Surveyor Project Status Report

As of 13 November 1964

Prepared by _____

L. S. Frankenstein
Surveyor Assistant Project Manager

Approved: _____

W. E. Giberson,
Surveyor Project Manager

JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CALIFORNIA

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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

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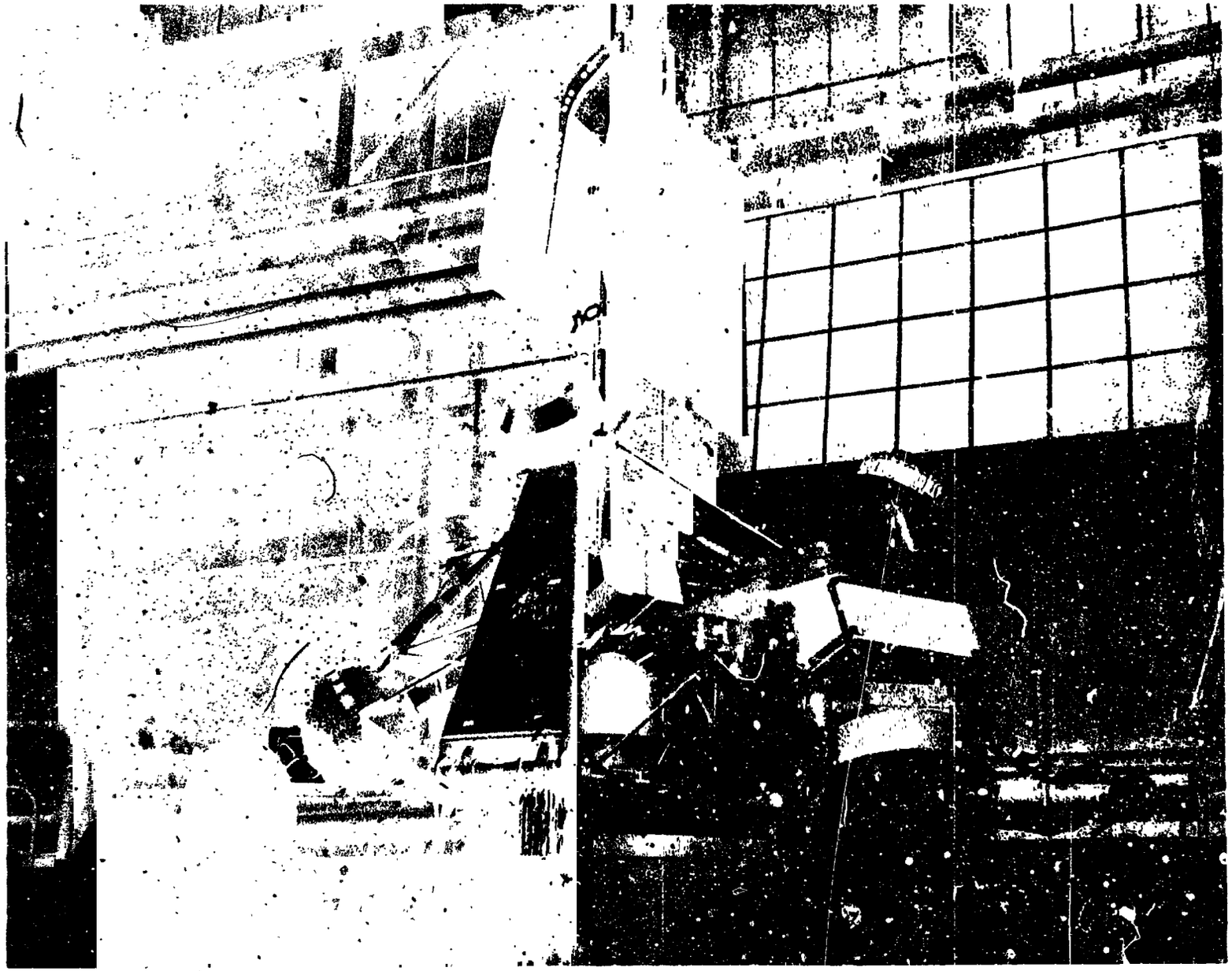

S-2A STRUCTURAL TEST VEHICLE UNDERGOING EXPLORATORY VIBRATION TESTING

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 RADVS group test and the Telecommunication Intergroup test were completed. The Television-Telecommunication test was started and is expected to be completed during the Reporting period. The Flight Control Tests are dependent on the return of the Flight Control Sensor Group following repair and checkout in the unit and subsystem area. Future test operations will consist of completion of the Television-Telecommunication test and resumption of Flight Control tests.

2.0 SC-1 First Flight Spacecraft
SC-1 continues through systems functional testing. Test operations during the past week consisted of some additional checks of the Boost Regulator, and completion of approximately 50% of the Mechanism Auxiliary/Spacecraft Power Test. The Signal Processing/Spacecraft Power Test is expected to begin next week. Systems group testing will continue until 23 November at which time the vehicle will be upgraded.

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.

4.0 S-2A Structural Test Vehicle
A failure of the Retro Rocket brackets occurred on 28 October 1964 during Type Approval Testing. At the time of the failure the vibration environment exceeded specified test levels. This error was attributed to a faulty connection in a monitoring accelerometer circuit. A revision is being made in the check-off procedures prior to testing, and additional "over-ride" channels are being incorporated to assure that correct levels are maintained during testing. The broken hardware has been replaced and further testing resumed.

5.0 Vernier Thrust Chamber Assembly (TCA)
Flow checks of temperature conditioning equipment used in design demonstration tests were completed and firing test data are being corrected. Data analysis of the upstream system used in these tests indicate excessive pressure drop during start, causing excessive time for the valve to come to control. Bench tests at component level indicate that much shorter time will be required with the Surveyor upstream system. Consequently, effort is presently underway to improve the test feed system.

6.0 Vernier Propulsion Feed System
During the post-run checkout after the S-6 propellant expulsion unbalance test, bladder leakage was found. In addition, replacement of the non-flight quality propellant tank revealed a crack in one tank. These two discrepancies caused postponement of future flow tests. During

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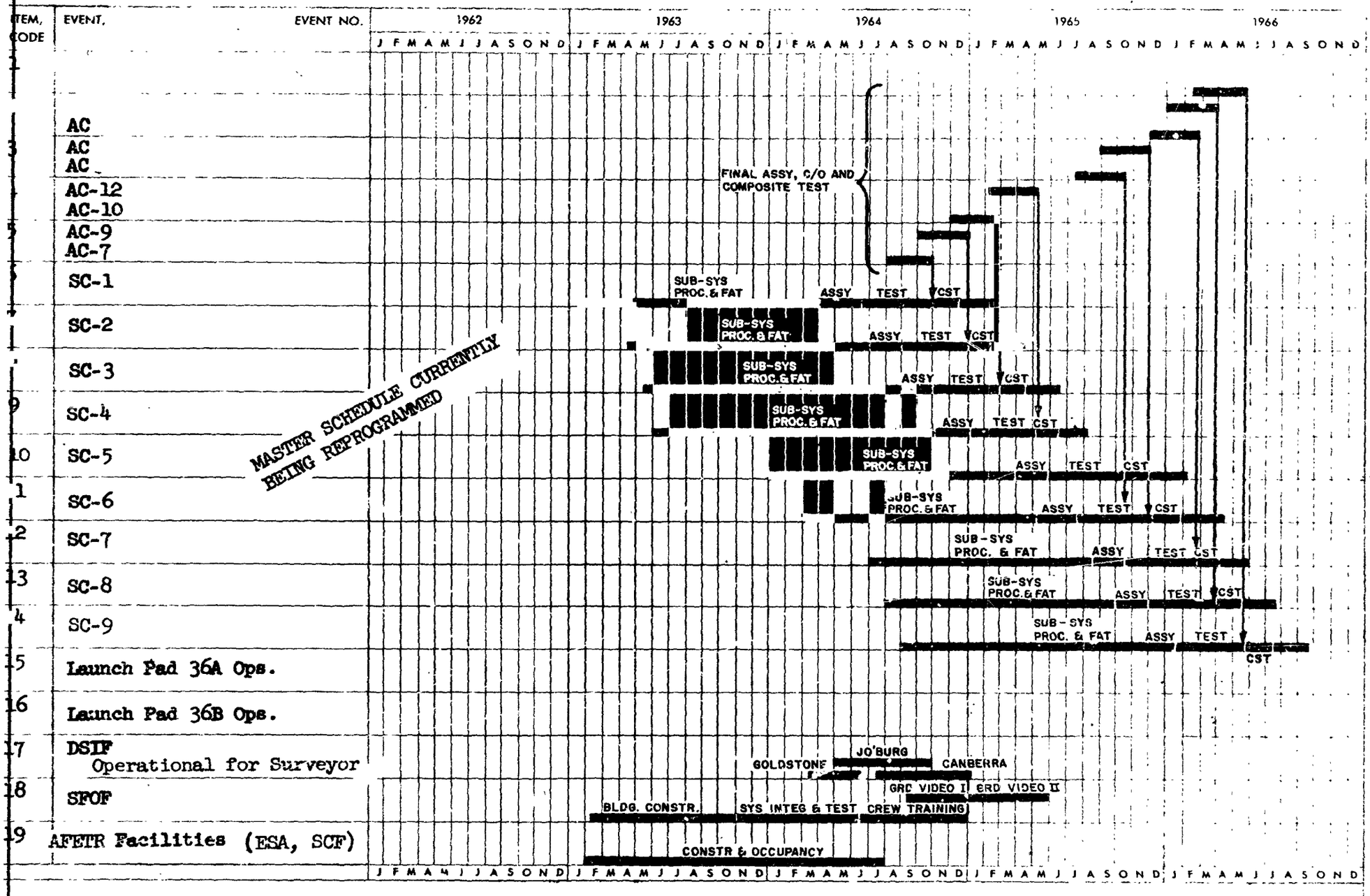
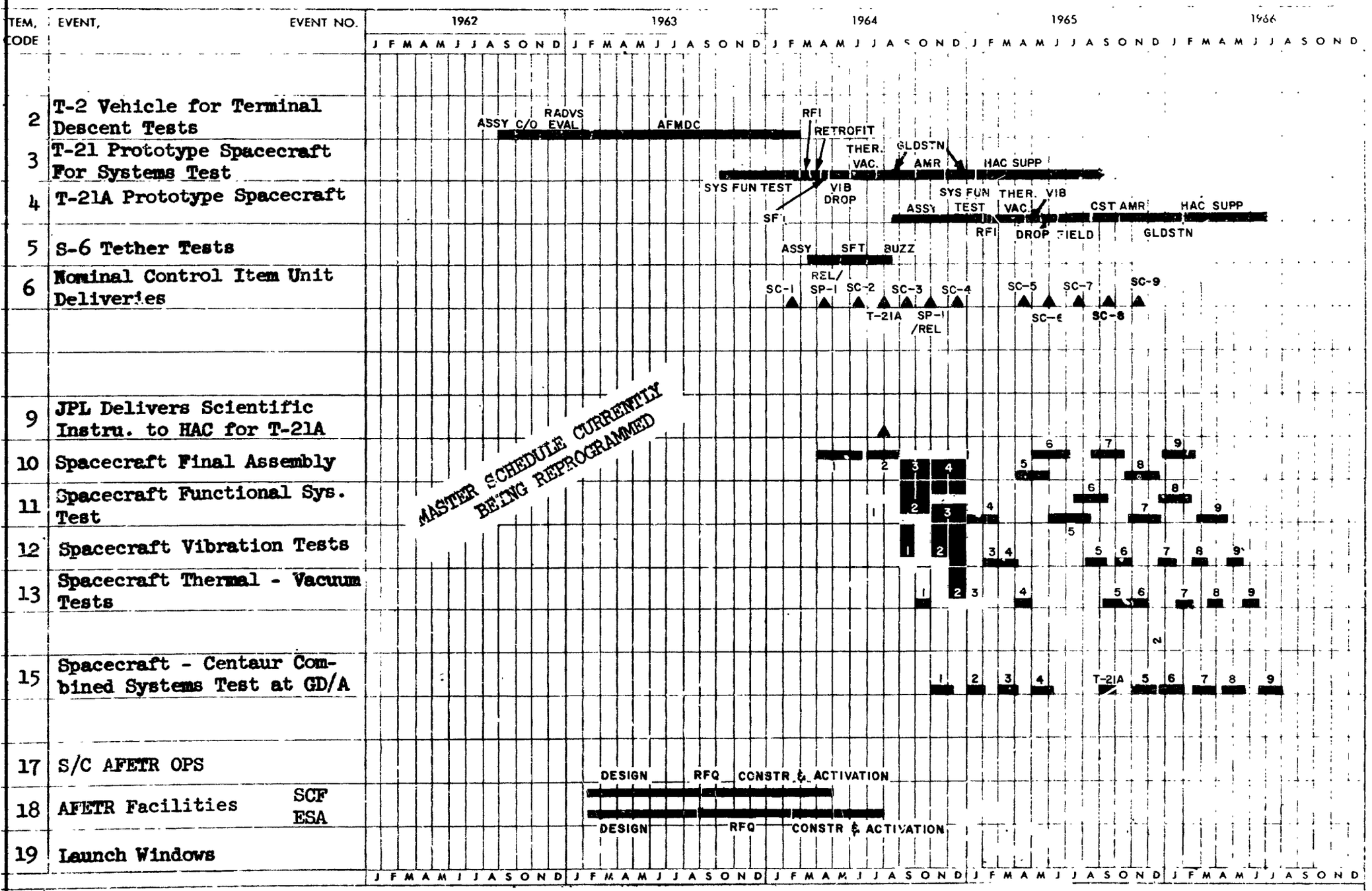
Project Master Schedule



Spacecraft Master Schedule



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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 (▲).

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SCHEDULED INTERFACE EVENTS

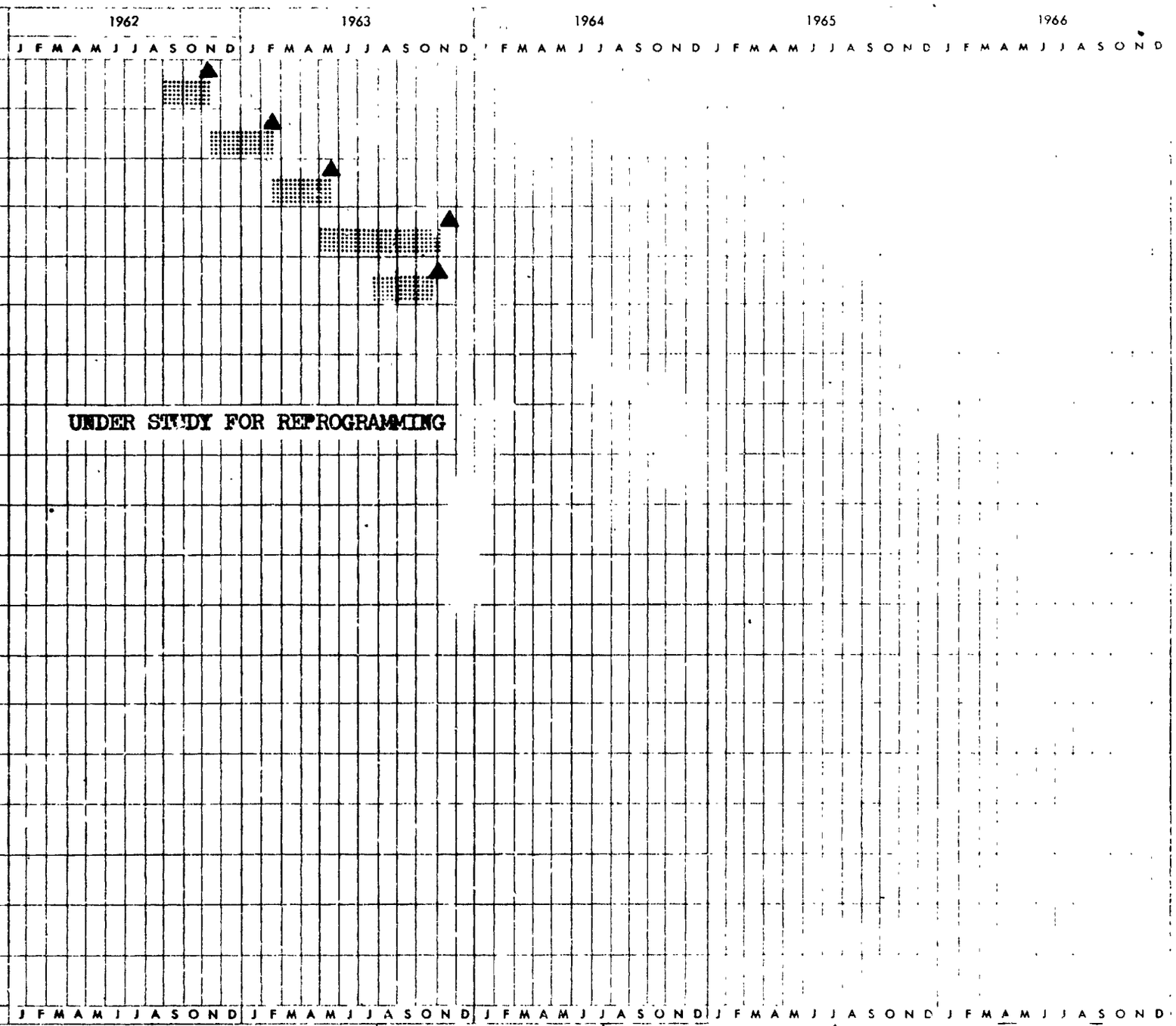
Primary Action	Primary Interest	Event Description	Event Number	Date Originated	Date Scheduled
HAC	GD/A	Compl Del SD-1 to GD/A			
HAC	GD/A	Compl Del SD-2 to GD/A			
HAC	DSIF	Compl Del CDC to Goldstone			
HAC	DSIF	Compl Del T-21 to Goldstone			
JPL	HAC	Compl Del T-21A Scientific Instruments to HAC			
HAC	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

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	



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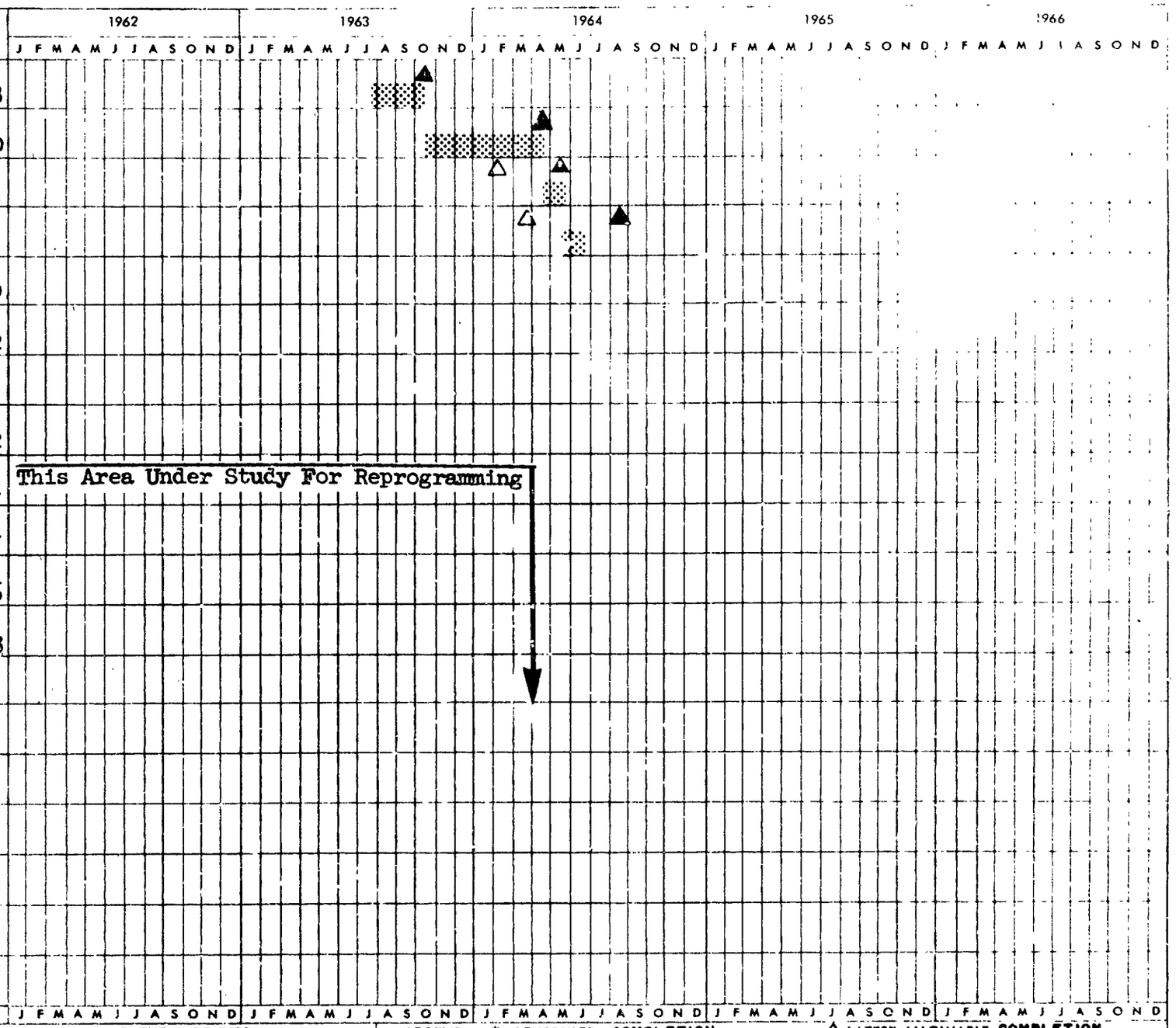
LEGEND: * SCHEDULED COMPLETION; EXPECTED COMPLETION; △ LATEST ALLOWABLE COMPLETION; ▲ ACTUAL COMPLETION

Surveyor Project Status Report AS OF: 13 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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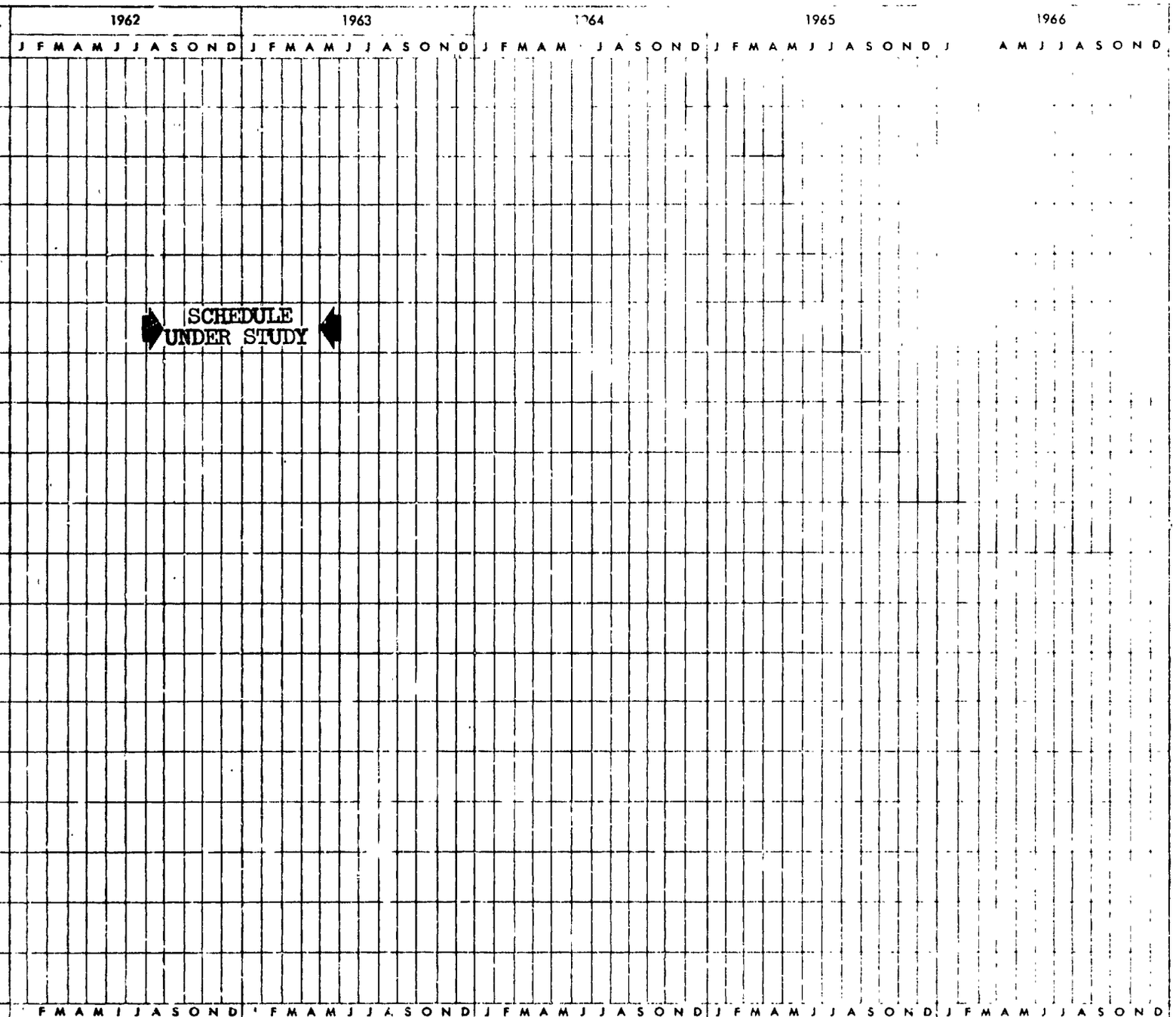
13 Nov 1964

Surveyor Project Status Report AS OF: 13 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	



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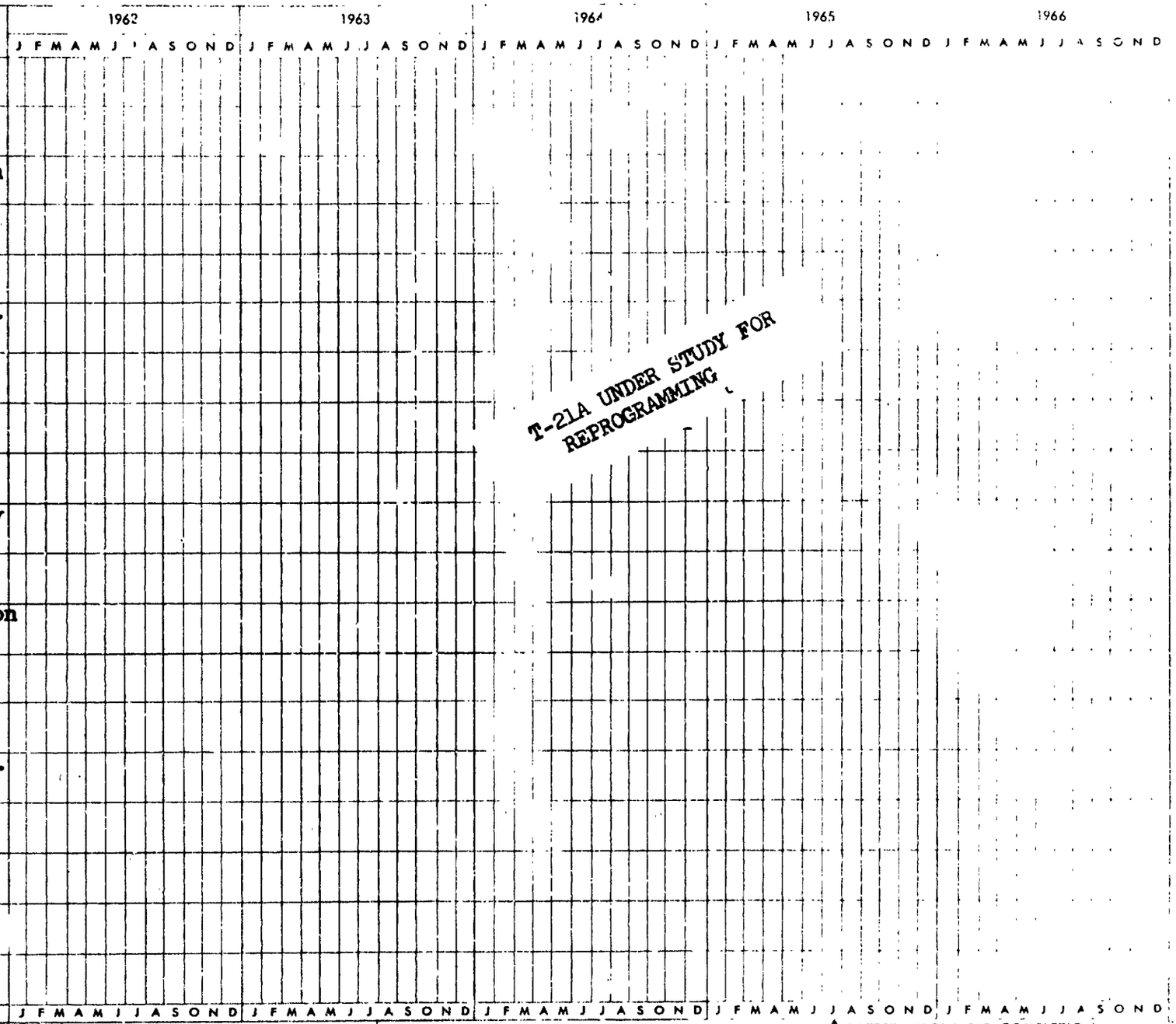
Surveyor Project Status Report AS OF: 13 Nov. 1964

ACTIVITY: Scientific Payload T-21A

SELECTED EVENTS

ITEM, CODE	EVENT,	EVENT NO.
1	Surface Sampler Fab & Assy	2
2	Surface Sampler FAT	2
3	Surface Sampler Integration & Test	4
4	Micrometeorite Ejecta Fab & Assy	
5	Micrometeorite Ejecta FAT	2
6	Micrometeorite Ejecta Integration & Test	4
7	Seismometer Fab & Assy	2
8	Seismometer FAT	2
9	Seismometer Integration & Test	4
10	Alpha Scattering Fab & Assy	
11	Alpha Scattering FAT	
12	Alpha Scattering Integration & Test	4
13	Touchdown Dynamics Fab & Assy	
14	Touchdown Dynamics FAT	
15	Touchdown Dynamics Integration & Test	4
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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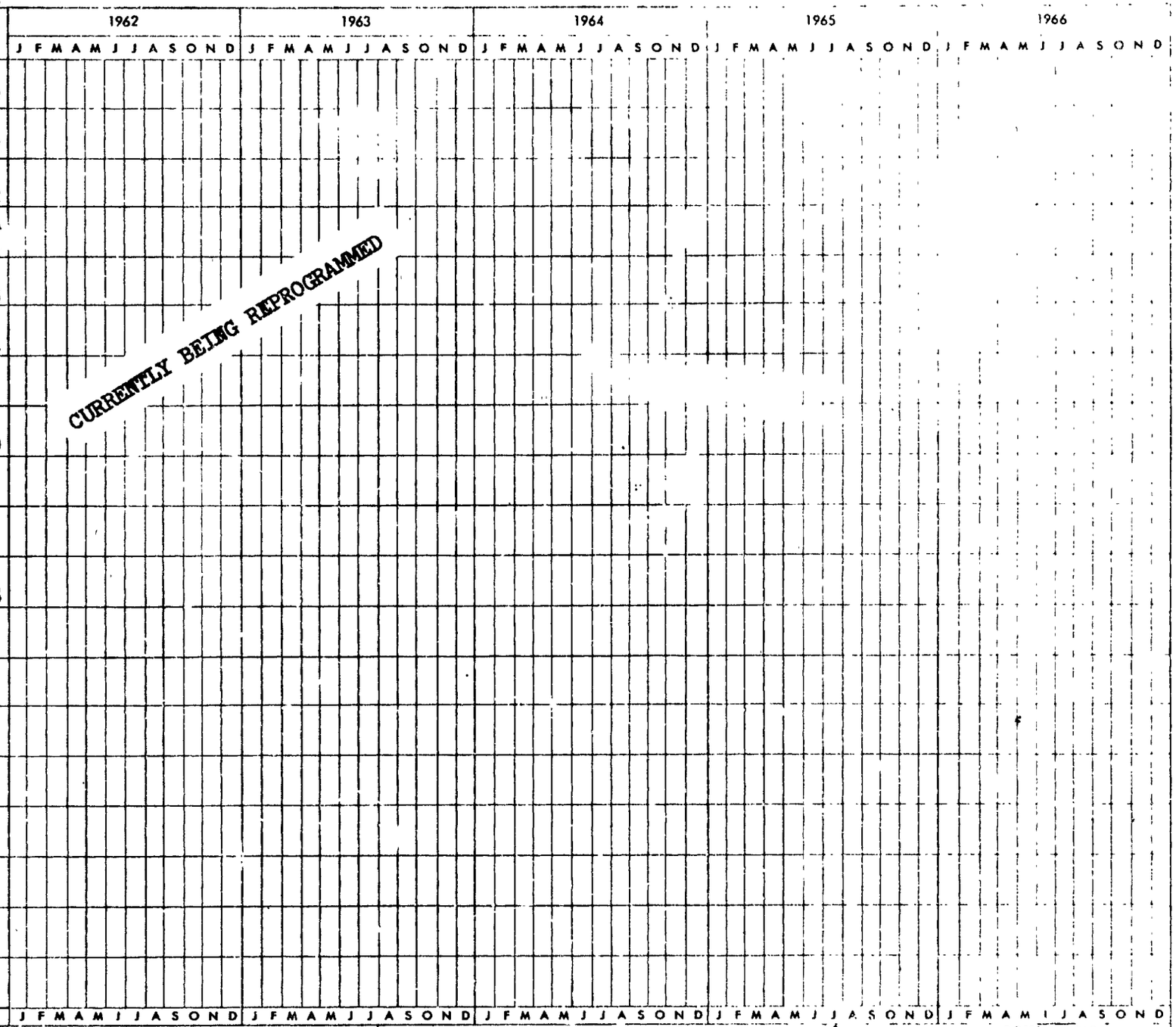
Surveyor Project Status Report AS OF: 13 Nov. 1964

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



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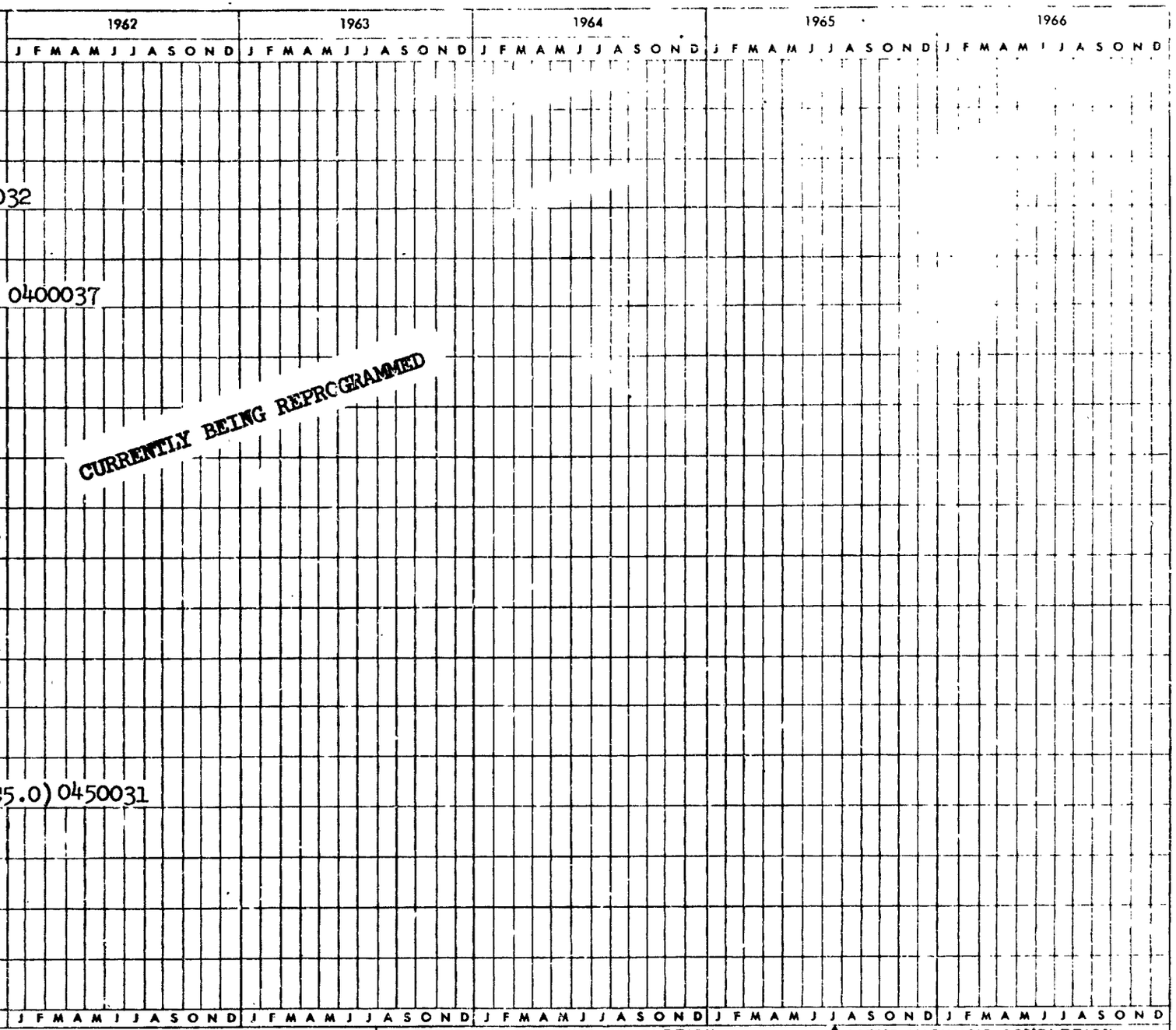
Surveyor Project Status Report AS OF: 13 Nov. 1964

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.

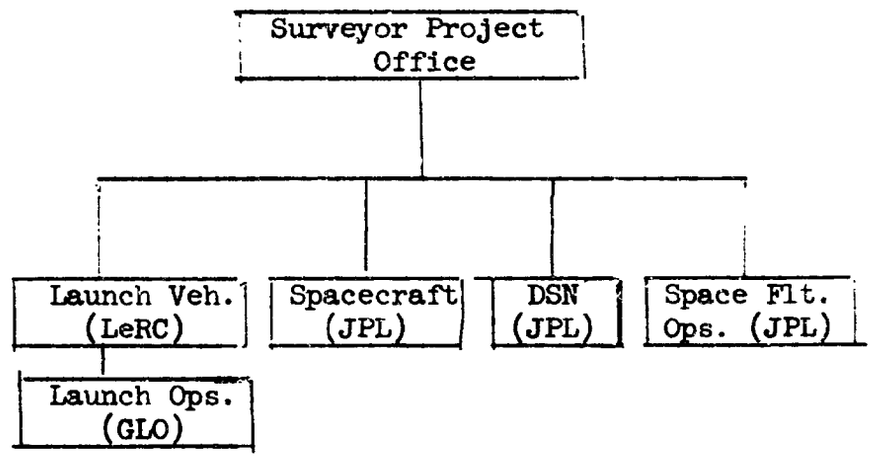
The Surveyor Project Block I currently comprises seven flight missions. These missions will utilize the Atlas/Centaur launch vehicle with launches to be conducted from Complex 36 at the Air Force Eastern Test Range (ETR), Cape Kennedy. The missions will be conducted utilizing direct ascent launch trajectories 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)

the previous tests, ambient temperature was maintained while the flow rate was varied. Subsequent tests will be conducted at varying thermal conditions to define the magnitude of any resulting propellant unbalance. During this reporting period it is expected that the S-7 vehicle will be de-serviced and returned to El Segundo for detailed material analysis and subsequent vehicle upgrade for the boost vibration TAT program.

7.0 Main Retro
Vibration tests of the inert main retro with live squibs were successfully completed at United Aerotest Labs. Vibration tests of two live qualification motors will take place on 24 November.

8.0 S-8 Test Vehicle
The S-8 vehicle will be used in evaluating the RADVS system in an actual spacecraft vibration environment. The start of this test has been delayed because of a malfunction of the Radar Altimeter Klystron power supply. The KPSM was returned to the vendor for repair. It is anticipated this test will begin at the close of this reporting period.

9.0 Shock Absorbers
Unsatisfactory bonding of strain gages to TAT shock absorbers S/N 20, 21, and 22 has delayed the application of thermal finish to these units. The anticipated completion date is now scheduled for 23 Noverber 1964. Delivery date of the SC-1 shock absorbers has been revised to the end of November 1964 due to vendor delays in the welding operation.

Events Anticipated

23 November - Complete application of thermal finish to type approval shock absorbers.
23 November - SC-1 enter upgrade.
24 November - Begin vibration tests of main retro motors.