PROGRAM MODIFICATIONS

D. R. Howard

8 January 1968
FIRST-ROUND PROGRAM DECISIONS

REPLACE 114E - UPGRADE 113T
SM EFFORTS MINIMUM JAN THROUGH JUNE, 1968
NO PERFORMANCE TESTING IN 100% O₂
ONE CITE PLUS TV SUPPORT AT HUNTINGTON BEACH - (DELETED IN SUBSEQUENT PROGRAM CHANGES)
MODAL SURVEYS ON DTS AND NO. 6 ONLY
NO LMQTV ACOUSTIC QUALIFICATION
COMBINE EK 30-DAY QUALIFICATION WITH LMQTV
TWO-POSITION SLIDING MASK
USE ULE; SUSPEND LOUVER DESIGN; POLISH ONE CERVIT
REFURBISH TEST ARTICLES FOR NO. 7 MAIN OPTICS
ELIMINATE THRUST TERMINATION TESTS ON 120-INCH MOTORS
INCORPORATE LOW LEVEL VIBRATION TEST ON EACH LM

REDUCE COMBINED GE/EK TESTING AT EK

ELIMINATE ONE ATS FROM 114

NO ARBITRARY REDUCTION OF TELEMETRY POINTS

DO NOT INCORPORATE ROLL-RATE BIAS

SIMPLIFY HEART RATE RECORDER

MAKE EK DYNAMIC TEST A TYPE TEST ONLY

ELIMINATE EK LM DYNAMIC DISTURBANCE SIMULATOR

DELETE REDUNDANT MMTS OPERATIONS & INSPECTION

DELETE EK DYNAMIC TEST CAMERA

ELIMINATE GE DEVELOPMENT & QUALIFICATION BASE SHAKE TESTS

ELIMINATE SYSTEM ENGINEERING DATA FROM GBQ

USE PRESENT CONFIGURATION MANAGEMENT PLAN FOR GEMINI B PROCEDURE SIMULATOR
ASSEMBLE LV AT HUNTINGTON BEACH (BASELINE)
PUT VAFB OPERATIONS ON 5-DAY WEEK
INSTALL MOST AGE AT VAFB BEFORE FLIGHT NO. 1
UTILIZE EDCTU FOR LV SOFTWARE VALIDATION
REDEFINE FLOW TIMES
/ MM AT EK
/ LV AT HUNTINGTON BEACH
DELETE REDUNDANT MISSION MODULE GROUND-CONDITIONING TESTS
### SECOND-ROUND PROGRAM DECISIONS

**(DOLLAR CHANGES COMPARED TO 12 + 8)**

12/7/67

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<td><strong>TOTAL</strong></td>
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(D) SECRET SPECIAL HANDLING
ITEMS YIELDING POSSIBLE FUTURE SAVINGS

- ON-PAD BUILDUP OF LABORATORY VEHICLE (RECOMMEND AGAINST)
- CDRL REDUCTIONS
- DELETE BLAST SHIELD
- AGE TO NON-CEI ITEMS
- MISSION SIMULATOR SIMPLIFICATIONS
- SYSTEM EFFECTIVENESS SCRUB
- EMI TESTING REQUIREMENTS REDUCTION
- VAFB AIR CONDITIONING REQUIREMENTS REDUCTION
- USE DYNAMIC TEST STRUCTURE FOR LM/MM STATIC TESTS
O Revision in schedule allows use of 113T for EK engineering development tests

O 114E
  / was to be prime except for deletion of Star Trackers

O 113T
  / Shell will be essentially prime configuration (except forward mount stiffening)
  / Sliding mask will be prime
  / Tripod will be beryllium instead of aluminum as originally planned for 113T
  / Thermal control system to be made prime
  / Detailed definition of electrical configuration (original 113T contained resistive head load simulation of electrical equipment) must be accomplished between GE and EK

(D) SECRET SPECIAL HANDLING
SM EFFORTS MINIMUM JAN THRU JUNE 1968

- **Desired Objective**
  - Defining SM sufficiently to avoid making it a deferred item.

- **Preferred Plan**
  - Proceed as originally planned.

- **Fall Back Plan**
  - Carry Phase I effort through development of CEI's. Defer PDR's to Phase II.
ITEM | NO PERFORMANCE TESTING IN 100% O₂

AFFECTED CONTRACTOR | EK

WORK STATEMENT REVISION | PROGRAM REQUIREMENTS DEFINITION REQUIRED

DISCUSSION
- PROGRAM REDUCTION INvolves use of the LMQTV testing for 100% O₂ systems tests.
- EK effort will include selected component tests for performance and safety tests.
- Component qualification will be for 30 days normal atmosphere (70/30) with 5 days additional testing at 100% O₂.
- There will be no complete dual qualification program for both the normal and emergency mode atmosphere.
- 100% O₂ test must be run on appropriate components prior to the manned LMQTV program.
CREW SAFETY ITEMS TO BE TESTED AT COMPONENT LEVEL.

- COMPONENT OPERATIONAL EXPOSURE TIME APPROX 8 HOURS,

PURE O₂ EMERGENCY BACKUP MODE TO BE DEMONSTRATED IN LMQTV TEST.

- ALL LM COMPONENTS (DAC & ASSOCIATE CONTRACTOR) WILL BE SUBJECTED TO O₂ ENVIRONMENT.

- LMQTV UNMANNED DURING THIS TEST.

AEROSPACE DISAGREES - OTHER O₂ SENSITIVE AND POTENTIALLY HAZARDOUS UNSEALED BOXES SHOULD ALSO BE TESTED.
The primary objective of this test will be to measure LV free-free bending and torsion modes in the on-orbit configuration. This information combined with mode survey data for the MMFS and MM will provide empirical verification of analytical modeling. The LV mode survey is a one-time test since the fundamental modes of the LV are not expected to vary from vehicle to vehicle in absence of a major configuration change. Concur with limiting survey to DTS and FV #6.
NO LM QUAL. ACOUSTIC QUALIFICATION

- Deletes the only LM structural dynamics qualification test.
- Due to age unavailability, LM subsystems were not functional during test.
- Included transportation cycle between pre & post test C/O's.
- LM structure and mass simulated components still subject to qual level acoustic development test.
- Production LM's subjected to low-level vibration acceptance test.
- LM components subjected to component vibration qualification tests.
- Represents some technical and schedule risk.
ITEM

COMBINE EK 30-DAY QUALIFICATION

AFFECTED CONTRACTOR

EK, DAC

WORK STATEMENT REVISION

NONE, LOCATION OF LM SYSTEM TESTING NOT DEFINED

DISCUSSION

- COMBINATION ELIMINATES DUPLICATE TESTING.
- PROVIDES MORE REALISTIC SIMULATION OF ENVIRONMENT.
- REQUIRES MORE EK SUPPORT OF DAC LMQTV EFFORT.
- REQUIRES MORE COMPREHENSIVE EK COMPONENT TEST.
- DETAIL QUALIFICATION TEST PLAN HAS NOT BEEN WRITTEN BY EK; HENCE, EK MANPOWER, EQUIPMENT, ETC. CANNOT BE ACCURATELY DEFINED TO DAC.

(SECRET SPECIAL HANDLING)
USE OF LOW COEFFICIENT MATERIAL FOR THE TRACKING MIRROR PERMITS USE OF TWO-POSITION SLIDING MASK

MAXIMUM SIMPLIFICATION OF SLIDING MASK CONTROL HARDWARE ACHIEVED BY SPECIFICATION VALUE FOR DOOR OPEN/CLOSE TIME

PRESENT SPECIFICATION VALUE OF 6 SECONDS CAN BE INCREASED TO 10-15 SECONDS WITHOUT SIGNIFICANT EFFECT ON RESOLUTION (< 2 LINES/MM).

GE SHOULD DETERMINE THE MINIMUM DOOR OPEN/CLOSE TIME CONSISTENT WITH DESIGN OF "SIMPLE" DOOR DRIVE

(D) SECRET SPECIAL HANDLING
ITEM

UTILITY ULE, EXEMPT BLINDER OR FOLDING ONE CIRCUIT

CER-VIT BLANK

AFFECTED CONTRACTOR

EK, GE

WORK STATEMENT REVISION

REVISE BASELINE MATERIAL FOR GLASSWARE

DISCUSSION

- BASELINE LOW COEFFICIENT MATERIAL, ULE THROUGH EK, CER-VIT THROUGH SAFSP WITH MATERIAL DECISION ABOUT MAY.
- USE LOW COEFFICIENT MATERIAL FOR ALL TRACKING MIRROR, OPTICAL AND THERMAL OPTICAL TESTS, AND ALL FLIGHT MODELS.
- INTRODUCE LOW COEFFICIENT MATERIAL IN PRIMARIES AS SOON AS POSSIBLE.
- REVISE THE SLIDING MASK TO A TWO-POSITION DEVICE.
- ORBIT PERFORMANCE PREDICTIONS SHALL BE BASED ON LOW COEFFICIENT MATERIALS AND TWO-POSITION MASK.
- NO OTHER PROGRAM CHANGES (POWER, WEIGHT SYSTEM TESTING, GROUND CONDITIONING, INTERFACE REQUIREMENTS) ARE INCLUDED WITH THE MATERIAL CHANGE.
ITEM
REFURBISH TEST ARTICLE FOR NO 7 MAIN OPTICS

AFFECTED CONTRACTOR
EK

WORK STATEMENT REVISION
APPROPRIATE WORD CHANGES THAT DELETE ONE FLIGHT MODEL AND SUBSTITUTE OAT, PLUS REMAINDER OF FLIGHT EQUIPMENT.

DISCUSSION
o THE OAT (OPTICAL ASSEMBLY AND TEST) MODEL IS A CARRYOVER OF THE ORIGINAL COMPATIBILITY MODEL. WITH PROGRAM REVISIONS THIS MODEL WAS REVISED TO INCLUDE ONLY OPTICS ASSEMBLY (NO CAMERA, VISUAL OPTICS, TRACKING MIRROR, ETC.). ITS AVOWED PURPOSE WAS FOR MANUFACTURING DEVELOPMENT. THE TECHNICAL NEED FOR THIS MODEL HAS NEVER BEEN JUSTIFIED.

o THE ADDITION OF THE REMAINING FLIGHT EQUIPMENT AND UPGRADING TO FLIGHT 7 EQUIPMENT WILL ALLOW EK TO USE THE HARDWARE FOR DEVELOPMENT AND SUBSEQUENT FLIGHT USE WILL ELIMINATE PART OF ONE FLIGHT MODEL HARDWARE NEEDS.
ELIMINATE THRUST TERMINATION TEST ON 120 INCH MOTORS

- PRIMARY OBJECTIVE OF TITAN IIIM FULL SCALE THRUST TERMINATION TEST IS VERIFICATION OF MATH MODEL FOR FLIGHT LOADS
- THRUST TERMINATION MODEL HAS PREVIOUSLY BEEN VERIFIED BY 2-SEGMENT AND 5-SEGMENT TITAN IIIC TEST FIRINGS
- A FULL-SCALE TITAN IIIM TEST WOULD ONLY CONTRIBUTE TO CONFIDENCE IN THE MODEL
- HIGH COST OF THE STATIC TEST IS NOT CONSISTENT WITH DATA TO BE ACQUIRED
- EXTRAPOLATION OF THE MODEL FOR TITAN IIIM DESIGN IS CONSIDERED TECHNICALLY ACCEPTABLE BY SPO/AEROSPACE AND UTC
- DELETION OF TITAN IIIM THRUST TERMINATION TEST IS RECOMMENDED AS COST SAVING ITEM
INCORPORATE LOW LEVEL VIBRATION TEST ON EACH LM

- LOW LEVEL LONGITUDINAL AXIS VIBRATION
- LM SUSPENDED FROM BUNGES
- *LM UNPOWERED DURING VIBRATION
- NO MODAL TYPE DATA TO BE ACQUIRED
- GE REQUIRES POWER-UP FOR GE-AVE EQUIPMENTS AND INTERFACES
- BKC HAS NO POWER-UP REQUIREMENTS

*AEROSPACE DISAGREES - UNPOWERED TEST WILL NOT EXPOSE INTERMITTENT DISCREPANCIES THAT MAY EXIST.*
REDUCE COMBINED GE/EK TESTING AT EK

ORIGINAL REQUIREMENT FOR MMTS BASED ON RUNNING AN MPSS LEVEL MISSION PROFILE AT EK

MAJOR ELEMENTS OF MPSS (ALL GE AND EK AVE IN LM) NOT AVAILABLE AT EK AND MUST BE SIMULATED FOR MPSS LEVEL TESTING, REDUCING VALUE OF SUCH TESTING

ELIMINATION OF REQUIREMENT FOR MPSS LEVEL TESTING RESULTS IN SIGNIFICANT REDUCTION IN GE ELECTRICAL AGE AT EK

DETAILED DEFINITION OF REMAINING TESTING REQUIREMENTS MUST BE ACCOMPLISHED BETWEEN GE AND EK

MISSION LEVEL TESTING OF LM MISSION PAYLOAD EQUIPMENT AT VALLEY FORGE MUST BE CONSIDERED

NEEDS FURTHER DEFINITION
ELIMINATE ONE ATS FROM 114

O DEVELOPMENT TESTS SHOULD INCLUDE VERIFICATION OF:

/ CAPABILITY OF SYSTEM TO ACHIEVE SIMULTANEOUS
  OPERATION OF BOTH ATS AND PRIMARY TRACKING MIRROR
/

/ ELECTRICAL CONFIGURATION FOR BOTH

O EITHER EDCTU TESTS OR 114 TESTS SHOULD INCLUDE
ABOVE VERIFICATIONS. COMPLETE HARDWARE
BOTH ATS NOT REQUIRED

O RECOMMEND GE CONSIDER MINIMUM DEVELOPMENT TEST
CONFIGURATION FOR ACCOMPLISHING VERIFICATIONS
DO NOT INCORPORATE ROLL RATE BIAS

- ROLL RATE BIAS NO LONGER REQUIRED.

- RATE DATA TO COMPUTER MUST BE IMPLEMENTED.

  - ROLL AXIS RANGE INCREASE FROM .20 TO .40 DEG/SEC

  - ROLL AXIS BANDWIDTH INCREASE FROM 1.0 TO 5.0 CPS

- ATTITUDE REFERENCE IMPROVEMENTS (DYNAMICS & CROSS-COUPLING) ACHIEVED BY ECP 261.

- RATE DATA MUST BE INCLUDED IN PROGRAM CONTENT.
SIMP liFY HEART RATE RECORDER

- HEART RATE RECORDER DELETED. PCM DIGITAL RECORDER STORES HEART BEAT INTERVAL DATA.

- INSTRUMENTATION (BASELINE)
  - CONTINUOUS FOR EACH OF CREW THROUGHOUT MISSION.
  - HEART BEAT SIGNAL CONDITIONER/DIGITIZER IN LAB.
  - HARDLINE HEART BEAT SIGNAL FROM GEMINI TO LAB CONDITIONER.
  - RF TRANSMITTER OR HARDLINE IN LAB.
  - DATA RATE <100 BITS/SEC TOTAL

- TELEMETRY
  - CORE BUFFER (NEW) - INTERIM STORAGE (10 MIN) OF DIGITAL HEART BEAT DATA.
  - PCM MULTIPLEXER (BASELINE)
    - READOUT OF BUFFER AT 10 MINUTE INTERVALS AS PART OF LAB PERIODIC DATA OR DURING PAYLOAD OPERATIONS.
    - MULTIPLEXED WITH LAB STATUS TELEMETRY
  - PCM DIGITAL RECORDER (BASELINE) - RECORDS PERIODIC AND MISSION DATA.
  - DATA COLLECTION AT ALL SCF TRACKING SITES.
### ITEM
MAKE EKC DYNAMICS TEST A TYPE TEST ONLY

### AFFECTED CONTRACTOR
EKC

### WORK STATEMENT REVISIONS
CHANGE TO MPSS TEST

### DISCUSSION
WITH THE MODIFICATION OF THE ORBIT DYNAMICS TEST TO A STRUCTURAL TRANSMISSIBILITY TEST, THE PURPOSE OF TESTING EACH FLIGHT MODEL FOR DYNAMIC DIFFICULTIES IS SHIFTED TO APPROPRIATE COMPONENT TESTS OF THE DYNAMIC DISTURBANCE GENERATORS. THUS, A ONE TIME TEST TO PROVE THE ANALYTICAL TECHNIQUE IS SUFFICIENT. THUS, THE STRUCTURAL TRANSMISSIBILITY TEST WILL BE RUN ONCE ON THE EK ENGINEERING MODEL.
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<th>ELIMINATE DYNAMIC DISTURBANCE SIMULATOR</th>
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<td>WORK STATEMENT REVISION</td>
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**DISCUSSION**

- Studies show original requirement for the LMDDS to be technically unfeasible.
- Have to depend on analysis for data LMDDS was to provide.
- Test program must be modified.
- Use thermal simulator structure for support structure.
- Include selected component vibration input testing at EK, GE and DAC.
- Provide GE analysis of EK test setup.
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**DISCUSSION**

The modification to the Orbit Dynamics Test eliminates the need for this article. Appropriate tests of each camera must be made to verify the dynamic disturbance created by the camera system.
ELIMINATE GE DEVELOPMENT AND QUALIFICATION BASE SHAKE TESTS

- ORIGINALLY GE PLANNED TO QUALIFY LOAD CARRYING STRUCTURE TO DYNAMIC ENVIRONMENT BY USE OF A BASE SHAKE TEST

- LENGTH OF VEHICLE PRECLUDES ATTAINMENT OF REALISTIC ENVIRONMENT FOR ALL VEHICLE HARDWARE BY USE OF A BASE SHAKE TEST

- LOAD CARRYING STRUCTURE SHOULD BE QUALIFIED BY APPLICATION OF A STATIC LOAD EQUIVALENT TO THE SUM OF STEADY STATE AND PEAK DYNAMIC LOADS

- CONCUR WITH ELIMINATION
ELIMINATE SYSTEM ENGINEERING DATA FROM GBQ

BASELINE PROGRAM
* METHOD OF PREPARATION
  o GENERATE SED FOR MANNED VERSION
  o DERIVE GBQ SED BY MODIFICATIONS
  o NOT NOW ON CONTRACT
* SCHEDULE
  o GBQ SED TOO LATE TO BE USEFUL IN DESIGN OF CEI'S
  o USEFUL FOR AFTER THE FACT VERIFICATION ONLY

RECOMMENDATION
* DELETE PREPARATION OF GBQ SED
* VERIFY GBQ BY COMPARISON WITH
  o MANNED GEMINI B
  o HST
  o NASA GEMINI NO. 3
USE PRESENT CONFIGURATION MANAGEMENT PLAN

FOR GEMINI B PROCEDURE SIMULATOR

PRESENT CONFIGURATION MANAGEMENT PLAN
* BASELINE DEFINED BY SAFSL EXHIBIT 12008 AND MAC E-734
* E-734 UPDATED TWICE, FINAL EDITION INCORPORATES 12008

PLAN B
* BASELINE DEFINED BY SAFSL EXHIBIT 12008 AND MAC E-734
* MORE FORMAL DOCUMENTATION OF CHANGES
* COST $75,000

PLAN C
* A PART I AND II SPECIFICATION WOULD BE WRITTEN WITH MANY
  EXCEPTIONS TO AFSCM 375-1
* COST $280,000

RECOMMENDATIONS
* RETAIN PRESENT CONFIGURATION MANAGEMENT PLAN
* PLAN C COST IS EXCESSIVE
PUT VAFB OPERATIONS ON 5-DAY WEEK

- DAC EFFORT NORMALLY 5 DAY/2 SHIFT WORK WEEK.
- AGE UPDATE AND CHECKOUT BETWEEN FLIGHTS 2 & 3 WILL BE 6 DAY/2 SHIFT WORK WEEK.
INSTALL MOST AGE AT VAFB BEFORE FLIGHT 1

DAC

- DOUGLAS INSTALLATION OF ALL AGE PRIOR TO FLIGHT 1.

- ASTEG TO BE CHECKED OUT BETWEEN FLIGHTS 1 & 2 FOR FLIGHT 2 REQUIREMENTS.

- DAC AGE TO BE UPDATED AND CHECKED OUT BETWEEN FLIGHTS 2 AND 3.
INSTALL MOST AGE AT VAFB BEFORE FLIGHT NO. 1 - GE

- CITE HARDWARE INSTALLATION BETWEEN FLIGHTS 1 AND 2
- CITE CABLING CONCURRENTLY WITH ASTEG AND CAGE PRIOR TO FLIGHT 1
- CITE HARDWARE AVAILABLE AT WTR PRIOR TO FLIGHT 1, SINCE USE AT VALLEY FORGE COMPLETED IN TIME - EARLIER INSTALLATION WOULD HAVE ADVANTAGES OF EARLIER CHECKOUT OF CITE AND ITS INTERFACE WITH ASTEG
- RECOMMEND GE CONSIDER INSTALLATION OF CITE PRIOR TO FLIGHT 1
INSTALL MOST AGE AT VAFB BEFORE FLIGHT NO. 1

GEMINI B

- BASELINE PROGRAM
  - BASELINE FLIGHT NO. 1 WAS GBQ SO AGE WAS REQUIRED PRIOR TO FLIGHT NO. 1
  - MAC FIELD MANPOWER UTILIZATION INEFFECTIVE BETWEEN GBQ AND FIRST MANNED FLIGHT
  - PART OF SAVINGS FROM LVD/GBQ SWITCH WAS DUE TO ELIMINATION OF THIS INEFFICIENCY

- RECOMMENDATION
  - INSTALL SOME GEMINI B AGE BEFORE FLIGHT NO. 1
  - COMPLETE INSTALLATION CHECKOUT AS LATE AS POSSIBLE
    - AVAILABLE FOR GBQ
    - NO INTERFERENCE WITH LVD OPERATIONS
UTILIZE EDCTU FOR LV SOFTWARE VALIDATION

DAC

- Schedule and approach now are compatible with this utilization.
- Actual GE and EK hardware required for EDCTU (minor exception for alignment servos in MMAS).
- Permits integrated LM & LV test software development.
- Permits integrated LM & LV hardware compatibility validation.
- Permits partial validation of on-board software utilizing actual hardware.

Status:
/ EK has not agreed to supply actual hardware or dynamic substitute.
/ GE indicates refurbished DSS-1 and STE to be supplied.
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<th>UTILIZE EDCTU FOR EK SOFTWARE SIMULATION - EK</th>
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<td>AFFECTED CONTRACTOR</td>
<td>EK, GE</td>
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<td>WORK STATEMENT REVISION</td>
<td>NONE (3 SETS OF EQUIPMENT ON CONTRACT LMQTV, RELIABILITY COMPONENTS, AND EK SYSTEM QUAL)</td>
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<td>DISCUSSION</td>
<td>WITH THE EK LM SYSTEM QUALIFICATION BEING ACCOMPLISHED IN THE DAC LMQTV TEST, A SET OF EK LM EQUIPMENT IS AVAILABLE FOR OTHER USE. IF THIS EQUIPMENT IS DIVERTED TO SUPPORT THE EDCTU, NO ADDITIONAL EK HARDWARE IS REQUIRED AND THE DESIRED EDCTU PROGRAM CAN BE ACCOMPLISHED AS FAR AS EK HARDWARE IS CONCERNED.</td>
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<td>THIS APPROACH ELIMINATES THE NEED FOR ONE EG-10 (MM SIMULATOR) INTENDED FOR USE WITH GD-5 FOR AN ELECTRIC SIMULATOR FOR EDCTU USE.</td>
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<td>COULD REQUIRE ADDITIONAL EK SUPPORT AT DAC.</td>
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EDCTU Objectives should include:

/ Integrated LM and LV test software development
/ Average and age software validation
/ Average hardware compatibility validation

Hardware furnished by GE should be near prime

Refurbished DSS-1 hardware considered satisfactory
ITEM

REDEFINE FLOW TIMES/MM AT EK

AFFECTED CONTRACTOR

GE, EK

WORK STATEMENT REVISION

NONE

DISCUSSION

- ONLY PRESENTLY IDENTIFIABLE REDUCTION RESULTS FROM ORBIT DYNAMICS REVISION.
- MPSS TEST PLAN AT EK IS STILL BEING REVISED AND DEFINED. REDUCTION IS ESSENTIALLY A MORE REALISTIC DEFINITION OF WHAT IS REQUIRED IN COMBINED TESTING AT EK.
- REDUCE THERMAL TEST TIME.
REDEFINE FLOW TIME/ LV AT HUNTINGTON BEACH

- FV3 PRECEDES LMQTV THROUGH ASSEMBLY & C/O CYCLES.
- FV3 ASSUMES LONGER "LEARNING CURVE" LM ASSEMBLY & C/O SPANS INSTEAD OF LMQTV.
- LV LOW LEVEL VIBRATION TEST DELETED ON FV3 THRU 7 (CREDIT 10 DAYS).
- LM LOW LEVEL VIBRATION TEST ADDED ON FV3 THRU 7 (ADD 5 DAYS).
- MODAL SURVEYS ON DTS (OV CONFIG) & FV6 (LV CONFIG) ONLY.
- LM C/O TO EMPLOY TWO STEP CONCEPT--DAC LM AVE C/O AND INTEGRATED LM C/O.
DELETE REDUNDANT ADDITIONAL GROUND CONDITIONING TESTS

O GE HAD PLANNED TO CONDUCT AN IN-HOUSE TEST OF PAD CONDITIONING SYSTEM USING 113T COMBINED WITH A MMAS SIMULATION

O A COMPLETE TEST OF THE PAD CONDITIONING SYSTEM AT THE MM LEVEL IS INCLUDED IN THE THERMAL TEST PROGRAM

O SINCE THE TESTING WILL PROVIDE SUFFICIENT VERIFICATION OF PERFORMANCE OF THE AIR CONDITIONING SYSTEM, THE GE TESTING IS NOT REQUIRED

O CONCUR WITH DELETION
CHANGE FLIGHT NO. 2 REQUIREMENT (NOW FLIGHT 1)

- CONTRACTORS PROPOSE AERODYNAMIC FAIRING ON TITAN III
  /   NO DATA FOR ORBITING VEHICLE

- POSSIBLE ALTERNATES INCLUDE MISSION MODULE (WITH NOSE FAIRING)
  OR LABORATORY VEHICLE (WITH NOSE FAIRING)
  /   ENGINEERING ANALYSIS REQUIRED TO STRUCTURALLY SUBSTANTIATE
  CONFIGURATION SELECTED
  o   WEIGHT C.G., AND MOMENT OF INERTIA
  o   LOADS AND STRUCTURAL RESPONSE
  /   MINIMUM INSTRUMENTATION REQUIRED TO CONDUCT FAILURE
  ANALYSIS
  o   STRAIN/TEMPERATURE MEASUREMENTS (ONE CHANNEL T/M)

- RECOMMEND AERODYNAMIC FAIRING ON TITAN III MAKING THIS A
  BOOSTER TEST ONLY
REduce 10010 BY 1/2

TO BE ACHIEVED BY:

/ FUNDING LIMITATION FOR FISCAL YEARS
  o LIMITING LEVEL OF EFFORT FOR CONTROL
  o ELIMINATE SOME TESTING AND DESIGN CHANGES

/ INCLUDE SAFSFL EXHIBIT 10010 IMPLEMENTATION AND FIRE DETECTION, FIRE SUPPRESSION

METHOD - TWO-STEP APPROACH

/ STEP I - CONTRACTORS
  o IDENTIFY AND CLASSIFY MATERIALS PLANNED FOR USE
  o DEFINE MINIMUM CONTROL
  o IDENTIFY SCREENING TESTS AND DESIGN CHANGES REQUIRED
  o IDENTIFY TEST REQUIREMENTS
  o SUBMIT FIRM PROPOSAL FOR RECOMMENDED DESIGN CHANGES AND TESTS

/ STEP II - SPO/AEROSPACE
  o REVIEW PROPOSED DESIGN CHANGES AND TESTS
  o AUTHORIZE CONTRACTORS TO IMPLEMENT CHANGES AND TESTING
  o IMPLEMENT ONLY THOSE DESIGN CHANGES AND CONDUCT THOSE TESTS THAT MAY HAVE MAJOR SAFETY IMPACT
SHIFT LMQTV

- TECHNICAL CONTENT OF QUAL CYCLE UNCHANGED EXCEPT FOR ELIMINATION OF LM ACOUSTIC QUALIFICATION TEST
- SHIFT MAKES LM 3 THE FIRST VEHICLE THRU ASSY & C/O
- LMQTV TESTS FOR ASSOCIATE HARDWARE QUALIFICATION ARE RELATIVELY LATE
ELIMINATE GIGS

- In case of off-nominal insertion, GIGs required for successful insertion
- Provides back-up to BIGs
- Deletion would cause extensive system impact
- Cost savings doubtful
- Recommend retaining GIGs
Δ STATUS
  o NOT NOW ON CONTRACT
  o DESIRED MAGNITUDE NOT DEFINED

Δ RECOMMENDATION
  o ELIMINATE
  o DO TRAINING IN-HOUSE
    * MOL SPO AND TRAINING COMMAND
REDUCE ATS RESOLUTION 10%

- HARDWARE IMPACT
  - REPLACES POSITION LOOP IN PITCH AXIS WITH RATE LOOP
  - ELIMINATES DIGITAL PROCESSORS IN BOTH AXES
  - PERMITS UTILIZATION OF LESS PRECISE POSITION ENCODERS

- SYSTEM IMPACT
  - GE CLAIMS SENSITIVITY TO BEARING NOISE INCREASED
    (≥10% LOSS OF RESOLUTION) AEROSPACE DISAGREES THAT
    LOSS OF RESOLUTION WILL OCCUR
  - SENSITIVITY TO ACTS FIRING AND TM SLEW DISTURBANCES
    DECREASED
  - ELIMINATES BACKUP MODE IN EVENT OF GYRO FAILURE

- IF COST REDUCTION IS AS SMALL AS IT APPEARS, RECOMMEND
  AGAINST CHANGE

(D) - SECRET - SPECIAL HANDLING
CDRL REductions - DAC

- DAC recommends deletion of 148 items

- Aerospace disagrees - recommends deletion of only 56 items
CDRL REDUCTIONS

GE

SPO/AEROSPACE AND GE EFFORT

In progress to reduce the total volume of documentation and data exchange required between contractors with minimum impact to the program.

Revision frequency of many of the CDRL and GFDL items is being reduced.

Form 9's are being rewritten to reduce in scope the specific task of the contractor in preparing many of the CDRL items.

To combine related documentation and thereby reduce total number of CDRL items required.

It is anticipated that significant cost savings will be realized.

(D) SECRET SPECIAL HANDLING
<table>
<thead>
<tr>
<th>ITEM</th>
<th>CDRL REDUCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EKC SUPPLIED DATA IN CDRL PRESENTLY MINIMAL.</td>
</tr>
<tr>
<td></td>
<td>COULD DECREASE FREQUENCY OF MASS PROPERTIES STATUS REPORT TO REFLECT PROGRAM SLIP.</td>
</tr>
<tr>
<td></td>
<td>COULD COMBINE SPECIFICATIONS WHERE HARDWARE ITEMS ARE COMBINED.</td>
</tr>
<tr>
<td></td>
<td>PROGRAM STATUS MUST BE ESTABLISHED BEFORE FURTHER CDRL REVISION CONSIDERED.</td>
</tr>
</tbody>
</table>

AFFECTED CONTRACTOR: EKC

WORK STATEMENT REVISION: CHANGES TO CDRL, F-017522-CH.
CDRL REDUCTIONS
GEMINI B

- A FEW LINE ITEMS MAY BE DELETED
  - SUBSTITUTE INFORMAL CONTRACTOR REPORTS

- SUBMITTAL FREQUENCY REDUCED ON MANY PERIODIC REPORTS
  - FREQUENCY MUST BE COORDINATED WITH THAT OF
    OTHER ASSOCIATES

- EXACT CHANGES UNDER STUDY BY MAC
DELETE BLAST SHIELD

- BLAST SHIELD REQUIREMENT BASED ON:
  / DIRECT EXHAUST IMPINGEMENT OF SIX SOLID MOTORS ON CRYOGENIC TANKS, PROPELLANT TANKS, GASEOUS ACCUMULATORS, FLUID LINES AND EQUIPMENT
  / CRYOGENIC TANKS - 300 TO 1000 PSI
  / PROPELLANT TANKS - 300 PSI
  / ACCUMULATORS - 400 TO 1250 PSI
  / HAZARD OF EXPLOSION DUE TO PENETRATION OF HIGH PRESSURE TANKS AND EXHAUST INTO EXPLOSIVE MIXTURES
    - DAMAGE TO GEMINI B HEAT SHIELD AND MOTORS, AND TIPOFF.
  / IMPACT ON CREW FATALITIES - REDUCTION FROM 10.66 TO 2.62 CREWS/1000

- RELATED CASES
  / NASA GEMINI
    - BLAST SHIELD USED - CONDITIONS SIMILAR TO MOL -- SOLID MOTOR'S IMPINGEMENT ON CRYOGENICS AND PROPELLANTS
  / T-III FIRE-IN-THE-HOLE
    - NO BLAST SHIELD - THERMAL COATING ON LOWER STAGE FORWARD DOME
    - LIQUID ENGINE IMPINGEMENT
    - LOWER STAGE - PROPELLANT DEPLETED - NEGLIGIBLE PRESSURE

- TEST DATA - NASA GEMINI
  / BURNED THROUGH 0.09 FIBERGLASS IN 0.47 SECONDS
    - REPRESENTATIVE OF MOL CONDITIONS

- RECOMMEND RETENTION OF THE BLAST SHIELD
AGE TO NON-CEI ITEMS - DAC

- DAC PROPOSES ALL MECHANICAL AGE CEI'S TO BE DELETED.

- AEROSPACE DISAGREES - REQUIRE 23 TO BE RETAINED (33 OK TO DELETE)

- RETENTION CRITERIA:
  - SIGNIFICANT/CRITICAL VEHICLE INTERFACE AFFECTING VEHICLE PERFORMANCE.
  - IMPORTANT VEHICLE INTERFACE WHERE NO SIGNIFICANT SAVINGS POSSIBLE.
  - IMPORTANT INTERFACE WITH ASSOCIATE CONTRACTOR.
AGE TO NON-CEI ITEMS - GE

O POTENTIAL COST REDUCTION BY RELAXATION OF SAFSL 24004 GE CONFIGURATION MANAGEMENT PLAN BY RECLASSIFICATION TO NON-CEI CONTROL FOR SELECTED ITEMS OF AGE

O MOST BUT NOT ALL OF 20 GE MECHANICAL AGE ITEMS ARE CONSIDERED CANDIDATES FOR RECLASSIFICATION TO NON-CEI STATUS

O ONLY ONE OF THE 5 ELECTRICAL AGE ITEMS IS CONSIDERED AS A CANDIDATE FOR RECLASSIFICATION

O SPECIFIC MECHANICAL AGE ITEMS TO BE RECLASSIFIED MUST BE DEFINED
AGE TO NON CEI'S

GEMINI B

Δ STATUS
- PRESENT REQUIREMENTS
  - LARGEST AND MOST COMPLEX AGE ITEMS ARE PRESENTLY SPECIFIED BY CEI
  - PREVIOUS NASA GEMINI EQUIPMENT
  - NEW AGE
- ELIMINATION OF CEI'S ON PREVIOUS NASA GEMINI EQUIPMENT ACCEPTABLE
  - OPERABILITY HAS BEEN DEMONSTRATED
  - MINIMUM RISK FOR THESE EQUIPMENTS NOT UNDER CONFIGURATION CONTROL
- ELIMINATION OF ALL CEI CONTROL ON NEW AGE NOT DESIRABLE
  - HARDWARE NEW, OPERATIONAL SUCCESS NOT DEMONSTRATED
  - MAJORITY OF NEW AGE INTERFACES WITH OTHER ASSOCIATE'S EQUIPMENT
  - PROBLEM OF CONTROLLING INTERFACES
    - IFS ARE CONTRACTUALLY A PART OF CEI
    - GOVERNMENT ACCEPTS HARDWARE TO CEI REQUIREMENTS
    - IF CEI'S DELETED, THEN IFS HAS NO CONTRACTUAL STANDING

Δ RECOMMENDATION
- USE IDENTIFICATION CEI'S ON SUBSTITUTES AND MAJOR NEW TEST AGE
  - INCORPORATE IF SPECIFICATIONS
  - ACCEPT TO IF SPEC REQUIREMENTS
- NO CEI'S FOR EXISTING NASA AGE - EXCEPT TO IF SPEC REQUIREMENTS
RECOMMENDED ITEMS

/ DELETE MOMIES, SMG OPERATIONS             .32  .91
/ LEASE INSTEAD OF BUY LVPS COMPUTER         2.66 (-.18)
/ DELETE PORTIONS OF COMM. ECP               .08  .20
/ DELETE GBPS/LMSE INTERFACE                 .10  .25
/ DELETE AURAL EFFECTS                       .03  .10
/ GE REWORK EK EXCHANGE HARDWARE FOR MDS     .03  .1
/ GFE HYBRID COMPUTERS FOR MDS                .09  .31
TOTAL                                       3.31 1.69

SPO/AEROSPACE/ASSOCIATES AGREE ON ABOVE ITEMS FOR SIMPLIFICATION

A FEW OTHER MINDR ITEMS ARE STILL UNDER CONSIDERATION
DAC

RECOMMENDS:

/ DELETION OF SAFETY COMPUTATION OF MATH MODEL

NOTE AEROSPACE CONCURS - FAULT TREE ANALYSIS TAKES ITS PLACE

/ DELETION OF ASSESSMENT PROGRAM

NOTE AEROSPACE DISAGREES

(AEROSPACE PROPOSES ALTERNATES - SCRUB OF CONTINGENCY EFFORT AND CURRENT PARTS ANALYSIS EFFORT)

GE

RECOMMENDS:

/ NO CHANGE IN TASKS OR ANALYSIS AT THIS TIME

/ MAKE MONTHLY EFFECT. REPORTS QUARTERLY

MAC

RECOMMENDS:

/ NO CHANGE IN TASKS OR ANALYSIS AT THIS TIME

MARTIN

RECOMMENDS:

/ NO CHANGE IN TASKS OR ANALYSIS AT THIS TIME
EMI TESTING REQUIREMENTS REDUCTION

- MAC PROPOSES DELETIONS OF EMI TEST REQUIREMENTS FOR
  - 7 NASA/GEMINI AGE ITEMS
  - GEMINI SUBSTITUTES FOR LAB AND T-111

- EQUIPMENTS INTERFACE WITH AVE AND ASSOCIATE CONTRACTORS AGE

- PRESENT TEST REQUIREMENTS - TESTED AGAINST 64-4 FOR CONDUCTED INTERFERENCE

- OTHER CONTRACTOR'S EMI TEST REQUIREMENTS FOR AGE INTERFACES AND EXCHANGE HARDWARE IS TO MEASURE EMISM'S

- DELETION OF ALL TEST REQUIREMENTS WOULD IMPAIR ASSURANCE OF INTERFACE COMPATIBILITY

- RECOMMEND REDUCTION TO MEASUREMENT OF EMISM'S
ITEM

AFFECTED CONTRACTOR
MMC, GE, EKC

WORK STATEMENT REVISION
NONE

DISCUSSION
- ITEM BASED ON INSUFFICIENT KNOWLEDGE OF CURRENT PROGRAM ACTIVITY. ORIGINAL MARTIN ESTIMATE HIGH BECAUSE OF GE ICD.
- AEROSPACE/SAFSL 14 EFFORT IN NOVEMBER 1967 HAS RESULTED IN HALVING OF CCN COST. NOT YET TRANSMITTED TO MARTIN.
- FURTHER REDUCTION OF AIR CONDITIONING FACILITY NOT REASONABLE WITH PRESENT OV REQUIREMENTS.
USE DYNAMIC TEST STRUCTURE FOR LM/MM STATIC TESTS

- Enables deletion of static test structure, (or use as backup for FV2).

- Makes results of structural qual tests late for program usage.
  - Approx 1 month before FV-2 flight, 6 months before FV-3 flight.

- Introduces tight coupling with static testing and arrival of stuffed MM at Huntington Beach.

- Not recommended.
CONTINGENCY PLAN FOR FAILURE OF FLIGHT 1

- RESCHEDULE NO. 2 BOOSTER
- PROCURE NEW FAIRING
- REPEAT FLIGHT 1
- ORDER A NEW BOOSTER
CONTINGENCY PLAN FOR FAILURE OF FLIGHT 2

PROBLEM

/ LVD NOW FLIGHT 1 AND GBQ FLIGHT 2
- LVD NOT AVAILABLE FOR GBQ BACKUP
- NO TIME TO CONVERT GB S/C2 FROM GBQ TO MANNED CONFIGURATION BETWEEN FLIGHTS 2 AND 3

PROPOSED ACTION

/ GEMINI
- BUILD S/C #2 IN MANNED CONFIGURATION PLUS WIRING, TRANSDUCERS, ETC. REQUIRED TO CONVERT TO GBQ
- PROCUREMENT AND ASSEMBLE CONTROLLERS, TM, ETC., ON PALLETS
- CONVERT S/C2 TO GBQ CONFIGURATION IF NEEDED
- SLIP FLIGHT 3 BY 1 OR 2 MONTHS
- PROCURE EXTRA GEMINI FOR THIRD MANNED FLIGHT IN FOLLOW-ON IF NECESSARY

/ BOOSTER
- USE #3 BOOSTER FOR GBQ IF NEEDED
- PROCURE ADDITIONAL BOOSTER IN FOLLOW-ON IF NECESSARY

/ LABORATORY
- USE EXISTING OR ADDITIONAL STRUCTURE
ALTERNATIVES FOR FLIGHT NO. 2 BACKUP

1 TO 2 MONTH SLIP OF FLIGHT 3 - GEMINI B CONTROLS

LABORATORY VEHICLE ALTERNATIVES

A. DYNAMIC TEST STRUCTURE
   CONTRACTOR PROPOSAL
   FLIES ACOUSTIC/SHOCK-TESTED STRUCTURE
   NO LM BURST TEST IF FV-2 FAILS

B. LIMIT LOAD STS
   (DTS ULT LOAD TESTED)
   ULTIMATE STATIC TEST OF FATIGUED STRUCTURE
   USE FOR FV-7 IF FV-2 SUCCESSFUL

C. ADDITIONAL STRUCTURE
   (FROM SOFT TOOLING)
   EARLY FUNDING IMPACT
   STRETCHES DOWNSTREAM FLIGHTS
   USE FOR FV-7 IF FV-2 SUCCESSFUL

7 1/2 MONTH SLIP OF FLIGHT 3

USE LAB PRODUCTION LINE STRUCTURES
ORDER ADDITIONAL STRUCTURE IF FV-2 FAILS
## FLIGHT TWO BACKUP ALTERNATIVES

<table>
<thead>
<tr>
<th>ALTERNATIVE</th>
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</table>
| A. USE SEPARATE STATIC AND DYNAMIC TEST STRUCTURES; USE DTS AS FV2 BACKUP. | o PRESERVES 5-MONTH INTERVAL TO BACKUP FLIGHT.  
  o PRESERVES CORRECT PHASING OF STRUCTURAL QUALIFICATION TEST COMPLETION.  
  o NECESSITATES BACKUP FLIGHT USE OF ACOUSTIC AND SHOCK TESTED STRUCTURE (DTS). |
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| B. CONDUCT ALL ACOUSTIC, SHOCK AND DESTRUCTIVE (ULTIMATE AND BURST) TESTS ON DTS; STOP AT LIMIT LOADS ON STS AND PREPARE FOR FV2 BACKUP; IF FV2 SUCCEEDS, REMOVE SUBSTITUTES AND FLY STS STRUCTURE FOR FV7. | - PRESERVES 5-MONTH INTERVAL TO BACKUP FLIGHT.  
- PRESERVES CORRECT PHASING OF LIMIT-LOAD TESTS, BUT DELAYS ULTIMATE-LOAD TESTING 8 1/2 MONTHS (WITH RESPECT TO FV2 AND FV3).  
- AVOIDS BACKUP FLIGHT USE OF ACOUSTIC/SHOCK-TESTED STRUCTURE.  
- REQUIRES ULTIMATE LOADS TEST OF STRUCTURE PREVIOUSLY EXPOSED TO ACOUSTIC/SHOCK TESTS.  
- ELIMINATES ONE STRUCTURE IF FV2 SUCCEEDS.  
- NECESSITATES TWO SET-UPS FOR STATIC TESTING. |
## FLIGHT TWO BACKUP ALTERNATIVES

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| C-1 USE SEPARATE STATIC AND DYNAMIC TEST STRUCTURES; ORDER ADDITIONAL STRUCTURE FOR FV2 BACKUP AND PRE-INSTALL SUBSTITUTES; IF FV2 SUCCEEDS, REMOVE SUBSTITUTES AND USE AS FV7. | - PRESERVES 5-MONTH LAUNCH INTERVAL ON BACKUP FLIGHT.  
- PRESERVES CORRECT PHASING OF STRUCTURAL QUALIFICATION TEST COMPLETION.  
- AVOIDS BACKUP USE OF ACOUSTIC/SHOCK TESTED STRUCTURE.  
- REQUIRES ONE EXTRA STRUCTURE IF FV2 FAILS.  
- ADDITIONAL STRUCTURE HAS EARLY FY IMPACT (REQUIRES EARLIER START OF MANUFACTURE).  
- IMPOSES EXTRA DELAY (BEYOND ONE NORMAL LAUNCH INTERVAL) ON FV7 DUE TO MMFS FABRICATION LEAD TIME. |
FLIGHT TWO BACKUP ALTERNATIVE C-1

1970

1971

1972

ST5: STATIC TESTS COMPLETE: MAR 1970

FLIGHT VEHICLE SCHEDULE (BASELINE)

* ORDER NEW FV-2 STRUTS IF BACKUP STRUCTURE IS USED; OTHERWISE AVOID BACKUP STRUCTURE TO FV-7.
<table>
<thead>
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</table>
| C-2 USE SEPARATE STATIC AND DYNAMIC TEST STRUCTURES; IF FV2 SUCCEEDS, PROCEED NORMALLY; IF FV2 FAILS, INSTALL SUBSTITUTES IN FIRST AVAILABLE FV STRUCTURES (FV 4 LM, FV6 MMFS, FV4 MMAS) FOR BACKUP FLIGHT AND ORDER NEW STRUCTURES FOR FV7. | o REQUIRES 12-MONTH INTERVAL ON BACKUP FLIGHT.  
o PRESERVES CORRECT PHASING OF STRUCTURAL QUALIFICATION TESTING.  
o AVOIDS BACKUP FLIGHT USE OF ACOUSTIC / SHOCK-TESTED STRUCTURE.  
o REQUIRES ONE EXTRA STRUCTURE IF FV2 FAILS.  
o LAUNCH INTERVAL O.K. AFTER BACKUP FLIGHT. |
FLIGHT TWO BACKUP-ALTERNATIVE C-2

1970

1971

1972

STS: STATIC TESTS COMPLETE MAR/1970

DIRECT FV#4 MMAS, LM TO BACKUP

HID divert FV#6 MMAS to BACKUP