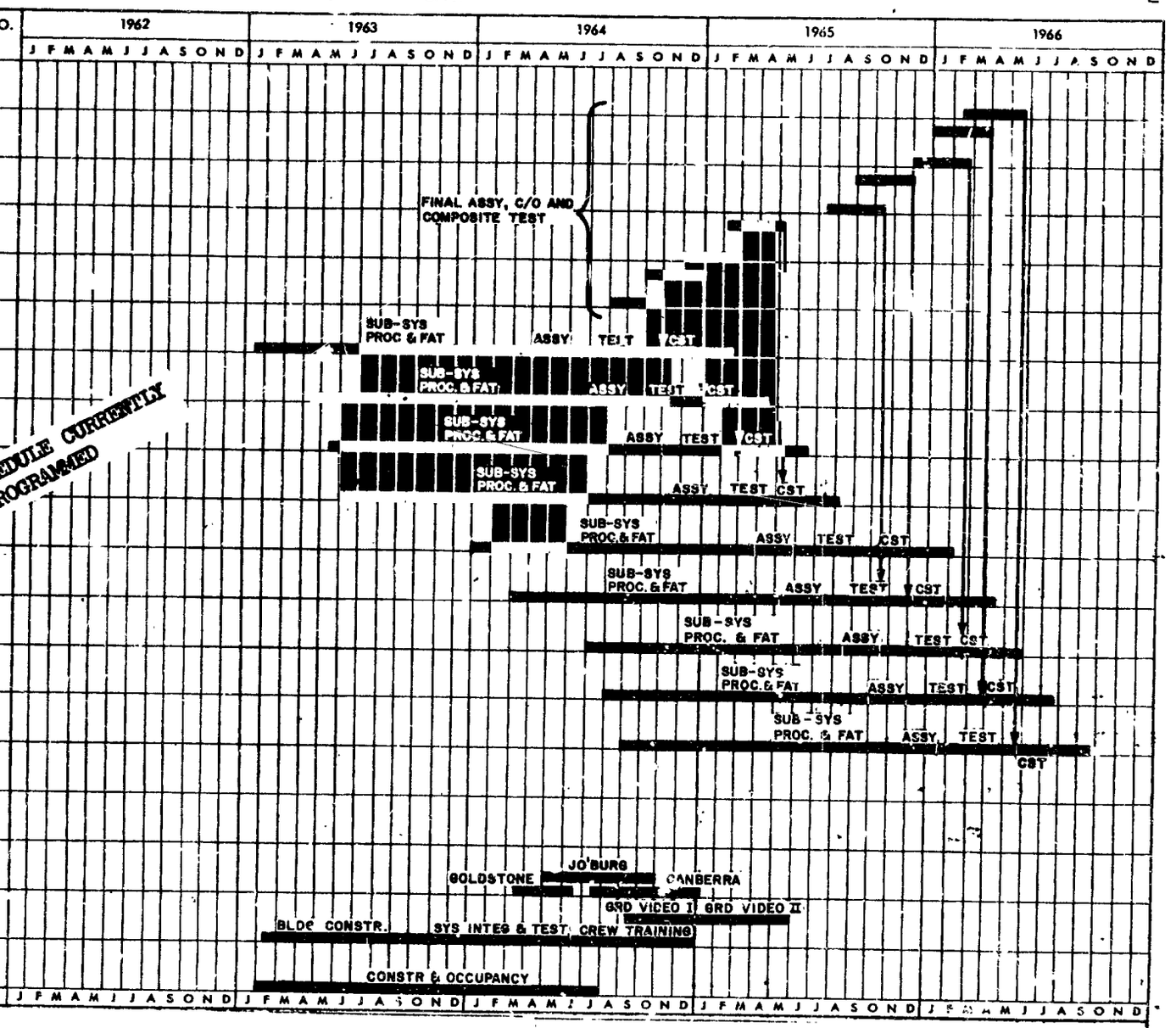
Continued on page 16

Project Master Schedule

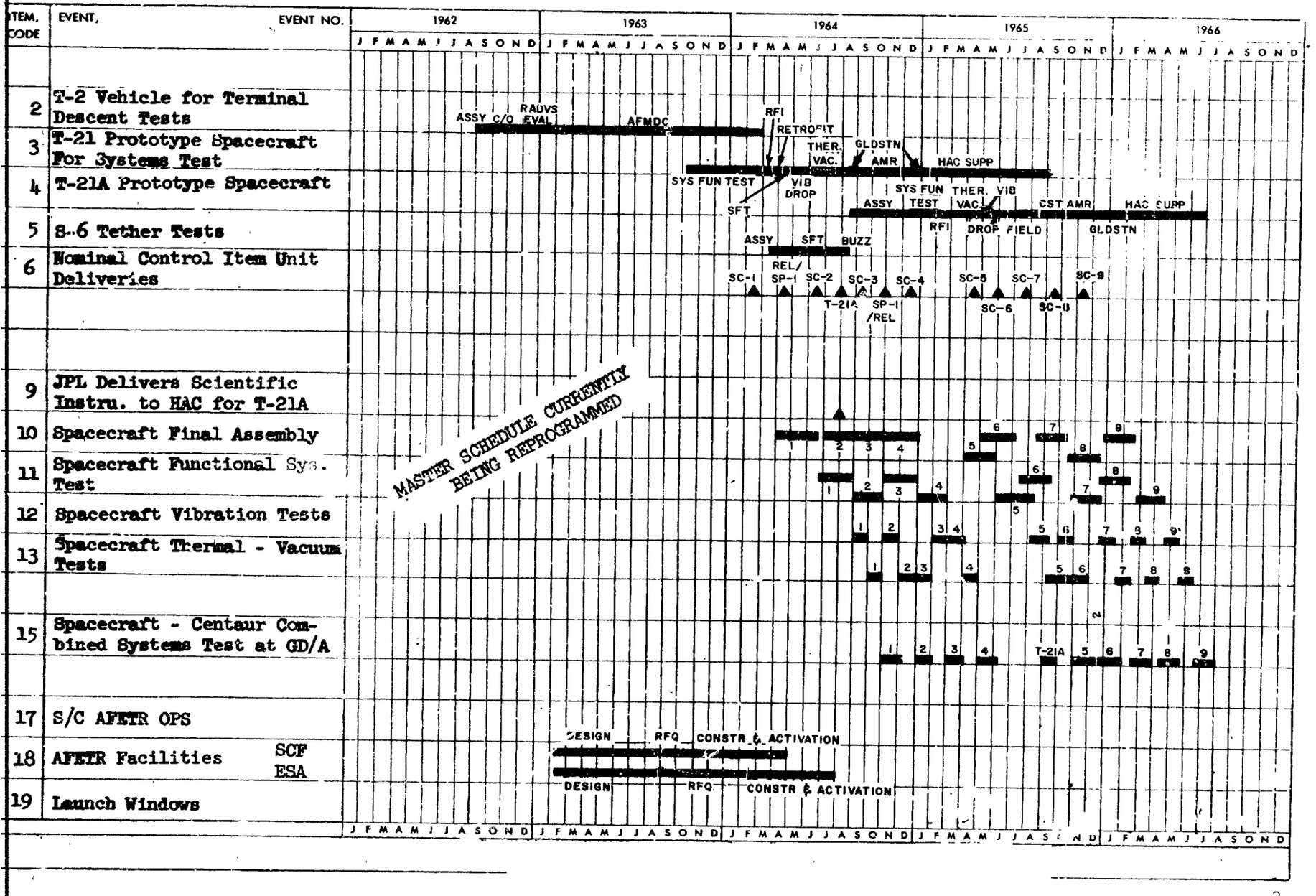
EL ENTS

2

ITEM, CODE	EVENT,	EVENT NO.
1		
2	AC	
3	AC AC	
4	AC-12 AC-10	
5	AC-9 AC-7	
6	SC-1	
7	SC-2	
8	SC-3	
9	SC-4	
10	SC-5	
11	SC-6	
12	SC-7	
13	SC-8	
14	SC-9	
15	Launch Pad 36A Ops.	
16	Launch Pad 36B Ops.	
17	DSIF Operational for Surveyor	
18	SFOF	
19	AFETR Facilities (ESA, SCF)	



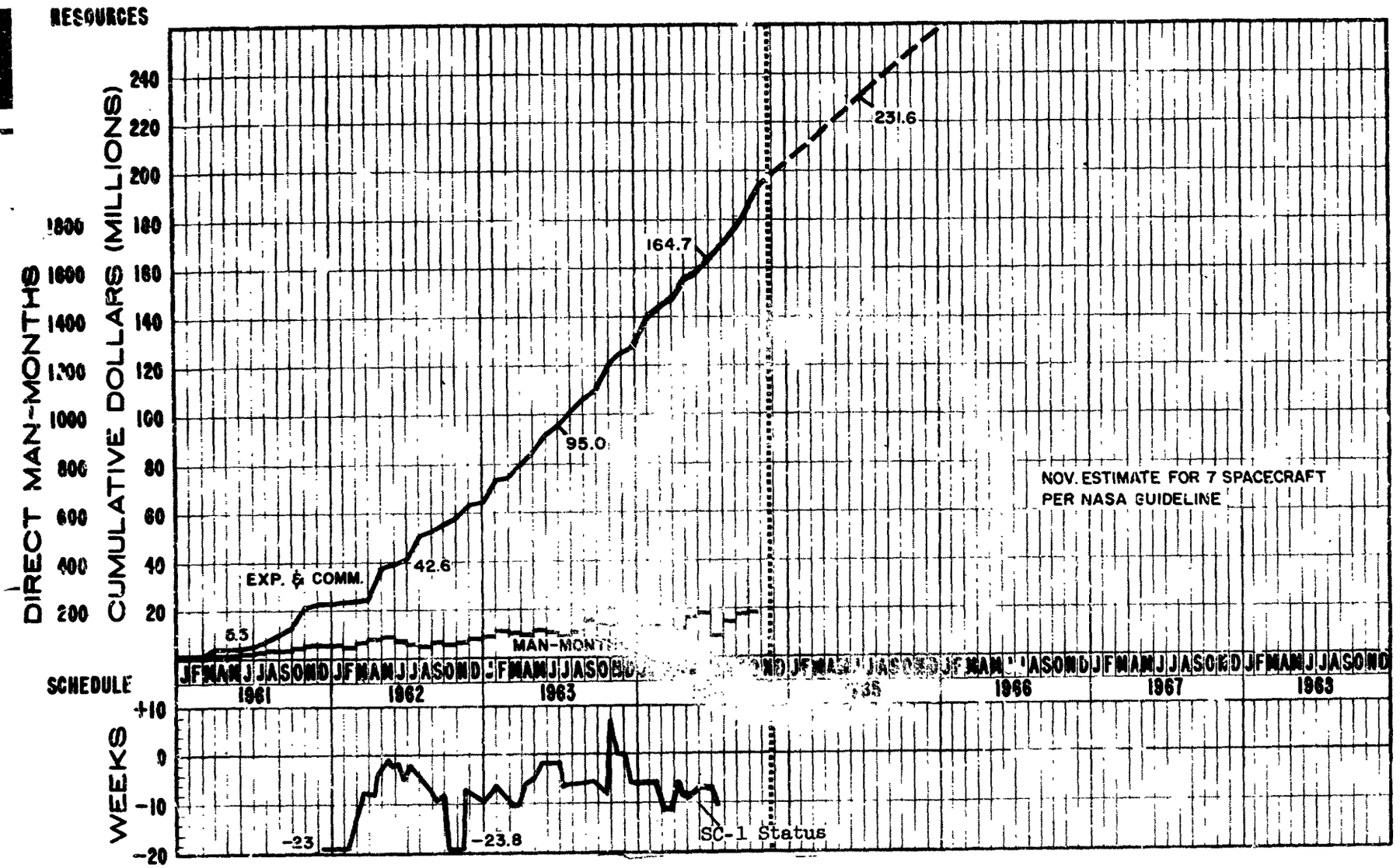
Spacecraft Master Schedule



Surveyor Project Status Report AS OF: 27 Nov 1964

ACTIVITY: PROJECT

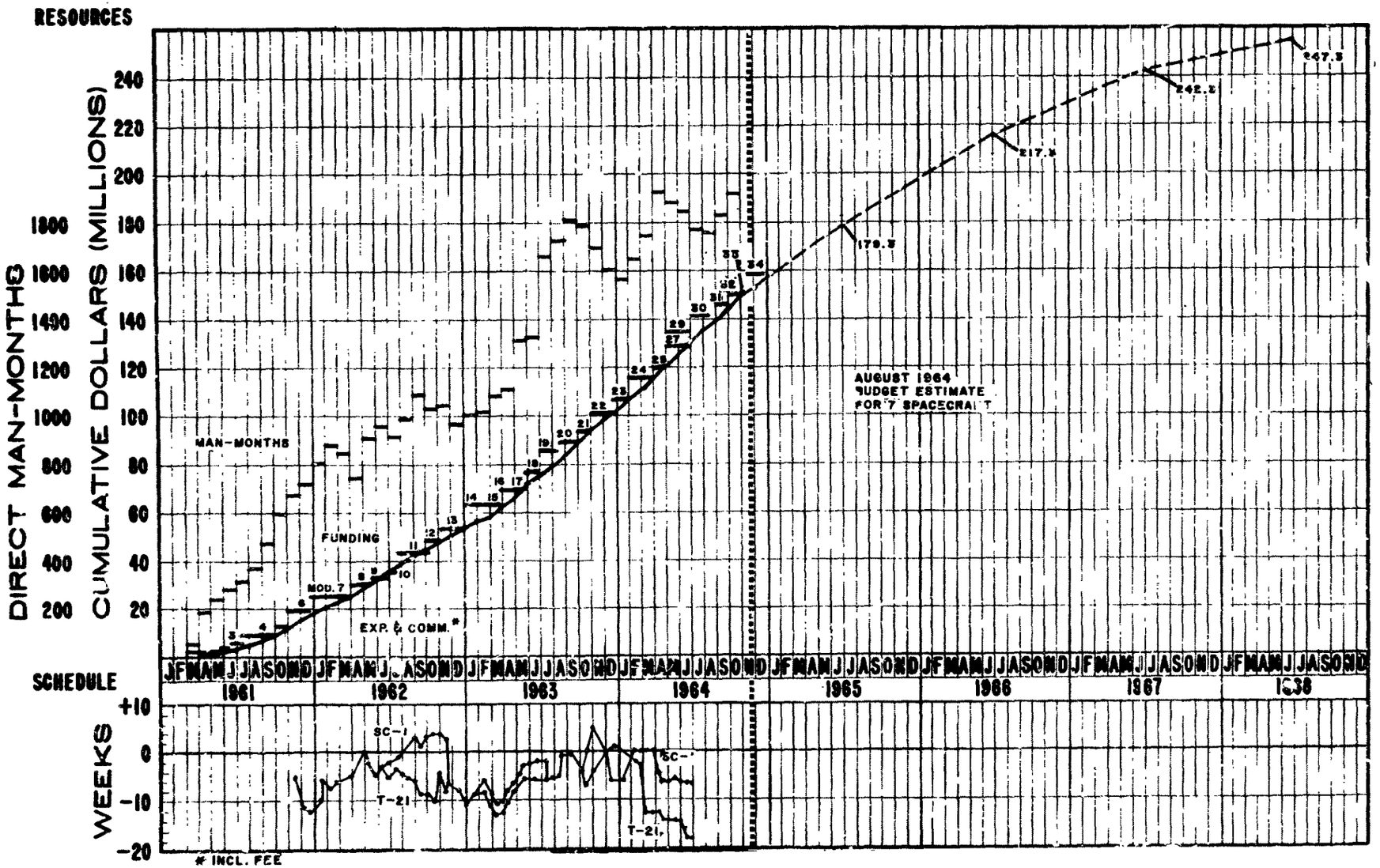
STATUS SUMMARY



Surveyor Project Status Report AS OF: 27 Nov 1964

ACTIVITY: SPACECRAFT SYSTEM

STATUS SUMMARY



SCHEDULED INTERFACE EVENTS CHART DESCRIPTION

The Scheduled Interface Events Chart lists currently planned dates for completion of events of primary importance to timely accomplishment of Surveyor missions. These events will normally involve action by two or more Surveyor System Managers. The following information is presented:

Primary Action
The primary action column indicates the organization charged with the responsibility for task performance leading to event completion and is responsible for reporting event status to completion.

Primary Interest
The primary interest column indicates the organization having tasks to perform which are dependent upon the interface event being completed by the organization of primary action.

Event Description
The event description column describes the event to be completed by the organization with primary action responsibility.

Event Number
The event number column references the event as it is portrayed in the Surveyor Project PERT Network.

Date Originated
The date originated column indicates the date the interface event schedule was established. A numerical suffix code provides a reference to the source from which the schedule was obtained. A reference code index will be maintained by the Surveyor Project Office for this purpose.

Date Scheduled
The date scheduled column indicates the schedule date for completion of the event described.

The Selected Event Chart portrays the current development program and status of systems and subsystems, and are changed only when the plans they are depicting are changed. The bar charts do not show all dependencies which exist on the Surveyor Project Summary PERT Network (e.g. facility availability, test equipment, etc.) However, the PERT symbols do represent status with respect to all constraints shown on the network.

The PERT information gives status relative to the completion of the planned activities (bars) by showing

1) when the activity is expected to be completed (▲);
2) the latest allowable completion date (△) which will enable all succeeding activities to be accomplished without affecting schedule;
3) the completion of activities (▲);
4) the scheduled completion of activities (*);
5) major constraints between systems (↑).

SCHEDULED INTERFACE EVENTS

Primary Action	Primary Interest	Event Description	Event Number	Date Originated	Date Scheduled
HAC	GD/A	Compl Del SD-1 to GD/A			
HAC	GD/A	Compl Del SD-2 to GD/A			
HAC	DSIF	Compl Del CDC to Goldstone			
HAC	DSIF	Compl Del T-21 to Goldstone			
JPL	HAC	Compl Del T-21A Scientific Instruments to HAC			
HAC	GD/A	Compl Del T-21 to AFETR			
HAC	DSIF	Compl Del CDC to Joburg			
GD/A	HAC	Compl CST Facility			
HAC	GD/A	Compl Del SC-1 to GD/A for CST			
HAC	DSIF	Compl Del CDC to Canberra			
GD/A	HAC	Compl AC-7 Prep for CST			
HAC	DSIF	Compl Del T-21 to Goldstone			
JPL	HAC	Compl SC/DSIF/SFOF Compatibility Test at Joburg (Bl.2)			
HAC	GD/A	Compl Del SC-1 to AFETR			
JPL	HAC	Compl SC/DSIF/SFOF Compatibility Test at Canberra (Item V-C, SFOS Sched.)			
JPL	HAC	Compl T-21/DSIF/SFOF Compatibility Test at Goldstone (Item V-E, SFOS Sched.)			
JPL	SFOF	Compl Operational Readiness Tests (Item V-D, SFOS Sched.)			

CURRENTLY BEING REPROGRAMMED

Surveyor Project Status Report AS OF: 27 Nov 1964

ACTIVITY: T-2, S-8

SELECTED EVENTS

ITEM CODE	EVENT	EVENT NO.
1	T-2 Assembly & Checkout	
2	T-2 AFMDC Testing (preliminary)	
3	RADVS Rework (prior to T-2H tests)	
4	T-2H Tests & Evaluation	9417068
5	T-2 Tether Tests	9432082
6	T-2 Terminal Descent Tests	9424084
8	S-8 Upgrade	
9	S-8 Tether Tests-Test Equipment Checkout	
10	S-8 Tether Tests	

CODE: 1. NEW EVENT 2. CHANGE IN DATA 3. EVENT COMPLETED 4. CHANGE IN SCHEDULE 5. EVENT DELETED

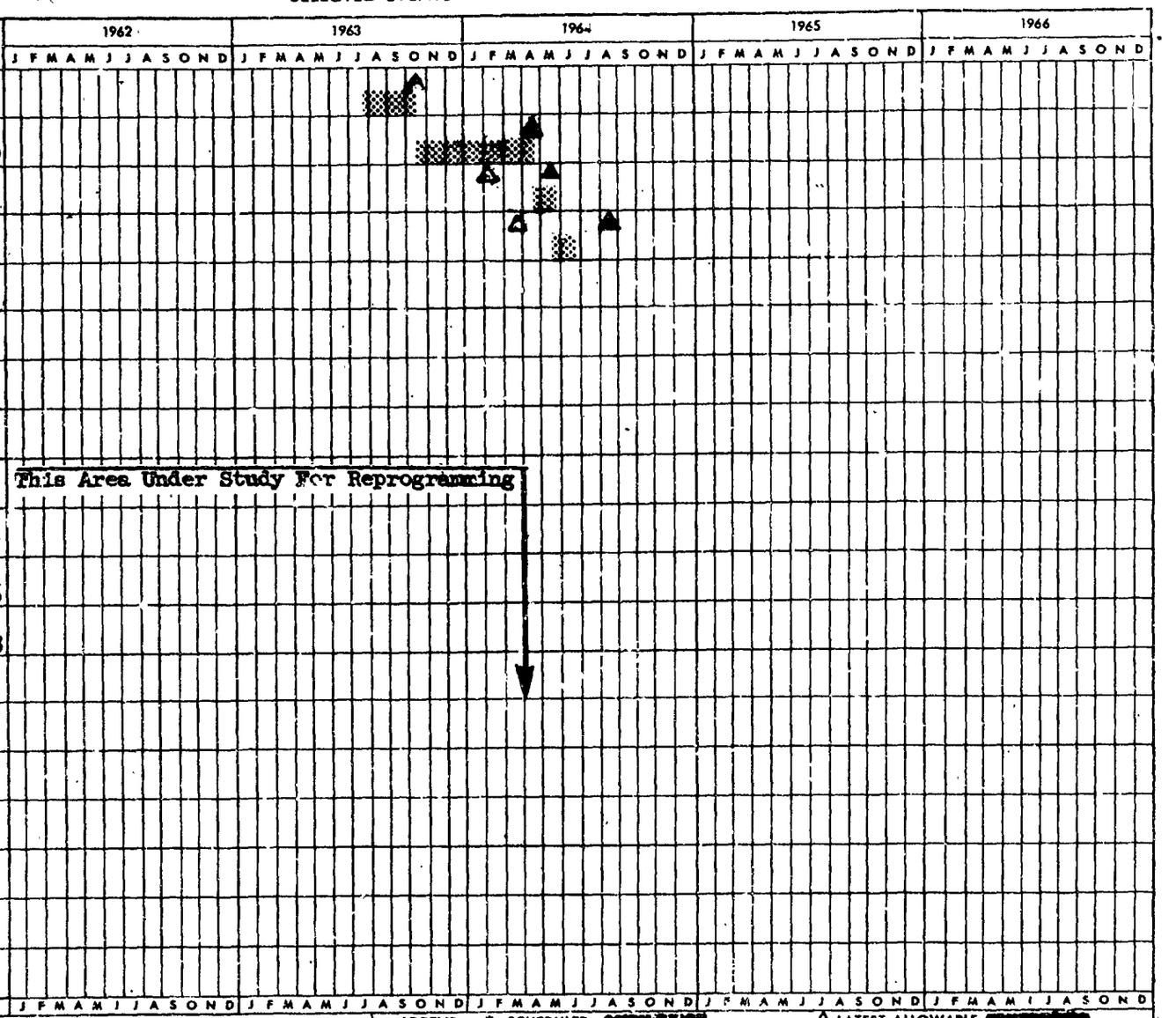
LEGEND: * SCHEDULED [redacted] EXPECTED [redacted] △ LATEST ALLOWABLE [redacted] ▲ ACTUAL COMPLETION

Surveyor Project Status Report AS OF: 27 Nov 1964

ACTIVITY: T-21

SELECTED EVENTS

ITEM. CODE	EVENT.	EVENT NO.
1	T-21 Assy (Flight Quality Hardware)	9015088
2	T-21 Sys Functional Test	9017090
3	T-21 Upgrade	9900041
4	T-21 Mission Sequence & RFI Tests	9900043
5	T-21 Compartment Upgrade & Ckout	9900049
6	T-21 VIB Test	9021002
7	T-21 Drop Test	9023002
8	T-21 Thermal/Vacuum Test	9025002
9	T-21 Shipment & Checkout at Goldstone	9025004
10	T-21/DSIF/CDC Goldstone Test	0400037
11	T-21 AGR Proofing Operations	0200026
12	T-21/SFOF/DSIF Goldstone Test	0400043
13	T-21 Engineering Proof Test Support	



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Surveyor Project Status Report AS OF: 27 Nov 1964

ACTIVITY: T-21A

SELECTED EVENTS

ITEM, CODE	EVENT, EVENT NO.
1	T-21A Assembly
2	T-21A System Functional Test
3	T-21A RFI Test
4	T-21A VIB Test
5	T-21A Drop Test
6	T-21A Thermal/Vacuum Test
7	T-21A Combined System Test
8	T-21A AFETR Test
9	T-21A Goldstone Test
10	T-21A HAC Support

1962 1963 1964 1965 1966

J F M A M J J A S O N D

SCHEDULE UNDER STUDY

CODE: 1. NEW EVENT 2. CHANGE IN DATA 3. EVENT COMPLETED 4. CHANGE IN SCHEDULE 5. EVENT DELETED

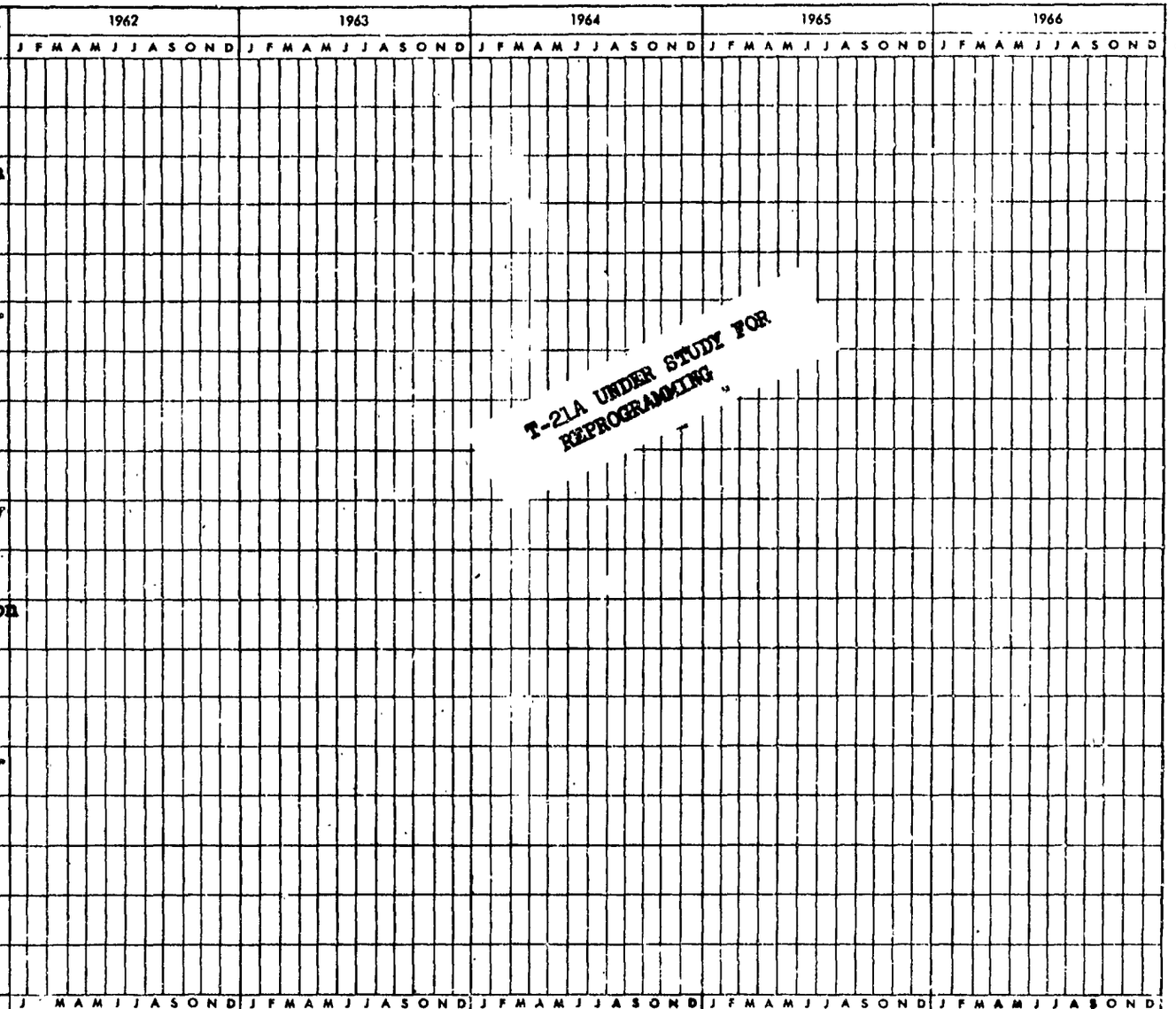
LEGEND: * SCHEDULED EXPECTED LATEST ALLOWABLE ACTUAL COMPLETION

Surveyor Project Status Report AS OF: 27 Nov 1964

ACTIVITY: Scientific Payload T-21A

SELECTED EVENTS

ITEM, CODE	EVENT, EVENT NO.
1 2	Surface Sampler Fab & Assy
2 2	Surface Sampler FAT
3 4	Surface Sampler Integration & Test
4	Micrometeorite Ejecta Fab & Assy
5 2	Micrometeorite Ejecta FAT
6 4	Micrometeorite Ejecta Integration & Test
7 2	Seismometer Fab & Assy
8 2	Seismometer FAT
9 4	Seismometer Integration & Test
10	Alpha Scattering Fab & Assy
11	Alpha Scattering FAT
12 4	Alpha Scattering Integration & Test
13	Touchdown Dynamics Fab & Assy
14	Touchdown Dynamics FAT
15 4	Touchdown Dynamics Integration & Test
16	T.V. 2 & 3 Fab & Assy
17	T.V. 2 & 3 FAT
18	Scientific Instrument Aux Fab & Assy
19	Scientific Instrument Aux FAT



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Surveyor Project Status Report AS OF: 27 Nov 1964

ACTIVITY: MISSION A

SELECTED EVENTS

ITEM CODE	EVENT	EVENT NO.
1	SC-1 Assembly	9107150
2	SC-1 System Funct & RFI Tests	9109152
3	SC-1 Therm/Vacuum Test	9207002
4	SC-1 Vib Test + Del to GD/A	9111154
5	SC-1 and AC-7 Combined Sys Test	9115158
6	SC-1 Readiness Testing	0500001
8	AC-7 Final Assy, c/o, + Composite Test	0200000
9	CST Facility Activation (Operational)	
10	STEA 2 Install + c/o at GD/A	
11	Launch Pad Availability	0500018

1962 1963 1964 1965 1966

J F M A M J J A S O N D

CURRENTLY BEING REPROGRAMMED

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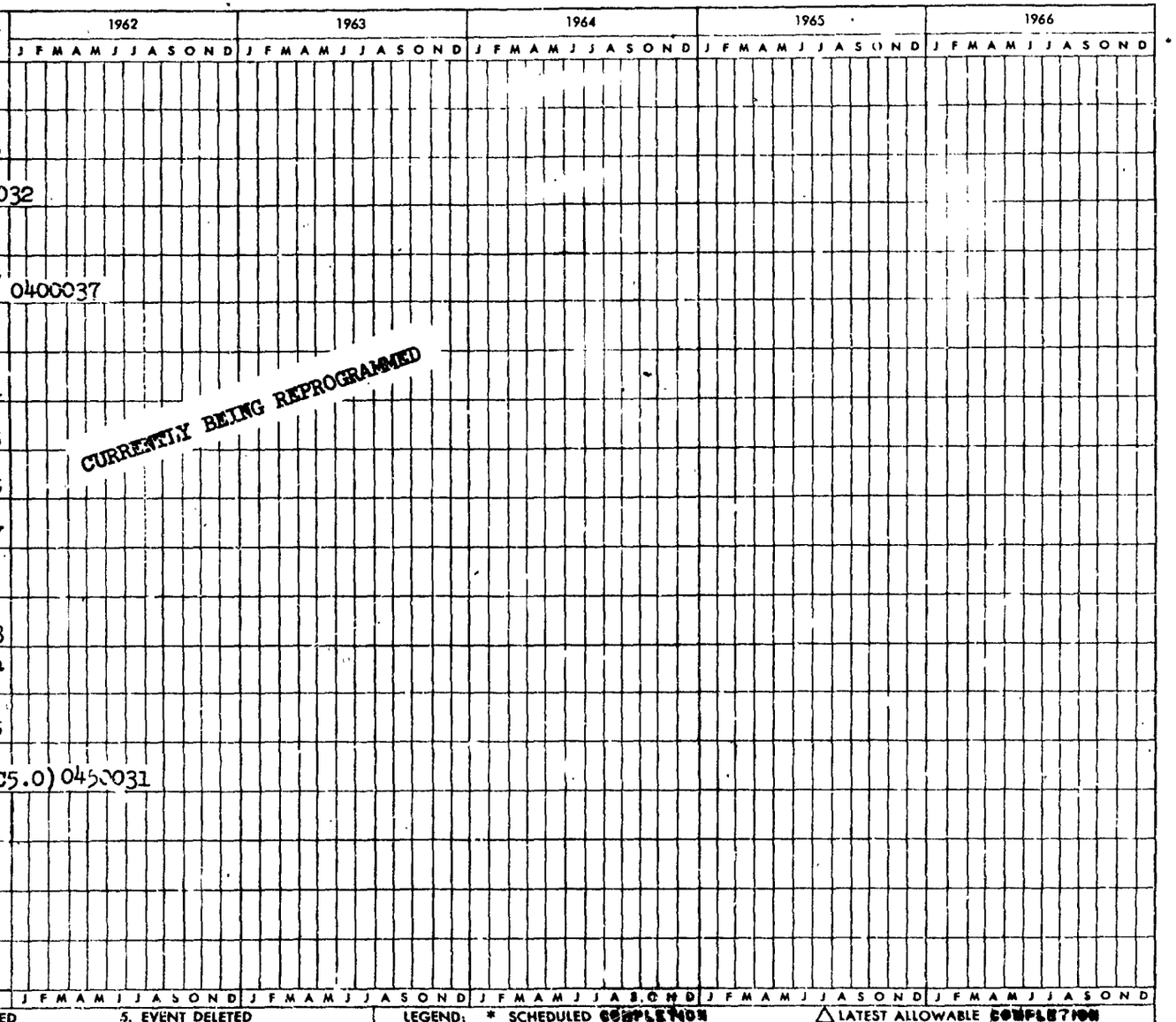
LEGEND: * SCHEDULED ▲ EXPECTED COMPLETION △ LATEST ALLOWABLE COMPLETION ▲ ACTUAL COMPLETION

Surveyor Project Status Report AS OF: 27 Nov 1964

ACTIVITY: DSIF/SFOF

SELECTED EVENTS

ITEM, CODE	EVENT, EVENT NO.
1	Goldstone Facility Rdy for CDC Instl.
2	CDC Instl. Ckout Goldstone 0400033
3	S-Band Instl. Compl.-Goldstone Operational 0400032
4	S-Band/CDC Compat Test Goldstone (A1.1) 0400035
5	T-21/DSIF/SFOF Compat. test Goldstone (A1.4,B1.4,C1.0) 0400037
6	Joburg Facility Rdy for CDC Instl.
7	CDC Instl. Ckout Joburg 0400071
8	S-Band Instl. Compl-Joburg Operational 0400073
9	S-Band/CDC Compat. Test Joburg (A1.2) 0400075
10	SC/DSIF/SFOF Compat. Test Joburg (B1.2) 0400077
11	Canberra Facility Rdy for CDC Instl.
12	CDC Instl. Ckout Canberra 0400053
13	S-Band Inst Compl.-Canberra Operational
14	S-Band/CDC Compat. Test Canberra (A1.3) 0400055
15	SFOF/DSIF Operational Readiness Test (C2.0,C4.0,C5.0) 0450031
16	



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PROJECT DEVELOPMENT PLAN SUMMARY *

Surveyor is a lunar soft landing and surface investigation project managed by JPL's Lunar and Planetary Project Office for the NASA Headquarters Office of Space Science and Applications. The Project is supported from within NASA by the Lewis Research Center (LeRC) and the Goddard Space Flight Center (GSFC). Within JPL, the cooperation of the Deep Space Network is involved. Hughes Aircraft Company (HAC) is under contract to JPL to develop the spacecraft.

The objective shall be to demonstrate a soft landing on the Moon in 1965 as evidenced by postlanding spacecraft operations in one or more missions. Subsequent to 1965, the primary objective will be to perform lunar surface operations contributing new scientific knowledge about the Moon and providing basic data in support of Project Apollo.

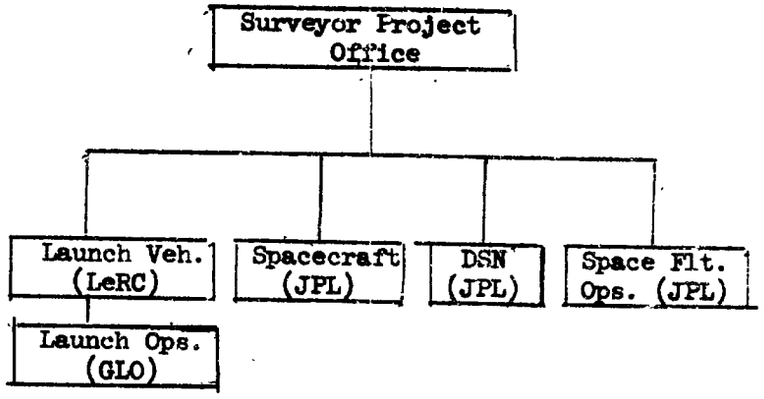
The Surveyor Project Block I currently comprises seven flight missions. These missions will utilize the Atlas/Centaur launch vehicle with launches to be conducted from Complex 36 at the Air Force Eastern Test Range (ETR), Cape Kennedy. The missions will be conducted utilizing direct ascent launch trajectories with a spacecraft having a nominal separated weight of 2150 lbs. The missions will be divided into two groups consisting of (1) four spacecraft designated as engineering test flights and containing an engineering performance payload and (2) three spacecraft designated as operational vehicles which contain a scientific instrument payload.

During transit, the Deep Space Instrumentation Facility will be used for spacecraft orbit determination and to transmit the necessary commands to effect a midcourse maneuver to minimize the lunar landing dispersion. The DSIF will also be used to receive engineering and scientific data telemetered from the spacecraft during transit to and operations on the lunar surface.

After spacecraft injection, all additional mission operations will be conducted from the JPL Space Flight Operations Facility. Accumulation of engineering and scientific data and the processing and partial reduction of the scientific data will be accomplished at this Facility. The SFOF will be the focus of continuing operations associated with the conduct of experiments during the 30 - to 90 day life of the Surveyor spacecraft on the lunar surface.

The scientific payload will consist of the following experiments: television (2 survey cameras), micrometeorite ejecta, seismographic, alpha scattering, surface sampler (for soil mechanics), and touchdown dynamics.

A project organization consisting of four systems has been planned for Surveyor. The four systems and their parent organizations are shown in the accompanying chart.



* Updated abstracts from prerelease PDP dated 28 February 1964.

GLOSSARY

Spacecraft Model Designations

SC-1 through SC-4. Flight-quality, subsystem and system flight-acceptance tested spacecraft carrying the engineering payload and designated for Surveyor test missions.

SC-5 through SC-7. Flight-quality, subsystem and system flight-acceptance test spacecraft carrying the scientific payload and designated for operational missions.

SD-1 through SD-4. Spacecraft dynamic models associated with Centaur R and D flight AC-5 and AC-6 and two Plumbrook tests respectively.

S-2. Test spaceframe for vibration, shock, and static structural tests of the A-21 spacecraft.

S-6, S-7. Test spaceframes for vernier propulsion system prequalification testing

S-8. Spacecraft for tether tests to determine dynamic compatibility of spaceframe, vernier engine subsystem and flight control subsystem.

T-1. Test spacecraft for simulated lunar landing drop tests (completed) and Centaur separation testing.

T-2. Test spacecraft for descent dynamics testing.

T-2H. Helicopter test vehicle for descent tests of T-2 RADVS.

T-21. Prototype spacecraft having same configuration as SC-1 through SC-4 for system, type-approval, and mission-simulation tests.

T-21A. Prototype spacecraft having same configuration as SC-5 through SC-7 for system, type-approval, and mission simulation tests.

MT-1. Thermal test spacecraft, constructed in three sectors, comprising together a thermal mockup of spacecraft.

Abbreviations

AC Atlas/Centaur launch vehicle system.

AFETR Air Force Eastern Test Range, Cape Kennedy

CDC Command and data-handling console installed at the DSS.

CST Combined System Test.

DSIF Deep Space Instrumentation Facility.

DSS Deep Space Station of DSIF (located at Krugersdorp, South Africa; Woomera, Australia; and Goldstone, California).

ESA Explosive Safe Area, ETR.

GD/A General Dynamics/Astronautics, Atlas/Centaur vehicle contractor (LeRC contract).

GSE Ground Support Equipment.

HAC Hughes Aircraft Company, Spacecraft System contractor (JPL contract).

LeRC Lewis Research Center, NASA

PDP Surveyor Project Development Plan, dated 28 February 1964

RADVS Radar Altimeter and Doppler Velocity Sensor.

RMD Reaction Motors Division, Thiokol, vernier engine subcontractor (JPL).

SCF Spacecraft Checkout Facility.

SFOF Space Flight Operations Facility.

SFOP Space Flight Operations Plan.

STEA System Test Equipment Assembly used to perform overall systems test on spacecraft.

STL Space Technology Laboratories, vernier-engine back-up feasibility contractor (JPL subcontract).

PROJECT SUMMARY (Continued)

next series of tests scheduled for January.

7.0 Main Retro
The Surveyor Main Retro will begin additional vibration testing at United Aerotest Labs on 1 December 1964. A program plan has been developed for the qualification of the main retro to allow for a spacecraft weight increase to 2250 lbs. Consequently, the tests currently scheduled for the T-3 cell at AEDC in December have been postponed in order to gain accurate data on flight engine tail-off characteristics.

8.0 S-8 Test Vehicle
The S-8 vehicle continues to be used in evaluating the RADVS system in an actual spacecraft vibration environment. Tests were successfully completed on the flight AM-1 RADVS system. Tests are now being conducted on the AM-2 RADVS unit.

9.0 Shock Absorbers
The SC-1 and spare shock absorber units are in preliminary flight acceptance test and are expected to enter full flight acceptance test at the end of this reporting period. Strain gauges on Type Approval Test units S/N 20, 21, and 22 will be removed and rewelded. The units will then be thermally finished and returned to the vendor by 31 December. Type Approval Testing is now scheduled for completion by 28 February 1965.

Events Anticipated
4 December - Results of T-28 Failure Review Board published.
7 December - Complete checkout of T-21.
28 December - Complete SC-1 upgrade period.