



NASA
Lyndon B. Johnson Space Center

**MISSION
OPERATIONS
DIRECTORATE**

SUBJECT:

NAME:

DATE:

PAGE

FLIGHT DESIGN PROCESS
INTRODUCTION

JON C. HARPOLD

APRIL 17, 1985



NASA
Lyndon B. Johnson Space Center

**MISSION
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SUBJECT:

AGENDA

NAME:

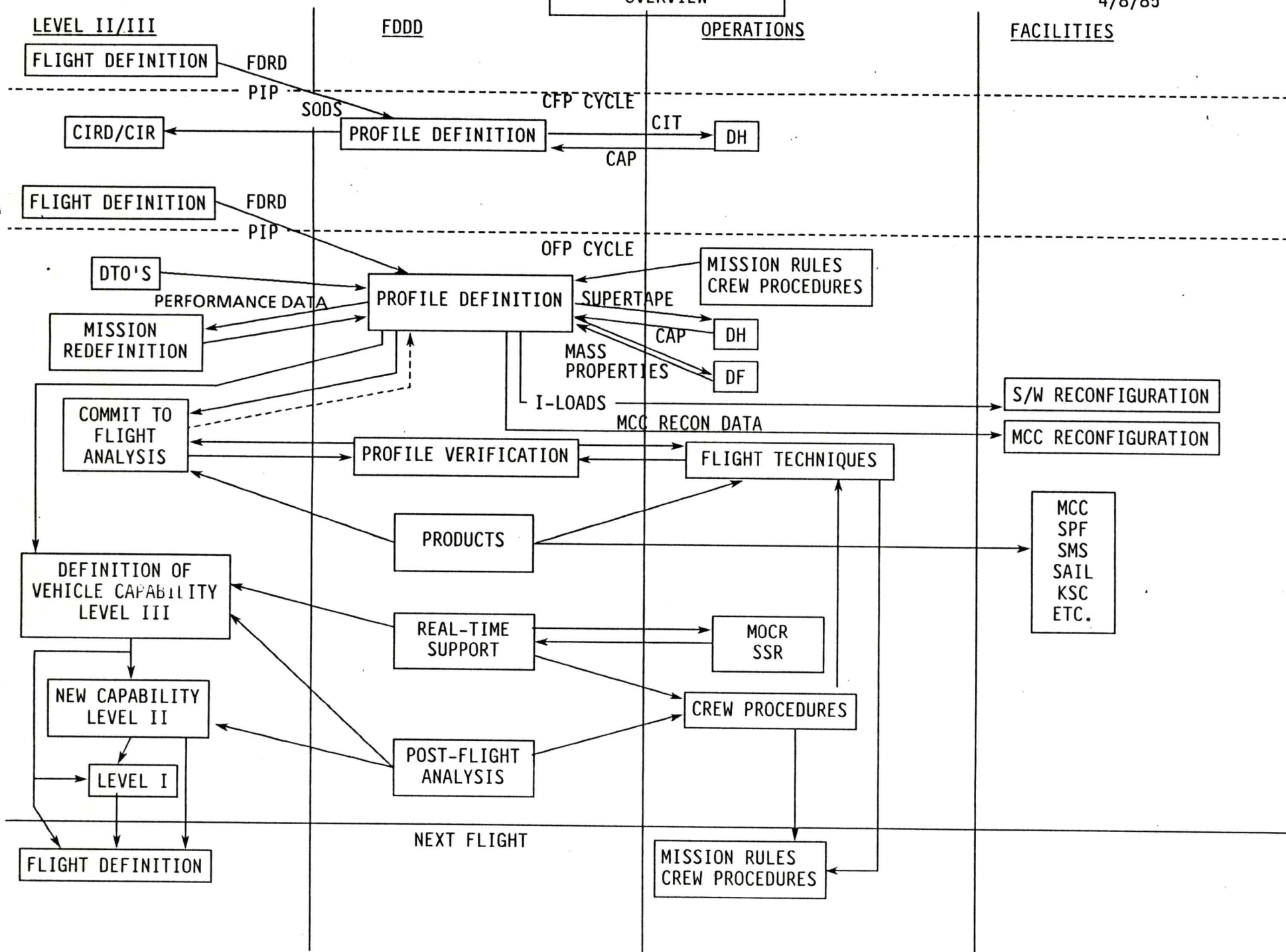
DM/J. C. HARPOLD

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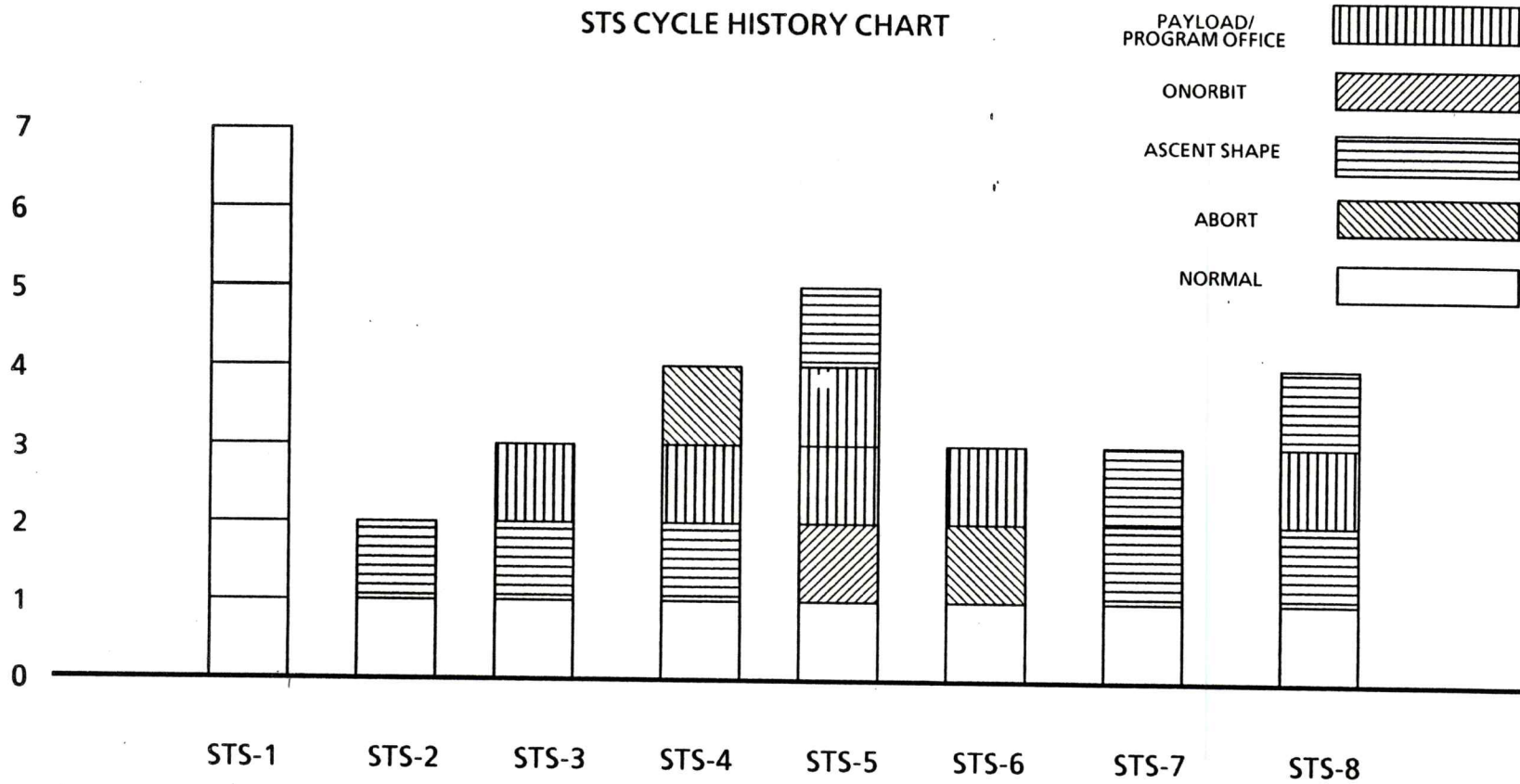
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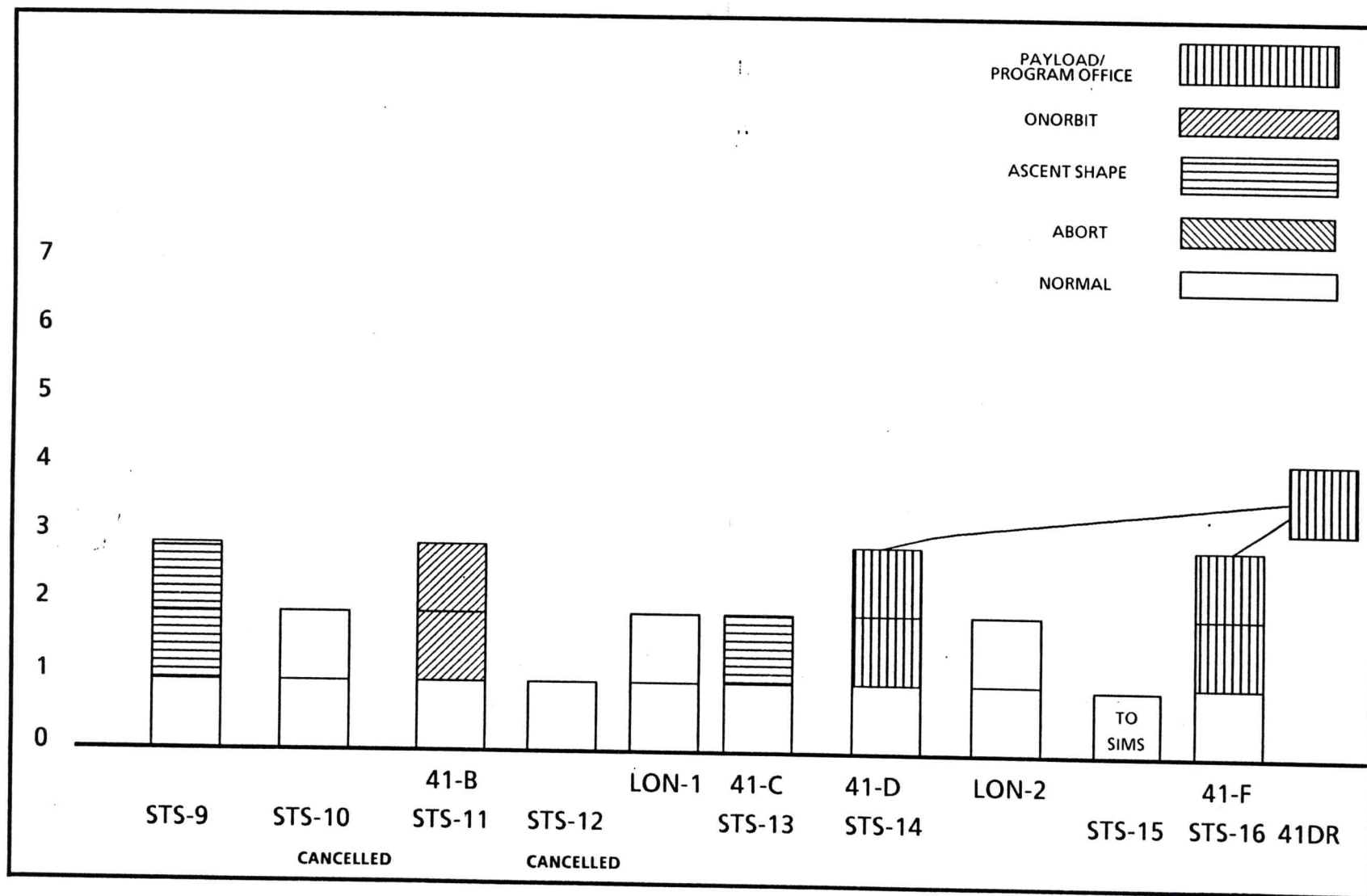
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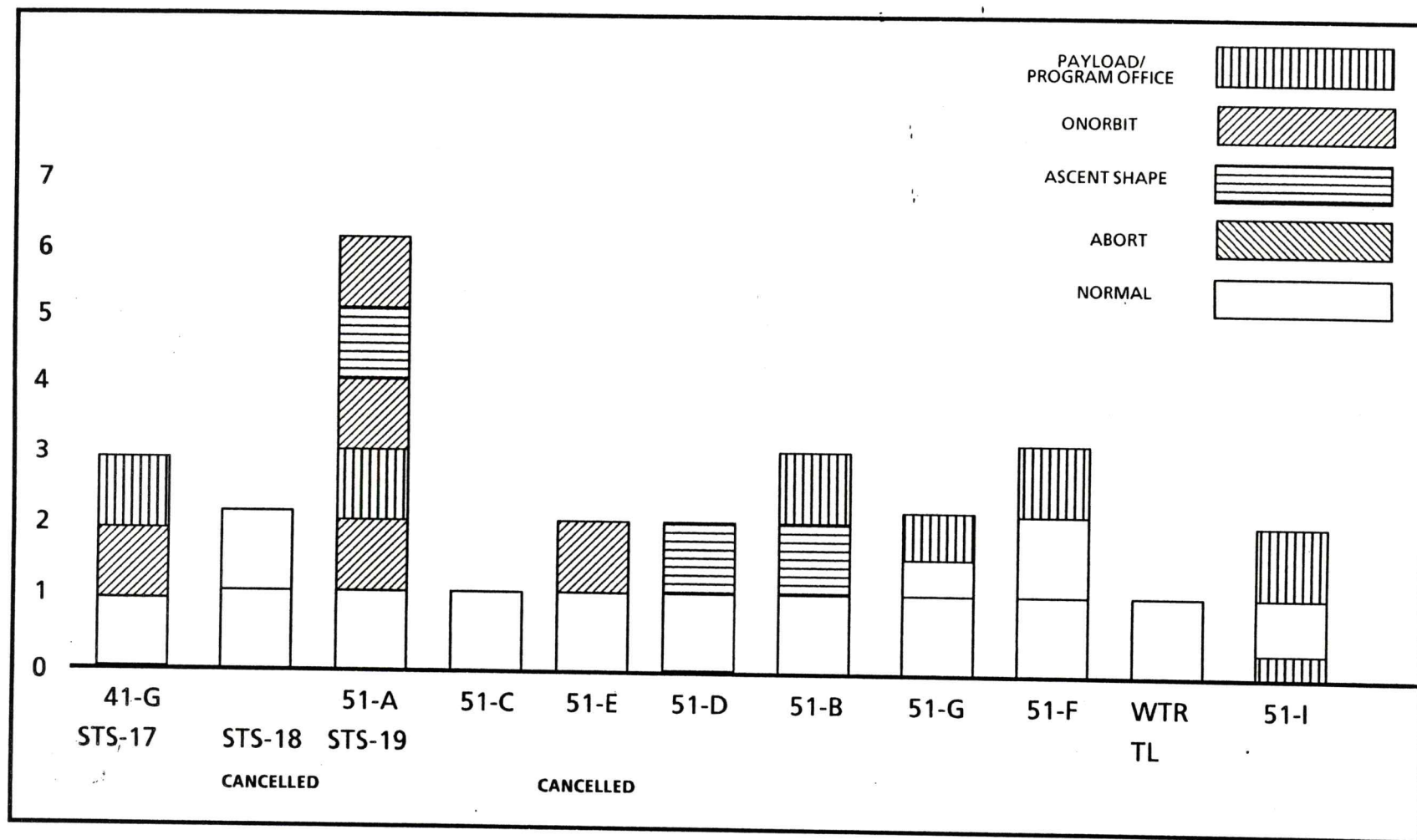
- FLIGHT DESIGN PROCESS INTRODUCTION J. C. HARPOLD
- FLIGHT DESIGN MANAGER FUNCTION L. D. DAVIS
- FLIGHT DESIGN PROCESS
 - ASCENT G. VENABLES
 - ORBIT J. ALLISON
 - DESCENT T. CRULL
 - NAVIGATION W. GREENWELL
- FLIGHT DESIGN SCHEDULING AND PRODUCT HANDLING . . . R. M. MOORE
- FLIGHT DESIGN COMPUTER TOOLS C. HUSS
- FLIGHT DESIGN "COST PER FLIGHT" DATA . . . J. C. HARPOLD
- ROLES OF I-LOAD OWNERS IN I-LOAD PROCESS . . . M. ROTHER
- SUPPLEMENTAL TOPICS
 - GROUND NAVIGATION FUNCTION R. K. OSBURN
 - TRACK/DYNAMICS FUNCTION B. C. CONNER
 - FLIGHT DYNAMICS PREMISSION PRODUCTS . . . M. F. COLLINS
 - DATA RECONFIGURATION PROCESS . . . DH/T. EGGLESTON



STS CYCLE HISTORY CHART







STS CYCLE HISTORY CHART

7
6
5
4
3
2
1
0

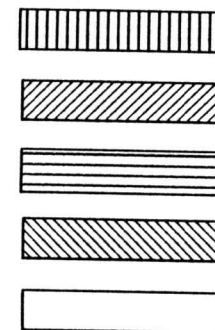
PAYLOAD/
PROGRAM OFFICE

ONORBIT

ASCENT SHAPE

ABORT

NORMAL

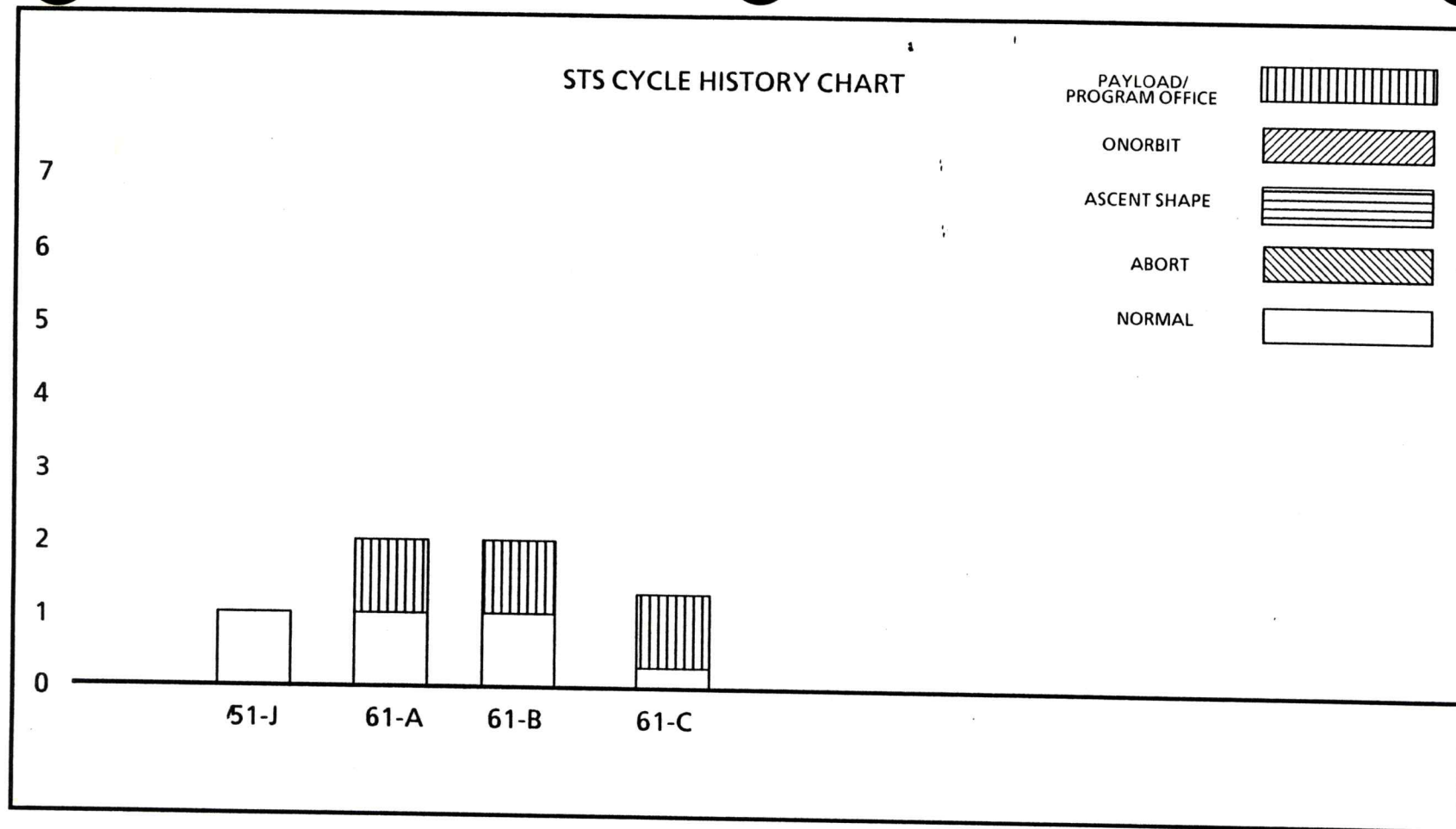


51-J

61-A

61-B

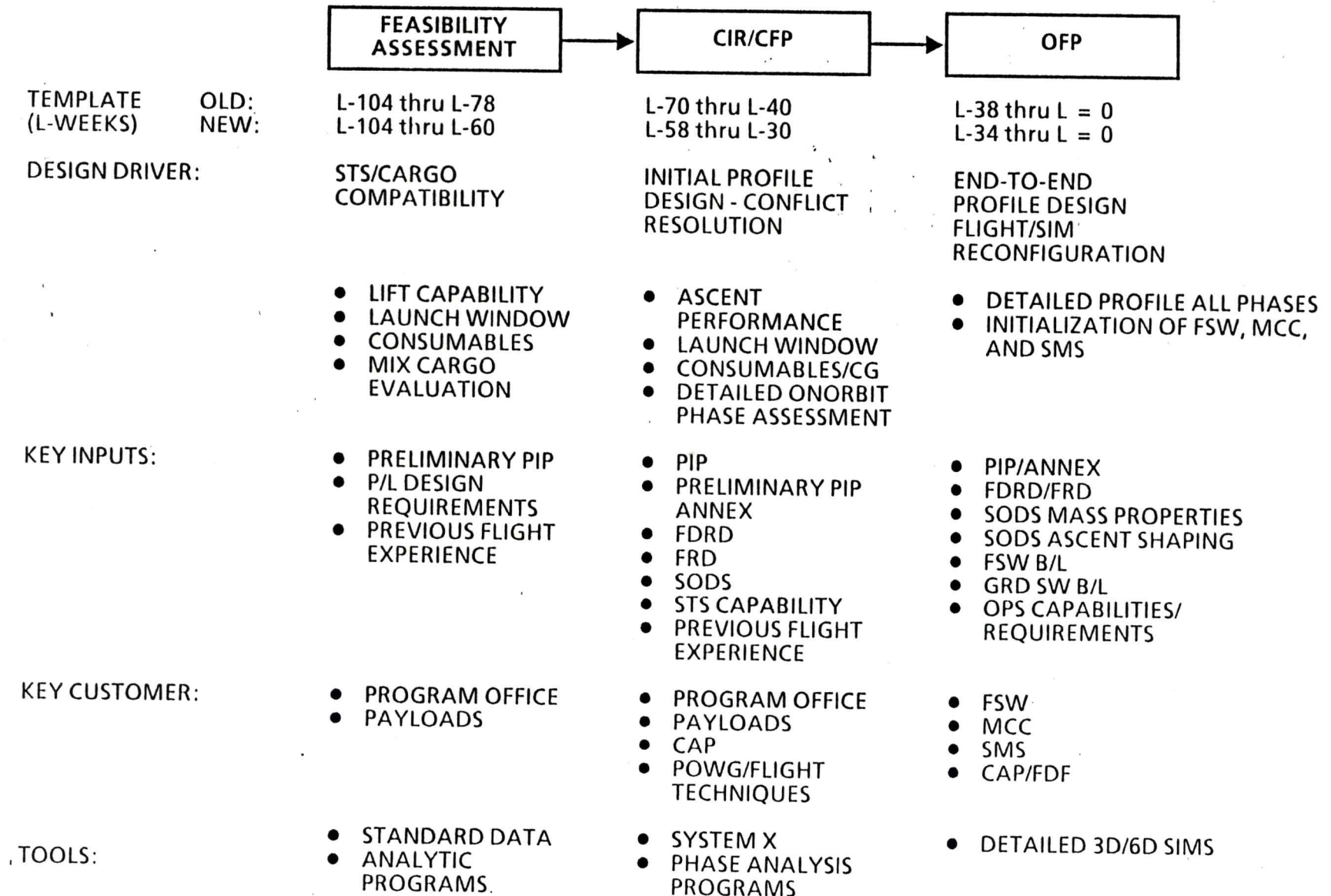
61-C



FLIGHT DESIGN INTEGRATION

Larry Davis
DM5/2855
May 1985

FLIGHT DESIGN FLOW



REQUIREMENT ANALYSIS

THE PROCESS OF INTEGRATING EXTERNALLY LEVIED REQUIREMENTS, RESULTS OF INTEGRATED PROFILE DESIGN, STANDARD GROUND RULES, AND STANDARD PRODUCTS INTO A PRODUCTION INITIALIZATION PACK. THIS PACK WILL CONTAIN ALL THE INFORMATION REQUIRED TO GENERATE A PROFILE AND ASSOCIATED PRODUCTS.

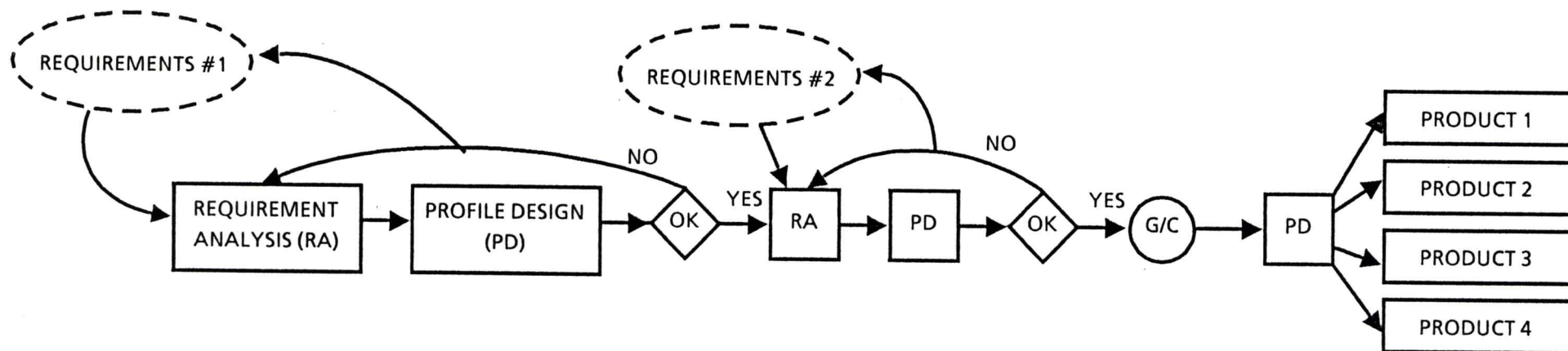
INTEGRATED PROFILE DESIGN

THE PROCESS OF INTEGRATING EXTERNAL REQUIREMENTS, HARDWARE/SOFTWARE CAPABILITIES, STANDARD GROUND RULES, STANDARD PHASES, AND STANDARD PRODUCTS INTO AN ACCEPTABLE PROFILE. THIS PROCESS INVOLVES AN ITERATIVE EXCHANGE WITH THE REQUIREMENT ANALYSIS FUNCTION. A FINAL QA OF ALL PRODUCTS IS ALSO REQUIRED.

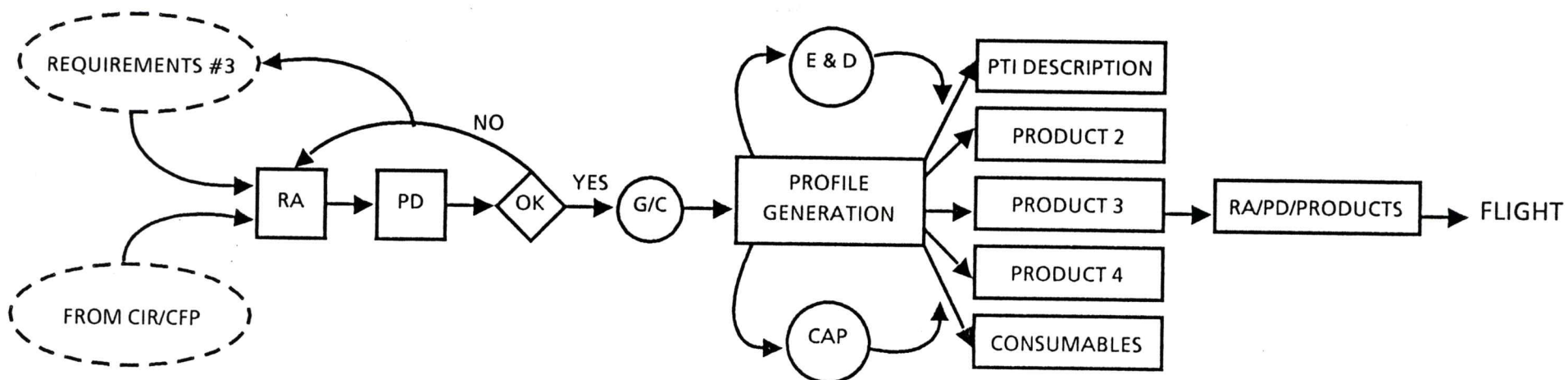
QUALITY ASSURANCE

THIS PROCESS INCLUDES VERIFICATION THAT THE PROFILE AND ASSOCIATED PRODUCTS SATISFY THE REQUIREMENTS, CAPABILITIES, AND LIMITATIONS LEVIED IN THE EXTERNAL REQUIREMENTS AND SUMMARIZED IN THE PRODUCTION INITIALIZATION PACK. THE PRIMARY QA WILL BE PERFORMED AS AN INTEGRAL PART OF PRODUCT GENERATION. ADDITIONAL QA WILL BE PERFORMED AS A PART OF THE PROFILE DESIGN FUNCTION.

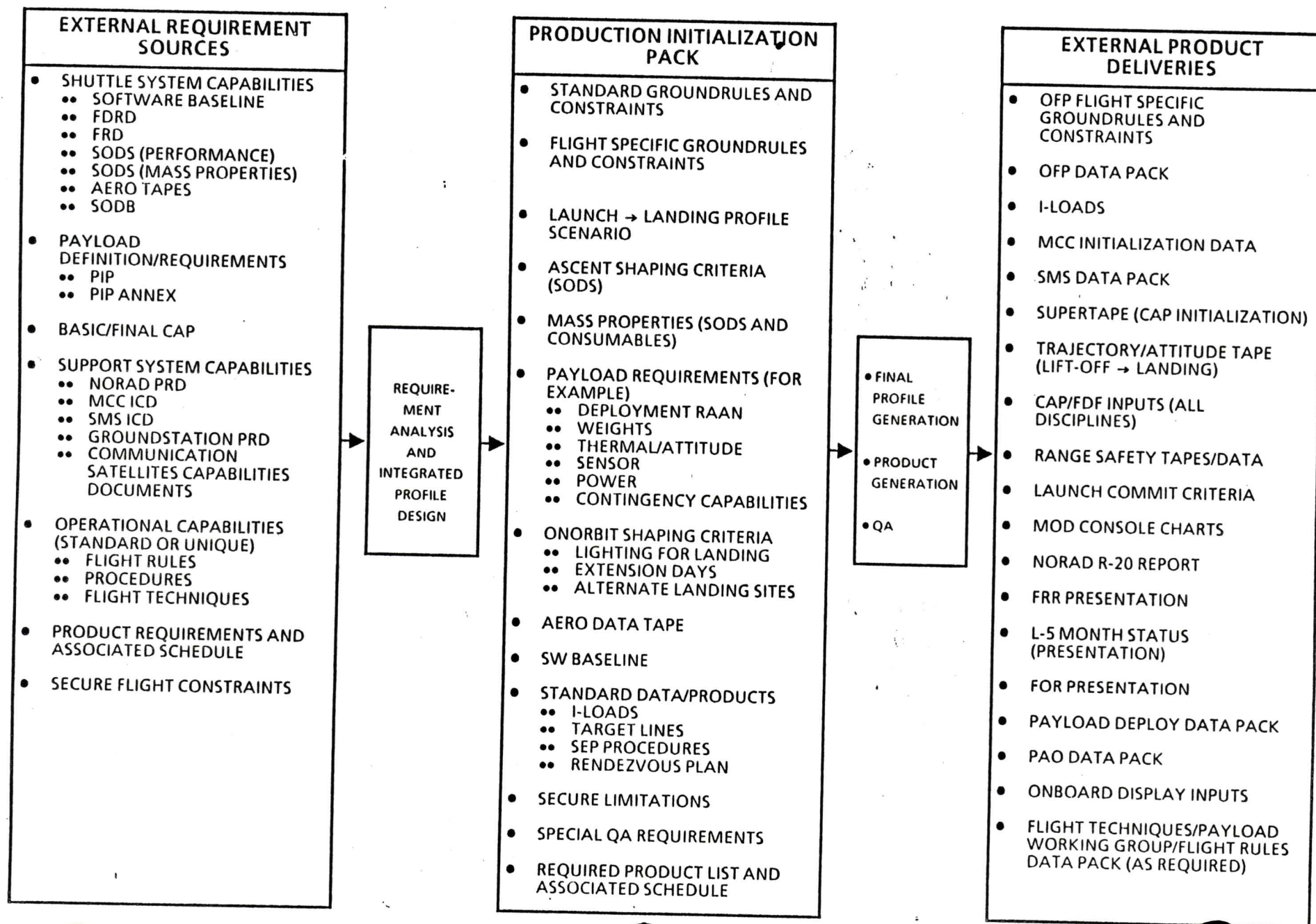
FEASIBILITY ASSESSMENT



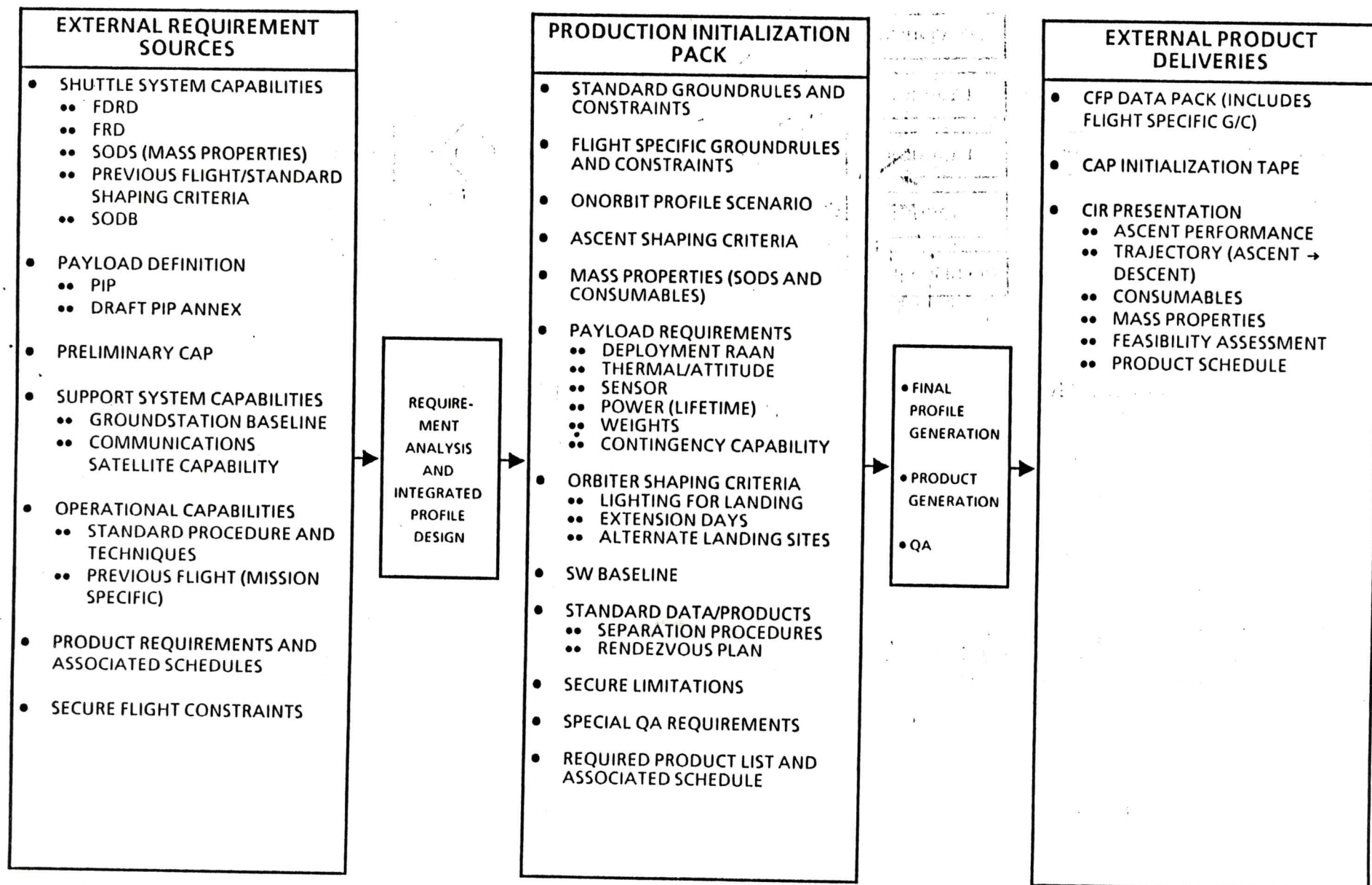
OFP (CYCLE 1)



OPERATIONAL FLIGHT DESIGN PHASE



CONCEPTUAL FLIGHT DESIGN PHASE



FLIGHT DESIGN MANAGEMENT

THE FLIGHT DESIGN MANAGER (FDM) IS RESPONSIBLE FOR MANAGING THE DEVELOPMENT OF A PROFILE (AND ASSOCIATED PRODUCTS) THAT SATISFY CARGO REQUIREMENTS WITHIN STS SOFTWARE, HARDWARE AND OPERATIONAL LIMITS. THIS RESPONSIBILITY INCLUDES THE DEVELOPMENT OF THE CONCEPTUAL FLIGHT PROFILE (CFP) WHICH SUPPORTS THE CARGO INTEGRATION REVIEW (CIR) AND THE OPERATIONAL FLIGHT PROFILE (OFP) WHICH SUPPORTS THE SIMULATION AND FLIGHT RECONFIGURATION PROCESS. HE IS DIRECTLY RESPONSIBLE FOR MANAGING THE REQUIREMENTS ANALYSIS, PROFILE DESIGN AND QUALITY ASSURANCE FUNCTIONS FOR HIS ASSIGNED FLIGHT.

FLIGHT DESIGN MANAGER SPECIFIC RESPONSIBILITIES

- KNOWLEDGE OF CURRENT STS CAPABILITIES/LIMITATIONS AND THEIR INTERRELATIONSHIP WITH THE FLIGHT DESIGN PROCESS
 - MANIFESTING
 - FLIGHT HARDWARE
 - FLIGHT SOFTWARE
 - GROUND SW (MCC/SMS/SAIL/SPF)
 - CAP
 - OPS TECHNIQUES/PROCEDURES

- TECHNICAL KNOWLEDGE OF ALL DISCIPLINES OF FLIGHT DESIGN
 - DRIVERS/CRITICAL INPUTS (ALL DISCIPLINES)
 - INTERRELATIONSHIP (ASCENT, DESCENT, CONSUMABLES, ETC.)
 - CRITICAL PATHS/MILESTONES/PRODUCTS

- KNOWLEDGE OF FLIGHT DESIGN COMPUTER TOOLS
 - CAPABILITIES
 - LIMITATIONS
 - TURNAROUNDS

FLIGHT DESIGN MANAGER SPECIFIC RESPONSIBILITIES - Continued

- INTEGRATION OF EXTERNAL REQUIREMENTS INTO A SET OF FLIGHT DESIGN GROUND RULES AND CONSTRAINTS
 - CARGO REQUIREMENTS
 - STS CAPABILITIES
 - PRODUCT SCHEDULE
- MANAGEMENT OF THE GENERATION OF BASIC PROFILE AND ASSOCIATED PRODUCTS TO MEET MAJOR PROGRAM MILESTONES
- MANAGEMENT OF THE QA PROCESS FOR THE BASIC PROFILE AND ASSOCIATED PRODUCTS
- COORDINATION OF KEY INTERNAL/EXTERNAL PRODUCT MILESTONES

FLIGHT DESIGN MANAGER SPECIFIC RESPONSIBILITIES - Continued

- POINT OF CONTACT FOR FLIGHT DESIGN WITH PRCB, MICB, FLIGHT TECHNIQUES, POWG, FLIGHT RULES, L-5 MONTH, FOR, CIRD, CIR, AND OASCB WHICH REQUIRES THE ABILITY TO COMMUNICATE/INTERREACT WITH PEOPLE AT VARIOUS TECHNICAL/MANAGEMENT LEVELS
 - LEVEL II
 - DIRECTORATE
 - FLIGHT DIRECTOR
 - DESIGN ENGINEERS
 - PARA-ENGINEERS
 - CONTRACTORS
 - NASA CENTERS

- RESPONSIBLE FOR KEY FLIGHT DESIGN DOCUMENTATION
 - GROUND RULES AND CONSTRAINTS
 - CFP/OFP
 - FRR PRESENTATION
 - R-20 DAY NORAD REPORT
 - PAO PACKAGES

FLIGHT DESIGN MANAGER SPECIFIC RESPONSIBILITIES - Concluded

- FLIGHT REPRESENTATIVE IN REAL-TIME (SPAN)

- RESPONSIBLE FOR TRAINING OF "NEW" FLIGHT DESIGN MANAGERS
 - FLIGHT INTEGRATOR
 - ON THE JOB TRAINING

ASCENT FLIGHT DESIGN OVERVIEW

GLENN VENABLES
MDTSCO / DM3
MAY 1985

MDTSCO-HOUSTON

MCDONNELL DOUGLAS



ASCENT FLIGHT DESIGN OUTLINE

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ASCENT FLIGHT DESIGN GOALS

- MAXIMIZE QUALITY TO ENSURE FLIGHT SAFETY
- MINIMIZE RECONFIGURATION COSTS
 - MINIMIZE THE NUMBER OF PRODUCTS
 - MINIMIZE INTERRUPTIONS
 - MAINTAIN STABLE LEVEL OF PRODUCTION
 - STANDARDIZE PRODUCT DESIGNS
- MAXIMIZE RESPONSIVENESS TO NSTSPO MANIFESTING
- MAXIMIZE EFFECTIVENESS OF STS OPERATIONAL CAPABILITY

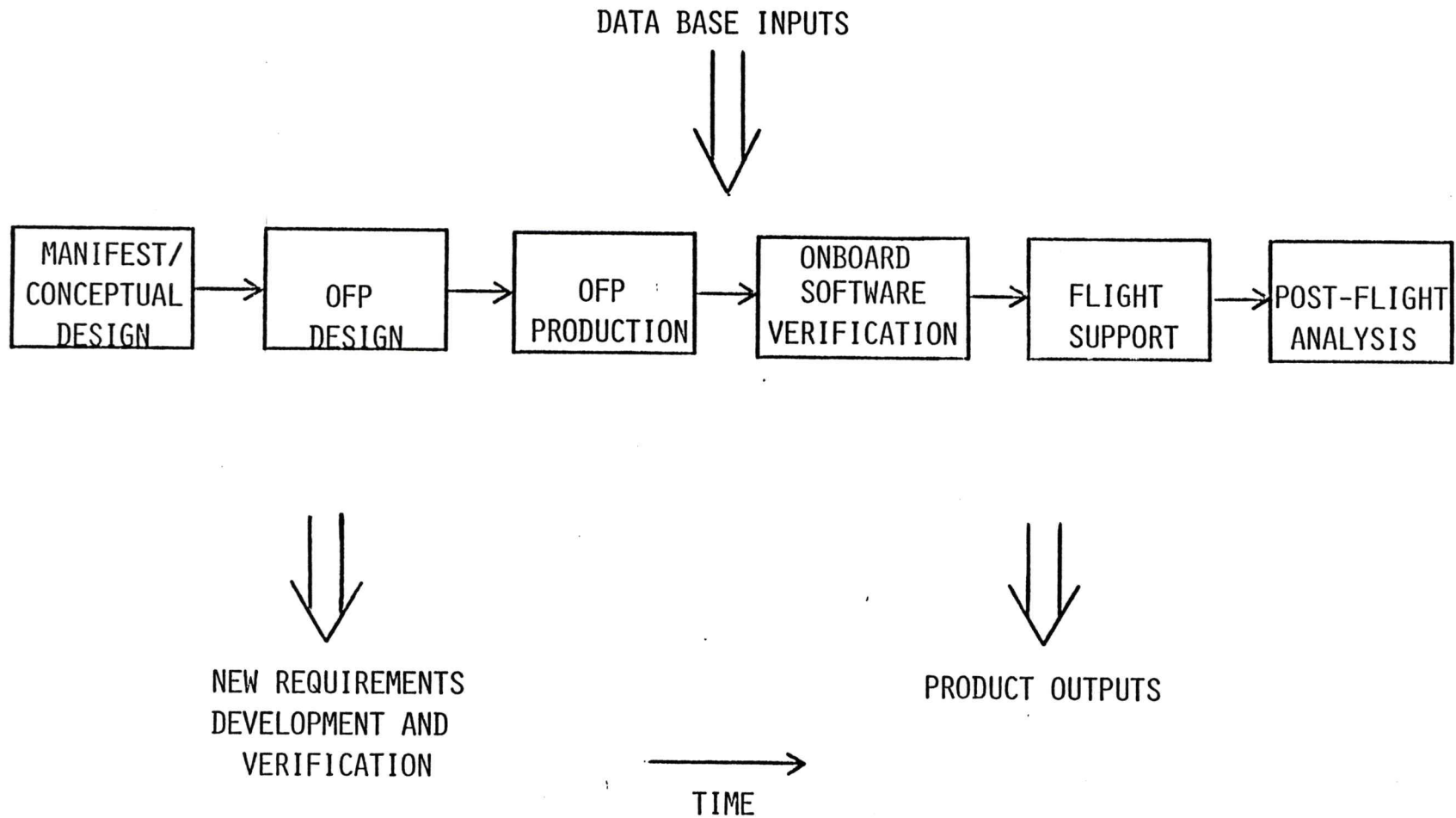
INTRODUCTION

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OVERVIEW OF ASCENT FLIGHT DESIGN



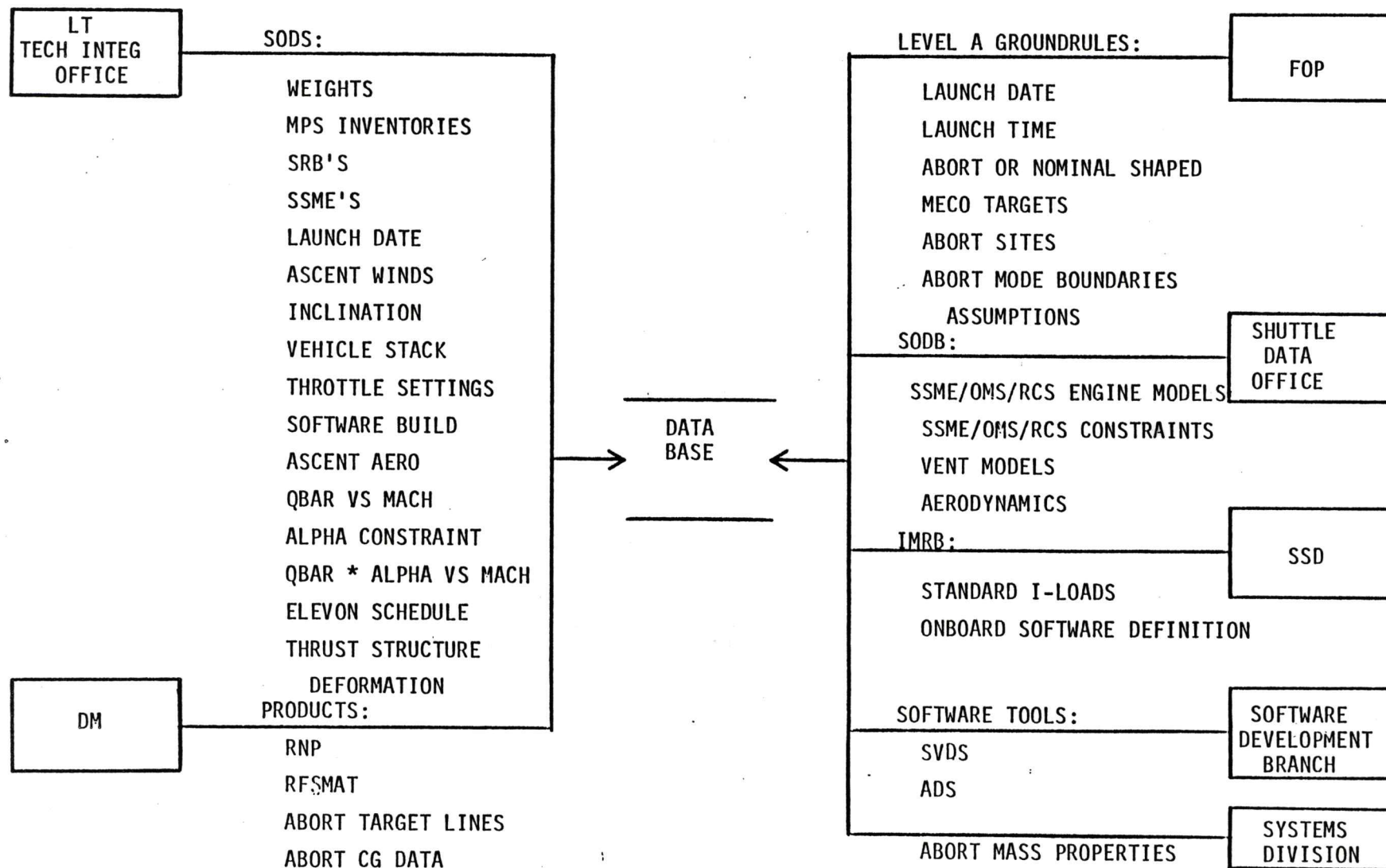
DM3 1985 MDTSCO STAFFING*

<u>ANALYSIS**</u>		<u>PRODUCTION</u>	
MANIFESTING/CFP DESIGN	4	OFP PRODUCTION	9 +(4 BTI)
NOMINAL I-LOAD DESIGN	4	PRODUCTION ENGINEERING	4 +(4 BTI)
RTLS/TAL I-LOAD DESIGN	4	DATA BASE/SOFTWARE REQMTS	<u>3</u>
AOA/ATO I-LOAD DESIGN	4		16 +(8 BTI)
SOFTWARE VERIFICATION	4		
FLIGHT SUPPORT	3		
RANGE SAFETY ANALYSIS	<u>4</u>		
	27		

* INCLUDES SUPERVISION AND MANAGEMENT

** INCLUDES STAFFING FOR LON, OPTIONAL SERVICES, AND WTR.

ASCENT FLIGHT DESIGN DATA BASE INPUTS

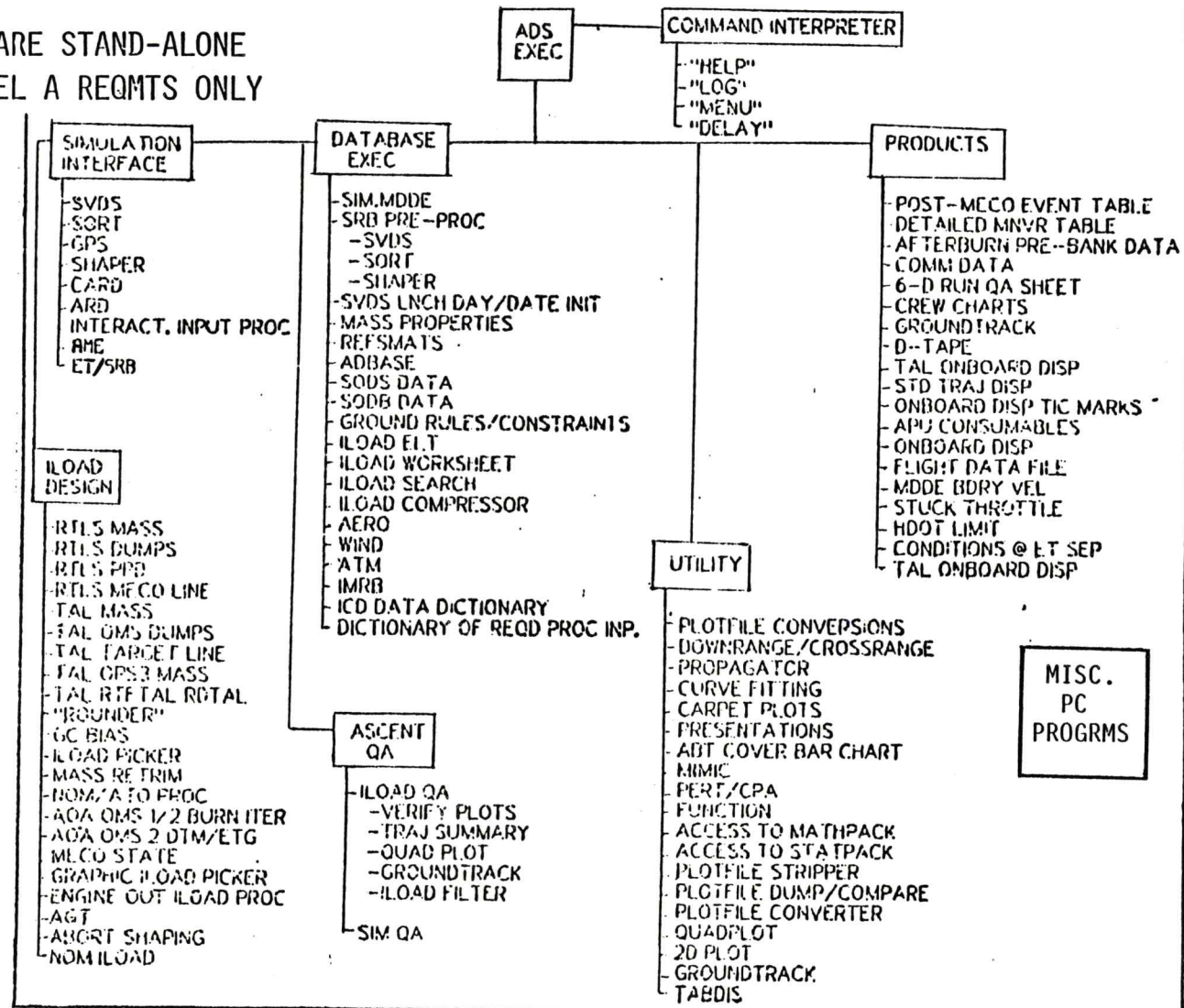


NOTE: INPUT ICD HAS IDENTIFIED 5000 PARAMETERS REPRESENTING 1.5 MILLION DATA WORDS.

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ASCENT FLIGHT DESIGN SOFTWARE TOOLS

- UNIVAC HOST
- ~75% PROGRAMS ARE STAND-ALONE
- ADS EXEC - LEVEL A REQMTS ONLY



PROCESS DESCRIPTIONS

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MANIFESTING / CONCEPTUAL DESIGN

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CONCEPTUAL DESIGN FUNCTIONS

- CONTINUALLY REPORT PERFORMANCE MARGIN/PAYLOAD LIFT CAPABILITY.
 - EVALUATE MANIFEST OPTIONS
 - EVALUATE GROUND RULES AND CONSTRAINTS
 - RECOMMEND "GET-WELL" OPTIONS
- EVALUATE FIRST STAGE I-LOAD OPTIONS AND THEIR SUITABILITY IN TERMS OF PERFORMANCE AND LAUNCH PROBABILITY.
 - RECOMMEND ONE OF THE FOLLOWING PRIOR TO OFP CYCLE 1:
 - USE AN EXISTING STANDARD I-LOAD
 - DEVELOPMENT OF NEW STANDARD I-LOAD REQUIRED (FM4)
 - DEVELOPMENT OF UNIQUE OR OPTIMAL I-LOAD REQUIRED
 - LACK OF INPUT DESIGN CRITERIA (Q , Q_{α} ALPHA TO SATISFY LOADS) OFTEN POSTPONES THE REAL FIRST STAGE DESIGN TO CYCLE 2.
 - AN "OFF-THE-SHELF" I-LOAD IS THEN USED FOR CYCLE 1 CREW TRAINING.

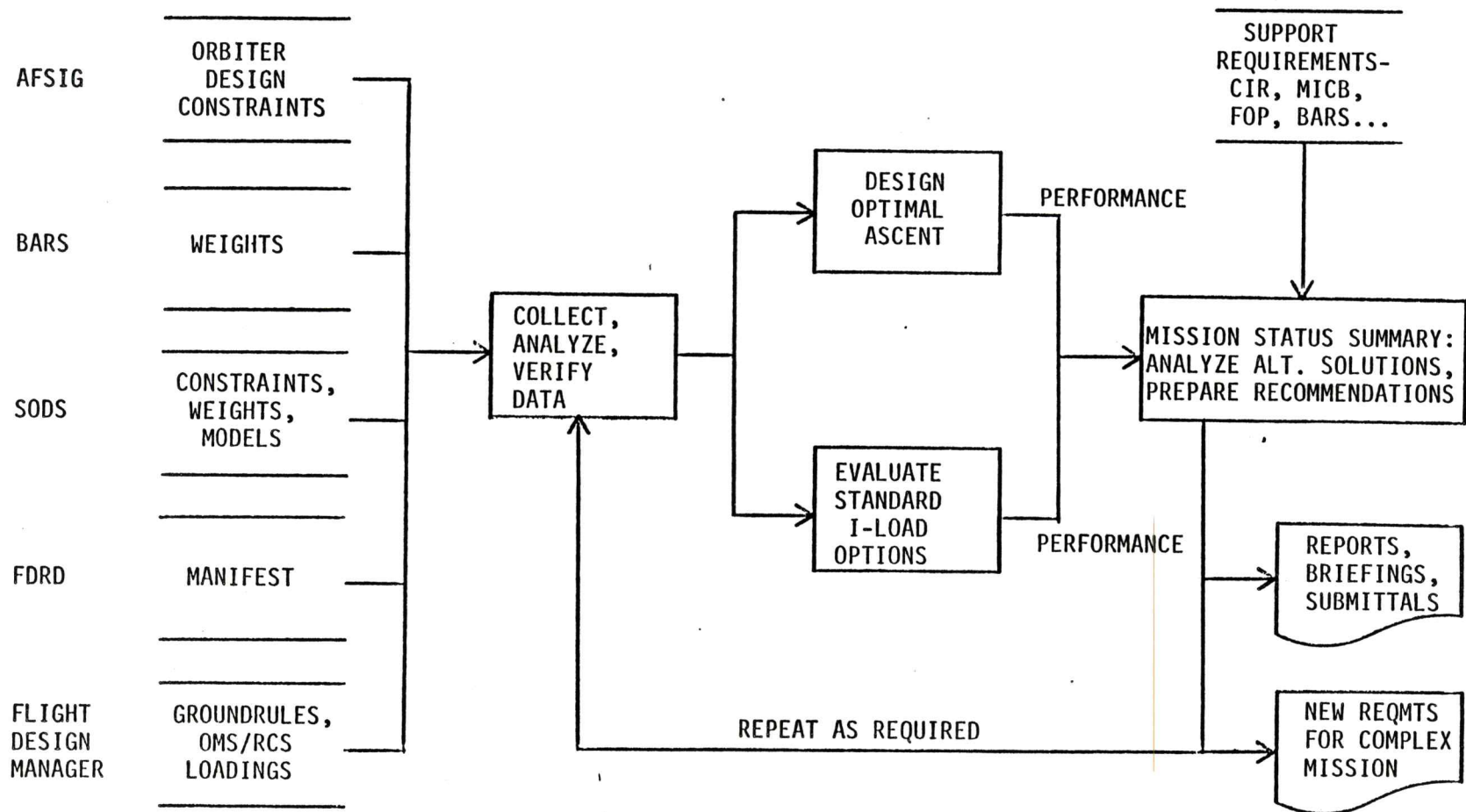
CONCEPTUAL DESIGN FUNCTIONS (CONT.)

- MONITOR, EVALUATE, AND IMPLEMENT NEW REQUIREMENTS AS REQUIRED FOR THE SPECIFIC MISSION.
 - DRIVERS:
 - NEW FLIGHT SOFTWARE CAPABILITIES (EX. 017)
 - NEW GROUND SOFTWARE CAPABILITIES (EX. ARD, AME, RENDEZVOUS)
 - COMPLEX MISSION GROUND RULES AND CONSTRAINTS (EX. WTR)
 - NEW OPERATIONAL CAPABILITY (EX. FWC, ABORT SHAPING)
 - NEW ENVIRONMENT MODELS (EX. AERO, SSME)
 - OUTPUTS:
 - DEVELOPMENT AND VERIFICATION OF SOFTWARE TOOLS FOR ANALYSIS, DESIGN, AND PRODUCTION
 - ADDITIONAL ONBOARD AND GROUND SOFTWARE VERIFICATION
- EVALUATE RANGE SAFETY AND SRB/ET DISPOSAL CONSTRAINTS AS REQUIRED AND FEED DATA BACK INTO THE CFP G & C.
 - DRIVERS:
 - NEW INCLINATION
 - STANDARD VERSUS DIRECT INSERTION
 - DIRECT INSERTION APOGEE ALTITUDE
 - OUTPUTS:
 - MECO TARGETS
 - MECO UNDERSPEED CONSTRAINTS FOR ATO OMS DUMPS
 - LAUNCH AZIMUTH AND VARIABLE IY CONSTRAINTS
 - WTR RTLS CROSSRANGE STEERING BIAS

CONCEPTUAL DESIGN FUNCTIONS (CONT.)

- EVALUATE ASCENT ABORT OPTIONS AND PERFORM DETAILED ANALYSES AS REQUIRED.
 - COMPLEX MISSIONS MAY REQUIRE SUBSTANTIAL ABORT ANALYSES PRIOR TO OFF CYCLE 1.
 - DRIVERS:
 - FIRST DIRECT INSERTION
 - NEW INCLINATION
 - WTR
 - OI7 RTLS/TAL WEATHER ALTERNATE CAPABILITY
 - CENTAUR
 - OUTPUTS:
 - LEVEL A & B GROUND RULES AND CONSTRAINTS
 - PRELIMINARY FLIGHT TECHNIQUES/FLIGHT RULES
 - PRELIMINARY ABORT PROFILES AND I-LOADS

MANIFESTING / CONCEPTUAL DESIGN PROCESS



OFF I-LOAD DESIGN

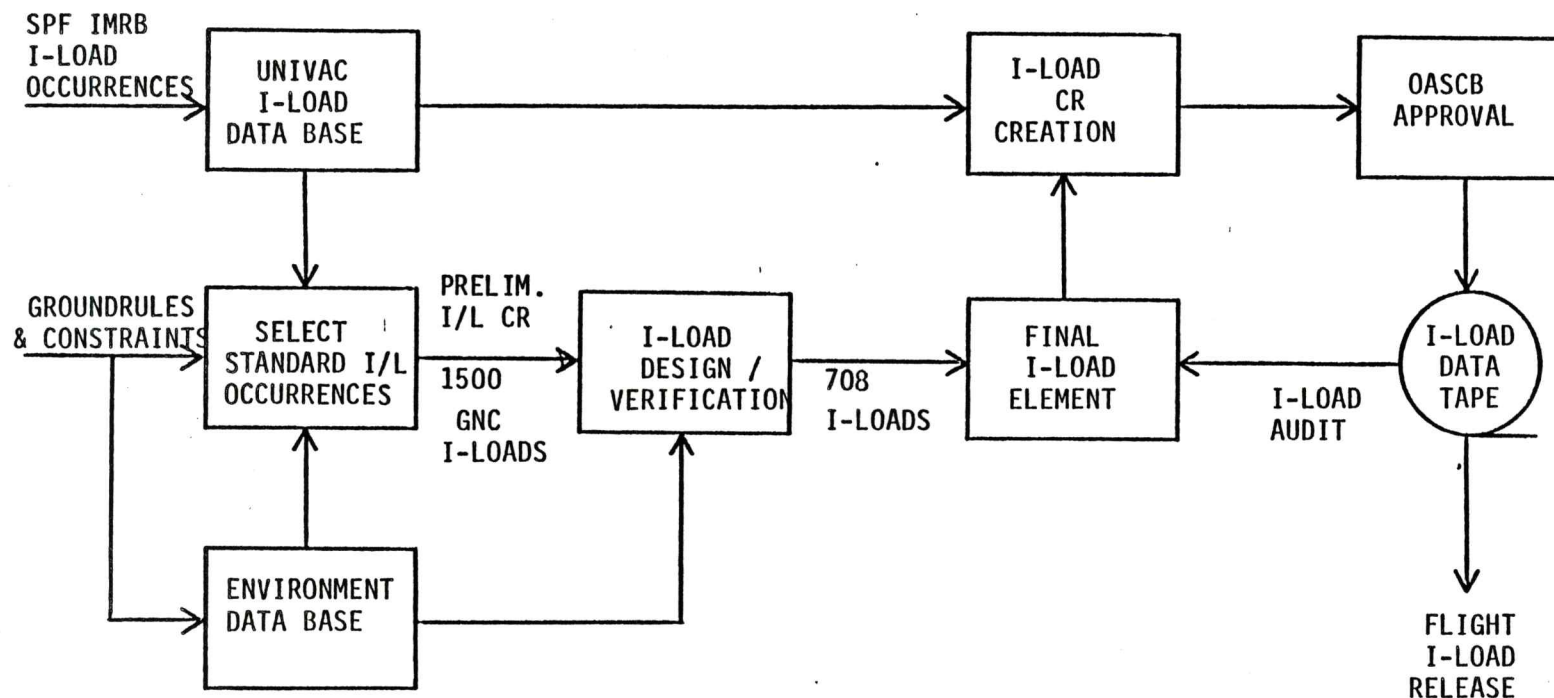
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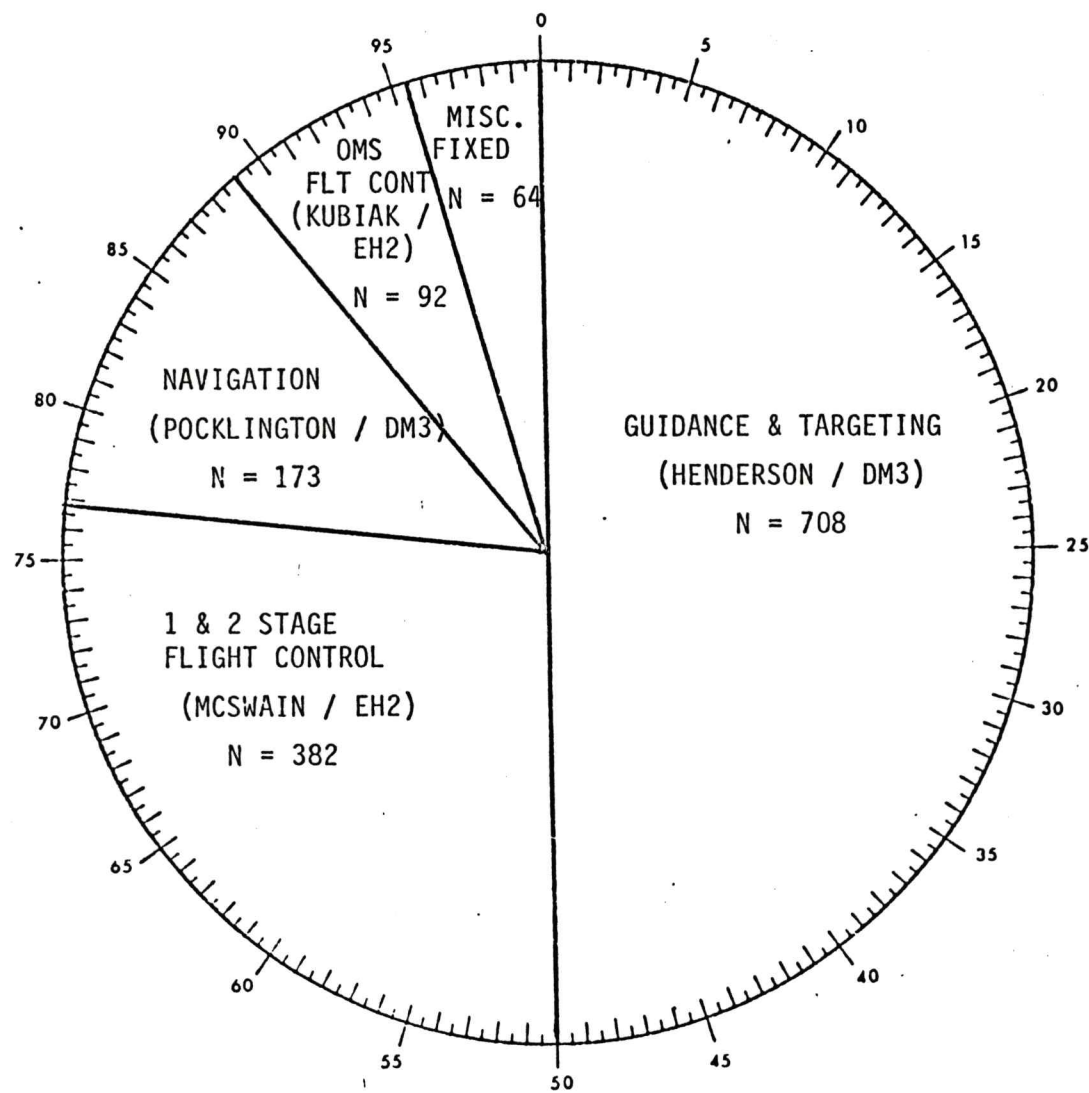
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PROCESS FOR I-LOAD CR CREATION

- MISSION DEFINITION CR (OCCURRENCE SELECTIONS)
- NEW OCCURRENCE CR



ASCENT I-LOADS REQUIRED FOR DESIGN / VERIFICATION



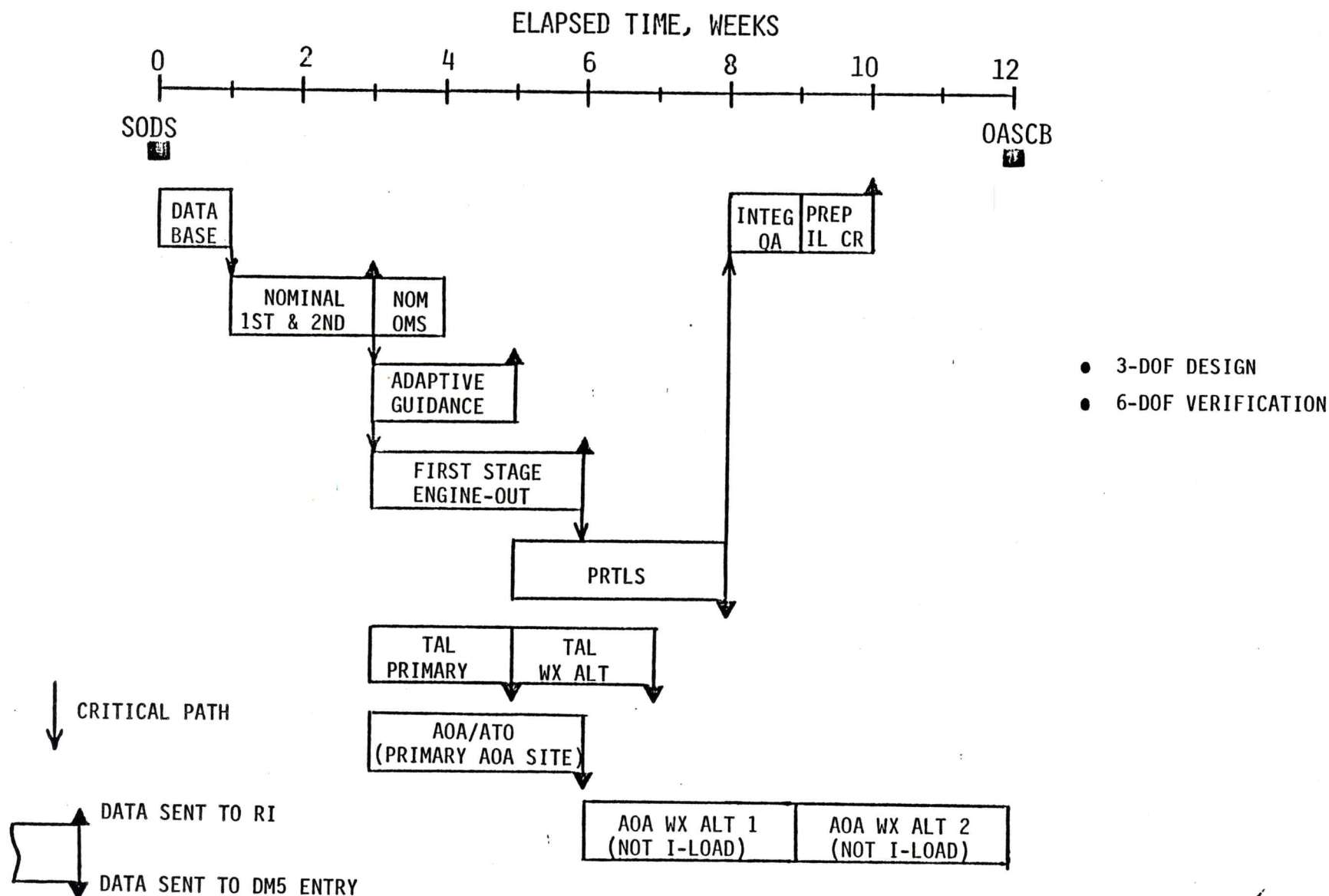
N TOTAL = 1419

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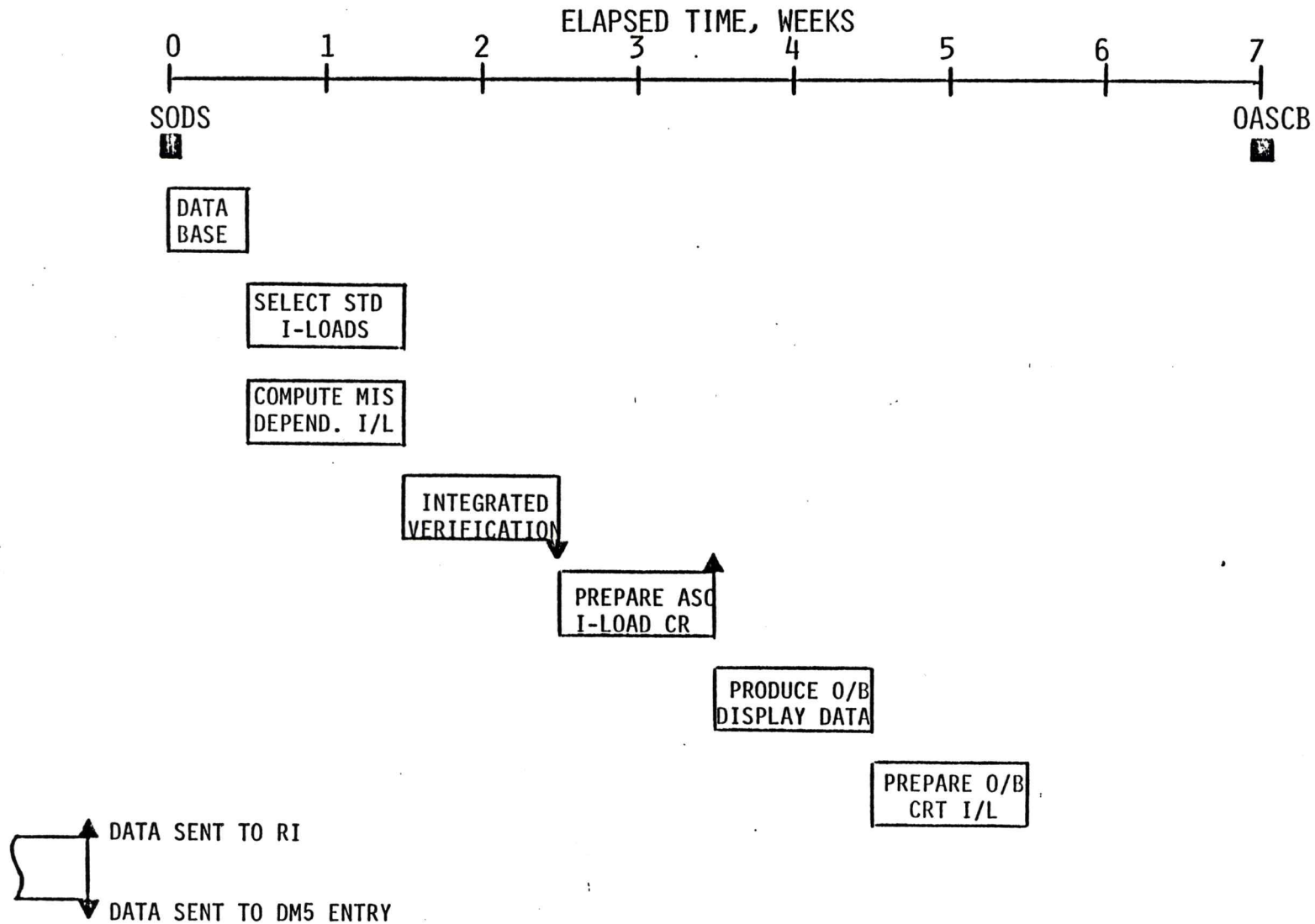
TYPICAL OFP I-LOAD DESIGN PROCESS FOR NEW MISSION



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TYPICAL OFF I-LOAD DESIGN PROCESS FOR STANDARD I-LOADS



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MAJOR DESIGN CONSTRAINTS FOR NOMINAL I-LOADS

	<u>DESIGN CONSTRAINTS</u>	<u>DRIVER</u>
FIRST STAGE	● DYNAMIC PRESSURE (Q) VERSUS MACH ● Q X ALPHA VERSUS MACH ● Q X BETA = 0 ● ALPHA = 2° AFTER MAX Q ● MAXIMIZE PERFORMANCE ● THROTTLE VERSUS ALTITUDE	- WING LOADS*; LAUNCH PROBABILITY* - WING LOADS*; LAUNCH PROBABILITY* - WING LOADS* - ET HEATING - PAYLOAD* - SSME NOZZLE
SECOND STAGE	● MECO TARGETS	ET DISPOSAL*
OMS INSERTION	● ORBIT PARAMETER TOLERANCES (HA, HP, PERIOD, INCLIN, NODE) ● DELAYED OMS CAPABILITY	- PAYLOAD - SYSTEMS PROBLEMS

* DYNAMIC DRIVERS THAT HAVE NOT ATTAINED OPS MATURITY

MAJOR DESIGN CONSTRAINTS FOR RTLS/TAL I-LOADS

DESIGN CONSTRAINTS

DRIVER

RTLS

- ET SEP: $Q < 10$ PSF
MPS $< 2\%$
ALPHA = -4°
BETA = 0°
PITCH RATE = $-.25^{\circ}/\text{SEC}$
FLIGHT PATH = 0°
RANGE - VELOCITY (RV) LINE
RV LINE + PLANE
- 20 SEC POWERED PITCHDOWN
- P TOTAL < 1.5 PSF WHEN $|\alpha| > 90^{\circ}$
- STABLE GUIDANCE BEHAVIOR

SAFE ET SEPARATION

"

"

"

"

GRTLS PULLOUT, ENERGY

" " "

ET DISPOSAL

CREW MONITORING

SSME PLUME HEATING

FLIGHT SAFETY

TAL

- ET SEP: ALTITUDE = 330,000 FT
FLIGHTPATH = 0°
RANGE - VELOCITY (RV) LINE
INERTIAL PLANE
RV LINE + PLANE

ENTRY HEATING, ENERGY

" " "

" " "

ENTRY CROSSRANGE CAPABILITY

ET DISPOSAL

- VELOCITY TO ROLL HEADS-UP

ET HEATING

* DYNAMIC DRIVERS THAT HAVE NOT ATTAINED OPS MATURITY

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MAJOR DESIGN CONSTRAINTS FOR AOA/ATO I-LOADS

DESIGN CONSTRAINTS

DRIVER

AOA

- COMMON AOA/ATO OMS-1
- EI TARGET LINES - RANGE, VELOCITY, δ
- STEEP AND SHALLOW TARGET OPTIONS FOR POSSIBLE MECO ENERGY STATES AND SYSTEMS PROBLEMS

MISSION CONTINUATION
ENTRY PERFORMANCE, HEATING
VEHICLE RETURN FOR MULTIPLE
FAILURES

ATO

- COMMON AOA/ATO OMS-1
- TARGET OPTIONS FOR ALL POSSIBLE MECO ENERGY STATES
- DELAYED OMS-1 CAPABILITY

MISSION CONTINUATION
MISSION CONTINUATION

SYSTEMS PROBLEMS

OMS/RCS DUMPS

- CG ENVELOPE
- LANDING WEIGHT
- TANK LANDING CONSTRAINTS
- SINGLE-SSME ROLL CONTROL

CONTROLLABILITY
STRUCTURE
STRUCTURE
CONTINGENCY CAPABILITY

* DYNAMIC DRIVERS THAT HAVE NOT ATTAINED OPS MATURITY

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ASCENT I-LOAD CATEGORIES (017)

<u>CATEGORY NAMES</u>	<u>NUMBER I-LOADS</u>	<u>MAJOR DRIVERS</u>
ASCENT ATO DUMP CONTROLS	4	OMS LOAD, "PRESS" PERFORMANCE
ASC ABORT PRIME LANDING AREA SPEC	2	ABORT SITE
RTLS/TAL GUID TARGETS - NAV AREA	13	ABORT SITE, WEIGHT, SEASON
RTLS/TAL GUID TARGETS - NAV AREA	13	ABORT SITE, " "
RTLS/TAL GUID TARGETS - NAV AREA	13	ABORT SITE, " "
RTLS/TAL GUID TARGETS - NAV AREA	13	ABORT SITE, " "
RTLS/TAL GUID TARGETS - NAV AREA	13	ABORT SITE, " "
SSME PITCH PARALLEL DISCRETE	1	NONE
RTLS FUEL DISSIPATION	6	SRB SEP CONDITION, THRUST/WEIGHT
MISSION UNIQUE MASSES	13	WEIGHTS OF ORBITER, PAYLOAD, ET, OMS, RCS, MPS
PSEUDO MECO TARGETS	4	NOMINAL VERSUS ABORT SHAPE
MISSION DEPENDENT RENDEZVOUS	3	RENDEZVOUS MISSION
FIRST STAGE ELEVON ANGLES	16	VEHICLE
FIRST STAGE TREF	1	SRB, SEASON, THROTTLE PROFILE
SECOND STAGE TRIMS	16	MASS PROPERTIES
VARIABLE IY	2	VARIABLE IY
FIRST STAGE NOMINAL	157	VEHICLE, SEASON, INCLINATION
FIRST STAGE ENGINE-OUT	88	VEHICLE, SEASON, INCLINATION
FIRST STAGE THROTTLE SCHEDULES	13	VEHICLE, SEASON, INCLINATION, PERFORMANCE
FIRST STAGE AGT	4	VEHICLE, SEASON, INCLINATION

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ASCENT I-LOAD CATEGORIES (017) - CONCLUDED

<u>CATEGORY NAMES</u>	<u>NUMBER I-LOADS</u>	<u>MAJOR DRIVERS</u>
SECOND STAGE AOA/ATO TARGETS	5	ABORT MECO TARGET
SECOND STAGE MECO TARGETS	3	STANDARD VS DIRECT INSERTION, INCLINATION
SECOND STAGE IY	16	INCLINATION
SECOND STAGE SSME POWER	7	SSME POWER LEVEL, PERFORMANCE
SECOND STAGE RTLS	1	PERFORMANCE
POST-MECO AOA	122	ABORT SITE, ORBIT ALTITUDE, MECO TARGETS, VAR IY, INCLINATION
POST-MECO NOMINAL	6	MECO TARGETS, ORBIT ALTITUDE, INCLINATION
POST-MECO ATO	9	MECO TARGETS, INCLINATION, AOA TARGETS
CONTINGENCY RCS DUMP	1	RCS LOAD, WEIGHT, CG
ATO PRE MECO DUMPS	3	OMS LOAD, MAX MECO UNDERSPEED
CONTINGENCY OMS DUMP	1	OMS LOAD, WEIGHT, CG
SRB SEP BACKUP TIME	1	SRB
RTLS POST MECO DUMPS	1	RCS LOAD, WEIGHT, CG
RTLS PRE MECO DUMPS	3	OMS LOAD, WEIGHT, CG
TAL POST MECO DUMP	1	RCS LOAD, WEIGHT, CG
TAL PRE MECO DUMPS	3	OMS LOAD, WEIGHT, CG
TAL ENTRY & AFT RCS DUMP	2	RCS LOAD, WEIGHT, CG
TO BE DELETED, PART 1	16	NONE
TO BE DELETED, PART 5	7	NONE
FIXED I-LOADS - BORDANO	12	DESIGN DEPENDENT
FIXED I-LOADS - BORDANO, CONTD	48	DESIGN DEPENDENT
FIXED I-LOADS - BORDANO, CONTD	45	DESIGN DEPENDENT

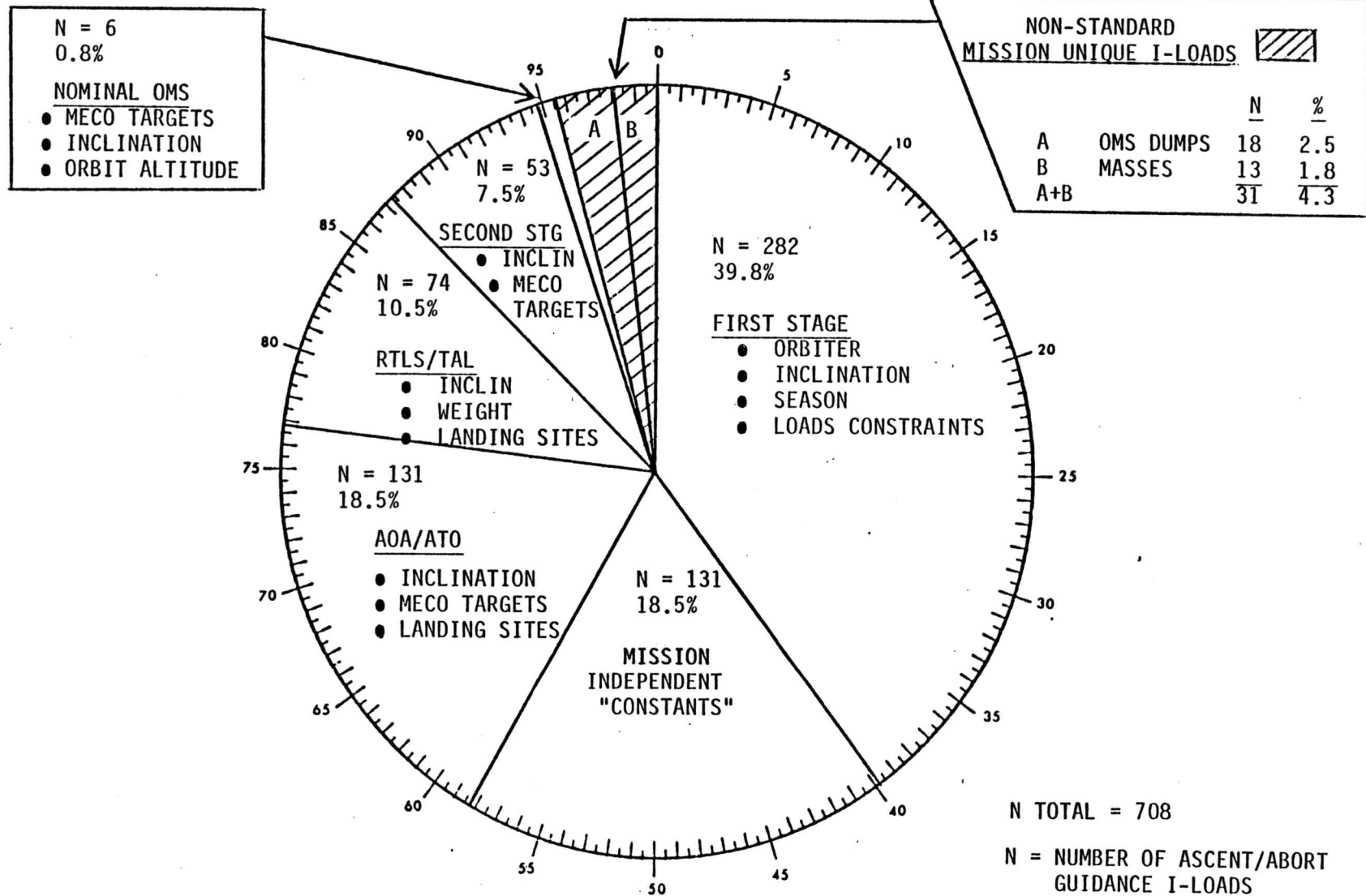
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TOTAL 708 (42 CATEGORIES)

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GROUPINGS OF STANDARDIZED ASCENT/ABORT I-LOADS



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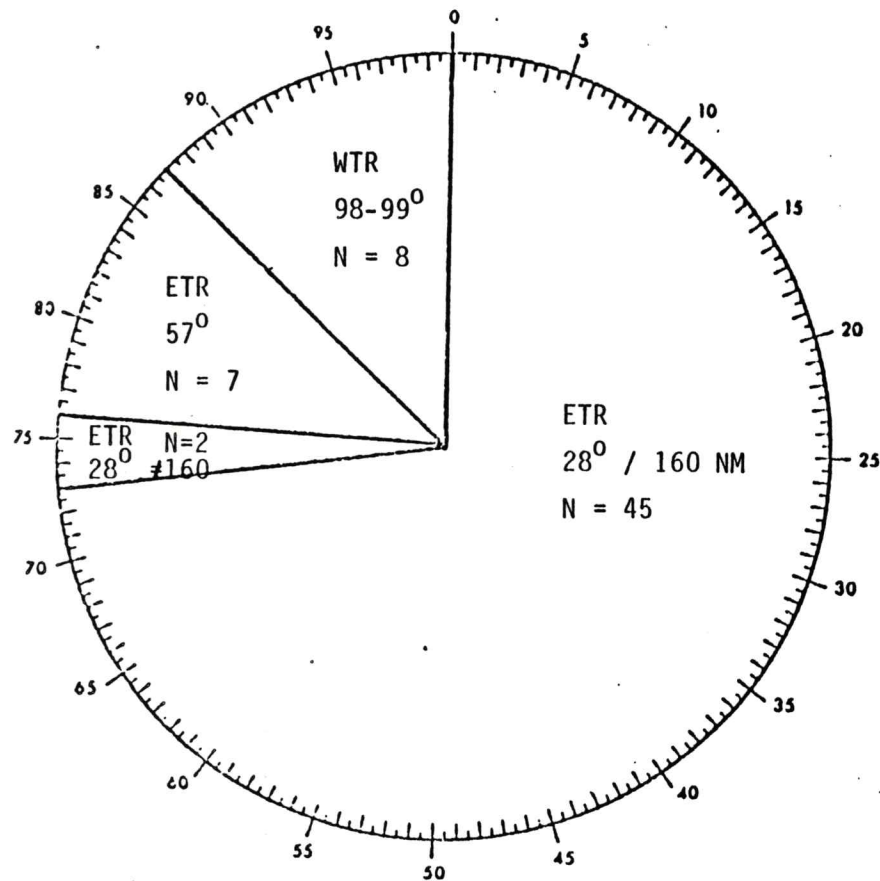
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DRIVERS TO ASCENT/ABORT I-LOADS

I-LOADS DRIVER	FIRST STAGE	SECOND STAGE	OMS 1/2	RTLS	TAL	AOA	ATO	MASSES	OMS/RCS DUMPS	POWER LEVEL
ORBITER	X			X				X		X
PAYLOAD				X				X	X	X
LOADS CONSTRAINTS	X			X				X		X
SEASON	X			X						
INCLINATION		X	X	X	X	X	X			X
PERFORMANCE	X									X
STANDARD VERSUS DIRECT INSERTION		X	X			X	X			
ORBIT ALTITUDE			X			X				
MASS PROPERTIES				X				X	X	
OMS/RCS LOADS									X	
ABORT SITES				X	X	X	X			

MANIFEST SUMMARY FOR 61-H (STS-37) THROUGH 91-T (STS-101) (JUNE 1986 THROUGH SEPTEMBER 1989)

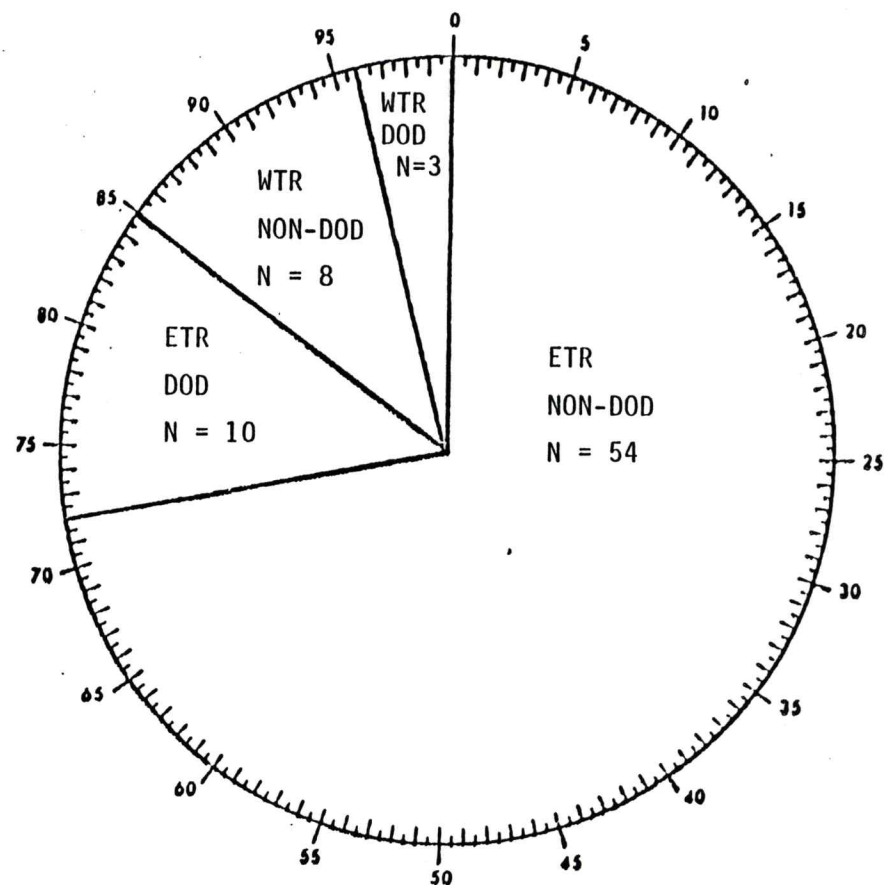
NON-DOD



N TOTAL = 62

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TOTAL



N TOTAL = 75

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FIRST STAGE STANDARD I-LOADS SETS - ETR

DESIGN CONSTRAINT				SUMMER MAY 15-OCT 15		TRANSITION APR, MAY, OCT, NOV		WINTER NOV 15-APR 15	
ORB	INCL.	QBAR	Q·α						
099,102	28°	TPS790	-2900	1S	41-D.1	1T	41-C.2,*	1W	41-B.3,*
099,102	57°	TPS790	-2900	2S	41-G.1	2T	41-A.3,*	2W	CNR
103	28°	660	-3500	3S	41-D.2,*	3T	CNR	3W	51-A.2,*
103	57°	660	-3500	4S	COMPLETE	4T	CNR	4W	41-G.2,*
099	28°	FL BUF 819	-3500	5S	51-L	5T	CNR	5W	51-E.1
099	49°	FL BUF 819	-3500	6S	51-F.2	6T	51-F.1	6W	CNR
099	57°	FL BUF 819	-3500	7S	CNR	7T	CNR	7W	CNR
102	28°	FL/DTO TPS 790	-3400	8S	51-I-DTO	8T	CNR	8W	TBS FOR 61-C.1
102	57°	FL/DTO TPS 790	-3500	9S	CNR	9T	TBS FOR 61-A.2	9W	CNR
099,102 103,104	28°	819	-3000	10S	TBS	10T	TBS	10W	TBS
099,102 103,104	57°	819	-3000	11S	TBS	11T	TBS	11W	TBS

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* - I-LOAD ACTUALLY FLOWN
CNR - CURRENTLY NOT REQUIRED

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NOMINAL OMS - 1/2 STANDARD I-LOAD SETS - ETR

#	NOMINAL MECO	ALTITUDE (N.MI.)		
		I = 28.5°	I = 49.5°	I = 57.0°
1	STANDARD	130.0		
2	STANDARD	153.5		
3	STANDARD	160.0		
4	STANDARD	165.0		
5	STANDARD			135.0
6	STANDARD			175.0
7	STANDARD			190.0
8	DIRECT INS.		186.0	
9	DIRECT INS.	190.0		
10	DIRECT INS.	250.0		

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PRTLs STANDARD I-LOAD SETS - ETR (KSC LANDING, 28.5° - 57°)

#	WEIGHT	ET SEP GRTLs TARGETS		PRTLs I-LOADS		
		RV	ALTITUDE (Q = 7.5 PSF)	RV @ PPD, MECO	ALTITUDE @ PPD	FUEL DISSIPATION
1	LIGHT <244 K	"DE FACTO" STD	SEASONAL	A/R	A/R	STD
2	HEAVY >244 K	"DE FACTO" STD	SEASONAL	A/R	A/R	STD
3	LIGHT 200-220 K	STD	SEASONAL	A/R*	A/R*	STD
4	HEAVY 220-245 K	STD	SEASONAL	A/R*	A/R*	STD
5	SUPER HEAVY 245-251 K	STD	SEASONAL	A/R*	A/R*	STD

A/R - ADJUSTMENTS REQUIRED FOR EACH MISSION DUE TO "OPEN-LOOP" POWERED PITCHDOWN

* - PARAMETRIC ANALYSIS REQUIRED PRIOR TO FINAL DEVELOPMENT OF STANDARD I-LOAD SETS. COMPLETION DATE TBD

TAL STANDARD I-LOAD SETS - ETR

#	INCLINATION	LANDING SITE		
		DAKAR	MORON	ZARAGOZA
1	28.5°	X,*	X,*	N/A
2	49.5°	N/A	X	X
3	57°	N/A	X,*	X,*

X - I-LOAD COMPLETE

* - I-LOAD ACTUALLY FLOWN

N/A - NOT APPLICABLE DUE TO CROSSRANGE LIMITATIONS

AOA/ATO STANDARD I-LOAD SETS - ETR

#	INCLINATION	NOMINAL MECO	ORBIT ALTITUDE (N.MI.)	LANDING SITE		
				EDWARDS	NORTHROP	KSC
1	28°	STANDARD	120-150	TBS	TBS	TBS
2	28°	STANDARD	150-200	X	X	X
3	28°	DIRECT INS.	150-250	X	X	X
4	28°	DIRECT INS.	250-350	TBS	TBS	TBS
5	49°	DIRECT INS.	100-200	N/A	X	X
6	57°	STANDARD	120-150	N/A	X	N/A
7	57°	STANDARD	150-200	N/A	X	N/A
8	57°	DIRECT INS.	100-200	N/A	TBS	N/A

X - I-LOAD COMPLETE

N/A - NOT APPLICABLE DUE TO CROSSRANGE LIMITATIONS

I-LOAD STANDARDIZATION STATUS

- SIGNIFICANT NUMBER OF POWERED FLIGHT STANDARD I-LOAD SETS HAVE BEEN DEVELOPED (1ST STAGE, NOMINAL OMS-1/2, PRTLs, TAL, AOA, ATO).
- REMAINING DEVELOPMENT WORK INCLUDES:
 - FIRST STAGE SEASONAL DESIGNS FOR "OPS"
 - ANALYSIS TO STANDARDIZE RTLS PPD I-LOADS
 - UNIQUE MISSIONS (ALTITUDE, INCLINATION) NOT IN THE INVENTORY
 - WTR
- AVAILABILITY OF STANDARD I-LOAD OCCURRENCES IS THE KEY TO RESPONSIVENESS IN SUPPORTING NEAR-TERM MANIFEST CHANGES.

FIRST STAGE STANDARDIZATION ISSUES

- FIRST STAGE DTO'S PLANNED ON INSTRUMENTED OV-102 REQUIRE UNIQUE I-LOADS.
 - FLUTTER BUFFET DTO PLANNED ON 61A AND 61C TO CLEAR MACH 1.0-1.4 CONSTRAINT.
 - NEW I-LOADS UNDER DEVELOPMENT BY MPAD TO SUPPORT 61A.2 AND 61C.1
 - AERO WING LOADS DTO UNDER CONSIDERATION FOR 61E AND 61H TO INCREASE THE ANGLE-OF-ATTACK RANGE FOR VERIFICATION OF PRESSURE DISTRIBUTIONS USED TO COMPUTE IVBC-3 LOADS CYCLE 6 INTERNAL STRESSES.
 - NEW I-LOADS WOULD BE REQUIRED WITH LOW Q, MORE POSITIVE QxALPHA.
- RESULTS OF OV-103/104 ORBITER CAPABILITY ASSESSMENT (OCA) WITH WING MODS WERE JUST REPORTED 4/23/85. ASCENT SHAPING CRITERIA FOR WTR (690 Q, -3500 QxALPHA) RESULTS IN 400 LB PERFORMANCE HIT TO MAINTAIN 85% LAUNCH PROBABILITY.
 - ET PROTUBERANCE LOADS AT -4000 QxALPHA ARE A CONCERN.
- ORBITER OFFICE CONCERNS WITH HIGH Q DESIGN CRITERIA USED ON 51F, 51I, AND SUBS PRODUCING UNACCEPTABLE VENTING/BULKHEAD LOADS.
 - ORBITER RECOMMENDS SHAPING TO 690 PSF MAX Q (2000-4000 LB ETR PAYLOAD HIT).

FIRST STAGE STANDARDIZATION ISSUES (CONTINUED)

- RESULTS OF IVBC-3 LOADS/STRESS ANALYSES FOR ALL VEHICLE ELEMENTS MAY IMPACT SHAPING CRITERIA IN MID 1986. PURPOSE OF CURRENT IVBC-3 IS TO RE-CERTIFY THE VEHICLE TO CURRENT ENVIRONMENTS AND TO DEFINE FACTORS OF SAFETY.
- OV-102 IS LIMITED TO TPS 790 Q BECAUSE OF UNDENSIFIED TILES.
 - TILE REPLACEMENT PLANS TO OBTAIN 819 Q ARE TBD.
 - OV-102 WILL CONTINUE TO REQUIRE UNIQUE I-LOAD SETS.
- DEPENDENCY ON AFSIG, SIR, AND PRCB COMMUNITY FOR FIRST STAGE DESIGN CRITERIA THAT CONTINUALLY EVOLVES.

OFF PRODUCTION

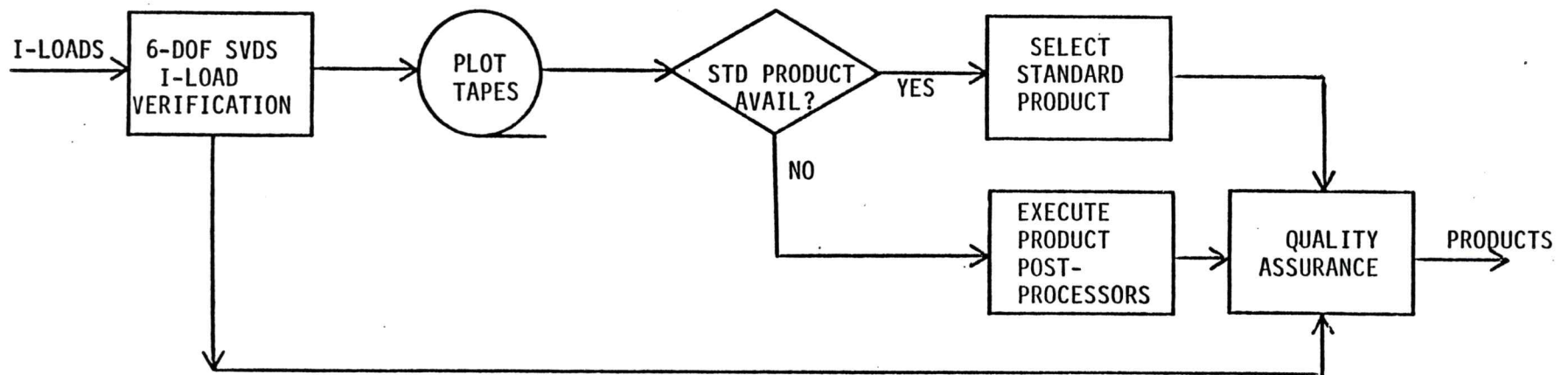
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OFF PRODUCTION PROCESS

- DM PRODUCT SCHEDULES DEFINE 33 NOMINAL PRODUCTS AND 36 ABORT PRODUCTS, MOST OF WHICH ARE REQUIRED FOR EACH DESIGN CYCLE.
- MANY PRODUCTS ARE GENERATED WITH POST-PROCESSORS THAT USE I-LOAD VERIFICATION PLOT TAPES AS INPUT.



- OTHER "COMPLEX" PRODUCTS REQUIRE MULTIPLE SIMULATIONS WITH TRAJECTORY RESULTS COMPARED AGAINST CONSTRAINT VALUES.

EXAMPLE OF ASCENT PRODUCT SCHEDULES FOR STS-51L

MEMBER NAME STS51L

51-L(31)

PAYLOADS: HS376, REFLT/PAM-D, TDRS-D/IUS
FSW: 017
FLIGHT DESIGN MANAGER:
VEHICLE: OV-104

EOM: KSC
DURA: 4 DAYS
RNDZ: NO
RMS: NO

WORK STATION ID	KEY MILESTONE PRODUCTS FOR 11/27/85 LAUNCH	LNCH MINS DAYS	SCHEDULE COMPLETION DATE MM/DD/YY	C / D / 1 / 2	C / D / 1 / 2	ACTUAL COMPLETION DATE MM/DD/YY	# OF CP	RESPONSIBLE PERSON	ORG
ASAB104	AOA S/V AT EI (I-LOAD VERIFICATION)	5H	201	05/09/85	16K/- 28		2	MCADAMS	DM32
ASAB106	ONBOARD DISPLAY INPUTS-ASCENT ABORT	5H	187	05/23/85	13K/ 0		3	R. DAVIS	DM32
ASAB143	RTLS ET SEP COND. FOR DM5 VERIF.	5H	187	05/23/85	13K/ 0		2	R. DAVIS	DM32
ASAB144	TAL ET SEP COND. FOR DM5 VERIF.	5H	187	05/23/85	13K/ 0		2	R. DAVIS	DM32
ASAB145	TAL WX ET SEP COND. FOR DM5 VERIF.	5H	187	05/23/85	13K/ 0		2	R. DAVIS	DM32
ASAB147	DISPLAY I-LOAD CR	5H	180	05/30/85	42K/ 0		3	R. DAVIS	DM32
ASAB108	FLIGHT DESIGN I-LOAD REVIEW -ASAB	5T	175	06/04/85	16K/ 2		0	R. DAVIS	DM32
ASAB109	I-LOAD CR APPROVAL	5H	173	06/06/85	16K/ 0		0	R. DAVIS	DM32
ASAB107	ATO S/V FOR DEORBIT TGT GENERATION	5H	159	06/20/85	16K/+ 14		2	R. DAVIS	DM32
ASAB110	PRIME AOA S/V FOR FDF PRE-BANK TDL	5H	145	07/05/85	16K/+ 28		2	R. DAVIS	DM32
ASAB134	OMS TARGET TABLE FOR AOA PRIME	5H	145	07/05/85	16K/+ 28		4	R. DAVIS	DM32
ASAB139	AOA S/V AT EI FOR 1ST WX - DM5 VERIF.	5H	145	07/05/85	16K/+ 28		2	R. DAVIS	DM32

EXAMPLE (CONTINUED)

ASAB126	ARD LAUNCH HOLD TABLE	5H	145	07/05/85	16K/+ 28		2	NORBRATEN	DM32
ASAB127	RTLS HDOT LIMIT AT SRB SEP	5H	145	07/05/85	16K/+ 28		3	R. DAVIS	DM32
ASAB140	AOA S/V AT EI FOR 2ND WX - DM5 VERIF.	5H	131	07/18/85	16K/+ 42		2	R. DAVIS	DM32
ASAB121	WX ALT AOA S/V FOR FDF PRE-BANK TBL	5H	124	07/25/85	13K/+ 63		2	R. DAVIS	DM32
ASAB136	FDF-OMS CREW CHART FOR 2ND WX AOA	5T	119	07/30/85	41K/- 42		4	R. DAVIS	DM32
ASAB117	FDF-RTLS PITCH AROUND	5T	119	07/30/85	41K/- 42		3	R. DAVIS	DM32
ASAB118	FDF-PRIME AOA & ATO	5T	119	07/30/85	41K/- 42		2	R. DAVIS	DM32
ASAB122	FDF-EARLY AOA TO 1ST WX ALT SITE	5T	119	07/30/85	41K/- 42		3	R. DAVIS	DM32
ASAB133	FDF-EARLY AOA TO 2ND WX SITE	5T	119	07/30/85	41K/- 42		2	R. DAVIS	DM32
ASAB135	FDF-OMS CREW CHART FOR 1ST WX AOA	5T	119	07/30/85	41K/- 42		4	R. DAVIS	DM32
ASAB123	FDF-FINAL ASC. MODE BOUNDARY VELOCITIES	5T	119	07/30/85	41K/- 42		3	R. DAVIS	DM32
ASAB120	FDF-OMS CREW CHART TO PRIME	5T	119	07/30/85	41K/- 42		2	R. DAVIS	DM32
ASAB141	FDF-OMS TGT TABLE FOR AOA TO 1ST WX ALT	5H	117	08/01/85	16K/+ 56		2	R. DAVIS	DM32
ASAB142	FDF-OMS TGT TABLE FOR AOA TO 2ND WX ALT	5H	117	08/01/85	16K/+ 56		2	R. DAVIS	DM32
ASAB130	FDF-OMS TGT TABLE FOR PRIME AOA	5T	91	08/27/85	26K/- 21		0	FLT INT	DM
ASAB111	PRIME AOA EI-5 COND. FOR DM54D-TAPE	5F	67	09/20/85	98K/ 67		2	R. DAVIS	DM32
ASAB137	RTLS ET SEP COND. - DM5 D-TAPE	5F	67	09/20/85	99K/ 67		2	R. DAVIS	DM32
ASAB138	EARLY TAL OPS-3 COND. - DM5 D-TAPE	5F	67	09/20/85	99K/ 67		2	R. DAVIS	DM32
ASAB113	D-TAPE & UG FOR E.O. AT L/O RTLS	5M	51	10/07/85	98K/ 51		3	R. DAVIS	DM32
ASAB114	D-TAPE AND UG FOR EARLIEST AOA	5M	51	10/07/85	98K/ 51		2	R. DAVIS	DM32
ASAB115	D-TAPE AND UG FOR EARLIEST TAL	5M	51	10/07/85	98K/ 51		3	R. DAVIS	DM32
ASAB129	I-LOAD AUDIT	5T	35	10/22/85	35K/ 14		0	FLT INT	DM
ASAB128	FDF-RTLS STUCK THROTTLE PERF.	5F	33	10/25/85	99K/- 33		3	R. DAVIS	DM32
ASAB125	ARD BIAS TABLE	5F	+ 28	01/27/ 1	96K/+ 28		3	NORBRATEN	DM32
ASCT132	FOP INPUTS - ASCENT	5H	264	03/07/85	04K/ 7		0	MCADAMS	DM32
ASCT133	SODS - ASCENT SHAPING	5H	250	03/21/85	05K/ 0		0	MCADAMS	DM32
ASCT106	NOMINAL OMS DELTA V'S & STATE VECTOR	5H	215	04/25/85	05K/+ 35		4	MCADAMS	DM32
ASCT108	SPF MATH MODEL DATA ASCENT	5F	205	05/03/85	16K/ 32	03/11/85	3	MCADAMS	DM32

EXAMPLE (CONCLUDED)

ASCT109	I-LOAD CR-NOM ASC & 1ST STAGE E.O.	5H	187	05/23/85	13K/ 0		4	MCADAMS	DM32
ASCT110	SPF COLDSTART DATA - ASCENT	5H	187	05/23/85	14K/ 7		1	MCADAMS	DM32
ASCT111	ONBOARD DISPLAY INPUTS-NOM. ASCENT	5H	187	05/23/85	13K/ 0		2	MCADAMS	DM32
ASCT112	FLIGHT DESIGN I-LOAD REVIEW - INPUTS	5H	180	05/30/85	16K/ 7		0	MCADAMS	DM32
ASCT145	DISPLAY I-LOAD CAR	5H	180	05/30/85	42K/ 0		0	MCADAMS	DM32
ASCT113	I-LOAD CR APPROVAL	5H	173	06/06/85	16K/ 0		0	MCADAMS	DM32
ASCT114	SPF ANAL. DATA (A THRU E)	5H	159	06/20/85	16K/+ 14		2	MCADAMS	DM32
ASCT116	6-DOF TAPES FOR APU/HYD. CONSUM. ANAL.	5H	159	06/20/85	16K/+ 14		2	MCADAMS	DM32
ASCT115	MCC DISPLAY INPUTS (MSK FORM REQ)	5H	145	07/05/85	17K/ 4		3	NORBRATEN	DM32
ASCT122	MCC TRAJ INPUTS-ASCENT (SP & MEDCV)	5M	127	07/22/85	24K/ 7		2	NORBRATEN	DM32
ASCT121	MCC DISPLAYS WITH TRAJ INPUTS	5M	120	07/29/85	24K/ 0		3	NORBRATEN	DM32
ASCT117	NOMINAL ASCENT DATA (A THRU E)	5T	119	07/30/85	41K/- 42		7	MCADAMS	DM32
ASCT120	COMM. COVERAGE-ASCENT	5T	119	07/30/85	41K/- 42		5	MCADAMS	DM32
ASCT118	D-TAPE AND UG FOR NOM. ASCENT	5F	53	10/04/85	99K/ 53		3	MCADAMS	DM32
ASCT123	SONIC BOOM FOOTPRINT - ASCENT	5H	47	10/10/85	30K/+ 14		2	MCADAMS	DM32
ASCT136	NOMINAL ASCENT RANGE SAFETY TAPE	5F	38	10/18/85	98K/- 38		3	MCADAMS	DM32
ASCT138	DISPERSED AND ABORT ASCENT RS TAPE	5F	38	10/18/85	98K/- 38		3	MCADAMS	DM32
ASCT139	SRB RANGE SAFETY TAPE	5F	38	05/20/85	98K/- 38		3	MCADAMS	DM32
ASCT140	ET RANGE SAFETY TAPE	5F	38	05/20/85	98K/- 38		3	MCADAMS	DM32
ASCT141	RANGE SAFETY DOC.	5F	38	05/20/85	98K/- 38		3	MCADAMS	DM32
ASCT131	FRR PRESENTATION INPUTS - ASCENT	5T	35	10/22/85	35K/- 14		0	MCADAMS	DM32
ASCT134	FLT READINESS STATEMENT	5T	35	10/22/85	35K/- 14		0	FLT INT	DM
ASCT135	I-LOAD AUDIT	5T	35	10/22/85	35K/ 14		0	FLT INT	DM
ASCT128	R-20 DATA PACKAGE (A THRU D)	5F	33	10/25/85	99K/- 33		2	MCADAMS	DM32
ASCT129	NOMINAL DATA FOR MSFC	5W	28	10/30/85	99K/ 28		2	MCADAMS	DM32
ASCT143	CG HISTORY FOR TRW BET	5W	28	05/20/85	98K/ 28		2	MCADAMS	DM32
ASCT130	PAO DATA (A THRU C)	5W	28	10/30/85	98K/ 28		2	MCADAMS	DM32
ASCT142	COLLISION AVOIDANCE DATA	5T	15	05/20/85	98K/ 15		3	MCADAMS	DM32
ASCT144	SMS DATA PACK INPUT	5W	7	05/20/85	98K/ 7		1	MCADAMS	DM32

PRODUCT DESCRIPTION

<u>MAJOR CATEGORY</u>	<u>DESTINATION</u>	<u>SPECIFIC PRODUCTS</u>	
* 1. I-LOAD CR	SSD	A. ASCENT/ABORT CR B. ONBOARD DISPLAY CR	C. AUDIT
2. SPF DATA	SSD	A. MATH MODEL DATA B. ANALYSIS DATA	
3. SMS DATA PACK	DG, FSD		
* 4. FLIGHT DATA FILE	FDDD	A. COMM COVERAGE B. NOMINAL DATA C. RTLS DATA	D. AOA/ATO DATA E. MODE BOUNDARY VELOCITIES F. OMS CREW CHARTS
* 5. MCC DATA	GDSD	A. MCC DISPLAYS B. ARD/AME TRAJECTORY DATA	
6. TRAJECTORY DTAPES	GDSD, MSFC, GSFC, KSC	A. NOMINAL B. RTLS	C. TAL D. AOA
* 7. RANGE SAFETY DATA	KSC/PAFB	A. SONIC BOOM DATA B. RANGE SAFETY TAPE C. VELOCITY TURN DATA D. COLLISION AVOIDANCE DATA	E. SRB RANGE SAFETY TAPE F. ET RANGE SAFETY TAPE G. RANGE SAFETY DOCUMENT
* MAJOR PRODUCT W.R.T. RESOURCES			

PRODUCT DESCRIPTION (CONT'D)

<u>MAJOR CATEGORY</u>	<u>DESTINATION</u>	<u>SPECIFIC PRODUCTS</u>
8. PAO DATA	PAO	A. NOMINAL DATA
9. CG DATA FOR BET	TRW	A. NOMINAL DATA
10. MSFC TRAJECTORY DATA	MSFC	A. NOMINAL DATA
* 11. MCC CONSOLE DATA	FDDD	A. OMS TARGET TABLE B. ARD LAUNCH HOLD TABLE C. ARD BIAS TABLE D. RTLS HDOT LIMIT E. RTLS STUCK THROTTLE
12. PRESENTATIONS	MISC.	A. FOP B. OASCB C. FLT DESIGN I-LOAD REVIEW D. FRR
13. SPACECOM DATA	HQ SPACE	A. NOMINAL DATA

* MAJOR PRODUCT W.R.T. RESOURCES

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CORPORATION

TRANSITION OF PRODUCTION TO PARATECHNICALS

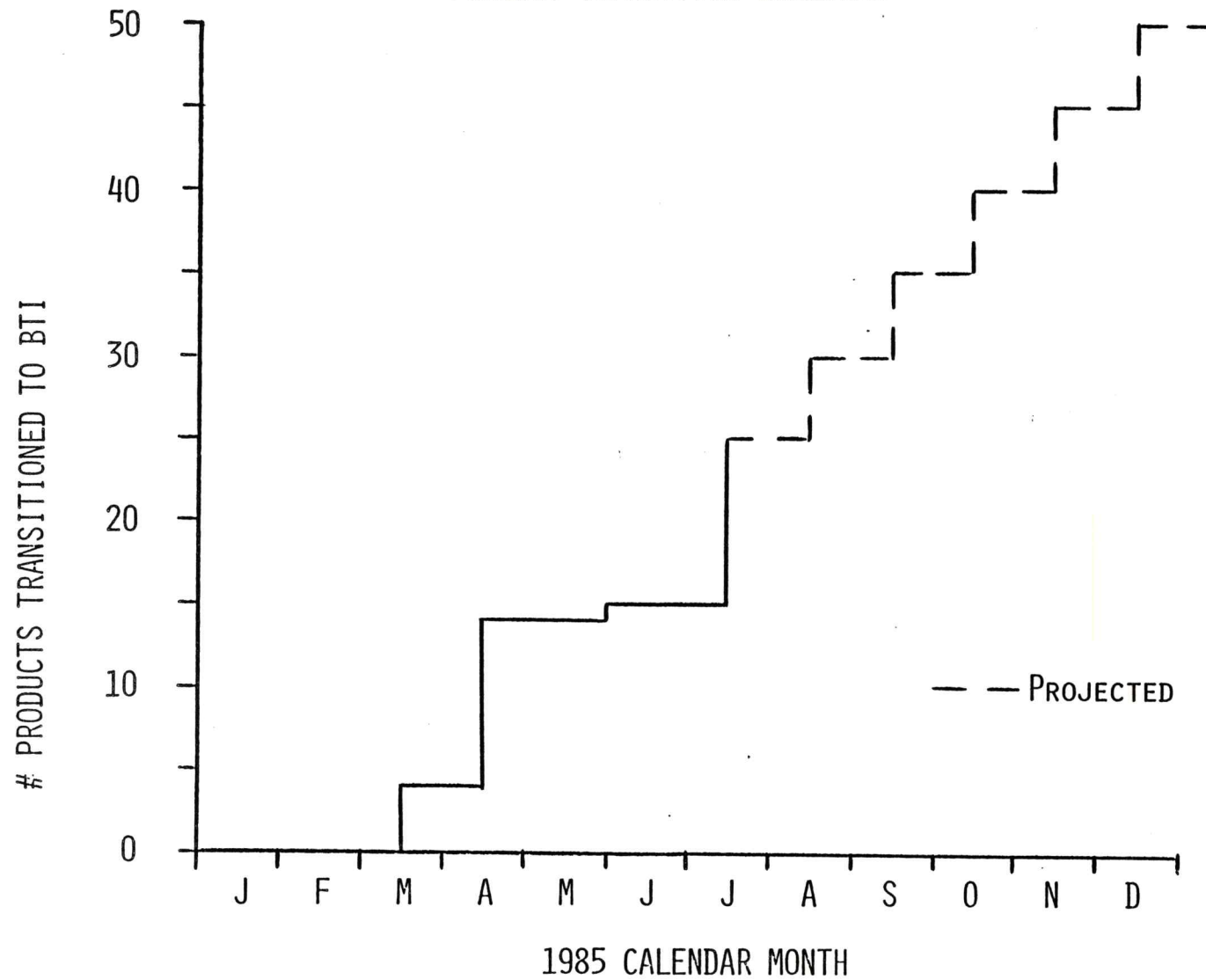
● TRANSITION OF PRODUCTS TO PARATECHNICALS IS UNDERWAY THROUGH:

- MDTSCO IN-HOUSE TRAINING OF BARRIOS PARATECHNICALS ON INPUTS, OUTPUTS, AND THE PROCESSES
- BTI DEVELOPMENT OF PRODUCTION PROCEDURES TO BE USED BY PARATECHNICALS FOR EACH PRODUCT
- DEFINITION OF AN ICD FOR EACH PRODUCT THAT DEFINES SPECIFICATIONS FOR INPUTS, OUTPUTS, QUALITY ASSURANCE, DATA CONTROL, AND CHANGE CONTROL.

● TRANSITION SCHEDULE PROJECTS 50 OF 69 PRODUCTS TRANSFERRED TO PARATECHNICAL RESPONSIBILITY BY DEC. 1985.

- 19 ARE RESPONSIBILITY OF ANALYSIS GROUP SINCE THEY ARE PART OF THE OFP I-LOAD DESIGN PHASE, THE SOFTWARE VERIFICATION PHASE, OR THE FLIGHT SUPPORT PHASE.
- ALMOST ALL OF THE 19 ARE FUTURE CANDIDATES FOR BARRIOS PRODUCTION AFTER COMPLETION OF FUTURE STREAMLINING/AUTOMATION IMPROVEMENTS.

PRODUCT TRANSITION SCHEDULE



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SOFTWARE VERIFICATION

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SAIL/SPF ASCENT SOFTWARE VERIFICATION

- SPF HAS REPLACED SAIL AS PRIME SOFTWARE AND I-LOAD RECONFIGURATION FACILITY.
 - SAIL IS UTILIZED ONLY FOR VERIFICATION OF NEW SOFTWARE OR CAPABILITIES THAT REQUIRE HARDWARE INTERFACES
- MISSIONS ARE CATEGORIZED BY COMPLEXITY OF VERIFICATION
 - STANDARD (DM3)
 - SECURE (DM3)
 - NEW CAPABILITY OR OI (DM3, FM4)

<u>VERIFICATION ACTIVITY</u>	<u>STANDARD</u>	<u>SECURE</u>	<u>NEW OI</u>
● TEST PROCEDURE REVIEW, RUN MATRIX DEFINITION			✓
● TEST CASE ANALYSIS SPF/SVDS COMPARISON	✓	✓	✓
SAIL/SVDS COMPARISON			✓
● I-LOAD AUDIT	✓	✓	✓
● FRR PRESENTATION	✓	✓	✓
● DOCUMENTATION	✓		✓

FLIGHT SUPPORT

MDTSCO-HOUSTON

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FLIGHT SUPPORT

● FLIGHT TECHNIQUES

FLIGHT RULES , CONTINGENCY ABORT ANALYSES
FLIGHT DATA FILE
MCC PROCEDURES

● ASCENT PERFORMANCE

FRR
WEEKLY ASCENT PERFORMANCE COMPARISONS (DM3, RI, ET,
MSFC)

● DAY-OF-LAUNCH (DOL) SUPPORT

WINDS DATA
6-DOF SVDS TRAJECTORY - PERFORMANCE GO/NOGO
LOADS PROGRAM - LOADS GO/NOGO (SMD TRANSITION TO DM3)
LSEAT, MISSION MANAGEMENT TEAM REVIEW
DOL I-LOAD UPDATE (UNDER DEVELOPMENT)

● FIDO/TRAJECTORY SUPPORT

ABORT SITE SELECTIONS
ARD
AME
OMS TARGETING
RANGE SAFETY - ET IMPACT

● GUIDANCE SUPPORT

RENDEZVOUS LAUNCH TARGETING
GUIDANCE PERFORMANCE
ONBOARD NAVIGATION (ONAV)

● PROCEDURES (FAO) SUPPORT

INTACT/CONTINGENCY ABORT PROCEDURES

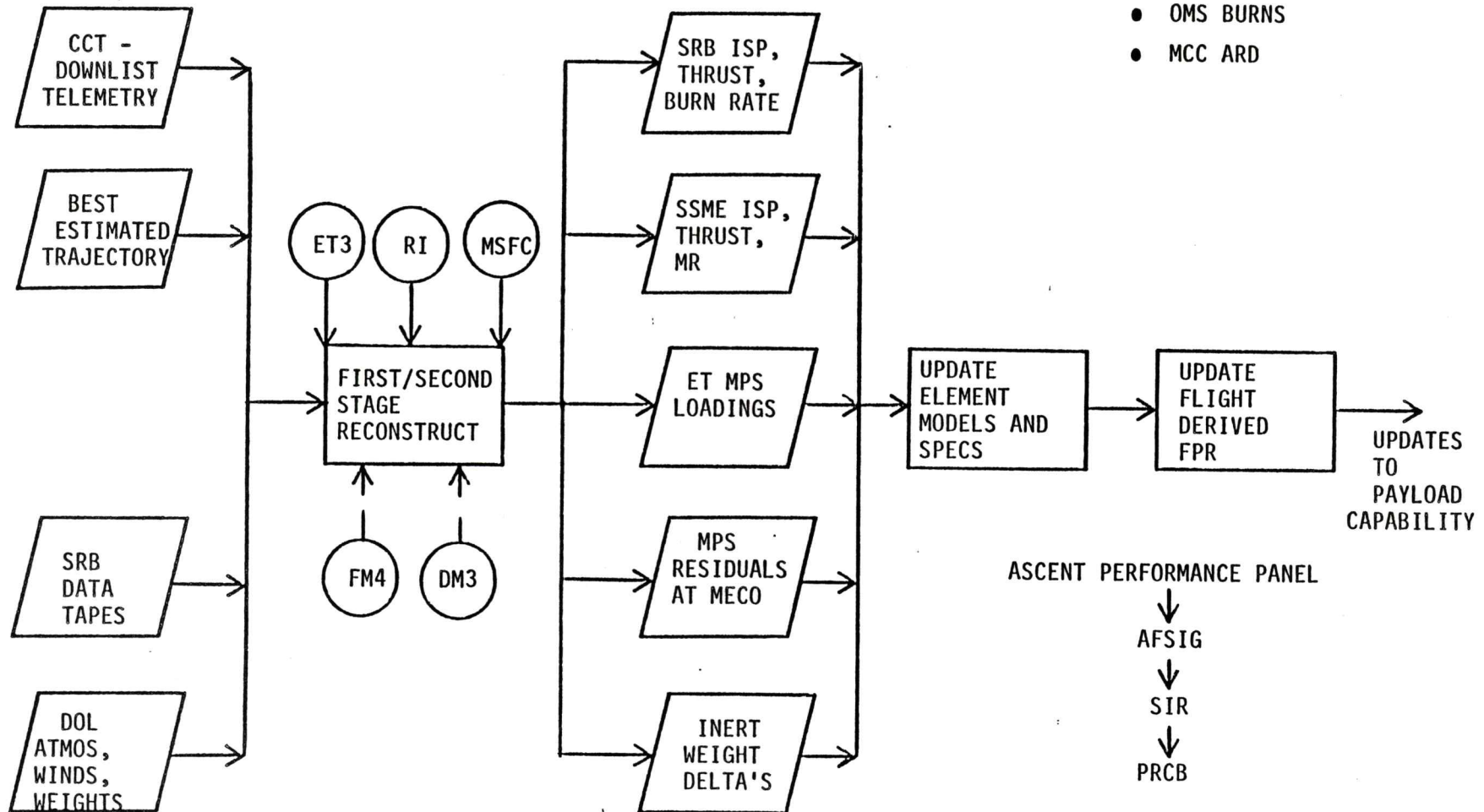
POST-FLIGHT ANALYSIS

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POST - FLIGHT ANALYSIS



OTHER POSTFLIGHT:

- OMS BURNS
- MCC ARD

ASCENT PERFORMANCE PANEL

↓
AFSIG
↓
SIR
↓
PRCB

INTERFACES

MDTSCO-HOUSTON

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FORUMS SUPPORTED BY ASCENT FLIGHT DESIGN

1. PRCB - PROGRAM REVIEW CONTROL BOARD
2. MICB - MISSION INTEGRATION CONTROL BOARD
3. SIR - SYSTEMS INTEGRATION REVIEW
4. AFSIG - ASCENT FLIGHT SYSTEMS INTEGRATION GROUP
5. LSEAT - LAUNCH SYSTEMS EVALUATION ADVISORY TEAM
6. ASCENT PERFORMANCE PANEL
7. CIR - CARGO INTEGRATION REVIEW
8. FOP - FLIGHT OPERATIONS PANEL
9. WEEKLY ASCENT PERFORMANCE REVIEW
10. FLIGHT DESIGN I-LOAD REVIEW
11. OASCB - ORBITER AVIONICS SOFTWARE CONTROL BOARD
12. FLIGHT TECHNIQUES
13. RANGE SAFETY PANEL
14. GUIDANCE MODE TEAM
15. ABORT PANEL
16. FLIGHT RULES REVIEW
17. BRR - BASELINE REQUIREMENTS REVIEW



DOCUMENTATION SUPPORTED BY ASCENT FLIGHT DESIGN

1. PRCBD
2. PCIN
3. PIP
4. FDRD
5. FRD
6. FRD APPENDIX A, LEVEL A GROUND RULES AND CONSTRAINTS
7. OFP CONCEPTUAL FLIGHT PROFILE
8. OFP PROFILE SUMMARY
9. SODB
10. SODS
11. STS OPERATIONAL FLIGHT DESIGN STANDARD GROUND RULES AND CONSTRAINTS, LEVEL B
12. I-LOADS REQUIREMENT DOCUMENT (ILRD) VOLUMES I, II, III
13. FLIGHT SOFTWARE CHANGE REQUESTS (CR'S)
14. BASELINE ACCOUNTING REPORTING SYSTEM (BARS)
15. FLIGHT RULES
16. SHUTTLE SYSTEMS WEIGHT AND PERFORMANCE ("GREENBOOK")
17. LEVEL II PROGRAM DEFINITION AND REQUIREMENTS, VOLUME X, SPACE SHUTTLE FLIGHT AND GROUND SYSTEM SPECIFICATION
18. LEVEL II PROGRAM DEFINITION AND REQUIREMENTS VOLUME XIV, SPACE SHUTTLE SYSTEM PAYLOAD ACCOMMODATIONS

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SCHEDULES

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SCHEDULES

- DM OFP PRODUCT SCHEDULE DEFINES ALL DUE DATES
 - SYSTEM RESPONDS TOO SLOWLY TO FREQUENT CHANGES DRIVEN BY MANIFEST CHANGES
- EACH DESIGN CYCLE IS OFTEN A UNIQUE PROCESS DUE TO LATE INPUT DATA AND G & C CHANGES DURING THE FLIGHT DESIGN PROCESS
 - THIS IS PARTICULARLY CRITICAL DURING CYCLE 2 + SUBS UPDATES
- PROPOSED DEC. 85 TEMPLATES CAN BE SUPPORTED THROUGH
 - STANDARD I-LOAD ENVIRONMENT WITH EXPECTED CHANGES AT G & C BASELINE
 - FRONT-END COMPLETION OF COMPLEX OR UNIQUE I-LOADS PRIOR TO G & C BASELINE

L - WEEKS

PROPOSED 12/85 TEMPLATE																																																																																																				
PROGRAM MILESTONES																																																																																																				
SODS'S																																																																																																				
PROPOSED AFSIG'S																																																																																																				
ASCENT I-LOAD DESIGN																																																																																																				

- MDTSCO-HOUSTON**

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PROBLEM AREAS

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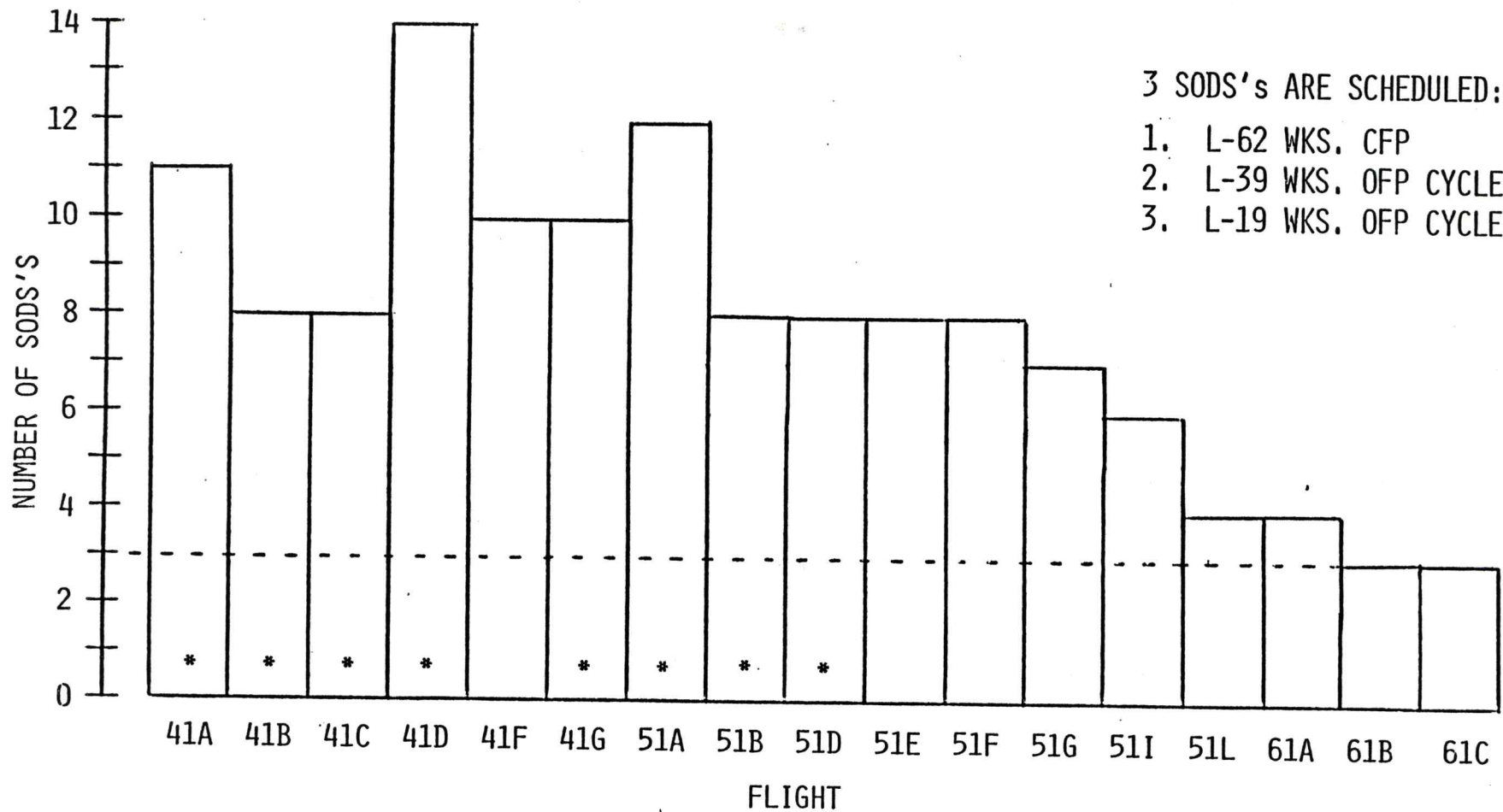
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PROBLEM AREAS

- INCOMPLETE AND/OR LATE INPUT DATA AT START OF CYCLE - ESPECIALLY SODS'S AND GROUND RULES AND CONSTRAINTS.
- SODS UPDATES DURING THE I-LOAD DESIGN AND PRODUCTION PHASES.
- MANIFEST CHANGES AFTER CYCLE 2 WORK FLOW IS WELL UNDERWAY.
- SCHEDULING SYSTEM CANNOT KEEP UP WITH NUMBER OF CHANGES FOR APPROVED AND UNAPPROVED MANIFEST OPTIONS.
- PRODUCTIVITY AND QUALITY IMPROVEMENT ARE IMPEDED BY MANUAL HANDLING OF THOUSANDS OF DATA INPUTS AND OUTPUTS.
- I-LOAD RECYCLES CAN BE DRIVEN BY NOGO ASSESSMENTS OF PERFORMANCE AND/OR LAUNCH PROBABILITY THAT CAN OCCUR ANYTIME DURING THE FLIGHT DESIGN TEMPLATE.
- STANDARD POLICY IS NEEDED FOR TRAINING REQUIREMENTS ASSOCIATED WITH MULTIPLE OFF CYCLES.

NUMBER OF DATA SUBMITTALS PER FLIGHT IS A MAJOR DRIVER



3 SODS's ARE SCHEDULED:

1. L-62 WKS. CFP
2. L-39 WKS. OFP CYCLE 1
3. L-19 WKS. OFP CYCLE 2

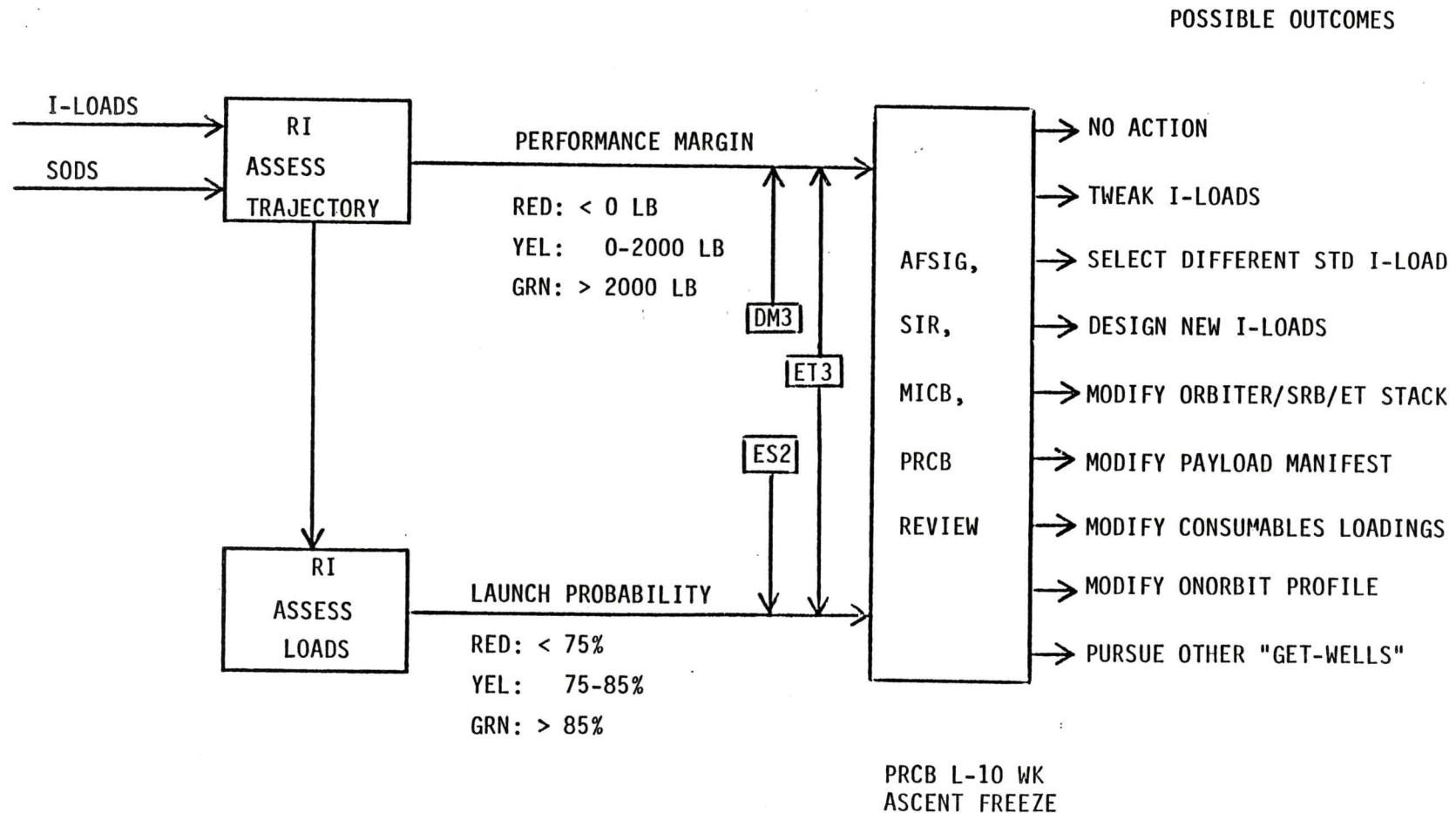
* FLOWN

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REVIEW CYCLE FOR ASCENT FIRST STAGE I-LOADS



PROBLEM AREAS (CONT'D)

● MANAGING IMPROVEMENTS

- IN ORDER TO FULLY REALIZE THE STS POTENTIAL, BETTER IMPROVEMENTS PLANNING IS NEEDED THAT SPANS ALL FACILITIES.
- WHERE, WHEN, AND HOW ARE FLIGHT PLANNING AND OPERATIONS TASKS BEST PERFORMED?

WHERE, HOW SHOULD THE
TASK BE PERFORMED ?

WHEN SHOULD THE TASK BE PERFORMED?
PRE-MISSION DAY-OF-LAUNCH REAL-TIME

● FLIGHT PLANNING

- | | | | |
|------------------------|---|---|--|
| ●● AUTOMATED VS MANUAL | X | X | |
| ●● COMPUTER HOST | X | X | |

● MCC

- | | | | |
|------------------------|--|---|--|
| ●● AUTOMATED VS MANUAL | | X | |
|------------------------|--|---|--|

● ONBOARD

- | | | | |
|------------------------|--|---|---|
| ●● AUTOMATED VS MANUAL | | X | X |
|------------------------|--|---|---|

SUMMARY

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WHAT'S AHEAD

● SOFTWARE CAPABILITY

- OI7 RTLS/TAL WEATHER ALTERNATES (5 SITES TOTAL) WITH IMPROVED PEG
- ADDITIONAL MPS/OMS/RCS DUMPS TO REDUCE RTLS, TAL LANDING WEIGHTS
- OI7 CENTAUR ABORT PROPELLANT DUMPING
- UPGRADED GPC'S

● PERFORMANCE CAPABILITY

- SRB FILAMENT WOUND CASE
- INCREASED SRB BURN RATE
- POSSIBLE FIRST STAGE ENHANCEMENTS - SSME/SRB PITCH PARALLEL, OPTIMUM ALPHA, HEAD'S UP ASCENT
- MPS FPR REDUCTIONS BASED ON FLIGHT EXPERIENCE
- FIRST STAGE "OPS" DESIGN CONSTRAINTS BASED ON OCA FOLLOW-ON LOADS, WING MODIFICATIONS, AND FLUTTER DTO

● WTR

- STANDARD I-LOAD AND TECHNIQUES DEVELOPMENT

WHAT'S AHEAD (CONT'D)

- OPERATIONAL CAPABILITY
 - TREND FROM STANDARD INSERTION TO DIRECT INSERTION
 - 3-STAGE OMS FPR
 - DAY-OF-LAUNCH I-LOAD UPDATE
 - ET TRACKING DTO TO RESOLVE ET RUPTURE MECHANISM
- OFP I-LOAD DESIGN
 - DEVELOPMENT OF STANDARD FIRST STAGE I-LOADS WITH FULL OPERATIONAL CAPABILITY
 - DEVELOPMENT OF STANDARD RTLS POWERED PITCHDOWN I-LOADS
 - AUTOMATED DATA INTERFACES BETWEEN I-LOAD DESIGN HOST AND SPF IMRB I-LOAD REPOSITORY
- OFP PRODUCTION
 - MORE PARATECHNICAL PRODUCTION CAPABILITY
 - CHANGE OF MANAGEMENT MENTALITY FROM R&D TO PRODUCTION
 - STREAMLINING OF FLIGHT DATA FILE PRODUCTS THROUGH CONSOLIDATION WITHIN DM

WHAT'S AHEAD (CONT'D)

- AUTOMATED DATA INTERFACES BETWEEN MCC DISPLAY AND TRAJECTORY DATA PROCESSORS AND SPF DATA ENTRY
- SOFTWARE TOOLS
 - TRANSPORTABLE SOFTWARE - ANSI FORTRAN WITH UNIX O.S.
 - DACS EVALUATION

FLIGHT DESIGN BRANCH
ORBIT DESIGN AND ANALYSIS PROCESS

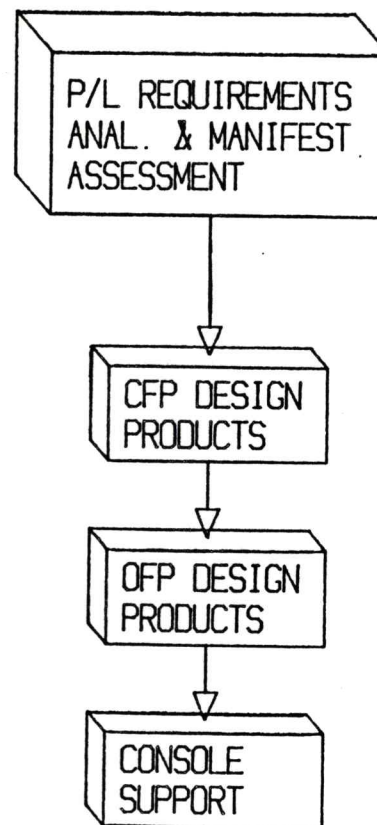
22 MAY 1985

J. L. ALLISON
MDTSCO/DM5
488-5660, X-242

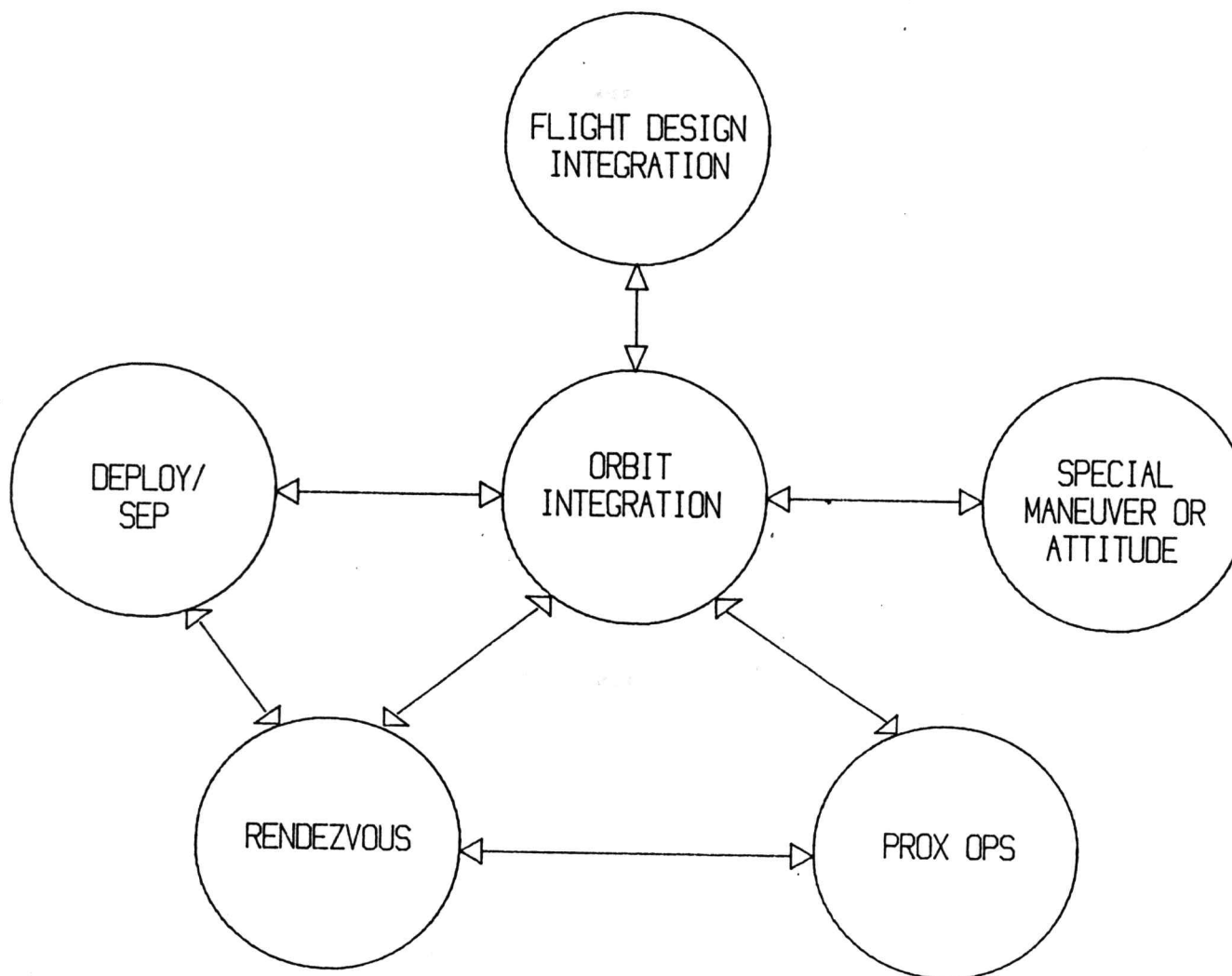
OUTLINE FOR ORBIT DESIGN AND ANALYSIS OVERVIEW

- o PROCESS OVERVIEW
- o STAFFING ALLOCATIONS
- o ORBIT DESIGN AND ANALYSIS
 - o END TO END (INTEGRATION)
 - o ATTITUDE AND POINTING FLIGHT DESIGN
 - o RENDEZVOUS FLIGHT DESIGN
 - o PAYLOAD SEPARATION FLIGHT DESIGN
 - o PROXIMITY OPERATIONS FLIGHT DESIGN
- o REAL TIME MISSION SUPPORT
- o FORUMS AND DOCUMENTS SUPPORTED
- o SOFTWARE USAGE
- o WHAT'S AHEAD

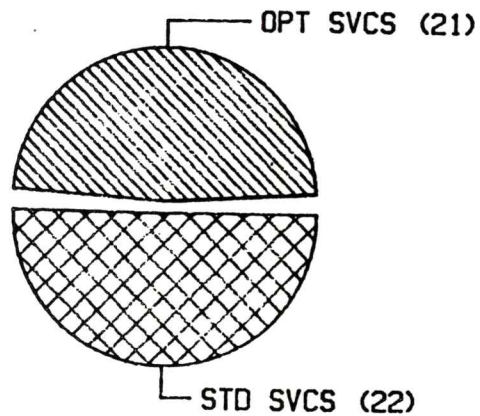
ORBIT DESIGN AND ANALYSIS PROCESS OVERVIEW



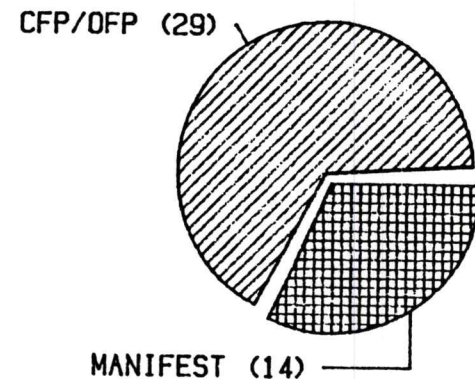
ORBIT DESIGN ELEMENTS



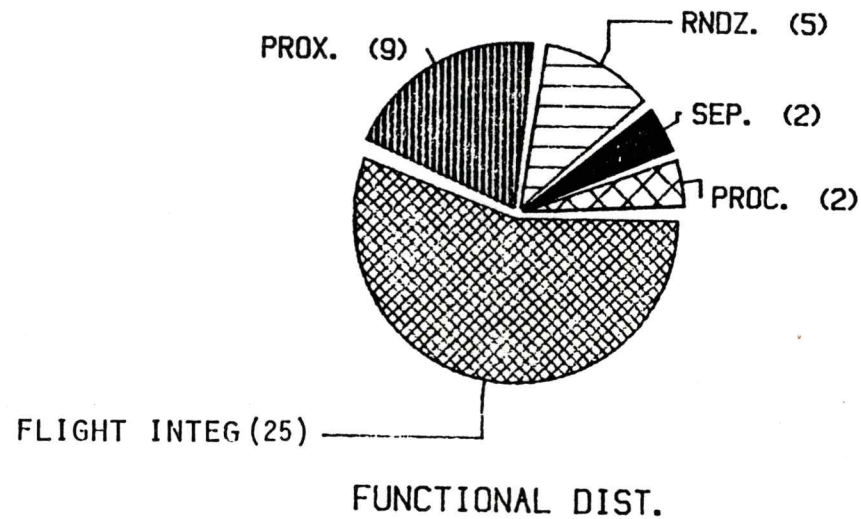
STAFFING DISTRIBUTION



FUND. CODE DIST.



FLT. DES. PHASE DIST.

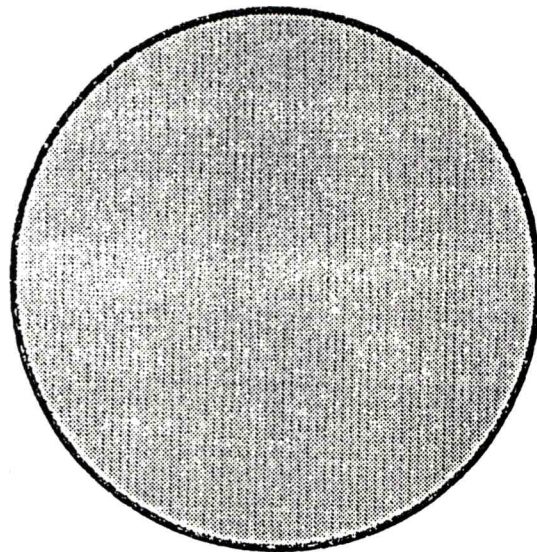


C.S. (10)

USAF (8)

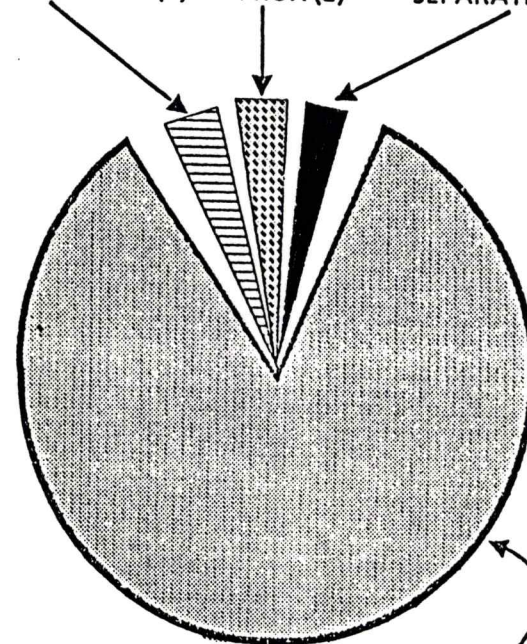
CURRENT BARRIOS SUPPORT TO THE FLIGHT DESIGN BRANCH

CFP/OFD (25)



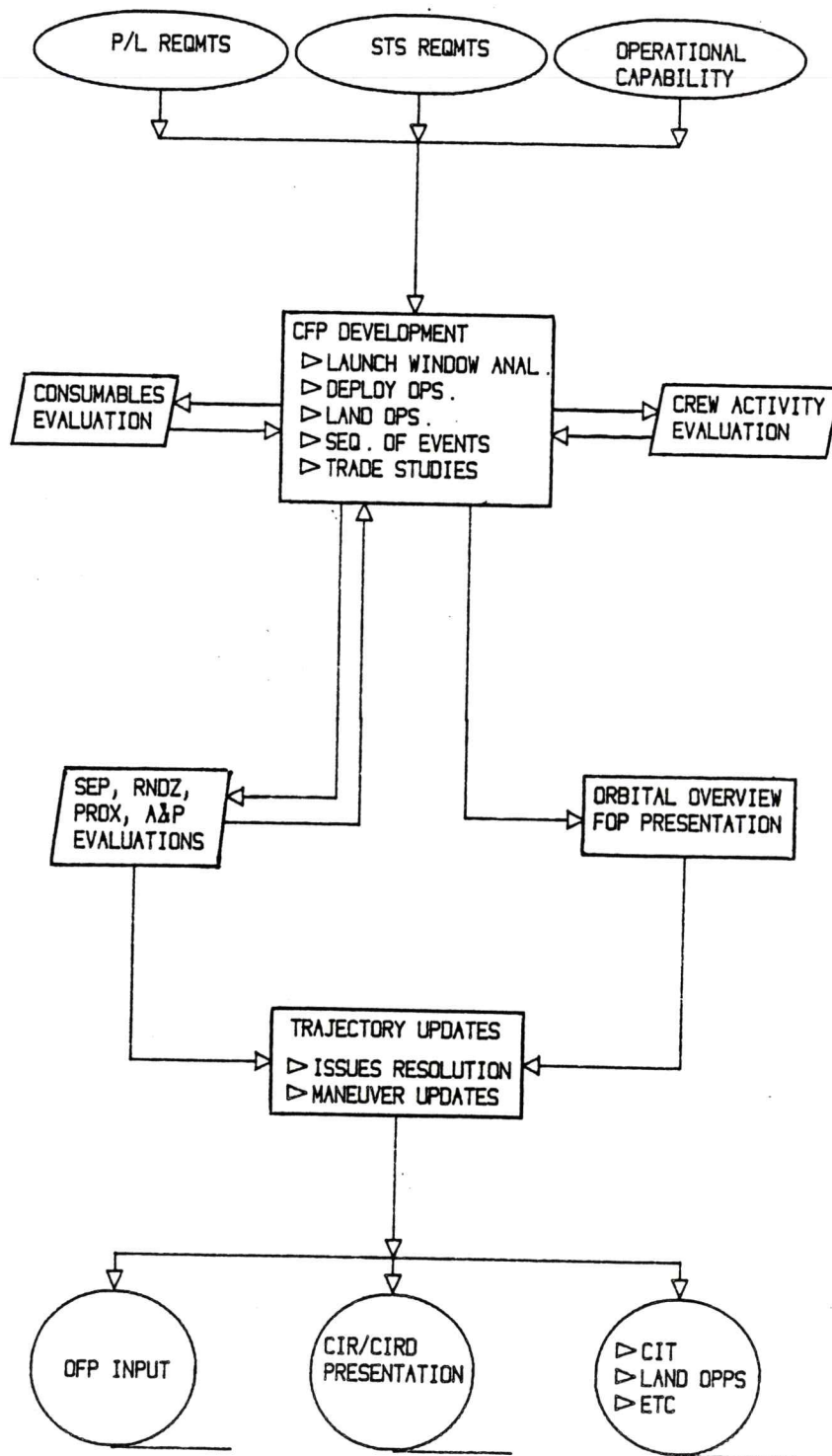
RECONFIGURATION DATA GENERATION SUPPORT

DESCENT/DEORBIT (3) PROX (2) SEPARATION (2)

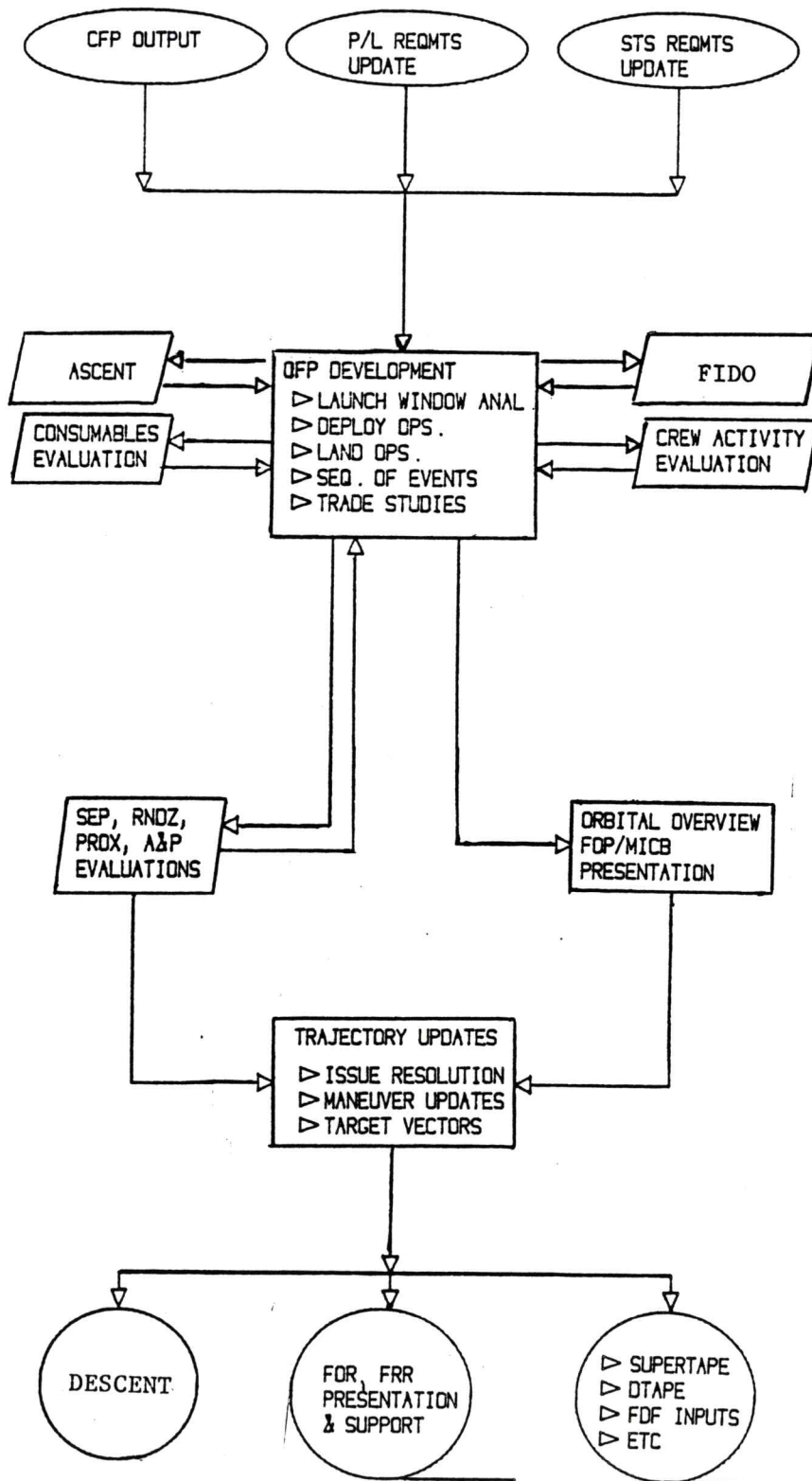


ONORBIT DATA PRODUCTS (18)
FUNCTIONAL DISTRIBUTION

PROCESS FLOW FOR ORBITAL DESIGN CFP CYCLE



PROCESS FLOW FOR ORBITAL DESIGN OPF CYCLE



FLIGHT DESIGN PRODUCTS

0 STANDARD PRODUCTS

- RESULTS OF MAINLINE DESIGN
- REQUIRED FOR ALL FLIGHTS
- WELL DEFINED/DOCUMENTED

0 ANALYSIS

- VARIES WITH FLIGHT COMPLEXITY
- INCLUDES STANDARD PARAMETRIC DATA BASE BUILD-UP, CONTINGENCY ANALYSES, FORUM SUPPORT (FLIGHT TECHNIQUES)

ORBIT DESIGN AND ANALYSIS PRODUCTS

PROD DESCR	INTEG	SEP	PROX	RNDZ	PROD
CAPS INITIALIZATION TAPE (CIT)					X
TRAJ SEQ OF EVENTS	X				
CIRD PRESENTATION SUPPORT	X				
CIR PRESENTATION SUPPORT	X				
SEP SEQUENCE DEPLOY VECTOR					X
PRE DE-ORBIT STATE VECTOR					X
SUPERTAPE DELIVERY					X
LANDING OPPORTUNITIES					X
POST MANEUVER STATE VECTOR					X
SPF COLDSTART DATA					X
SMS DATA TAPE INPUT					X

ORBIT DESIGN AND ANALYSIS PRODUCTS (CONTINUED)

PROD DESCR	INTEG	SEP	PROX	RNDZ	PROD
MCC TRAJECTORY INPUTS					X
COMMON FORMAT TAPE AND U.G.					X
FRR PRESENTATION INPUTS	X				
FLT DESCR CARD LAYOUT					X
NORAD R-20 DATA PACK					X
FOP INPUTS	X				
PRELIM DEPLOY VECTOR					X
FDF - ASCENT TDRSS COMM COVERAGE					X
FDF - ASCENT DAY/NIGHT COVERAGE					X
ILOAD AUDIT	X				
ON-ORBIT COMM COVERAGE					X
PAO NETWORK SUPPORT PLAN					X

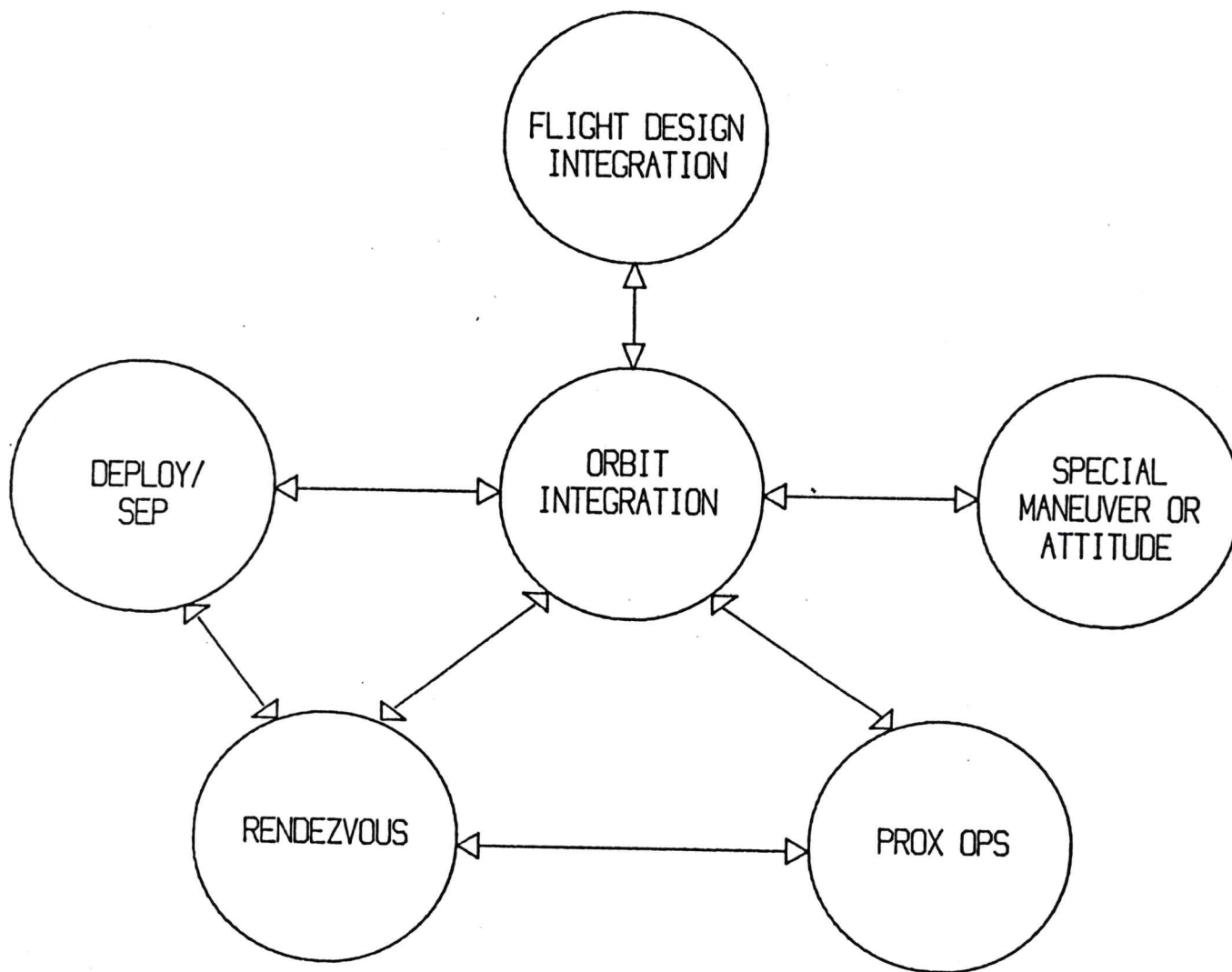
ORBIT DESIGN AND ANALYSIS PRODUCTS (CONTINUED)

PROD DESCR	INTEG	SEP	PROX	RNDZ	PROD
SUPERTAPE SEQ OF EVENTS					X
RNP MATRIX AND REFSMMATS					X
DIGITAL LAUNCH WINDOW DATA					X
FDS POST BURN STATE VECTORS					X
SUN LOOK ANGLES					X
ORBIT TGTING ILOADS				X	
SPF COLD START DATA				X	
SPF VERIFICATION DATA				X	
FRR PRESENTATION INPUTS				X	
ILOAD AUDIT				X	
SMS DATA PKG				X	
MCC TGTING INPUTS				X	

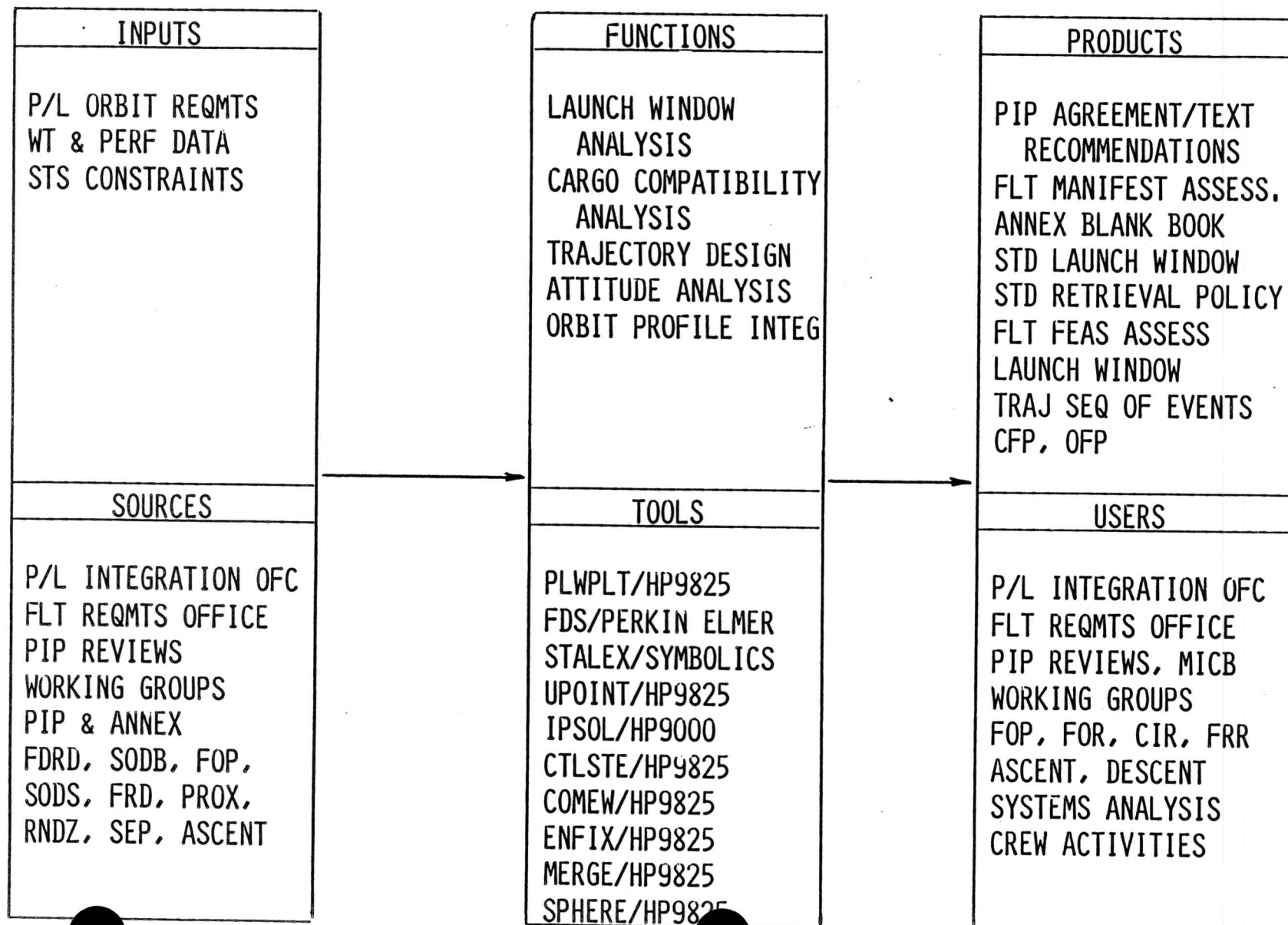
ORBIT DESIGN AND ANALYSIS PRODUCTS (CONCLUDED)

PROD DESCR	INTEG	SEP	PROX	RNDZ	PROD
SES RESET POINTS				X	
MONTE CARLO ANALYSIS				X	
FDF INPUTS				X	

ORBIT DESIGN ELEMENTS



ORBIT INTEGRATION



ATTITUDE AND POINTING

0 FLIGHT DESIGN

- FEASIBILITY ASSESSMENTS
- EARLY STUDIES
- DOD LOE OPTIONAL SERVICES
- COMMUNICATIONS STUDIES
- NOT PROCEDURES, CREW ACTIVITY PLANNING

0 I-LOADS

- CONSIST OF TOLERANCES FOR AVOIDING COMPUTATIONAL SINGULARITIES, OR DEFAULT REFERENCE ATTITUDES AND BODY VECTORS.
- DESIGNED FROM THE OUTSET TO BE STANDARDIZED; THE FEW CHANGES WHICH HAVE OCCURRED WERE FOR ALL SUBSEQUENT FLIGHT.
- QUALITY ASSURANCE REQUIRES ABILITY TO FORESEE THOSE RARE INSTANCES WHEN THESE I-LOADS NEED CHANGING FOR A PARTICULAR FLIGHT.

0 MCC PARAMETERS ARE PROVIDED BY OPERATIONS DIVISION.

ATTITUDE AND POINTING I-LOADS

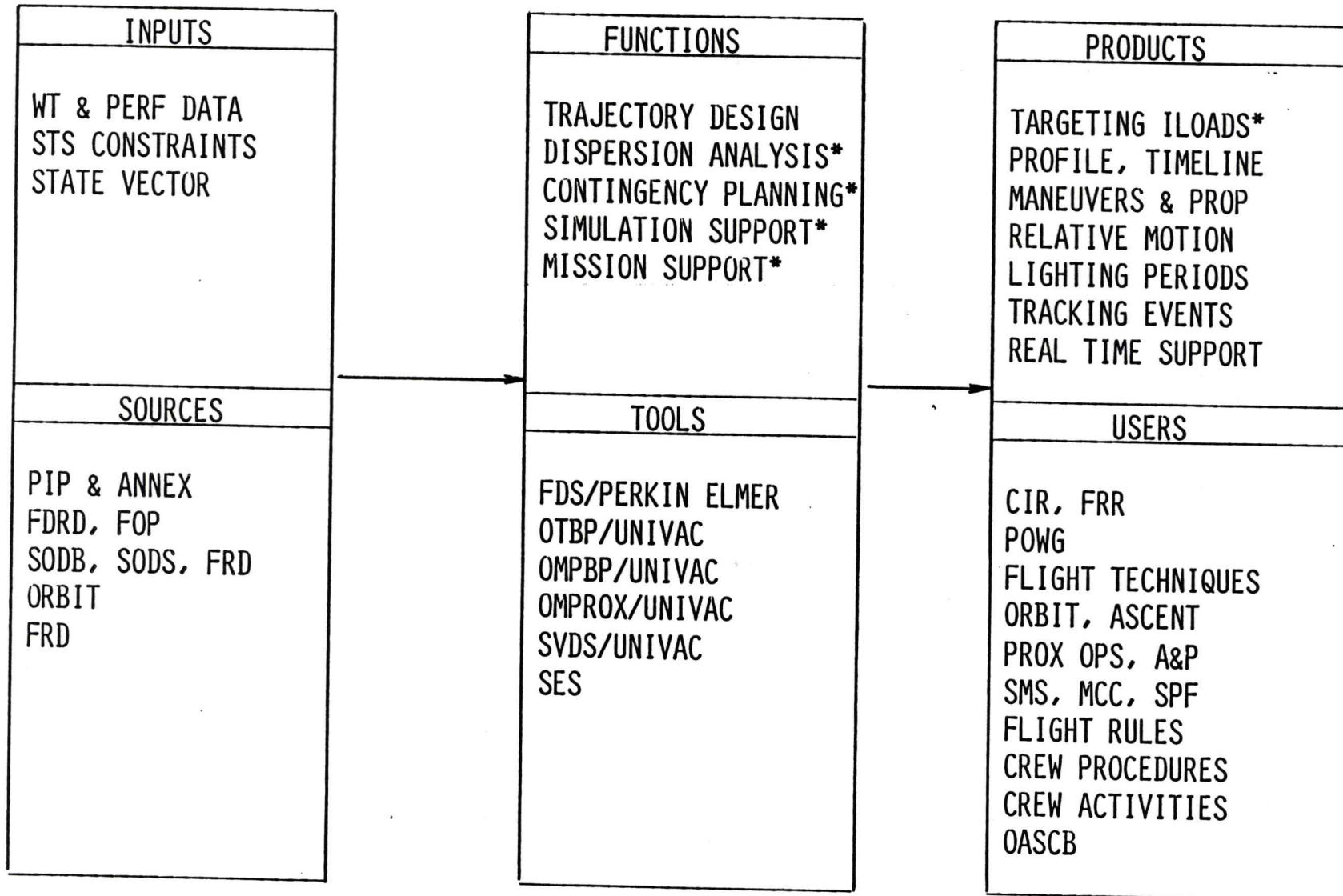
CATEGORY	I-LOAD DESCRIPTION	COUNT
ORBIT ATTITUDE (OATO)	BODY INERTIAL X-AXIS (2 DEGREES BELOW GEOMETRICAL X-AXIS) ADI REFERENCE QUATERNION ("STARBALL")	6
FIXED I-LOADS - JENNESS (ZFM1)	DEFAULT BODY AXES FOR AUTO MODE OPTIONS (+X, -X, -Z, USER CHOICE), ADI LOCAL VERTICAL BIAS QUATERNION (IDENTITY), ATTITUDE TOLERANCE FOR MANEUVER COMPLETION (1.1 X DEADBAND)	13
SCRUB I-LOADS- JENNESS (ZSMO)	MANUAL ENTRY STAR DEFAULT, ADI INERTIAL QUATERNION (IDENTITY), MAXIMUM AUTO TRACK RATE (3 DEGREES PER SECOND), BODY AND TARGET VECTOR TOLERANCE FOR ALTERNATE REFERENCE PLANE SELECTION (1 DEGREE), MINIMUM RANGE FOR TARGET TRACKING RATE COMPUTATION (100 FT)	11

TOTAL

30

RENDEZVOUS FLIGHT DESIGN

* INDICATES OFF CYCLE ONLY



RENDEZVOUS I-LOAD DESIGN

- PRINCIPAL FUNCTION IS ORBIT TARGETING (OT) SPECIALIST FUNCTION. FOR RENDEZVOUS MISSIONS, OT IS USED ONLY IN THE LAST 2 REVS.
- I-LOADS CONSIST PRIMARILY OF ITERATION AND CONVERGENCE CONTROL VARIABLES AND UP TO 20 MANEUVER TARGET SETS (TIG, X, Y, Z OFFSET, ETC.)
- I-LOAD DRIVERS ARE ORBITAL PERIOD, ELLIPTICITY, LIGHTING, AND DIFFERENTIAL DRAG BETWEEN VEHICLES
- I-LOAD DESIGN CONSTRAINTS ARE ACCEPTABLE RELATIVE MOTION, TARGET VISIBILITY FOR CREW AND ONBOARD SENSORS, AND SENSOR LIMITS (MIN & MAX RANGE)
- CONTROL BOARD AND SOURCE OF OFFICIAL DELIVERY IS ORBITER AVIONICS SOFTWARE CONTROL BOARD (OASCB)
- OT IS ALSO USED TO SUPPORT NON-STANDARD MISSIONS SUCH AS 51-F PDP FREE FLIGHT. CONSTRAINTS AND DRIVERS ARE UNIQUE TO THE MISSION AND DESIGN TIME IS GREATLY INCREASED

RENDEZVOUS I-LOADS

CATEGORY	I-LOAD DESCRIPTION	COUNT
ZFW0	- PARAMETERS WHICH CONTROL COMPUTATIONS - MINIMUM NUMBER OF ITERATIONS - MAXIMUM NUMBER OF ITERATIONS - ITERATION CONTROL - CONVERGENCE TOLERANCES - SIZE OF SINGULARITY ZONES	27
OT10	- BASE TIME FOR ALL ORBIT TARGETING BURNS - ORBITER CD, AREA, AND THRUST - ORBIT TARGETING TARGET SETS 1-19 - TIME OF BURN (RELATIVE TO BASE TIME) - TRANSFER TIME - ELEVATION ANGLE FOR ELEVATION ANGLE BURNS - TARGETED X, Y, Z OFFSET FROM TARGET - FLAG INDICATING COMPUTATION TYPE (LAMBERT OR CW)	4 3 19 19 57 19
OT20	- ORBIT TARGETING TARGET SETS 20-40	147
TOTAL		313

RENDEZVOUS MCC PARAMETER DESIGN

- 0 FOR RENDEZVOUS MISSIONS, RENDEZVOUS TARGETING PROCESSOR (RTP) IS USED TO TARGET OMS MANEUVERS FROM OMS-2 TO RENDEZVOUS COMPLETION
- 0 INPUTS TO THE PROGRAM CONSIST OF MANEUVER SEQUENCE CONSTRAINT TABLES WHICH RTP USES TO DEFINE THE TRAJECTORY PROFILE BY SOLVING FOR MANEUVER EVENT TIMES AND VELOCITY INCREMENTS
- 0 PROFILE DESIGN DRIVERS ARE MNVR PLACEMENT, ΔV , ΔV SENSITIVITY TO DISPERSIONS (ASCENT DISPERSIONS, GROUND PERFORMANCE AND REL MOTION TRACKING UNCERTAINTIES, MNVR EXECUTION ERRORS, DRAG UNCERTAINTY, AND TRANSLATION DISPERSIONS CAUSED BY ATTITUDE MNVRS)
- 0 PARAMETER (PROFILE) DESIGN CONSTRAINTS ARE ORBITER PERFORMANCE LIMITATIONS, DEPLOYABLE PAYLOAD REQUIREMENTS, TARGET PHASE ANGLE THROUGHOUT LAUNCH WINDOW, TARGET ALTITUDE, POST MECO ORBIT (STD INSERSION VS DIRECT), CREW TIMELINE CONSTRAINTS
- 0 DELIVERY IS TO FIDO THROUGH FLIGHT TECHNIQUES PANEL

RENDEZVOUS DESIGN QUALITY ASSURANCE

- 0 DETAILED QA OF MCC PROFILE DESIGN AND FSW ILOADS IS ACCOMPLISHED WITH TWO MONTE CARLO SIMULATION TOOLS
- 0 THE "GROUND SIMULATION" (GNDSIM/SVDS) SIMULATES THE GROUND TARGETED PORTION OF RENDEZVOUS.
 - 0 INPUTS ARE MANEUVER CONSTRAINT TABLES, STATE VECTORS AND TIME TAGS OF ORBITER AND TARGET POST MECO, GROUND TRACKING UNCERTAINTIES BEFORE EACH MANEUVER, MANEUVER EXECUTION ERROR, AND IMU ALIGN TIMES (FOR TRANSLATION DISPERSIONS).
 - 0 GNDSIM OUTPUT INCLUDES MNVR DISPERSIONS, TRAJECTORY DISPERSIONS (CONTACT TARGET, HIGH ENOUGH FOR PAYLOAD DEPLOY?) PROPELLANT REQUIREMENT FOR DISPERSIONS, QA OF GROUND TARGETED SEQUENCE, AND INDICATORS FOR REAL TIME TRAJECTORY QA.
- 0 THE "FLIGHT SIMULATION" (FLTSIM/OMPROX) SIMULATES ONBOARD TARGETED PORTION OF RENDEZVOUS
 - 0 FLTSIM INPUTS ARE STATE VECTORS AND DISPERSIONS FROM GNDSIM, FSW I-LOADS, ONBOARD NAV AND SENSOR SEQUENCING, OT SEQUENCING, MANEUVER EXECUTION ERROR, AND ATTITUDE PROFILE.
 - 0 FLTSIM OUTPUTS ARE MNVR DISPERSIONS, TRAJECTORY DISPERSIONS (CONTACT TARGET?, MISSION SUCCESS), PROPELLANT REQUIREMENT FOR DISPERSIONS, QA OF OT FSW I-LOADS, INDICATORS FOR REAL TIME TRAJ QA, MISSION SPECIFIC QUANTITIES FOR FLIGHT RULES

RENDEZVOUS DESIGN QUALITY ASSURANCE (CONTINUED)

- 0 OTHER MISSION SPECIFIC ANALYSIS IS DONE TO INVESTIGATE CONTINGENCIES SUCH AS COST OF SENSOR FAILURES, LATE AND MISSED BURNS, BAILOUTS, ETC.
- 0 OFFICIAL DELIVERY OF DISPERSION AND CONTINGENCY ANALYSIS IS TO FLIGHT TECHNIQUES PANEL

MEMORANDUM

Lyndon B. Johnson Space Center

NASA

REFER

TO: DA8-85-18 (FT)

DATE

March 28, 1985

INITIATOR

DA8/ALBriscoe:skl:3/22/85:4372

ENCL

TO: Distribution

CC

FROM: DA8/Chairman, STS 51-F Orbit Flight Techniques

SIGNATURE

Alan L. Briscoe

SUBJ: STS 51-F Orbit Flight Techniques Panel Meeting #3 Minutes

The third STS 51-F Orbit Flight Techniques Panel meeting was held on February 22, 1985, at JSC. NASA Headquarters, MSFC, Rockwell-Downey, and Draper Laboratory personnel participated via teleconference.

Prox Ops Analysis

1. Total Norm Z Ops for PDP Freeflight - MDTSCO/G. E. Schrage

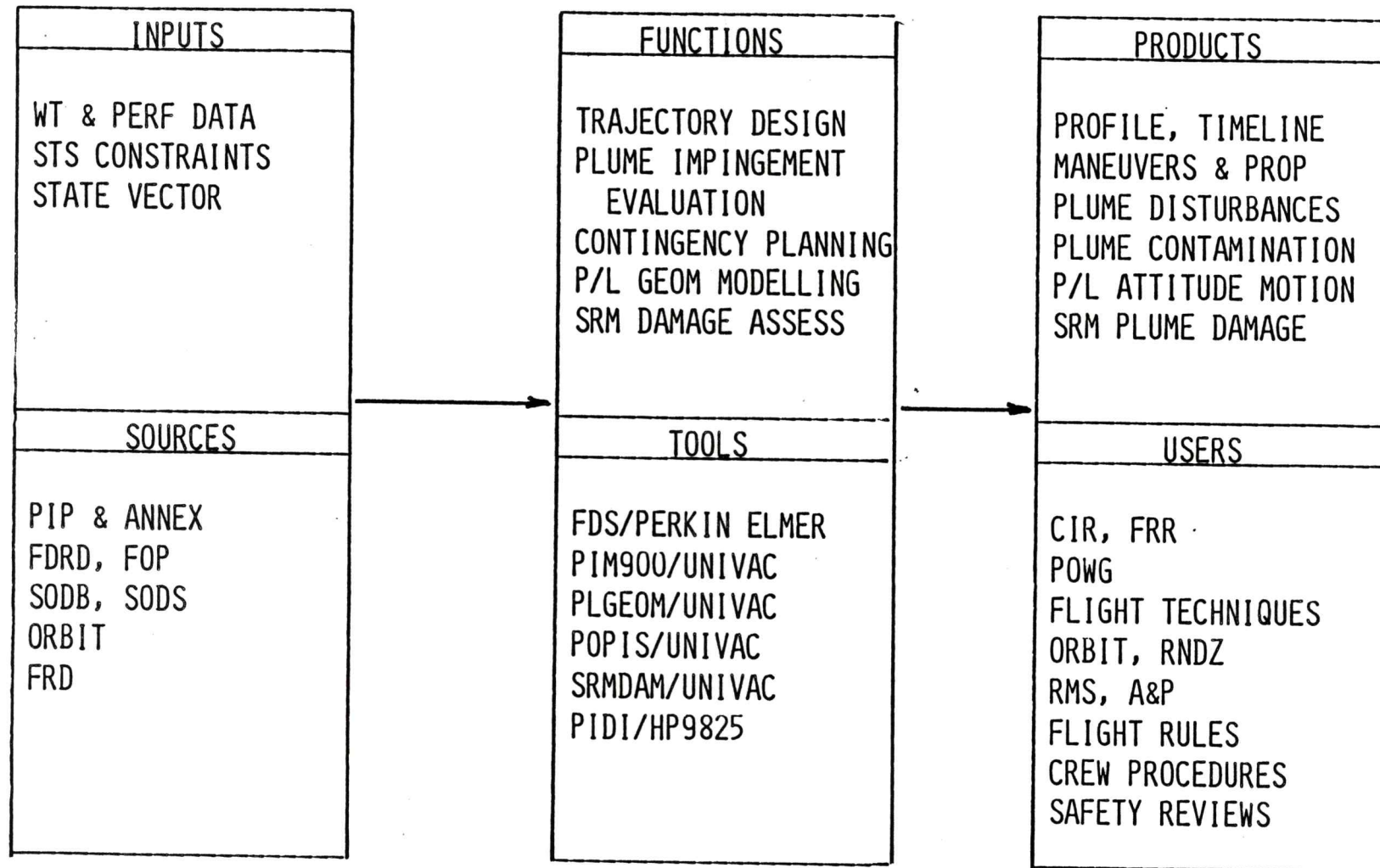
Mr. Schrage presented an analysis of the plume disturbances on the PDP using norm Z during the separation and approach phases of PDP prox ops. The bottom line of the analysis was that (1) total norm Z ops could increase the PDP residual spin rate over the nominal by 1 deg/sec (not taking into account the rate gyro package implemented recently), (2) the PDP angular momentum displacement (spin axis attitude change) could be increased about 2 degrees, and (3) approximately 60 pounds of RCS propellant (33 out of the forward tank) could be saved. The payload community also stated that there were no known contamination constraints. Based on this data and the desire of the crew to use the primary jets in the norm Z mode, it was decided that the PDP freeflight operations should be conducted using norm Z. Low Z would be used in the event the crew did notice any adverse effects on the PDP.

PDP Analysis

2. PDP Breakout Maneuvers - MDTSCO/N. Tursa

Ms. Tursa presented a summary of the PDP flyaround abort decisions made during the prox ops splinter group meetings. The basic abort from a nominal PDP fly-around would be a 2 fps posigrade or retrograde maneuver based on where you are in the flyaround. The generic abort would be used if the crew became disoriented and was out of comm coverage. This set of maneuvers would consist of establishing a 1 fps separation rate, then a 2 fps out-of-plane maneuver, followed 15 minutes later by a 3 fps posigrade burn. It should be noted that the burn delta V requirements have been reduced from those defined in the original generic breakout maneuvers, but no recontact problems were encountered. *flight* New rules regarding the generic breakout and the appropriate 482 to change the checklists have been submitted.

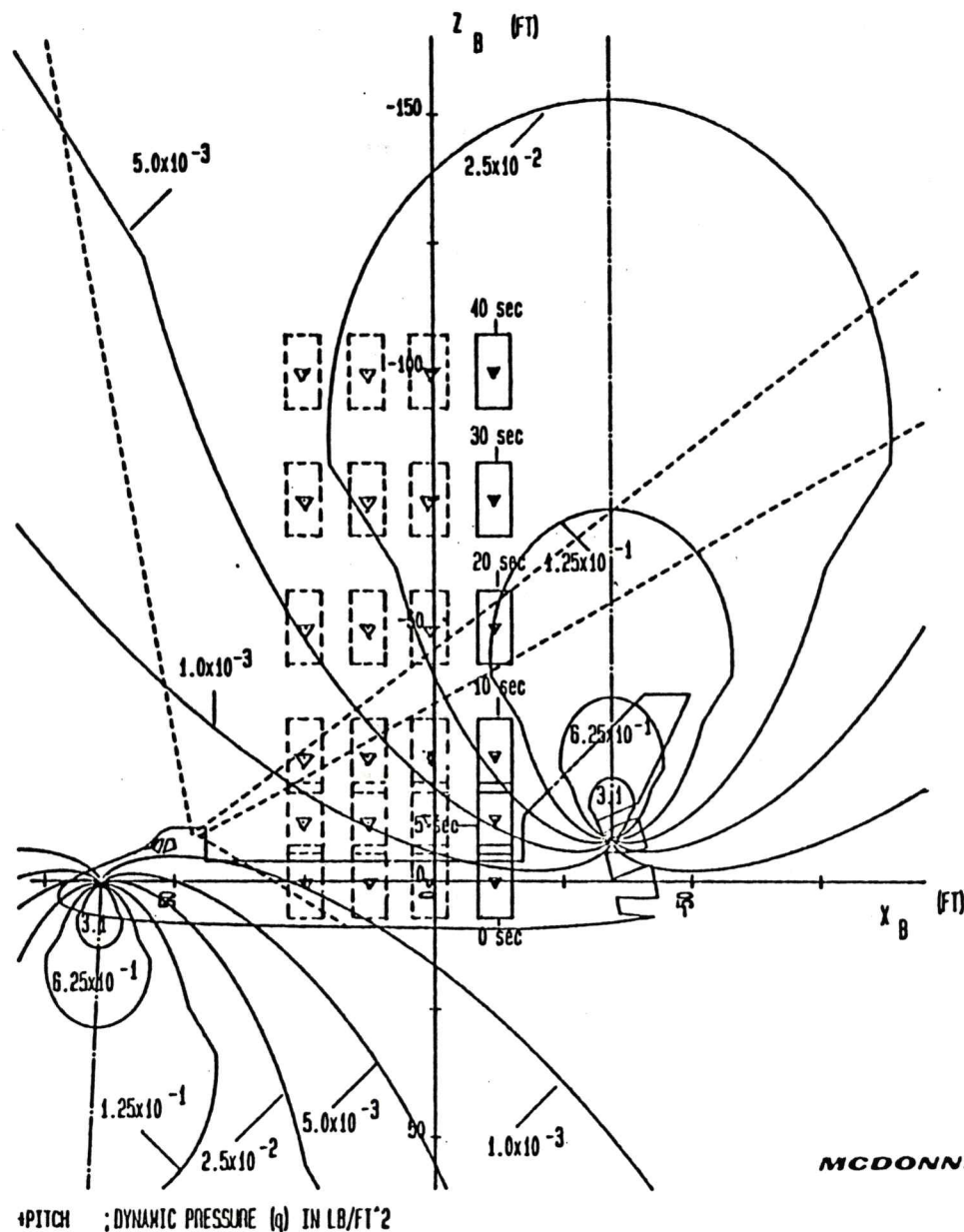
P/L SEPARATION FLIGHT DESIGN



● PAM-D TRAJECTORY
IN ORBITER BODY
FRAME

● +PCH PLUME PRESSURE
CONTOURS SHOWN

● +PCH JET FIRINGS TO
NULL NEGATIVE ORBITER
PITCH RATE

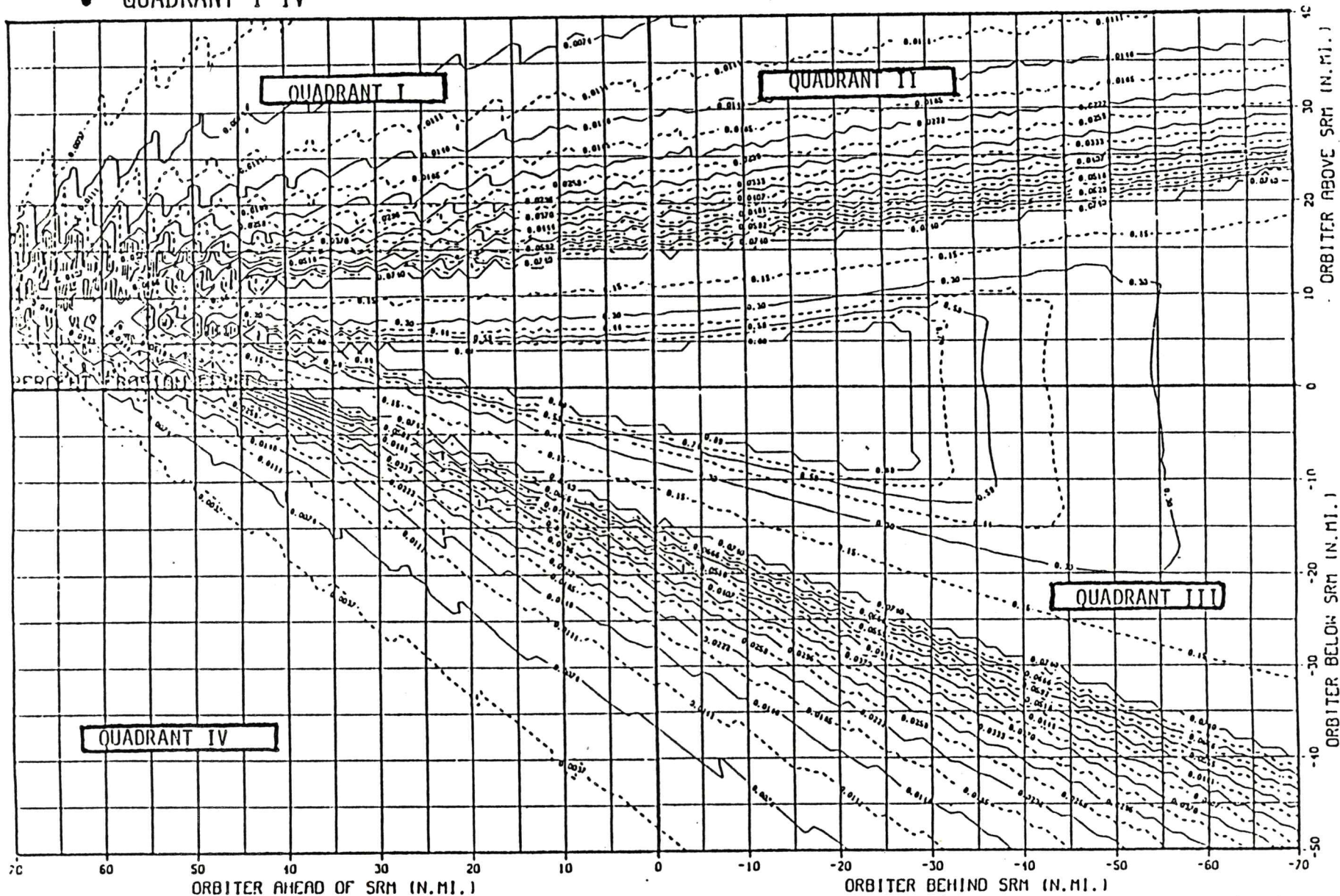


MCDONNELL DOUGLAS



2. NORMAL ORBITER PERCENT EROSION CONTOURS FOR SMALL IUS.

● QUADRANT I-IV

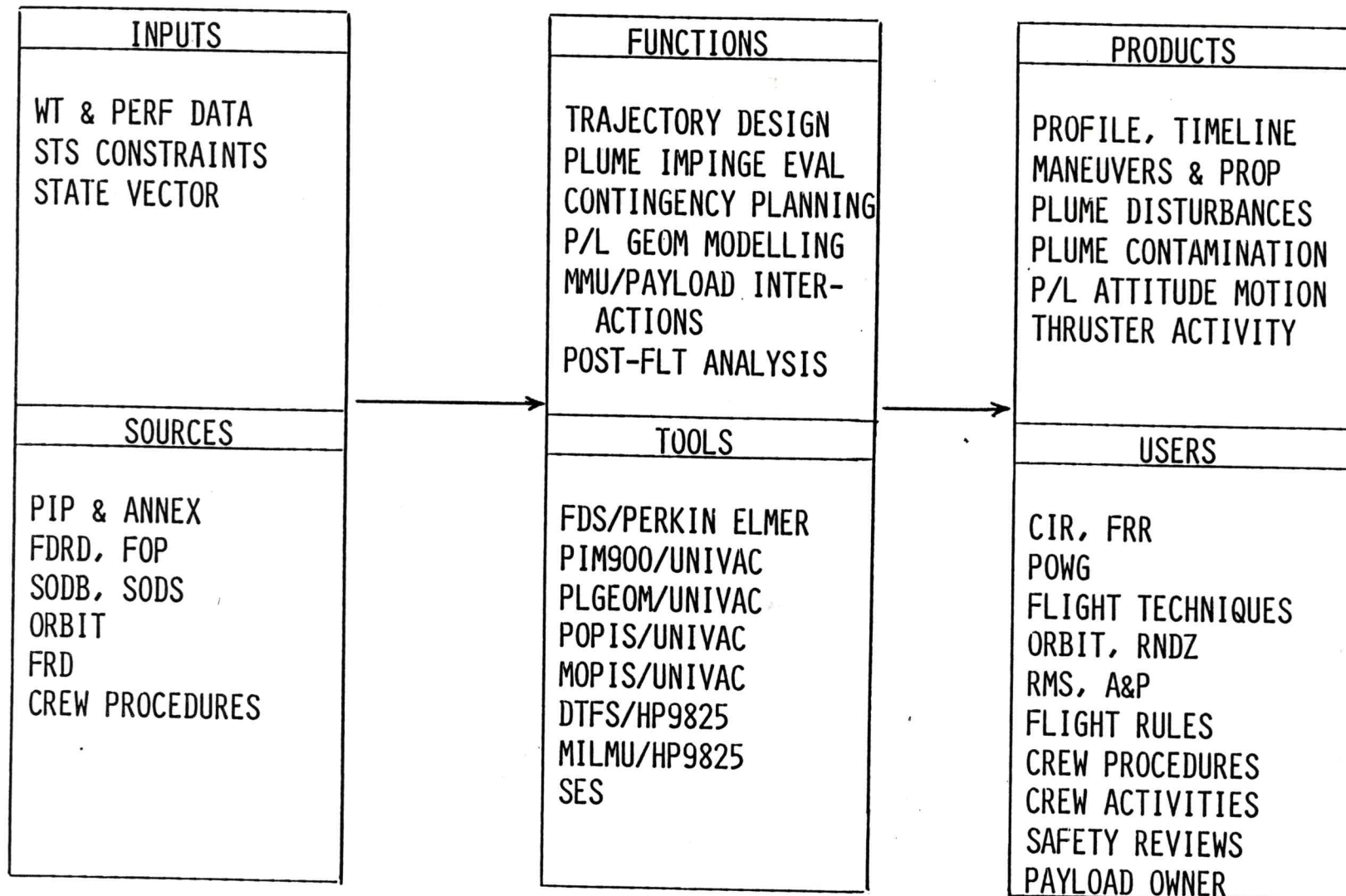


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1.2-TM-DW85002-65
Enclosure 2
3 of 7

PROX OPS FLIGHT DESIGN



3.

FLIGHT PROFILE: $\bar{R}$ APPROACH (SCENARIO IIB, 180° YAW)

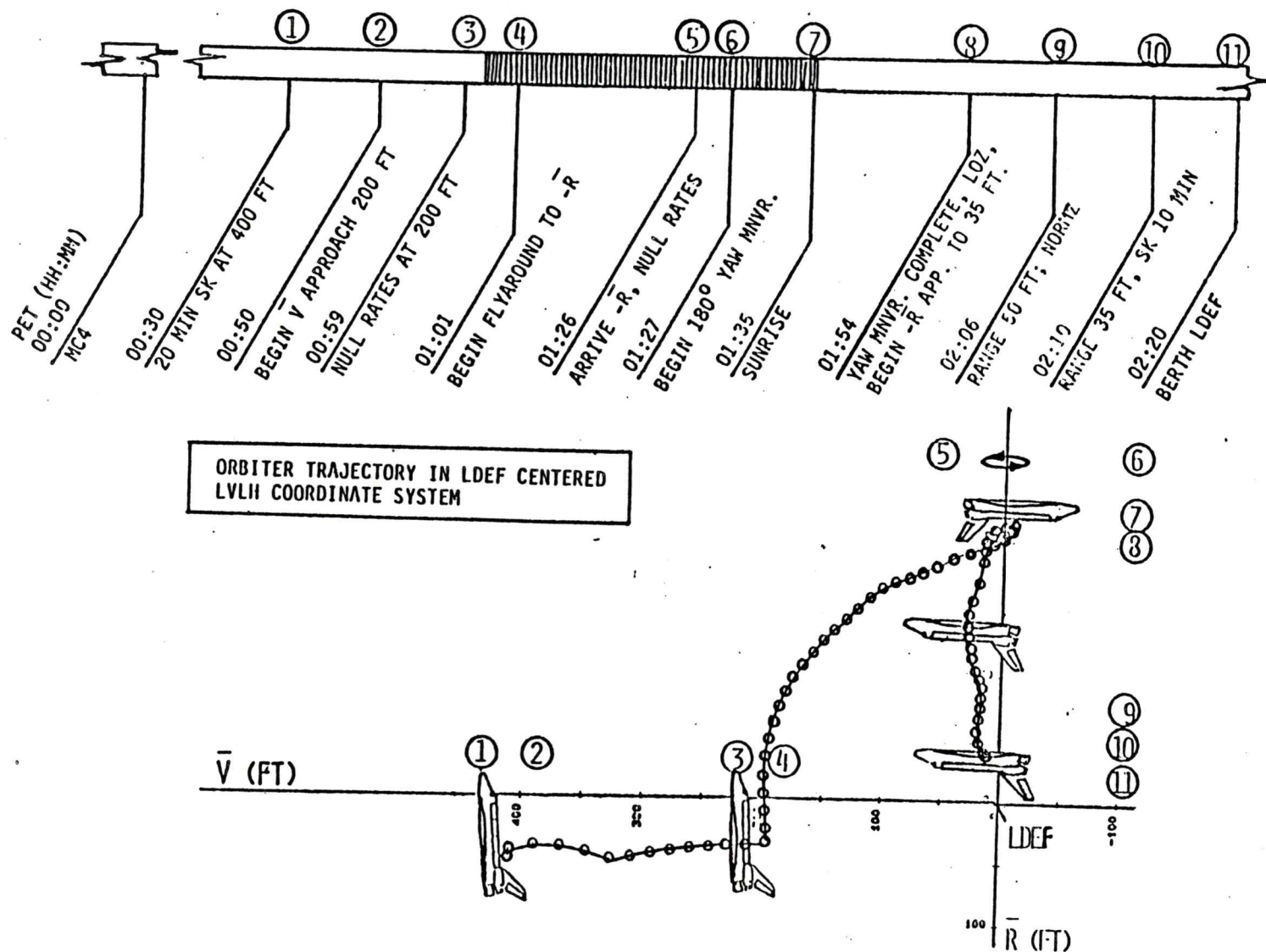


FIGURE - LDEF RETRIEVAL SCENARIO IIB:
INERTIAL FLYAROUND, 180° YAW, $\bar{R}$ APPROACH

MCDONNELL DOUGLAS



5. PLUME EFFECTS: -RBAR RETRIEVAL PROFILE (SCENARIO IIB)

PHASE	JET MODE	PET (M:S)	PLUME TORQUE IMPULSE* (ft-lbf-sec)			CONTAMINATION* (Å)		
			L _x	L _y	L _z	C _x	C _y	C _z
MC4→400' on V	NORMZ	29:27	0.031	0.065	0.708	19.683	15.378	0.486
Null Rates	NORMZ	29:29	0.057	0.007	0.109	2.506	25.703	0.983
Stationkeep @ 400' on V	NORMZ	49:29	0.039	0.017	0.334	2.530	15.828	0.862
V Approach 400'→200'	NORMZ	61:46	0.239	0.389	2.279	1.780	25.344	1.615
Inertial Stationkeep @ 200'	NORMZ	85:16	0.230	0.931	13.927	32.522	36.847	1.261
180° YAW MNVR	NORMZ	105:16	0.120	4.392	4.621	64.057	5.335	4.706
-R Approach 200' - 35'	LOZ** NORMZ	125:36	0.058	0.482	11.447	5.432	6.752	0.383
-R Stationkeep @ 35'	NORMZ	135:36	0.02	0.045	2.713	1.437	1.824	0.032
Totals	-----	135:36	0.794	6.328	36.138	129.95	133.025	10.329

* Absolute, cumulative value

** Switch to NORMZ @ 50'

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ORBIT DESIGN AND ANALYSIS

SIM/FLT SUPPORT

EX: STS-51G	ENGRS	HRS EACH	
RNDZ/PROX OPS SIM	4	8	
DEPLOY SIM	1	6	
RNDZ/PROX OPS SIM	4	8	
PLANNING SHIFT RNDZ SIM	4	8	
RNDZ	4	10	
SIM PREPARATION	4	4	
SIM TOTAL			158
FLT DEPLOY	1	6	
FLT NC-1	1	4	
FLT NC-2 - TF	4	10	
FLT TOTAL			50*
GRAND TOTAL			208

* FOR 51I, FLIGHT SUPPORT WILL INCREASE TO ABOUT 80 HRS
SINCE THERE ARE MORE GROUND COMPUTED BURNS.

MCDONNELL DOUGLAS



J. L. ALLISON

TITLE:

ORBIT DESIGN AND ANALYSIS
REAL TIME MISSION SUPPORT

DATE:

1 MAY 1985

PAGE:

STS-51DR EXAMPLE

ORBIT DESIGN
(6 MAN HOURS)

- PREDICTED SYNCOM ORBIT DECAY TO END OF YEAR TO SUPPORT CONTINGENCY PLANNING
- PREDICTED FUTURE OPPORTUNITIES FOR SYNCOM ORBIT INSERTION

RENDEZVOUS DESIGN
(201 MAN HOURS)

- ANALYZED THE 51-D LDEF RNDZ ILOADS FOR USE WITH THE CONTINGENCY PROFILE
- PROVIDED INPUTS TO THE DESIGN AND ANALYSIS OF THE SYNCOM SEP SEQUENCE
- DESIGNED THE 51-DR CONTINGENCY RENDEZVOUS PROFILE
- PROVIDED REAL TIME SUPPORT TO GIDO AND FIDO INCLUDING RELATIVE MOTION TRAJECTORY PLOTS AND QA OF STANDARD BAILOUTS THROUGH THE RENDEZVOUS

MCDONNELL DOUGLAS

CORPORATION

J. L. ALLISON

TITLE:

ORBIT DESIGN AND ANALYSIS
REAL TIME MISSION SUPPORT

DATE:

1 MAY 1985

PAGE:

RENDEZVOUS DESIGN (CONT'D) - MADE INPUTS TO AND REVIEWED RENDEZVOUS MESSAGES
SENT TO THE CREW INCLUDING IMPROVISED RENDEZVOUS
BOOK

PROX OPS DESIGN
(86 MAN HOURS)

- ANALYZED AND VERIFIED THAT THE PROPOSED CONTINGENCY
SEPARATION SEQUENCE WAS FEASIBLE AND SAFE FROM:
 - RELATIVE MOTION TRAJECTORY
 - ORBITER RCS PLUME DISTURBANCES ON SYNCOM
 - ORBITER RCS CONTAMINATION LEVELS ON SYNCOM
 - ORBITER SURFACE DAMAGE FROM SYNCOM INSERTION BURN
- RECOMMENDED LOW-Z SEP BURN

FORUMS SUPPORTED BY ORBIT DESIGN AND ANALYSIS

- 0 MICB - MISSION INTEGRATION CONTROL BOARD
- 0 CIR - CARGO INTEGRATION REVIEW
- 0 PIWG - PAYLOAD INTEGRATION WORKING GROUP
- 0 FLIGHT DESIGN I-LOAD REVIEW
- 0 OASCB - ORBITER AVIONICS SOFTWARE CONTROL BOARD
- 0 FLIGHT TECHNIQUES
- 0 FLIGHT RULES REVIEW
- 0 BRR - BASELINE REQUIREMENTS REVIEW
- 0 POWG - PAYLOAD OPERATIONS WORKING GROUP
- 0 FDWG - FLIGHT DESIGN WORKING GROUP
- 0 FRR - FLIGHT READINESS REVIEW
- 0 FOR - FLIGHT OPERATIONS REVIEW
- 0 FOP - FLIGHT OPERATIONS PANEL
- 0 SAFETY REVIEWS

DOCUMENTATION SUPPORTED BY ORBIT DESIGN AND ANALYSIS

- 0 PIP - PAYLOAD INTEGRATION PLAN
- 0 PIP ANNEX
- 0 FDRD - FLIGHT DEFINITION AND REQUIREMENTS DOCUMENT
- 0 FRD - FLIGHT REQUIREMENTS DOCUMENT
- 0 FRD - APPENDIX A, LEVEL A GROUND RULES AND CONSTRAINTS
- 0 CFP - CONCEPTUAL FLIGHT PROFILE
- 0 OFP - OPERATIONAL FLIGHT PROFILE
- 0 STS OPERATIONAL FLIGHT DESIGN STANDARD GROUND RULES AND CONSTRAINTS, LEVEL B
- 0 I-LOADS REQUIREMENT DOCUMENT (ILRD) VOLUMES I, II, III
- 0 FLIGHT SOFTWARE CHANGE REQUESTS (CR'S)
- 0 FLIGHT RULES

ORBIT DESIGN AND ANALYSIS SOFTWARE USAGE

SYMBOL	NAME	SYS	LANG	LOC	OWNER	TEST CASE(S)?	USER'S GUIDE?	COMMENTS
SVDS	SPACE VEHICLE DYNAMIC SIMULATION	UNIVAC	FORTTRAN	TBS	?	PARTIAL	PARTIAL	FSW MONTE CARLO/ GNDSIM (SVDS 4.2 FIELDATA)
FDS	FLIGHT DESIGN SYSTEM	PE	FORTTRAN	TBS	?	PARTIAL	PARTIAL	
OTBP	ORBIT TARGETING BENCH PROGRAM	UNIVAC	FORTTRAN	500 + SVDS	DANNEMILLER	YES	NO	FSW ILOAD DESIGN (SVDS 4.2 ASCII DRIVER)
OMPBP	ORBITAL MANEUVER PROCESSOR BENCH PGM	UNIVAC	FORTTRAN	500+ SVDS	DANNEMILLER	YES	NO	MCC PARAMETER DESIGN (SVDS 4.2 ASCII DRIVER)
OMPROX	ORBITAL MANEUVER & PROX OPS PGM	UNIVAC	FORTTRAN	TBS	DANNEMILLER	YES	YES	FSW MONTE CARLO/ FLTSIM (SVDS DERIV)
DTFS	ORBITER M-I-L DESK-TOP FLT SIM	HP9825	HPL	3000	SWAIM (TRW)	YES	YES	PROFILE & PROPELLANT GENERATION
MILMU	MMU M-I-L DESK-TOP FLT SIM	HP9825	HPL	3000	SWAIM (TRW)	YES	NO	PROFILE & PROPELLANT GENERATION
PROXPROP	PROX OPS PROPELLANT CONSUMPTION PGM	IBMPC	BASIC	700	SWAIM	YES	YES	PROP CONSUMPTION ESTIMATES
SRMDAM	SRM PLUME DAMAGE ASSESSMENT	UNIVAC	FORTTRAN	1000	WHYNOTT	YES	NO	ORBITER SURFACE DAMAGE ASSESSMENT
PIDI	PARTICLE IMPACT DAMAGE INTEGRATOR	HP9825	HPL	1000	SWAIM (TRW)	YES	YES	ORBITER SURFACE DAMAGE ASSESSMENT

ORBIT DESIGN AND ANALYSIS SOFTWARE USAGE

SYMBOL	NAME	SYS	LANG	LOC	OWNER	TEST CASE(S)?	USER'S GUIDE?	COMMENTS
PLGEOM	P/L GEOMETRY MODELLING PGM	UNIVAC	FORTRAN	1100 + DISSPLA	STAAS	YES	NO	P/L SEQUENTIAL VIEW GENERATION
ORBPLT	ORBITER GEOMETRY PLOTTING PGM	HP9825	HPL	1500	RHODES	YES	NO	ORBITER SEQUENTIAL VIEW GENERATION
PLDPLT	P/L GEOMETRY PLOTTING PGM	HP9825	HPL	400	RHODES	YES	NO	
PIM900	STATIC PLUME IMPINGEMENT	UNIVAC	FORTRAN	1500	SWAIM	YES	YES	STATIC P.I. ASSESS FOR PAYLOAD
POPIS	PROX OPS PLUME IMPINGEMENT SIMULATION	UNIVAC	FORTRAN	TBS + SVDS	SWAIM	YES	PARTIAL	DYNAMIC P.I. ASSESS (SVDS 3.17 DRIVER)
MOPIS	MMU OPS PLUME IMPINGEMENT SIMULATION	UNIVAC	FORTRAN	TBS + SVDS	SWAIM	YES	PARTIAL	DYNAMIC P.I. ASSESS (SVDS 3.17 DRIVER)
MASPROP	MASS PROPERTIES PROGRAM	IBMPC	BASIC	190	SAWIN	YES	YES	COMBINED MASS PROPERTIES
OMIN	SPINNING P/L ATTITUDE DYNAMICS PGM	IBMPC	BASIC	418	SAWIN	YES	YES	P/L WOBBLING PLOT & CONING ANGLES
EUMAQ	EULER ANGLE, MATRIX & QUATERNION X-FORM	IBMPC	BASIC	967	STAHL	YES	YES	
CURVFIT	CURVE FITTING PROGRAM	IBMPC	BASIC	537	MANNO	YES	YES	POLYNOMINAL CURV FIT

SYMBOL	NAME	SYS	LANG	LOC	OWNER	TEST CASE(S)?	USER'S GUIDE?	COMMENTS
STPROC	STATISTICAL POST-PROCESSOR	UNIVAC	FORTRAN	1500	DANNEMILLER	YES	NO	USES SVDS & OMPROX OUTPUT
WORKSHEET	TRAJECTORY STATISTICAL POST PROCESSOR	UNIVAC	FORTRAN	200	DANNEMILLER	YES	NO	USES OMPROX OUTPUT
DVSUM	ΔV STATISTICAL POST PROCESSOR	UNIVAC	FORTRAN	100	DANNEMILLER	YES	NO	USES OMPROX OUTPUT
PROPSUM	PROPELLANT STATISTICAL POST PROCESSOR	UNIVAC	FORTRAN	100	DANNEMILLER	YES	NO	USES OMPROX OUTPUT
MOPP	RELATIVE MOTION PLOT POST PROCESSOR	UNIVAC	FORTRAN	500 + DISSPLA	DANNEMILLER	YES	NO	USES OMPROX OUTPUT
COVDRV	DISPERSED STATE GENERATOR	UNIVAC	FORTRAN	500	DANNEMILLER	NO	NO	GENERATES 1σ and 3σ STATES

ORBIT DESIGN AND ANALYSIS SOFTWARE USAGE

SYMBOL	NAME	SYS	LANG	LOC	OWNER	TEST CASE(S)?	USER'S GUIDE?	COMMENTS
UPOINT	UNIVERSAL PTG. UTIL.	HP9825	HPL	1000	CARTER	YES	YES	ATTITUDE TIMELINE
IMUAL	IMU ALIGN UTIL.	HP9825	HPL	331	POWELL	YES	YES	ATTITUDE TIMELINE*
CTLSTE		HP9825	HPL	542	CARTER	NO	NO	COMMUNICATIONS*
COMEW		HP9825	HPL	673	CARTER	NO	NO	COMM POST PROCESSOR*
SPHERE		HP9825	HPL	365	DESOBRY	YES	YES	ATL
BIASFT		ALL	ALL		DESOBRY	YES	YES	
ENTMET		HP9825	HPL		POWELL	NO	NO	ATL*
ENTXYZ		HP9825	HPL		POWELL	NO	NO	ATL*
ENTFIX		HP9825	HPL		POWELL	NO	NO	ATL*
MERGE		HP9825	HPL		POWELL	NO	NO	ATL*
TDRCOM	TDRS COMMUNICATIONS	HP9825	HPL	344	DESOBRY	YES	NO	
DISSPL	DISSPLA DRIVER	UNIVAC	FORTTRAN	1200	DESOBRY	YES	YES	PLOTS FOR S/W VERIF.
KUFLUX	REFLECTIONS FROM TROUGH	UNIVAC	FORTTRAN	1000	DESOBRY	YES	YES	SPECIAL ANALYSES
POLYN	SYMBOLIC MANIPULATION	UNIVAC	FORTTRAN	200	DESOBRY	YES	NO	SPECIAL ANALYSES

* Will be replaced by FDS

SYMBOL	NAME	SYS	LANG	LOC	OWNER	TEST CASE(S)?	USER'S GUIDE?	COMMENTS
IPSMCC	IPS MCC PROCESSOR	HP9000	FORTRAN	4528	TEPLITZ	YES	YES	TELEMETRY MONITORING
IPSOL	IPS OFF-LINE	HP9000	FORTRAN	7743	TEPLITZ	NO	NO	ATL
PLWPLT		HP9825	HPL	-	AHLF	YES	YES	LAUNCH WINDOW ANAL
SHIFT		HP9825	HPL	-	PATTON	NO	NO	
RANPLT		HP9825	HPL	-	AHLF	NO	NO	
SPARTAN		HP9825	HPL	-	AHLF	NO	NO	
STALEX	SHUTTLE TRAJECTORY AND LAUNCH WINDOW EXPERT SYSTEM	SYMBOLICS	FORTRAN LISP	-	AHLF	NO	NO	REQUIREMENTS DEVELOPMENT

WHERE WE ARE

- 0 STANDARDIZED MAJORITY OF PRODUCTS AND TRANSITIONED THESE TO PARA-PROFESSIONAL GENERATION.
- 0 STANDARDIZED FLIGHT PHASES
- 0 STANDARDIZED INPUTS TO PRODUCTION GROUP
- 0 REDUCED NUMBER/VOLUME OF PRODUCTS
- 0 GENERATED PARAMETRIC DATA BASES
- 0 STANDARDIZED GROUND RULES AND CONSTRAINTS (LEVEL A/B)
- 0 STANDARDIZED PRESENTATIONS/DOCUMENTATION.
- 0 STANDARDIZED SOFTWARE DATA BASE.

WHAT'S AHEAD

- 0 REDUCE THE NUMBER OF PROCESSORS
- 0 INTEGRATE REQUIRED PRODUCTION CAPABILITY ON FDS-X
- 0 REDUCE THE NUMBER OF PRODUCTS
- 0 INCREASE THE NUMBER OF STANDARDIZED PRODUCTS
- 0 IMPROVE PRODUCTION SOFTWARE TOOL VERIFICATION
- 0 IMPLEMENT PRODUCTIVITY IMPROVEMENT THRU APPLICATION OF EXPERT SYSTEMS

DESCENT DESIGN

- o RESPONSIBILITIES
- o STAFFING AND DRIVERS
- o TOOL OVERVIEW
- o TASK SUMMARIES AND GOALS
 - oo RECON
 - oo WTR & STANDARDIZATION
 - oo ADVANCED TOOL REQUIREMENTS
- o DESCENT DESIGN SYSTEM (DDS) DEMONSTRATION

TIM CRULL/MDTSCO
MAY 1985

RESPONSIBILITIES

- o DESCENT FLIGHT DESIGN
- o DESCENT PHASE INTEGRATION
- o DESCENT COMMIT TO FLIGHT ANALYSIS
- o ENTRY GUIDANCE DESIGN
- o MCC ENTRY PROCESSOR DESIGN
- o VEHICLE CAPABILITY ASSESSMENT
- o NEW CAPABILITY DEVELOPMENT AND ASSESSMENT
- o FLIGHT DESIGN TOOL & MATH MODEL REQUIREMENTS

STAFFING SUMMARY

ACTIVITY	MDTSCO	CS/AF	BARRIOS	TOTAL
RECONFIGURATION	22	7	4	33
DIRECT RECON ACTIVITY	17			
FLIGHT INTEGRATION	3			
AUTOMATION REQUIREMENTS	2			
WTR	7	4		11
TOOL/MATH MODEL REQUIREMENTS AND SUSTAINING ENGINEERING (INCLUDING IMPLEMENTER SUPPORT)	7	.5		7.5
MCC AND ONBOARD SOFTWARE REQUIREMENTS AND VERIFICATION	2	.5		2.5
ETR STANDARDIZATION SUSTAINING ENGINEERING	<u>3</u>	<u>2</u>	<u>4</u>	<u>5</u>
	41	14	4	59

MAJOR DRIVERS FOR CONTINUED SUSTAINING ENGINEERING

- O CONTINUED STANDARDIZATION AND AUTOMATION
- O HEAVYWEIGHTS (WEIGHTS GREATER THAN 240 KLB)
 - OO DUMP CHANGES AND IMPACTS ON EXISTING STANDARD TARGETS & TOOLS
 - OO FORWARD RCS DUMP DTO AND MATH MODEL MODS
 - OO STANDARD ENVELOPE EXPANSION
- O WTR
 - OO HIGH LATITUDE ATMOSPHERES AND ENTRY INTERFACE TARGETING
 - OO INCREASED EFFECTS OF VARIABLE I_y
(VARIABLE INCLINATIONS AS A FUNCTION OF TIME OF ABORT)
 - OO GRTLS WITH CROSSRANGE TO AID TANK DISPOSAL
- O EVOLVING AERO HEATING, AERO, AND ATMOSPHERE MODELS
- O TAEM AND AUTOLAND GUIDANCE EVOLUTION, E.G., SPEEDBRAKE CONTROL
- O MCC MAINTENANCE AND MODS
 - OO NEW ETG
 - OO EXPANDED ATMOSPHERE FILE

OVERVIEW OF MAJOR TOOLS

PROGRAM	ESTIMATED NUMBER OF USERS	ESTIMATED USAGE (% OF SECTION TOTAL)*
DESCENT DESIGN SYSTEM + POST-PROCESSORS	31	65%
SVDS 3-DOF AND 6-DOF + POST-PROCESSORS	11	25%
LAND 3-DOF AND 6-DOF + POST-PROCESSORS	3	10%

*350 SUPHOURS/WK

TASK SUMMARIES

RECON RESPONSIBILITIES/DRIVERS

0 DESIGN AND MISSION INTEGRATION FOR POSSIBLE DESCENTS

- o NOMINAL END-OF-MISSION
- o INTACT ABORTS (GRTLS, TAL, AOA)
- o NON-DEPLOYED PAYLOAD SITUATIONS
- o DEORBIT UNDERBURNS
- o CONTINGENCY ABORTS
- o NON-CONUS AND NO - COMM RETURNS

0 PHASE INTEGRATION (MULTIPLE I-LOADS & TARGETS)

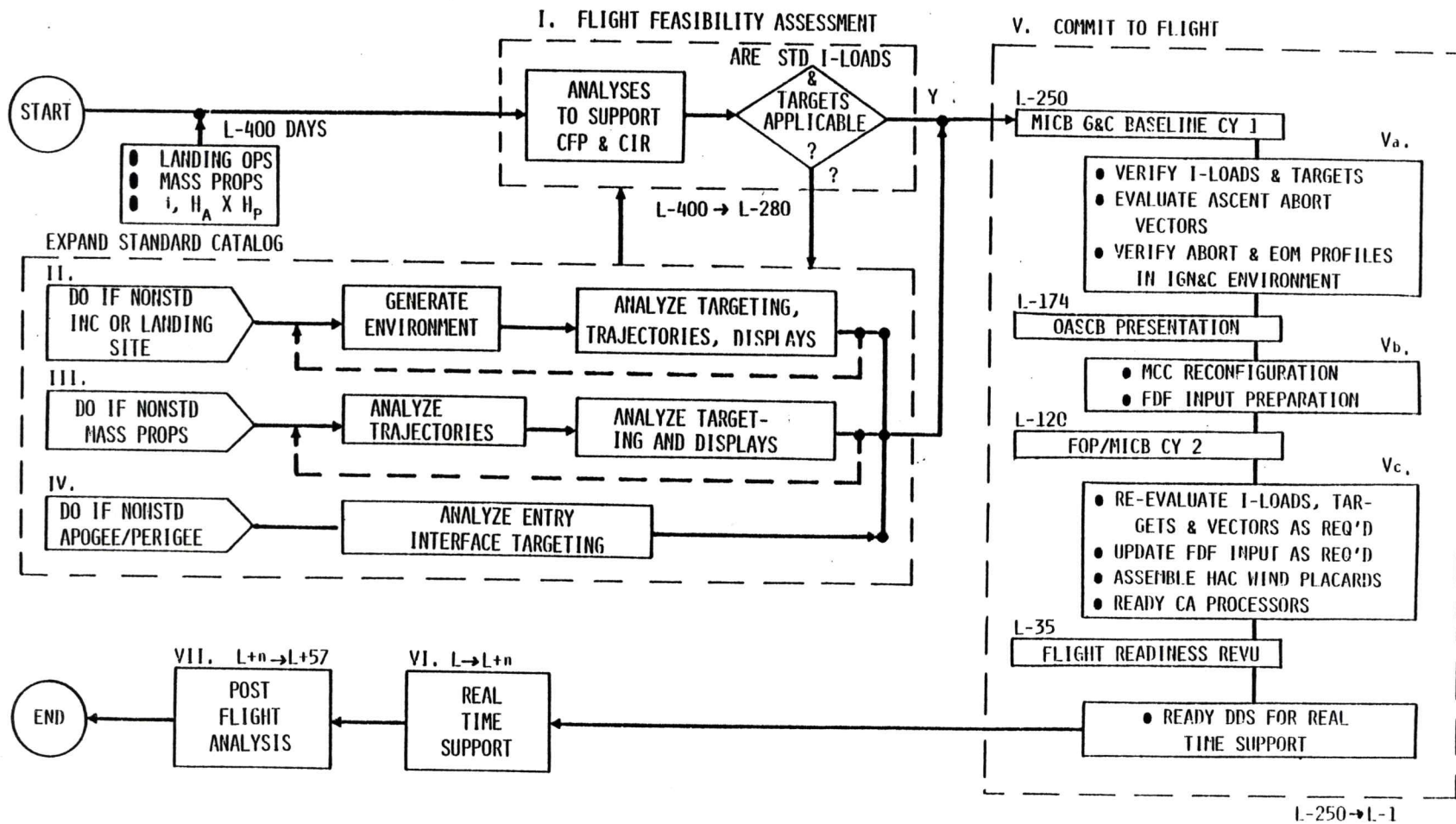
- o DEORBIT
- o ENTRY
- o TERMINAL AREA ENERGY MANAGEMENT (TAEM)
- o GRTLS TAEM
- o APPROACH & LANDING

0 SYSTEM/DESIGN DRIVERS

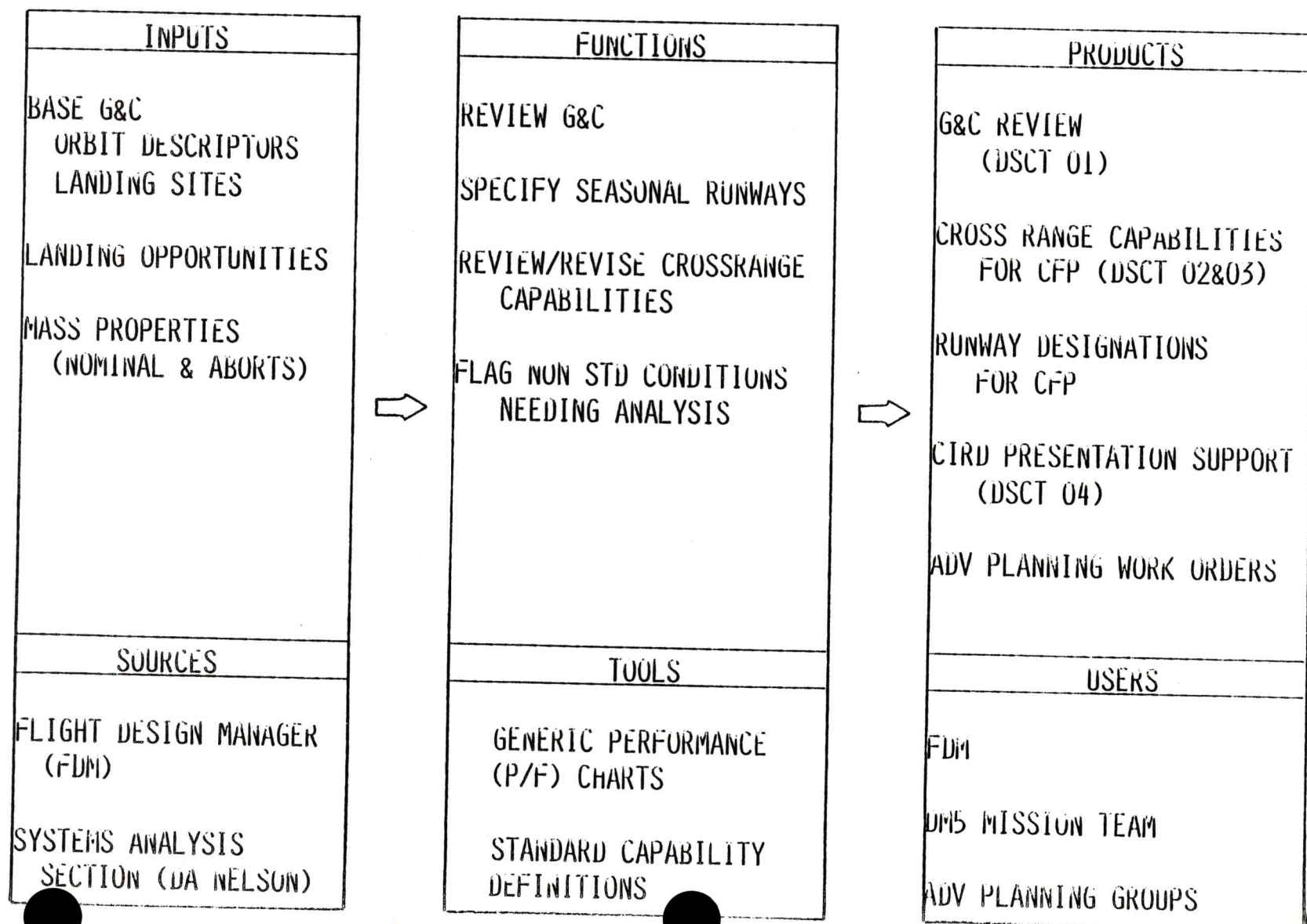
- o MANIFEST
- o THERMAL PROTECTION SYSTEM
- o STRUCTURE
- o FLIGHT CONTROL SYSTEM
- o ENERGY MANAGMENT PROBABILITIES IN AN UNCERTAIN ENVIRONMENT

- oo WINDS
- oo DENSITY

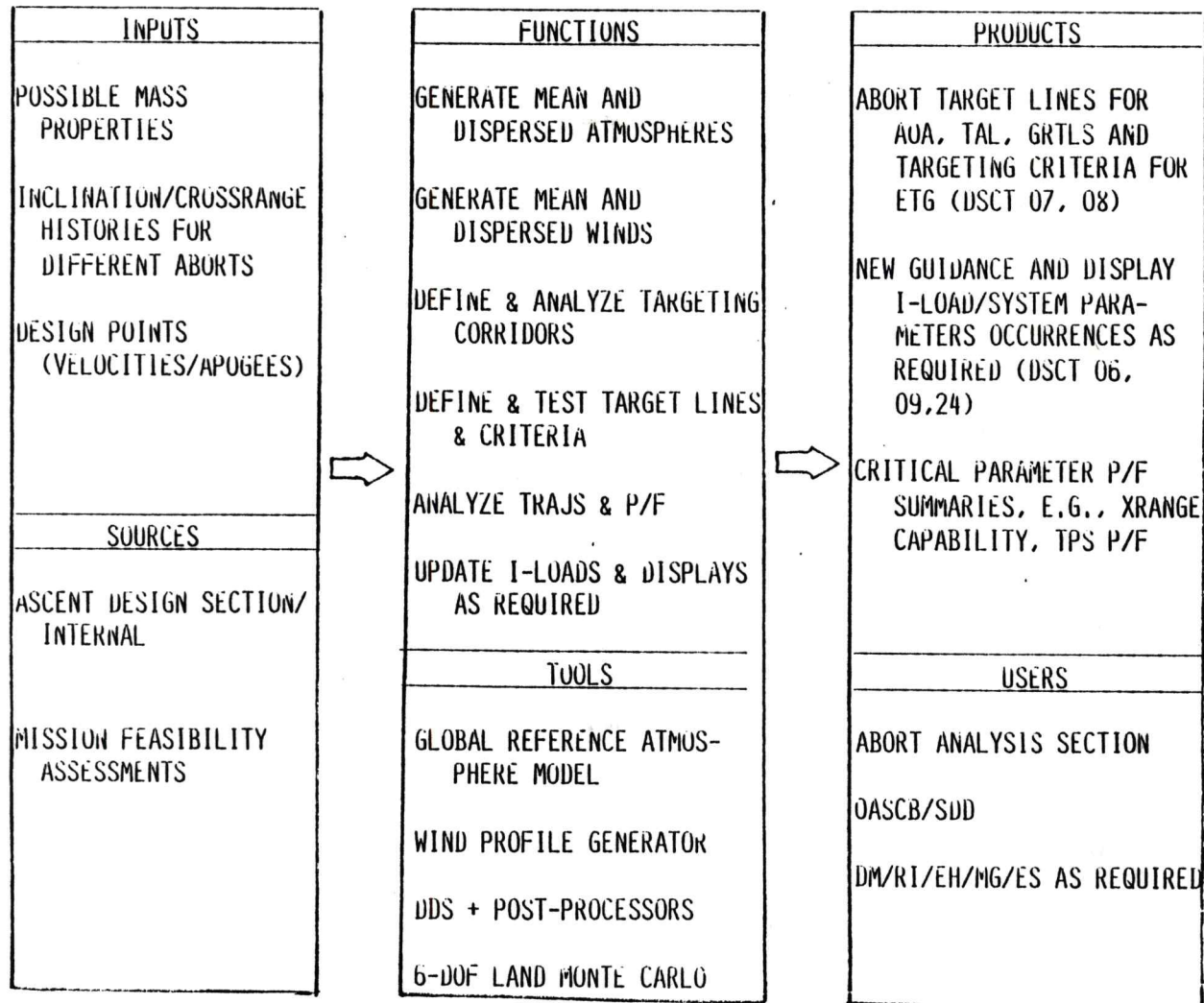
DESCENT RECON FLOW



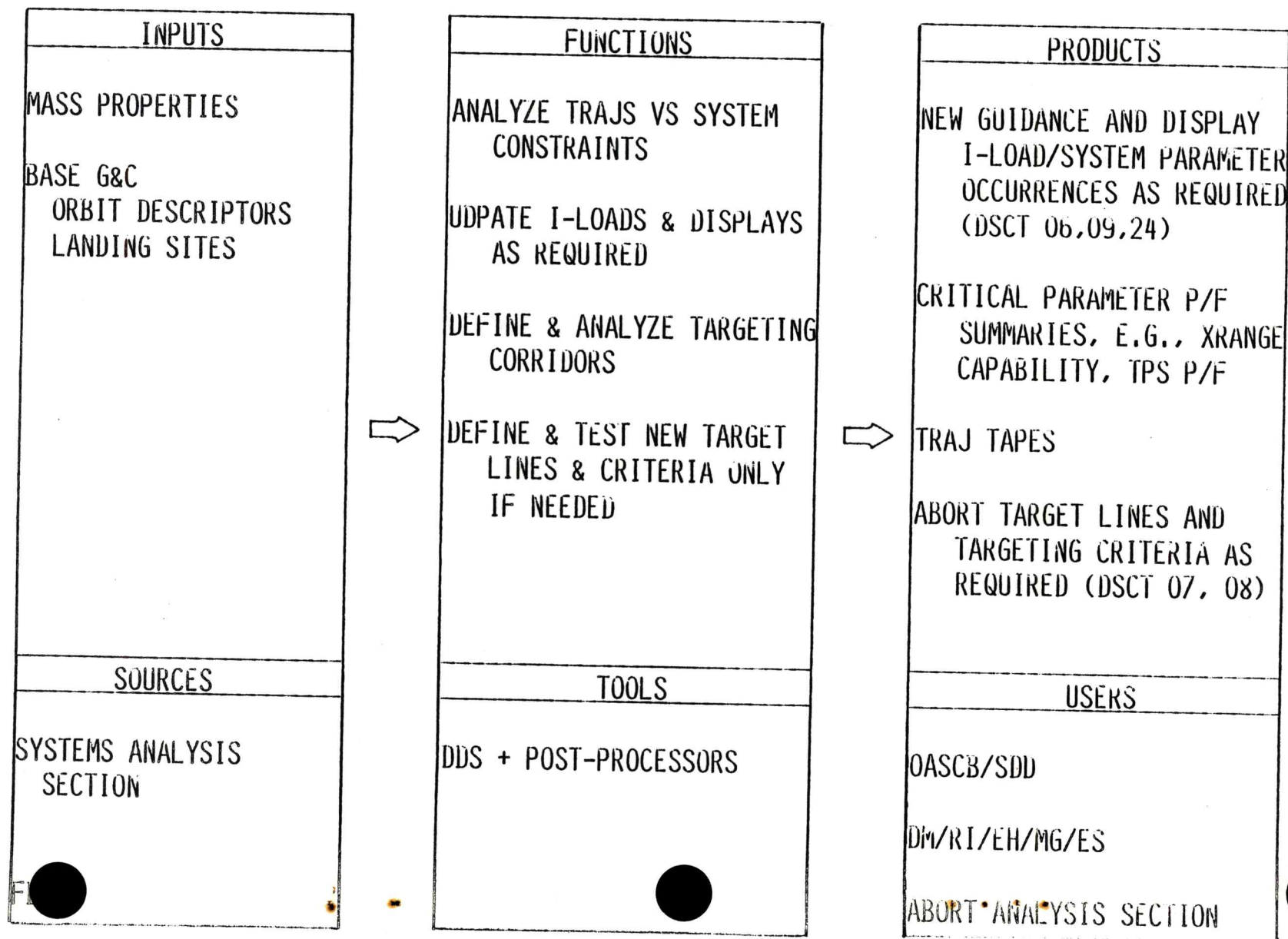
1. FLIGHT FEASIBILITY ASSESSMENT



II. NON STANDARD INCLINATION OR LANDING SITE ANALYSIS

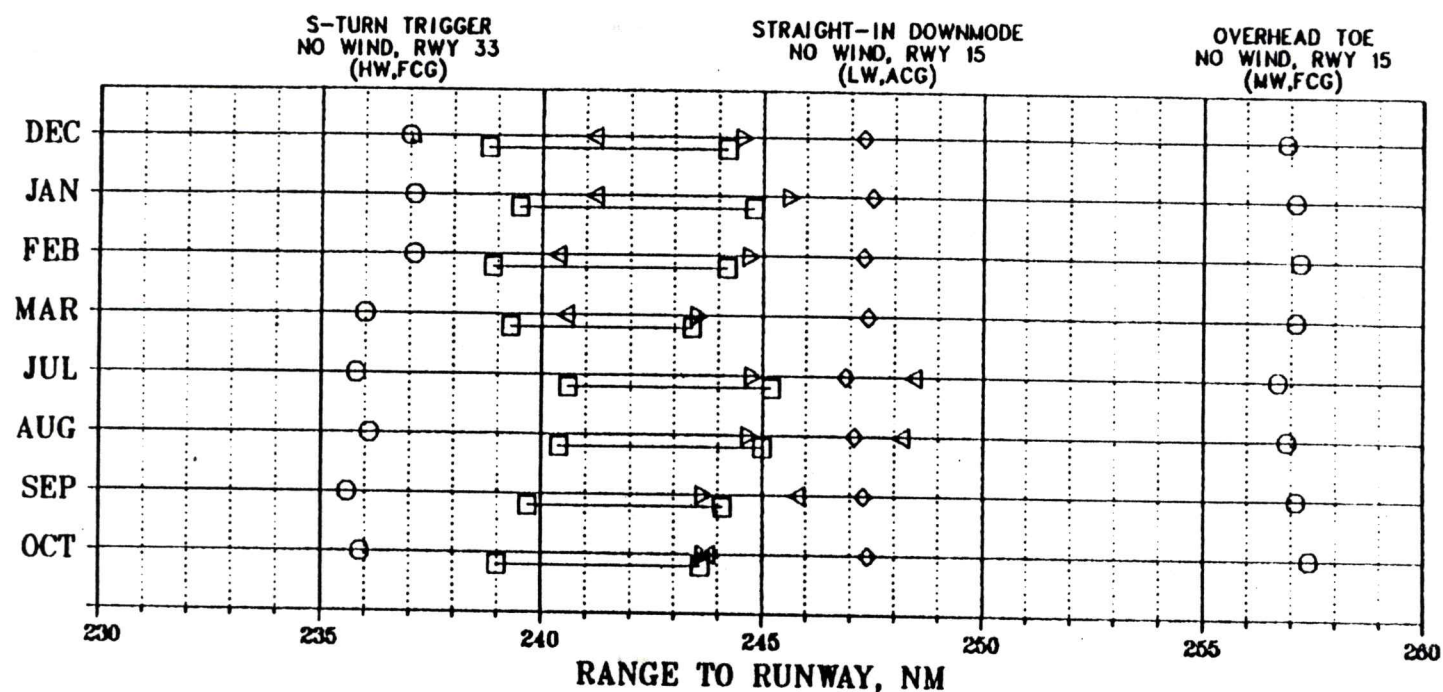


III. NON STANDARD MASS PROPERTY ANALYSIS



KSC SUPER HEAVY WEIGHT FOOTPRINTS

28.5 DEG INCLINATION



LOADS:
HW,FCG - GRNZC1=1.06, ALT AND HDNOM ARE MONTH
DEPENDANT (ALT BASED ON AN 8 PSF ETSEP QBAR)
MW,FCG AND LW,ACG - GRNZC1=1.13, HDNOM=-1482.0,
HD=211140 (AVERAGE ETSEP QBAR OF 7.5 PSF)

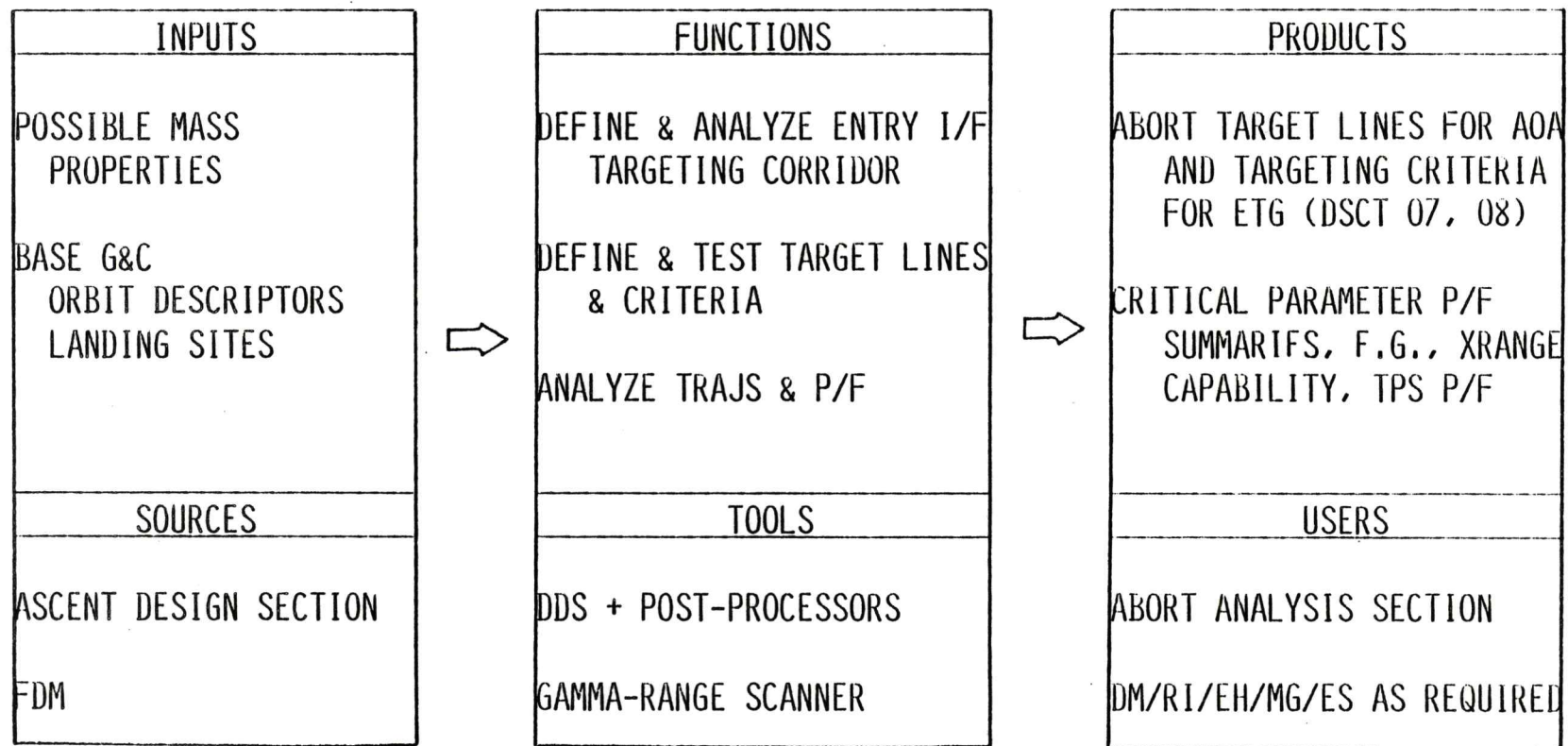
LEGEND
□ = NOMINAL POINTS (LW,ACG-HW,FCG)
◇ = OVERHEAD TO STRAIGHT-IN DOWNMODE
▷ = RSS CONVERGENCE FROM S-TURN TRIGGER
◁ = RSS CONVERGENCE FROM OVERHEAD TOE

	WT(ETSEP) (LB)	CGX (IN)	RCS DMP (S)
HW,FCG	262000.	848.887	270.
LW,ACG	240000.	870.953	130.
MW,FCG	246000.	844.560	130.

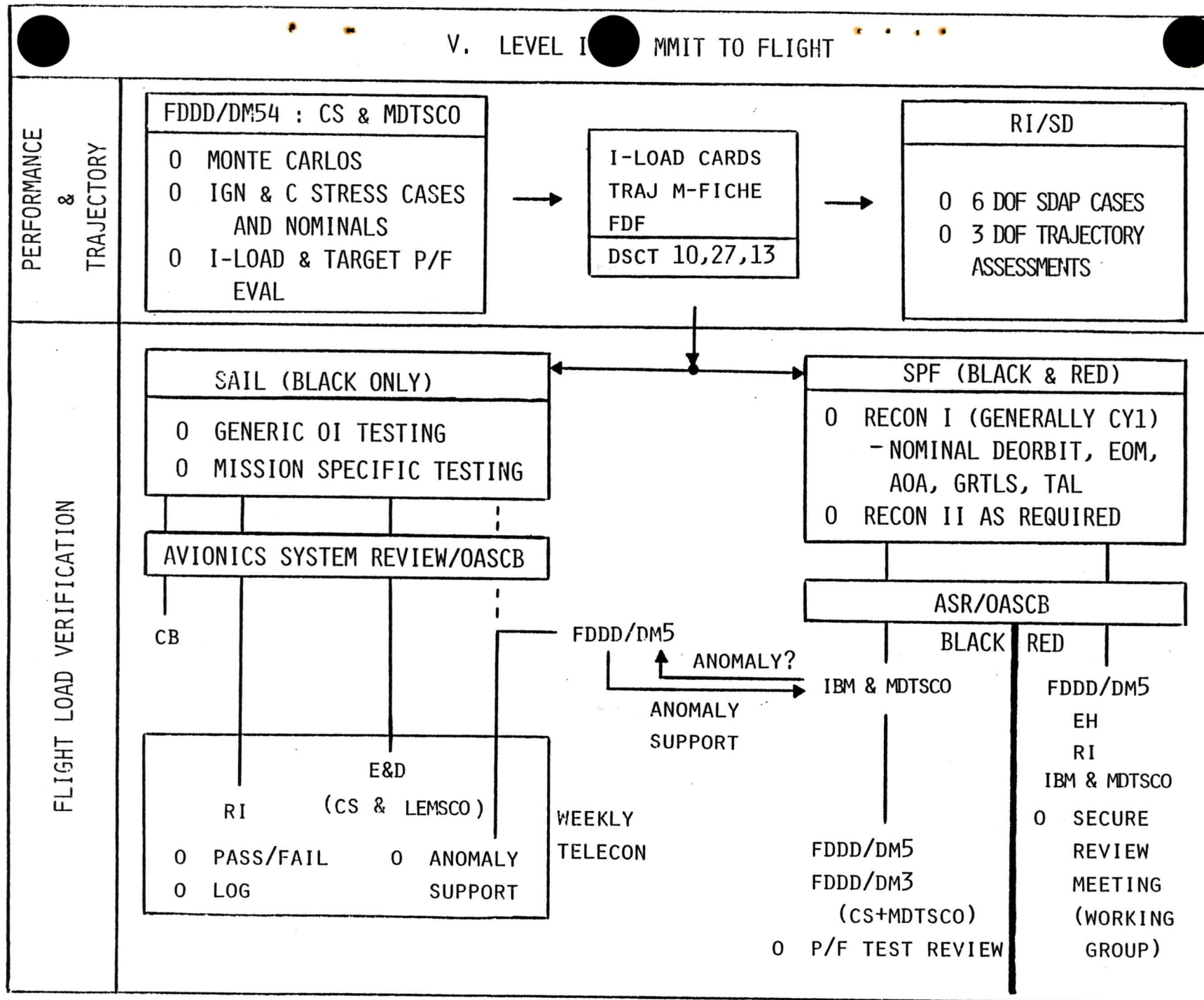
DESIGN VELOCITY = 6350 FPS

NOTE: CASES WHICH USE THE 270S RCS
DUMP ALSO USE THE NEW MPS DUMP.

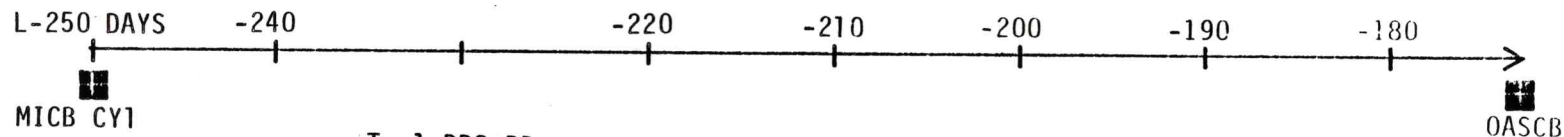
IV. NONSTANDARD APOGEE/PERIGEE ANALYSIS



V. LEVEL I COMMIT TO FLIGHT



Va. PRE-OASCB ACTIVITY



Tool: DDS+PP

VERIFY GUIDANCE I-LOADS
AND ABORT TARGET LINES

DSCT 06
DSCT 07

- TUNE I-LOADS AS REQD
- VERIFY ABORT & EOM
PROFILE PERFORMANCE
WITH FLT SPECIFIC DATA

Tool: SVDS+PPs

EVALUATE EOM
PROFILE IN
IGN&C ENVIR.

DSCT 23&29
VERIF 22&24

- NOMINAL & STRESS
6-DOFs
- DTO EVAL

TOOLS: DDS+PP; SVDS/FDS

GENERATE/VERIFY DEORBIT
TARGETING INPUT FOR EOM

DSCT08

- BALANCE SURFACE AND
BACKFACE TEMPERATURES

TOOLS: DDS+PPs; HP9845

GENERATE/VERIFY ONBOARD DISPLAY I-LOADS

DSCT 09

- EVALUATE USE OF STD I-LOADS
WITH FLT SPECIFIC DATA

TOOL: DDS+PPs

EVALUATE ASCENT ABORT VECTORS

VERIF 17, 27, 28

- AOA, TAL, RTLs
- PRIME & Wx

TOOLS: LAND & SVDS+PPs

EVALUATE AOA
PROFILE IN
IGN&C ENVIR.

VERIF 17
VERIF 20

- NOMINAL 6-DOF
- MONTE CARLO

TOOLS: LAND & SVDS+PPs

EVALUATE EOM,
TAL&GRTLs
IN IGN&C
ENVIRONMENT

- NOMINAL & STRESS
6-DOFs FOR TAL
AND GRTLs
- TAL, GRTLs &
EOM MONTE CARLOS

PP = POST-PROCESSOR

STD = STANDARD

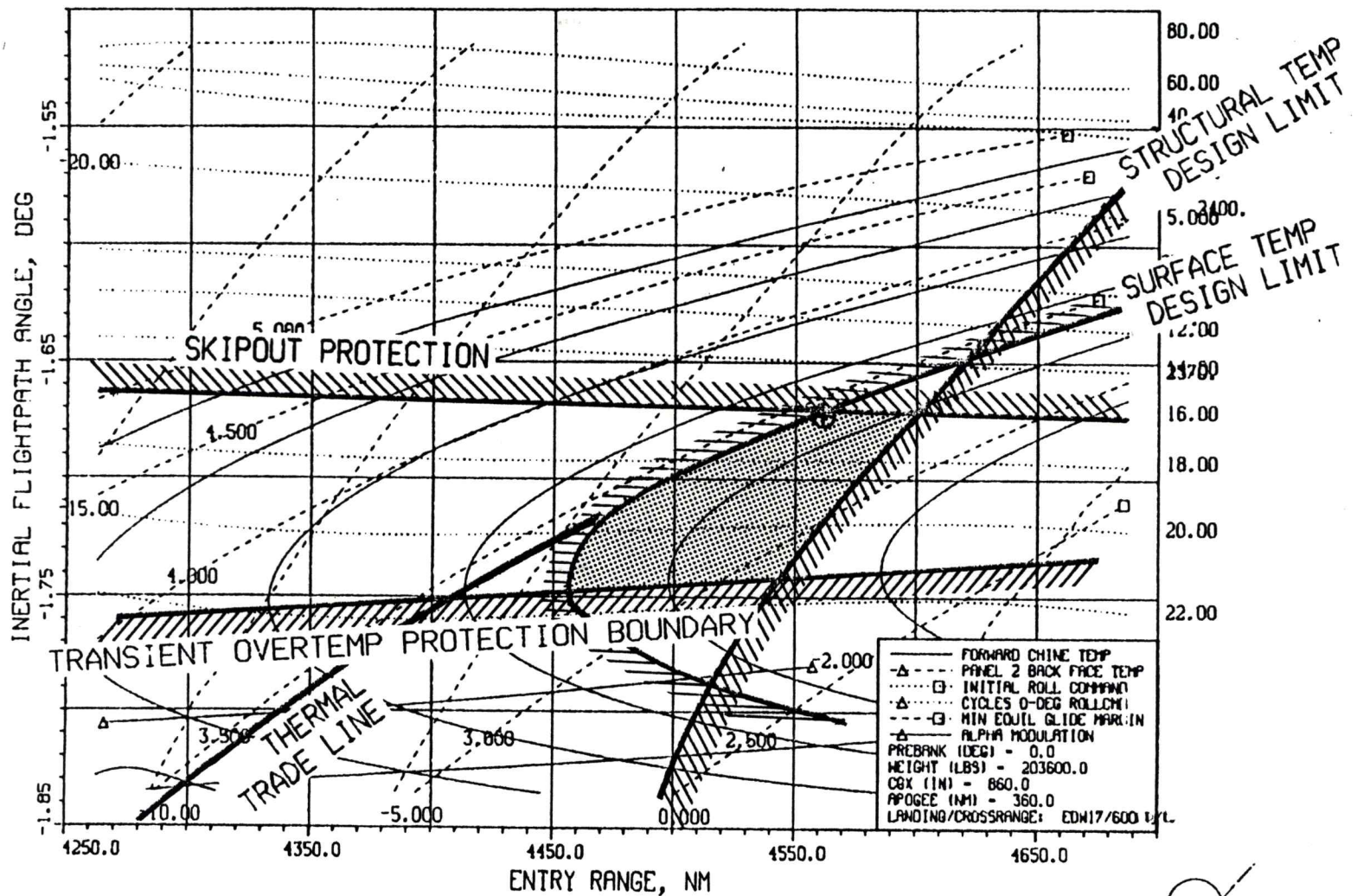
MDTSCO-HOUSTON

MCDONNELL DOUGLAS

CORPORATION

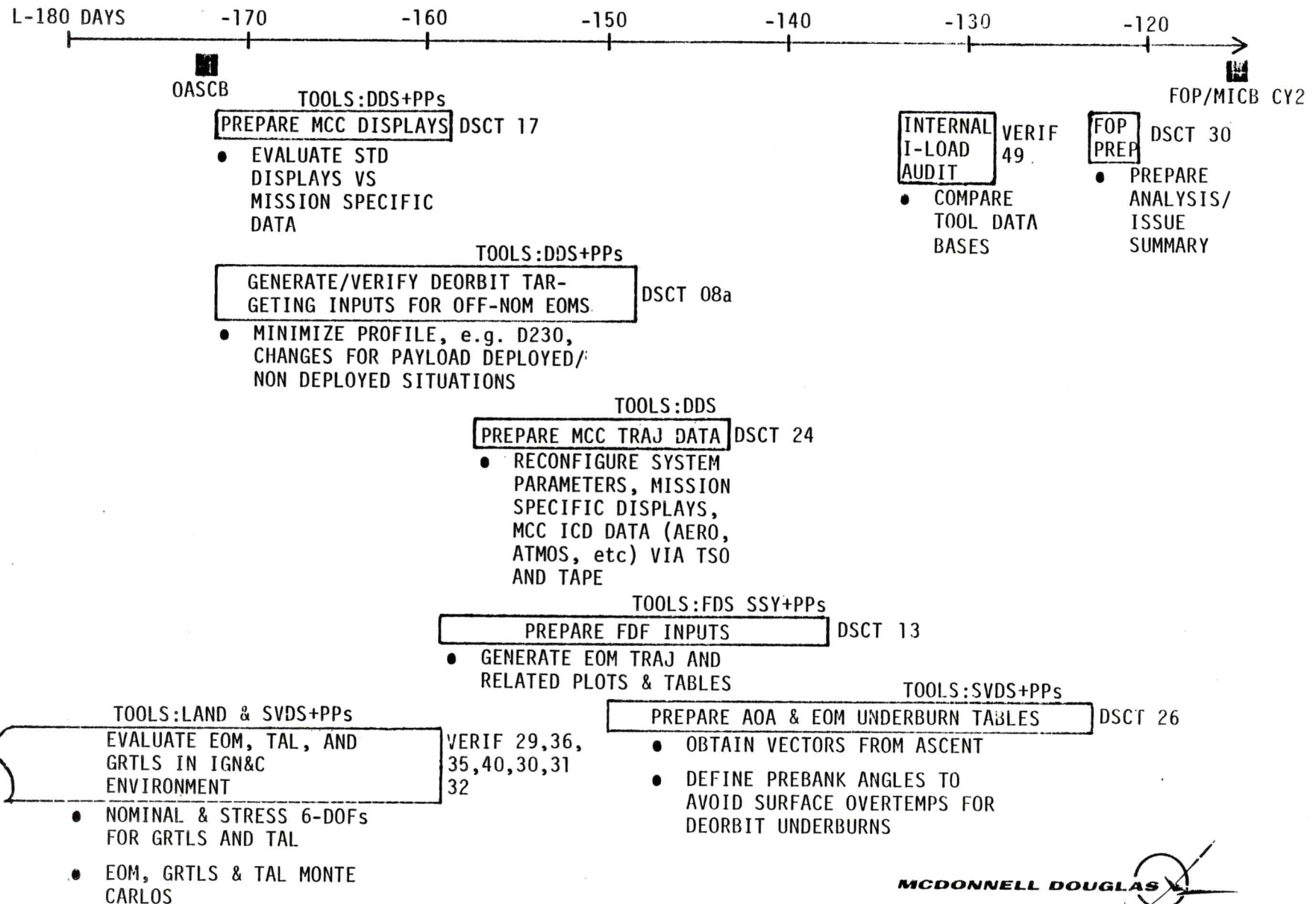
Figure 10 - 72° Descending January Mean Gamma-Range Scan

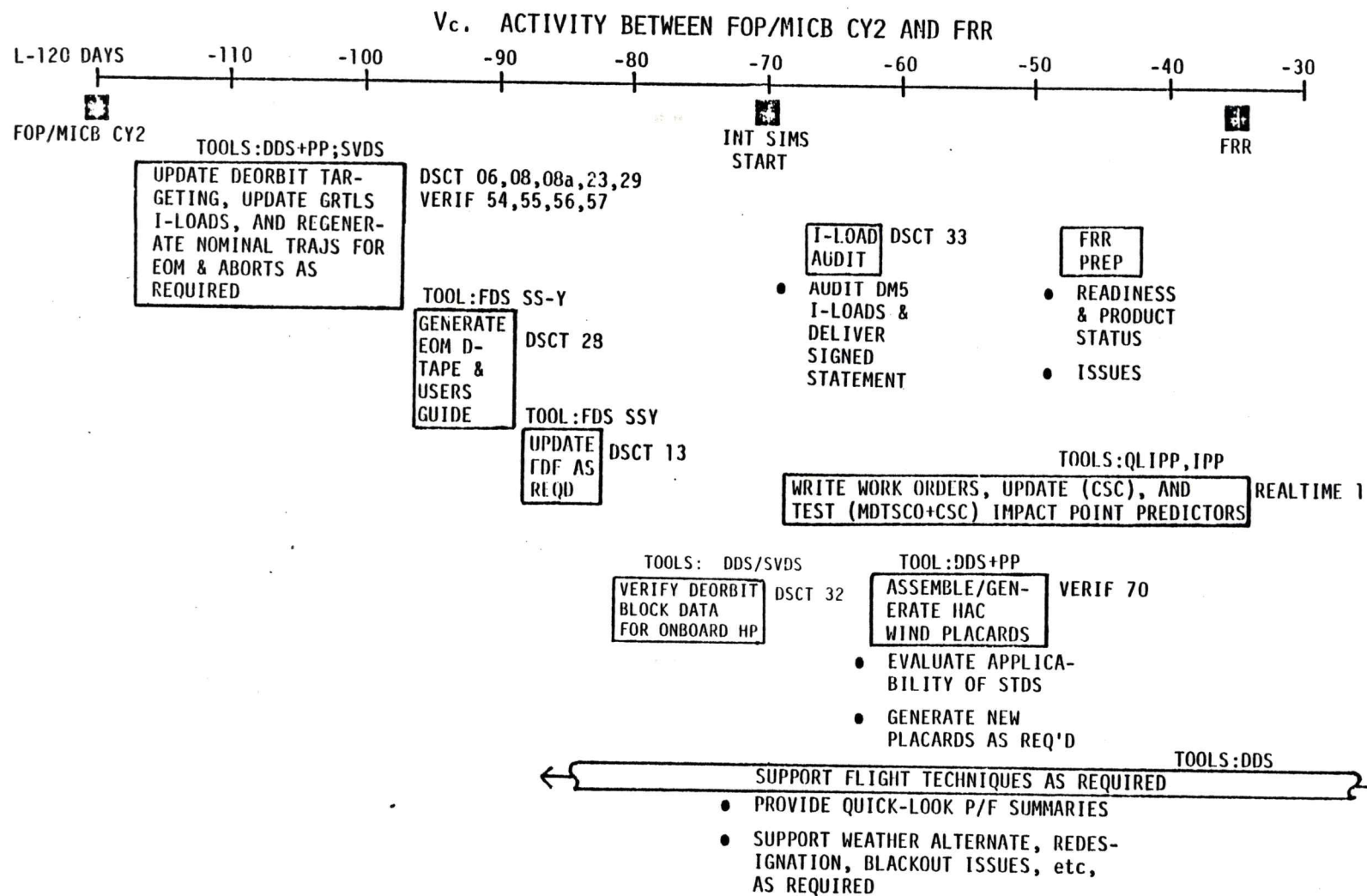
GAMMA-RANGE SCAN



MCDONNELL DOUGLAS CORPORATION

V_b. ACTIVITY BETWEEN OASCB AND FOP/MICB CY2

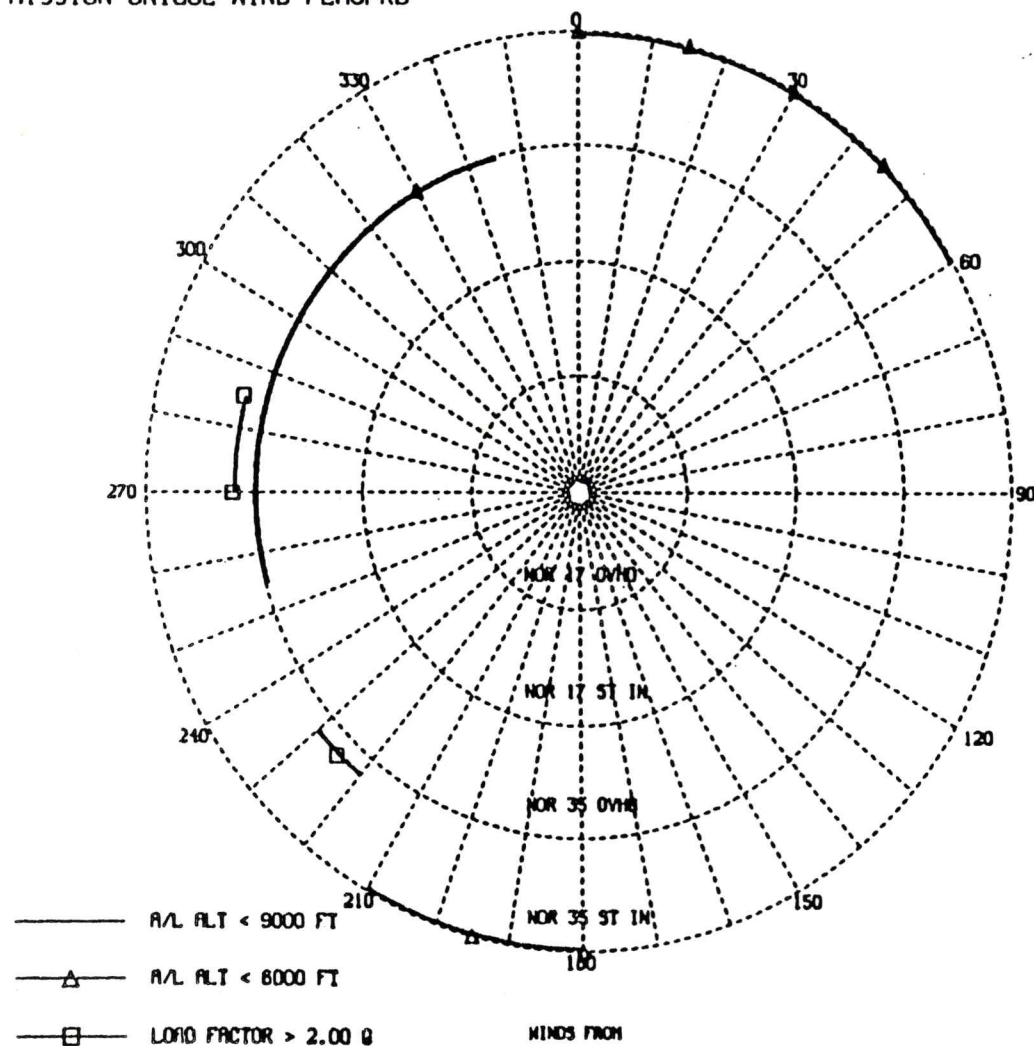




STS-51B AOA TO NORTHRUP

80% KSC FEB WIND

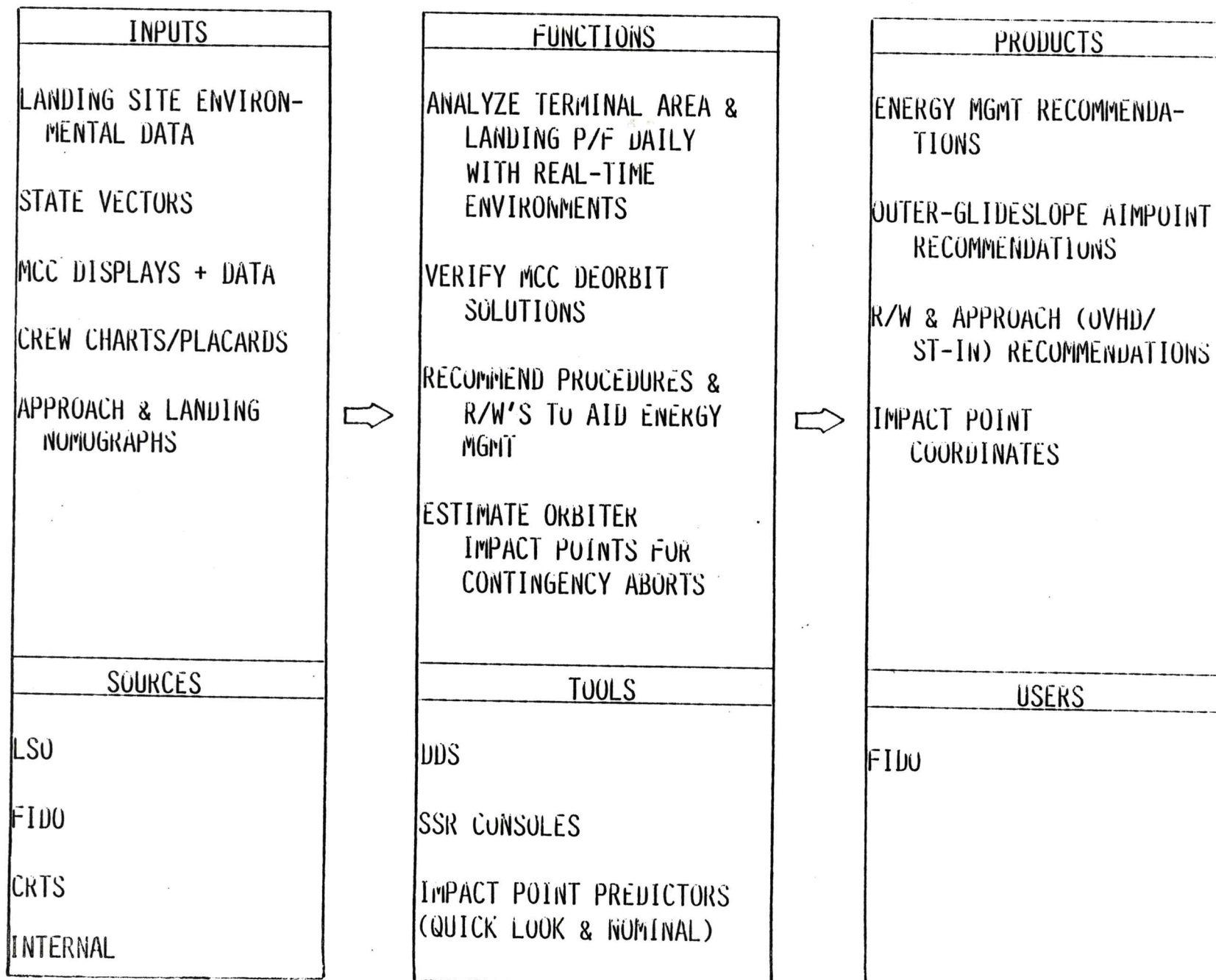
MISSION UNIQUE WIND PLACARD



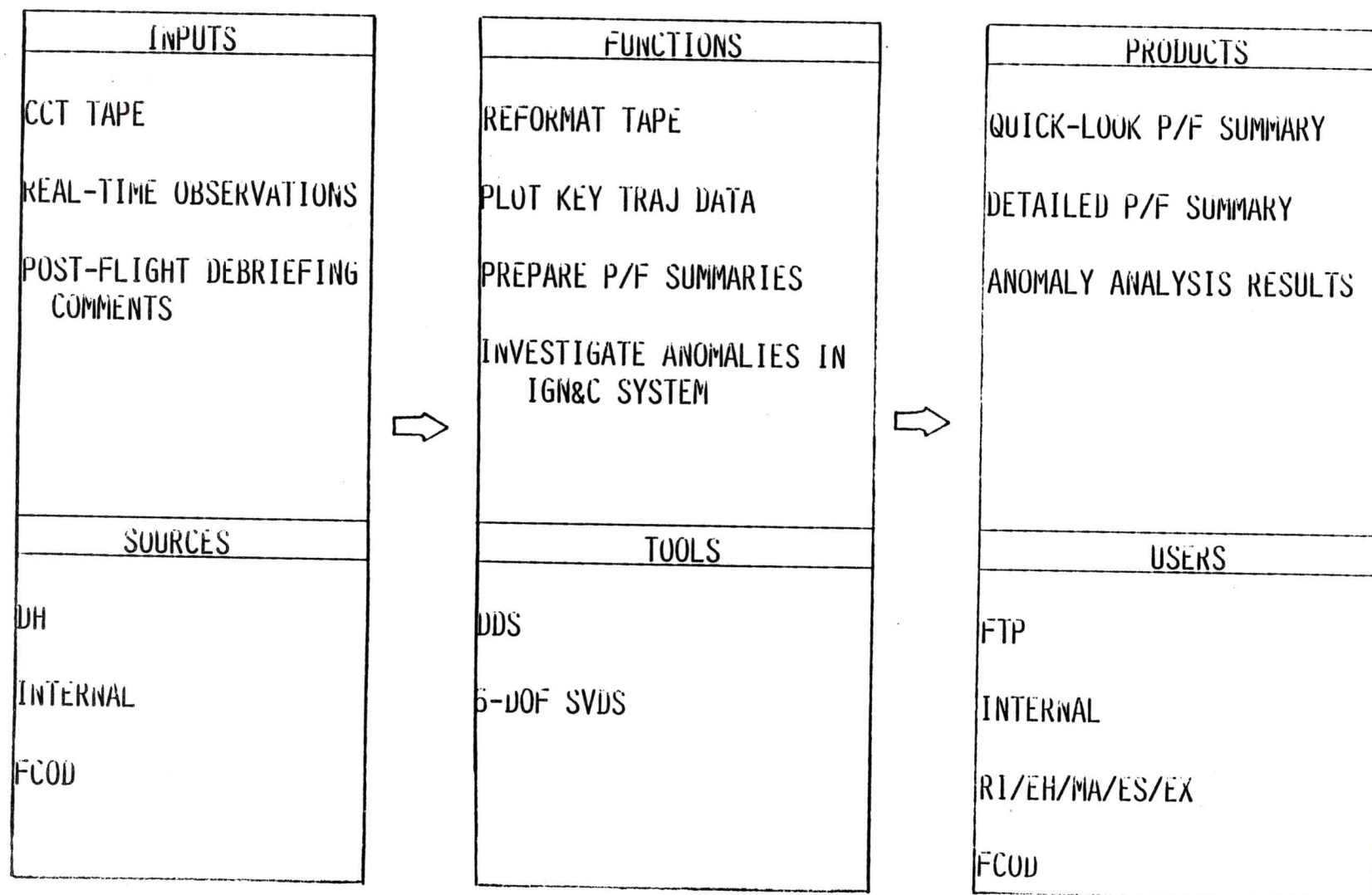
MCDONNELL DOUGLAS



VI. REAL-TIME SUPPORT



VII. POST-FLIGHT ANALYSIS



DESCENT GUIDANCE I-LOADS

<u>CAT</u>	<u>CATEGORY DESCRIPTION</u>	<u>I-LOADS</u>	<u>OCC. #</u>	<u>COMMENTS</u>
<u>ENTRY</u>				
GDE0	ENTRY GUIDANCE	70	002	ETR
		70	003	WTR
ZF10	FIXED I-LOADS - HARPOLD	89	003	ETR
		89	004	WTR
GDT0	ENTRY GUIDANCE, TRAJ. ANCHOR	1	002	STANDARD
<u>TAEM</u>				
GT31	TAEM GUIDANCE, OPS 3	50	102	STANDARD
ZFU1	FIXED I-LOADS - MOORE*	80	101	STANDARD
ZSU2	FIXED I-LOADS - MOORE, CONTD.*	135	201	STANDARD
<u>AUTOLAND</u>				
GL31	AUTOLAND GUIDANCE, OPS 3	21	101	STANDARD
GLC1	AUTOLAND GUIDANCE, COMMON	27	102	STANDARD

* RETAINED BY E&D UNTIL NEW GUIDANCE IS CERTIFIED

DESCENT GUIDANCE I-LOADS (CONCLUDED)

<u>CAT</u>	<u>CATEGORY DESCRIPTION</u>	<u>I-LOADS</u>	<u>OCC. #</u>	<u>COMMENTS</u>
	<u>AUTOLAND</u>			
ZFH1	FIXED I-LOADS - DYER	50	101	STANDARD
ZSH0	SCRUB I-LOADS - DYER	5	001	STANDARD
	<u>GRTLS</u>			
GT12	TAEM GUIDANCE, OPS 1	60 60	202 203	HEAVYWEIGHT LIGHTWEIGHT
XS30	SPF DERIVED STEEP GLIDESLOPE PROFILES	8 8	001 002	HEAVYWEIGHT LIGHTWEIGHT
GL11	AUTOLAND GUIDANCE, OPS1	18 18	101 102	HEAVYWEIGHT LIGHTWEIGHT
GRMO	GRTLS TAEM MISSION UNIQUE	4	-	MISSION WEIGHT

DESCENT I-LOADS FOR ONBOARD DISPLAYS

<u>CAT</u>	<u>CATEGORY DESCRIPTION</u>	<u>I-LOADS</u>	<u>OCC. #</u>	<u>COMMENTS</u>
<u>ENTRY TRAJECTORY DISPLAYS</u>				
ETD1	ENTRY TRAJECTORY DISPLAY PROCESSING	21	102	28 1/2° INCL
		21	103	57° INCL
XS10	SPF DERIVED DISPLAY LABELS	30	001	STANDARD ETR
		30	002	WTR TL
ZFG0	FIXED I-LOADS	94	001	STANDARD
ET10	ENTRY TRAJECTORY DISPLAY 1	143	005	LIGHTWEIGHT 28 1/2° INCL
		143	007	HEAVYWEIGHT 28 1/2° INCL
		143	009	LIGHTWEIGHT 57° INCL
		143	010	HEAVYWEIGHT 57° INCL
		143	012	WTR TL
ET20	ENTRY TRAJECTORY DISPLAY 2	93	005	LIGHTWEIGHT 0° ELEV
		93	006	LIGHTWEIGHT 2° ELEV
		93	007	LIGHTWEIGHT 4° ELEV
		93	008	HEAVYWEIGHT 0° ELEV
		93	009	HEAVYWEIGHT 2° ELEV
		93	010	HEAVYWEIGHT 4° ELEV
		93	011	WTR TL

DESCENT I-LOADS FOR ONBOARD DISPLAYS (CONCLUDED)

<u>CAT</u>	<u>CATEGORY DESCRIPTION</u>	<u>I-LOADS</u>	<u>OCC. #</u>	<u>COMMENTS</u>
ET30	ENTRY TRAJECTORY DISPLAY 3	75	004	LIGHTWEIGHT
		75	005	HEAVYWEIGHT
ET40	ENTRY TRAJECTORY DISPLAY 4	103	001	LIGHTWEIGHT
		103	003	HEAVYWEIGHT
ET50	ENTRY TRAJECTORY DISPLAY 5	126	003	LIGHTWEIGHT
		126	004	HEAVYWEIGHT

VERT SIT DISPLAYS

VE10	VERT SIT 1 DISPLAY, OPS 3	58	004	HEAVYWEIGHT
		58	005	LIGHTWEIGHT
VE20	VERT SIT 2 DISPLAY, OPS 3	47	006	LIGHTWEIGHT
		47	007	HEAVYWEIGHT
VR10	VERT SIT 1 DISPLAY, OPS 1	58	003	HEAVYWEIGHT
		58	005	LIGHTWEIGHT
VR20	VERT SIT 2 DISPLAY, OPS 1	47	006	HEAVYWEIGHT
		47	007	LIGHTWEIGHT
VSA0	VERT SIT DISPLAY, ALPHA-MACH	24	001	LIGHTWEIGHT
		24	002	HEAVYWEIGHT
VSC0	VERT SIT DISPLAY, COMMON	65	001	STANDARD

I-LOAD STATUS

GRTLS

0 CATEGORY GRMU

- 00 CREATE STANDARD CATEGORIES AT 2000LB INCREMENTS
- 00 PERFORM AS REQUIRED UNTIL CR 69971 + MODS IS INCORPORATED (NEW I-LOAD)
- 00 ~ 35 OCCURRENCES

0 WTR ANALYSIS RESULTS

- 00 WILL CHANGE SOME ETR I-LOADS

TAEM & GRTLS

0 CR 69971 + MODS: LOAD FACTOR LIMITER AND NEW SPEEDBRAKE LOGIC

- 00 LIMITS LOAD FACTOR AND IMPROVES HIGH WIND PERFORMANCE
- 00 I-LOAD CHANGES
 - 4 DELETIONS
 - 10 ADDITIONS

- 00 INCORPORATION: 0110

TAEM

- 0 VERIFICATION OF STANDARD ENERGY TRIGGER LINES MAY CHANGE SOME PRESENT I-LOADS

I-LOAD STATUS (CONCLUDED)

ENTRY

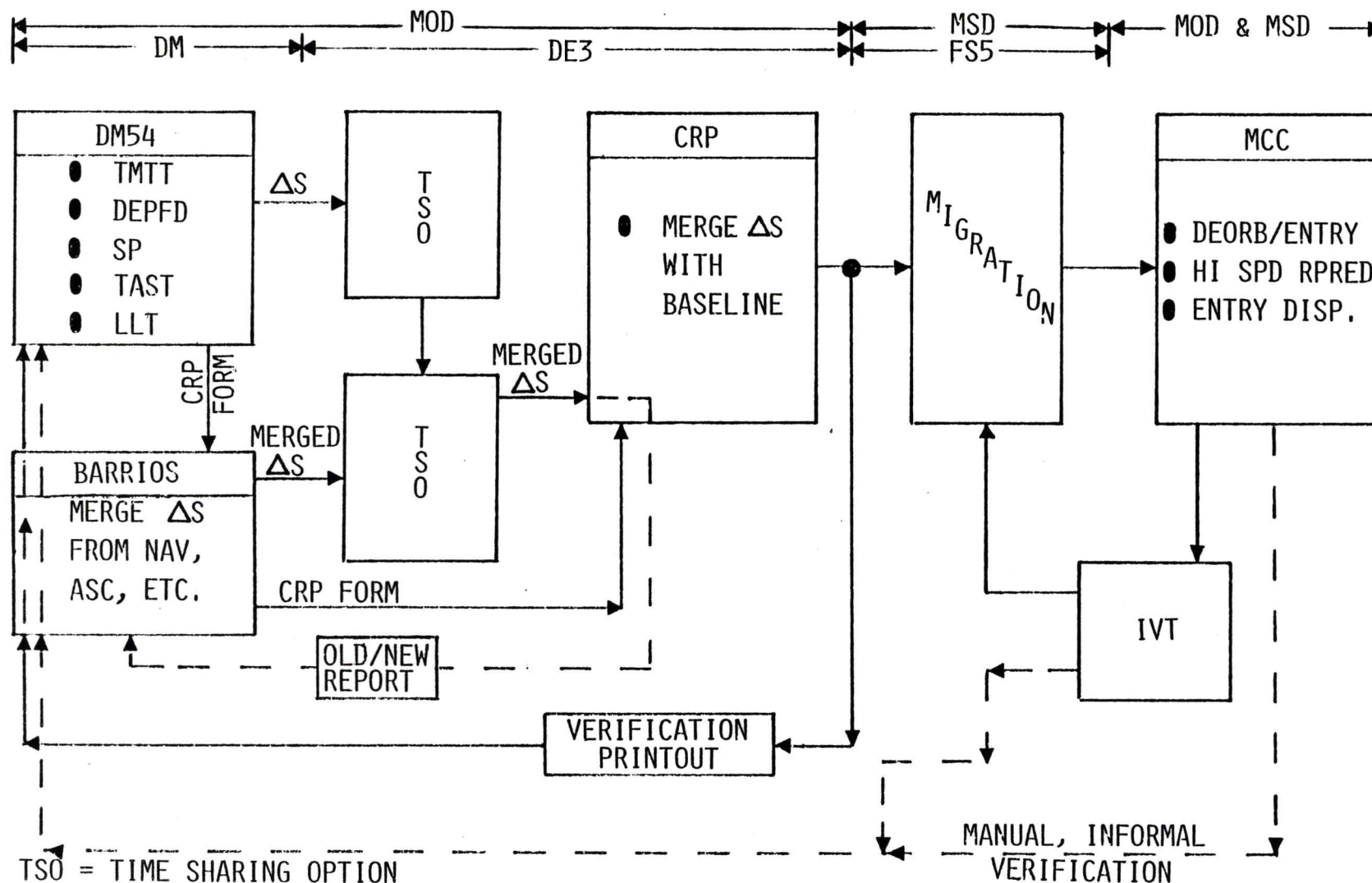
- 0 ALL ETR OCCURRENCES ARE STANDARD I-LOADS
- 0 A NEW WTR OCCURRENCE WILL UPDATE THE TRAINING LOAD OCCURRENCE

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MCC SYSTEM PARAMETER RECONFIGURATION



TSO = TIME SHARING OPTION

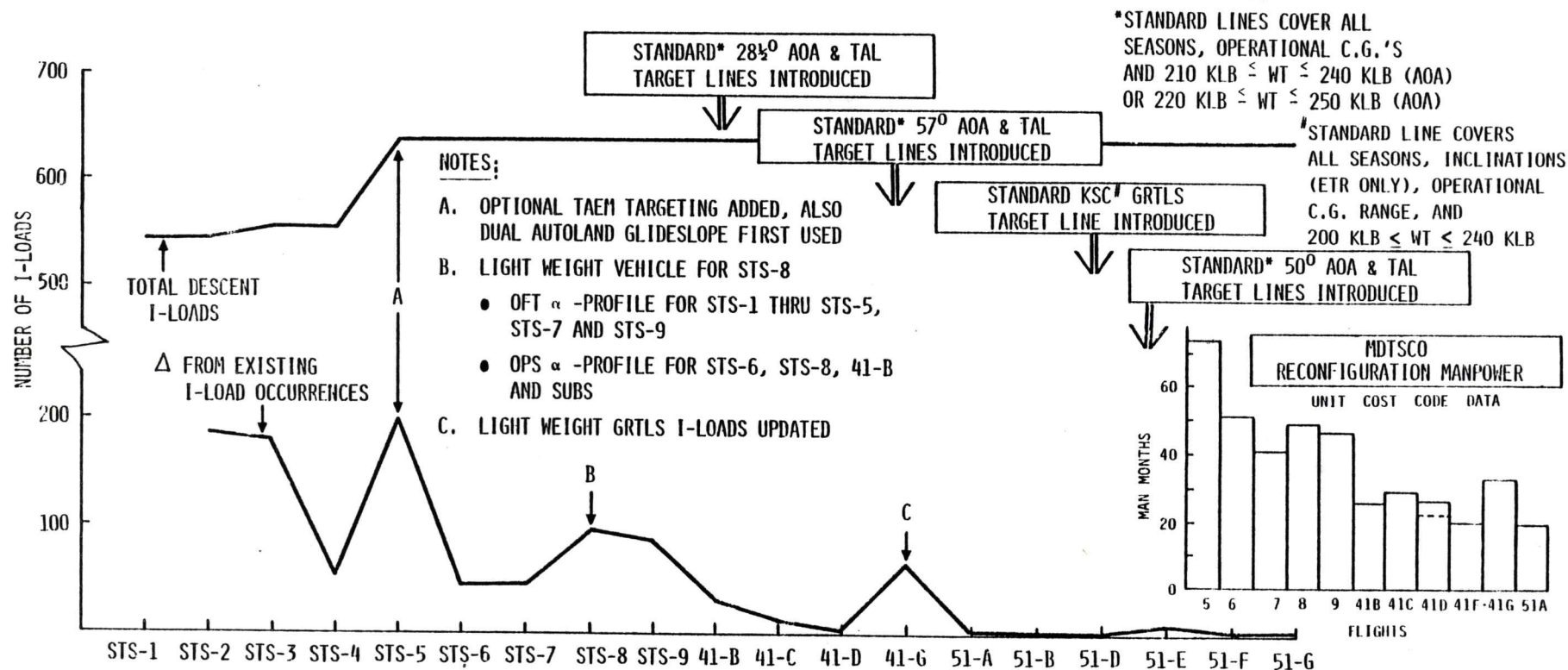
CRP = CONFIGURATION REQUIREMENTS PROCESSOR

IVT = INTERFACE VERIFICATION TEST

MCC DATA LOADING VIA TSO

TMTT (~ 50)	MISCELLANEOUS TRAJECTORY TABLE	MISCELLANEOUS ENTRY, TAEM I-LOADS: RARELY CHANGE
DEPFD (~ 250)	DEORBIT ENTRY PLANNING FLIGHT DEPENDENT TABLE	ENTRY/TAEM I-LOADS: RARELY CHANGE
SP (~ 600)	SYSTEM PARAMETERS TABLE	ENTRY/TAEM I-LOADS & ETG VALUES: THREE MISSION SPECIFIC CHANGES FOR ETG
TAST (150)	TRIM AERODYNAMIC SCHEDULE TABLE	ELEVON, SPEEDBRAKE SCHEDULES AND OTHER CONTROL SURFACE DATA: ELEVON & SPEEDBRAKE SCHEDULES ARE MISSION DEPENDENT AND ARE THE ONLY ITEMS TO CHANGE (~ 18 ITEMS)
LLT (380 X 2)	LIMIT LINES TABLE o ENTRY DRAG CORRIDOR o ENTRY RANGE LIMITS o GRTLS ENERGY CORRIDOR o TAEM RANGE LIMITS	ENTRY, TAEM AND GRTLS MCC DISPLY DATA: ETR TAEM & GRTLS ARE STANDARDIZED (CHOOSE LIGHT OR HEAVYWEIGHT SET). NUMEROUS MISSION SPECIFIC UPDATES FOR ENTRY (226).

DESCENT STANDARDIZATION PROGRESS

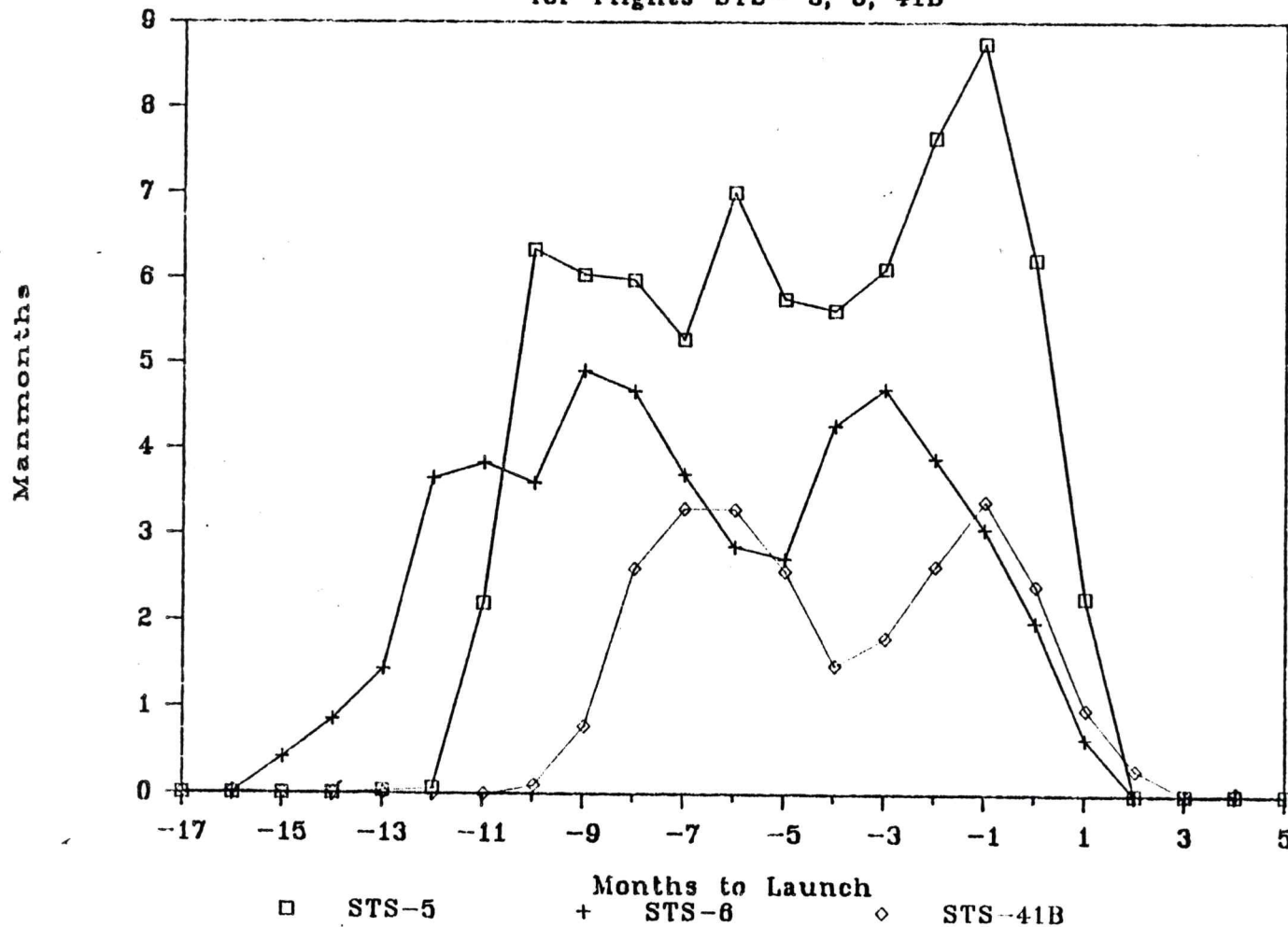


OTHER PRODUCTIVITY IMPROVEMENTS

- 0 6-DOF STRESS CASE REDUCTIONS
- 0 STANDARD ABORT D-TAPES AND FDF INPUTS
- 0 STANDARD MCC AND ONBOARD DISPLAY INPUTS
- 0 STANDARD HAC WIND PLACARDS (75% DONE)
- 0 STANDARD DDS RUNSTREAMS FOR TARGET LINE, I-LOAD, ASCENT ABORT VECTOR, AND DISPLAY INPUT VERIFICATION

MDTSCO Descent Group Manpower

for Flights STS- 5, 6, 41B



MDTSCO - HOUSTON

MCDONNELL DOUGLAS



RECON STREAMLINING GOALS

- o "REPEAT" DEFINITION IMPROVEMENTS
 - oo MONTE CARLOS
 - oo O/B & MCC DISPLAY DATA
 - oo OTHER VERIFICATION DATA AS POSSIBLE
- o CONTINUED STANDARDIZATION OF COMPUTER INTENSIVE PRODUCTS
 - oo CREW CHARTS AND PLACARDS
- o CONTINUED DEFINITION OF AUTOMATION CANDIDATES
 - oo CONCEPT OF DATA BASES LINKED WITH AUTO-QA FUNCTIONS SHOWS PROMISE
 - oo INPUT TO ADV TOOL REQUIREMENTS TASK
- o INCREASED USE OF PARAPROFESSIONALS
 - oo PRIORITIZED LIST OF CANDIDATE TASKS FOR TRANSITION IS IN WORK
 - oo CONTROLLED I-PACKS, CHECKLISTS, QA-PACKS, AND SOFTWARE TO BE DEFINED THROUGHOUT THE SUMMER
- o INCREASED LEAD TIME FOR MCC LOAD QA

WTR & STANDARDIZATION

GOALS

- o MINIMIZE OVERALL FLIGHT SYSTEM RECON
- o PROVIDE REMANIFESTING & LAUNCH SLIP FLEXIBILITY
- o EVOLVE TO A "PULL-OFF-THE-SHELF" OPERATION
 - STANDARD DESIGNS WITH CATALOGED CAPABILITIES

APPROACH

- o DEVELOP MINIMUM NUMBER OF I-LOAD OCCURRENCES AND ABORT TARGET LINES
 - oo VERIFY & CATALOG THE MASS PROP/SEASONAL CAPABILITIES THAT ARE CONSISTENT WITH SYSTEM CONSTRAINTS AND ENVIRONMENTAL UNCERTAINTIES

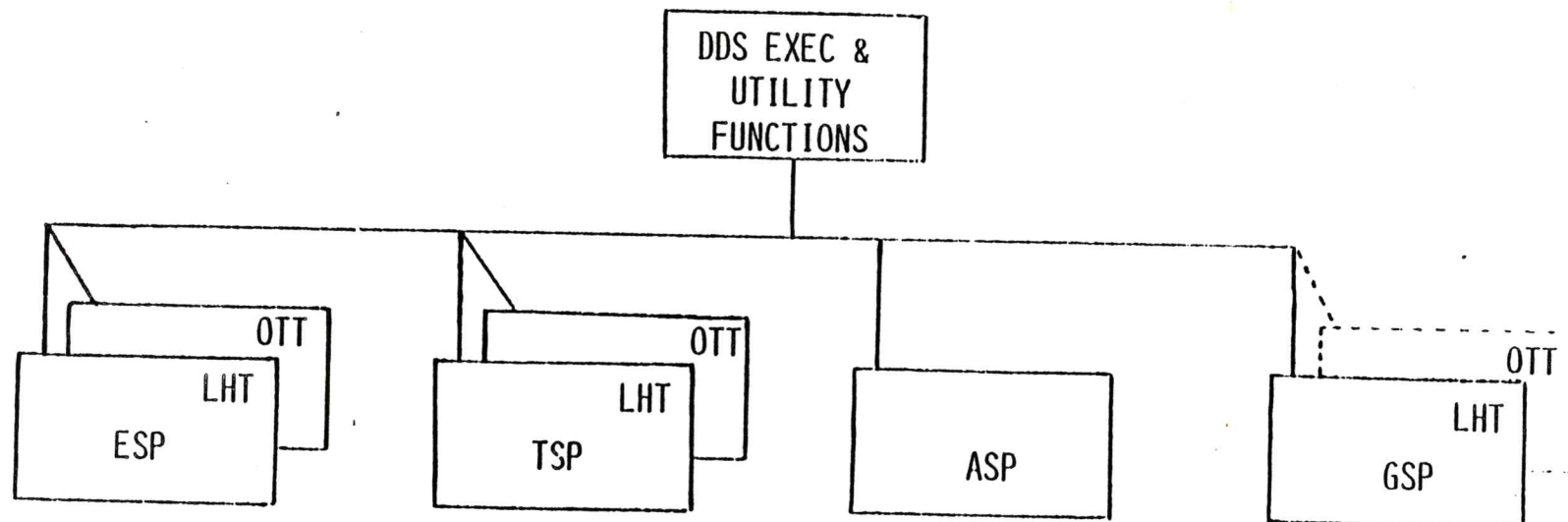
CURRENT CHALLENGES/ISSUES

- o WTR ENTRIES ON DESCENDING REVS
- o WTR GRTLS W/CROSSRANGE FOR TANK DISPOSAL
- o ETR HEAVYWEIGHTS & ASSOCIATED DUMP MODS
- o TPS DESIGN LIMITS

ADVANCED TOOL REQUIREMENTS

- o CONSISTENT EFFORT HAS BEEN DEVOTED TO ADVANCING THE TOOLS FOR THE DESCENT DESIGN JOB
 - oo 1ST GENERATION TOOLS EVOLVED AS SEPARATE BATCH PROGRAMS
 - oo DDS (2ND GENERATION TOOL): 1) COLLECTED TOOLS, 2) USED INTERACTIVE APPROACH, AND 3) PROVIDED ELECTRONIC DATA TRANSFERS
- o RECENT THRUSTS HAVE BEEN TOWARD FURTHER IMPROVING DDS DATA HANDLING/PROCESSING
 - oo PLACARD PLOTTER DATA TRANSFER & POST-PROCESSORS
 - oo GAMMA-RANGE SCANNER DATA TRANSFER & POST-PROCESSORS
 - oo GRTLS TARGETING CORRIDOR FUNCTIONS
 - oo PRODUCT AUTOMATION DATA TRANSFERS & POST-PROCESSORS
 - oo DATA BASE INITIATIVES
- o WE ALSO PROVIDE TEST SUPPORT TO REQUIREMENTS IMPLEMENTERS
 - oo MDTSCO SDB (DDS)
 - oo CSC (SVDS)

DESCENT DESIGN SYSTEM OVERVIEW



- LHT VERSION INITIALLY RELEASED 9/80
- OTT VERSION INITIALLY RELEASED 12/81
- PROTOTYPE MODULES RELEASED 11/77

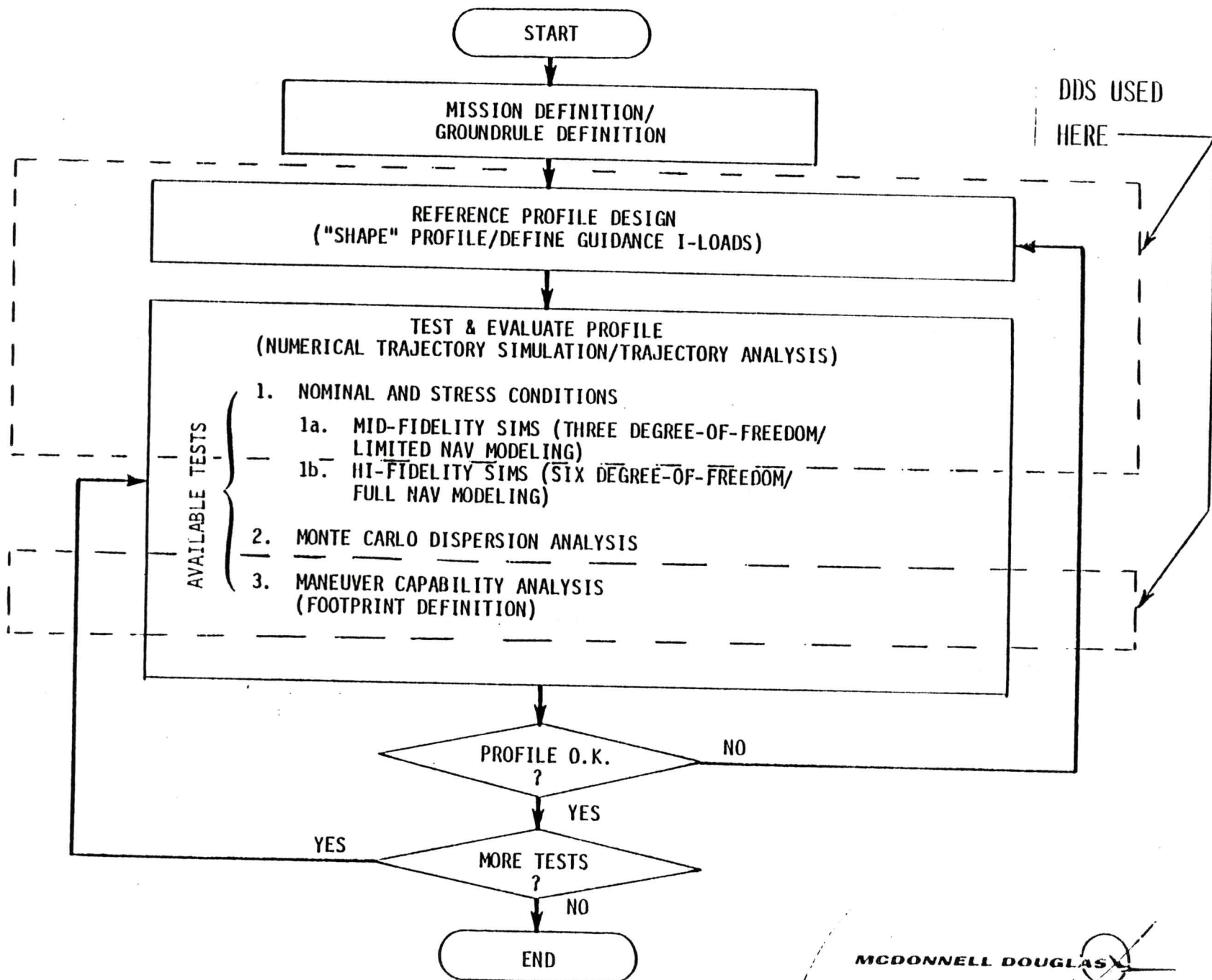
- LHT VERSION INITIALLY RELEASED 2/80
- OTT VERSION INITIALLY RELEASED 2/81

- INITIALLY RELEASED 2/79

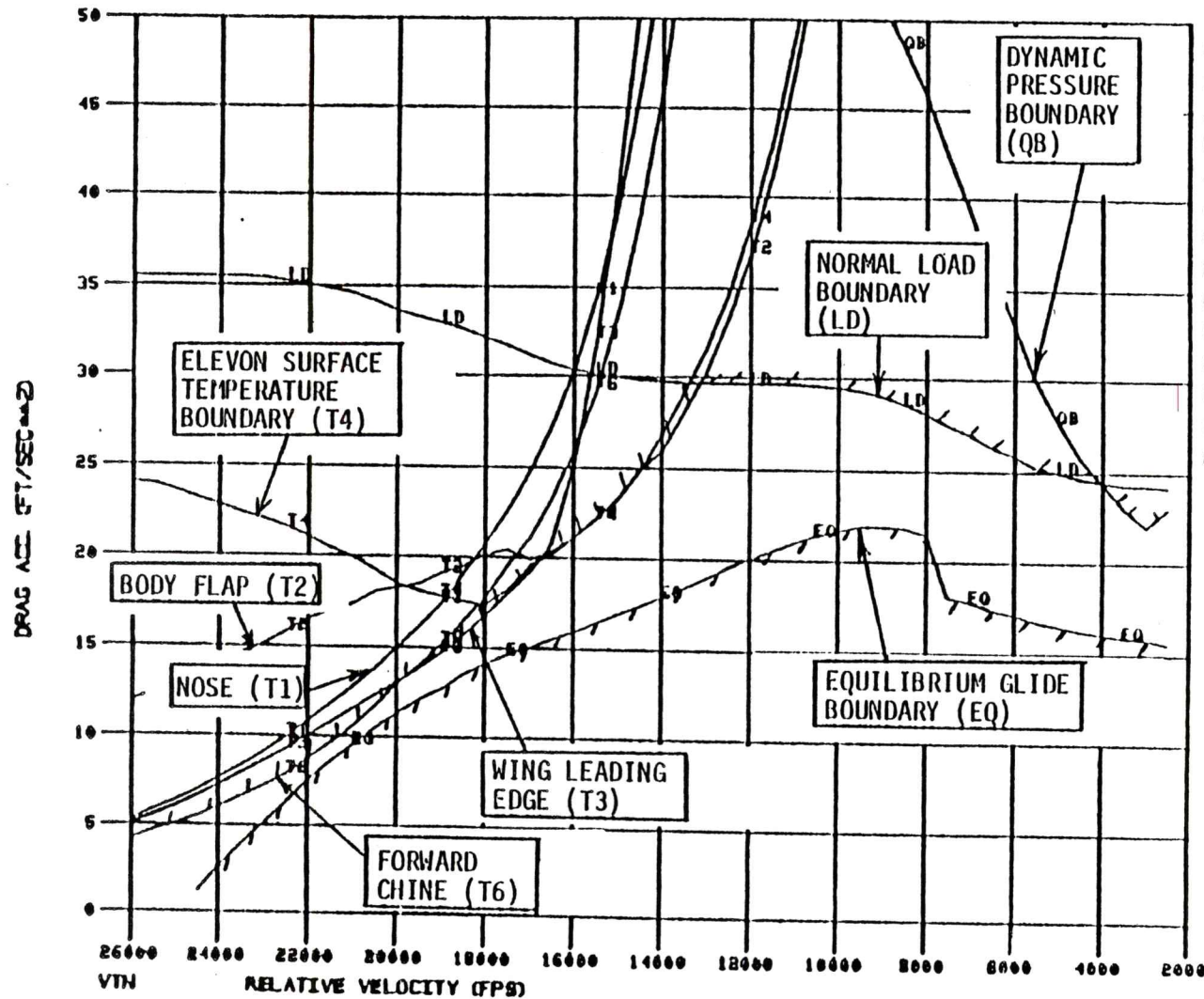
- LHT VERSION INITIALLY RELEASED 12/81
- PROTOTYPE GSP-LHT FULLY OPERATIONAL 11/81
- REQUIREMENTS FOR GSP-OTT TO BE DELIVERED MID-APRIL 1982

DDS = DESCENT DESIGN SYSTEM
 ESP = ENTRY SHAPING PROCESSOR
 TSP = TAEM SHAPING PROCESSOR
 ASP = APPROACH & LANDING PROCESSOR
 LHT = LEFT-HAND-TURN (FLIGHT S/W VERSION 18)
 OTT = OPTIONAL TAEM TARGETING (FLIGHT S/W VERSION 19)

THE DDS AND DESCENT FLIGHT DESIGN



DEFINE ENTRY CORRIDOR



TEST CASE 1
 VT 200000
 XCG 87L
 ALPHA 30/20
 ELEV 25/DEG
 ATM 62/STD
 AERO OCT/79
 OBAR 300/300
 EO GL 37/ 20
 LF 16/ 16
 CP1 2600
 CP2 2400
 CP3 2751
 CP4 2421
 CP6 2453

DESCENT DESIGN SYSTEM
DEMONSTRATION

BRET McCLEARY
MDTSCO X511
23 MAY 1985



0 INTRODUCTION

00 MAJOR ENTRY SHAPING PROCESSOR PROFILE DESIGN STEPS

- 000 ANGLE OF ATTACK PROFILE DEFINITION
- 000 ENTRY CORRIDOR DETERMINATION
- 000 TRAJECTORY PROFILE SHAPING
- 000 ENTRY INTERFACE TARGETING
- 000 TRAJECTORY SIMULATION

00 DESCENT DATABASE TRACKER

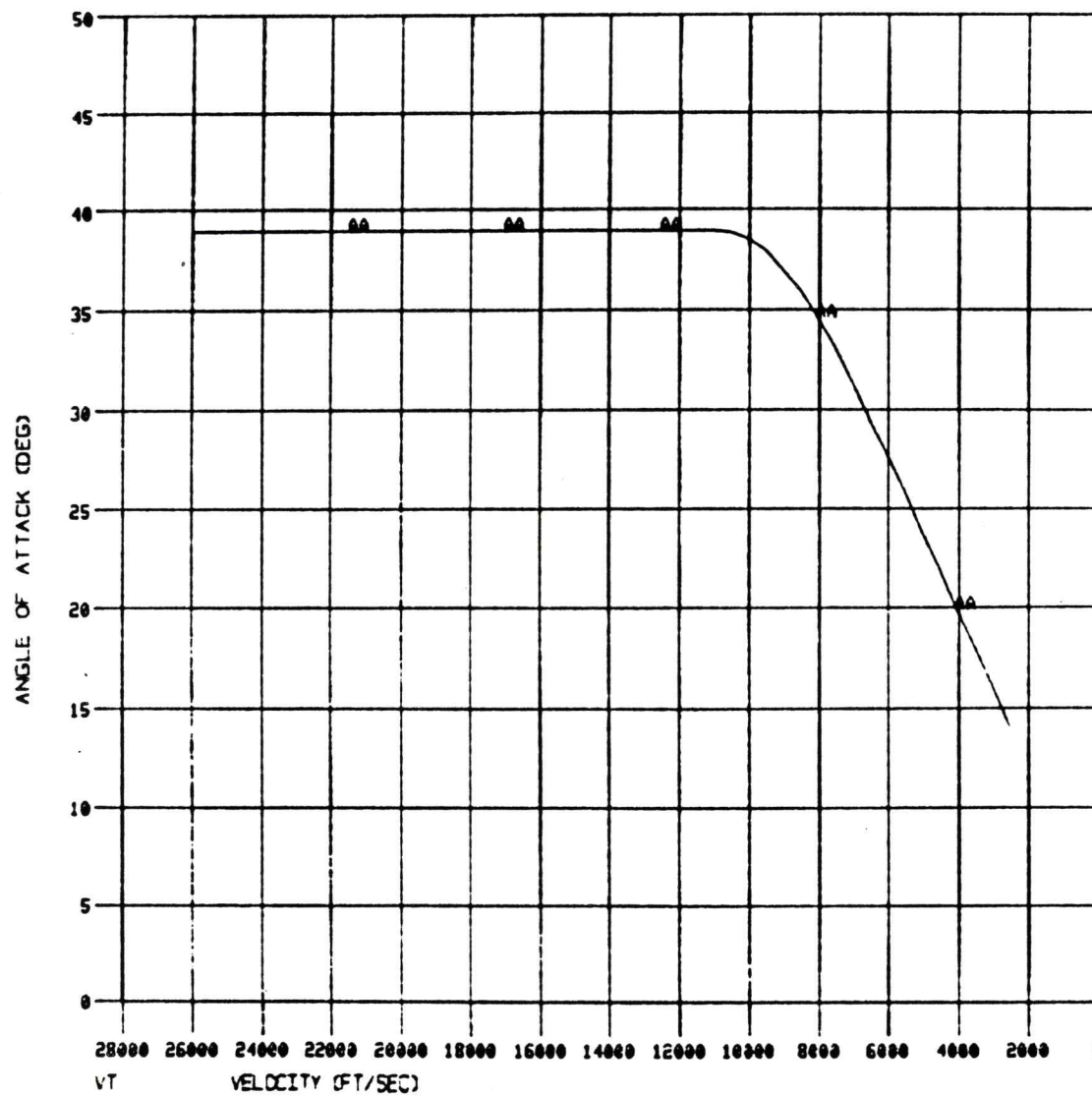
0 ANGLE OF ATTACK PROFILE DEFINITION

00 DEFINED BY ALPHPT OR CV TABLE

00 $\alpha = \text{CALP0(I)} + \text{CALP1(I)} * V + \text{CALP2(I)} * V^2$

00 ANGLE OF ATTACK PROFILE CAN BE PLOTTED (FIGURE 1)

FIGURE 1 - ANGLE OF ATTACK SCHEDULE



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0 ENTRY CORRIDOR DETERMINATION

00 DEFINED BY LIMITS TABLE

00 DRAG VALUES FOR ALL BOUNDARIES CAN BE
LISTED AND PLOTTED (FIGURES 2 AND 3)

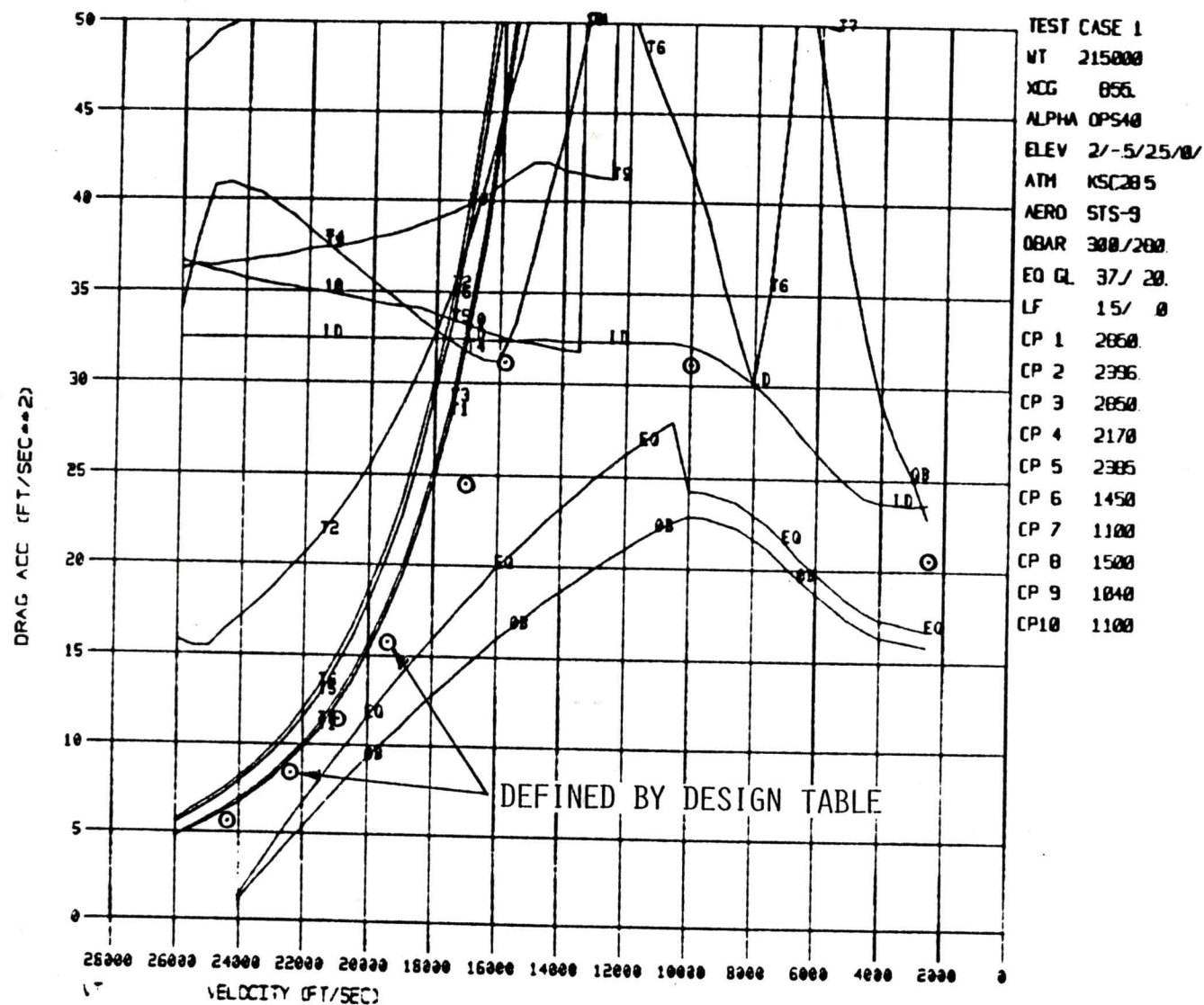
FIGURE 2 - DESIGN LIMIT DRAG ACCELERATION SUMMARY

VELOCITY FT/SEC	CP1 2850.	CP2 2396.	CP3 2850.	CP4 2170.	CP5 2385.	CP6 1450.	CP7 1100.	CP8 1500.	CP9 1040.	CP10 1100.	EQ GLIDE 37./20.	LOAD FAC 1.50/.00	QBAR 300./280.	UPPER LIMIT	LOWER LIMIT
26000.	4.70	15.76	4.83	34.01	5.52	5.73	47.80	674.27	36.26	36.64					
25500.	5.16	15.44	5.29	38.05	6.05	6.27	48.52	742.59	36.45	36.42			32.50	4.70	
25000.	5.61	15.43	5.76	40.81	6.58	6.83	49.49	815.52	36.41	36.09			32.49	5.16	
24500.	6.12	16.36	6.29	41.02	7.19	7.45	49.91	897.90	36.57	35.98			32.49	5.61	
24000.	6.70	17.08	6.87	40.69	7.86	8.16	50.66	991.13	36.68	35.74			32.49	6.12	
23500.	7.34	17.88	7.54	40.42	8.62	8.95	51.44	xxxxxx	36.81	35.55	1.32		32.48	6.70	1.32
23000.	8.07	18.76	8.29	39.73	9.49	9.85	52.26	xxxxxx	36.95	35.39	2.74		32.48	7.34	2.74
22500.	8.91	19.72	9.14	39.17	10.47	10.87	53.13	xxxxxx	37.12	35.24	4.10		32.48	8.07	4.10
22000.	9.85	20.65	10.11	38.39	11.59	12.02	54.04	996.58	37.37	35.10	5.40		32.48	8.91	5.40
21500.	10.92	21.70	11.22	37.70	12.85	13.34	55.00	981.30	37.40	34.99	6.70		32.48	9.85	6.70
21000.	12.15	22.84	12.48	37.01	14.30	14.84	56.02	965.79	37.54	34.78	7.97		32.48	10.92	7.97
20500.	13.56	24.12	13.93	36.30	15.97	16.57	57.09	950.43	37.72	34.61	9.20		32.52	12.15	9.20
20000.	15.18	25.55	15.59	35.57	17.88	18.56	58.23	934.26	37.92	34.47	10.40		32.47	13.56	10.40
19500.	17.06	27.13	17.52	34.90	20.10	20.86	58.69	919.05	38.16	34.34	11.58		32.47	15.18	11.58
19000.	19.24	28.95	19.76	34.23	22.67	23.54	59.69	905.59	38.43	34.23	12.72		32.47	17.06	12.72
18500.	21.78	30.76	22.38	33.55	25.68	26.72	60.63	895.40	38.73	34.15	13.83		32.46	19.24	13.83
18000.	24.78	32.88	25.51	32.91	29.58	30.37	61.65	901.39	39.07	33.83	14.92		32.46	21.78	14.92
17500.	28.33	35.25	29.10	32.33	33.42	34.71	62.77	961.80	39.47	33.53	15.97		32.45	24.78	15.97
17000.	32.53	37.97	33.43	31.80	38.40	39.89	63.95	xxxxxx	39.91	33.30	16.99		32.45	28.33	16.99
16500.	37.53	41.16	38.57	31.32	44.45	46.18	65.42	xxxxxx	40.37	32.94	17.99		32.44	31.80	17.99
16000.	43.69	44.74	44.90	31.28	51.65	53.66	66.29	xxxxxx	41.02	32.68	18.94		32.43	37.53	18.94
15500.	51.02	48.00	52.44	33.34	60.75	63.29	67.54	xxxxxx	41.59	32.43	19.92		32.43	43.69	19.92
15000.	60.64	52.38	62.47	36.88		69.97	68.89	xxxxxx	42.23	32.31	20.78		32.41	51.02	20.78
14500.		58.08		40.53		67.81	70.33	xxxxxx	42.22	32.12	21.63		32.44	60.64	21.63
14000.		64.38		44.05		64.56	71.93	xxxxxx	41.77	31.97	22.45		32.44		22.45
13500.				48.63		60.63	73.72	xxxxxx	41.60	31.88	23.23		32.43		23.23
13000.				52.80		56.73	77.18	xxxxxx	41.39	166.98	24.05		32.41		24.05
12500.				58.83		53.75	95.51	xxxxxx	41.32	208.81	24.79		32.40		24.79
12000.				65.55		50.83	123.64	xxxxxx	117.19	263.87	25.50		32.39		25.50
11500.						48.47	157.46	xxxxxx	149.55	277.70	26.18		32.40		26.18
11000.						46.13	204.25	xxxxxx	193.81	274.69	26.84		32.40		26.84
10500.						44.11	234.37	xxxxxx	234.28	265.03	27.54		32.42		27.54
10000.						41.67	225.70	xxxxxx	221.90	250.28	28.07		32.41		28.07
9500.						39.06	207.30	xxxxxx	201.97	229.11	24.27		32.24		24.27
9000.						35.75	185.30	xxxxxx	180.49	198.71	24.23		31.87		24.23
8500.						32.84	163.93	xxxxxx	163.98	168.39	23.98		31.44		23.98
8000.						30.25	135.38	xxxxxx	143.15	140.08	23.65		30.86		23.65
7500.						35.36	103.83	xxxxxx	138.45	122.10	23.11		30.18		23.11
7000.						45.21	77.32	834.36	162.76	133.82	22.45		29.39		22.45
6500.						59.04	60.06	534.06	168.34	142.18	21.58	61.02	28.46		21.58
6000.						81.99	50.08	348.53	122.75	107.41	20.69	54.43	27.46		20.69
5500.						122.85	49.86	407.49	109.47	103.07	19.86	48.26	26.51		19.86
5000.						341.95	55.95				19.12	42.52	25.53		19.12
4500.							77.14				18.38	37.15	24.75		18.38
4000.											17.81	32.91	24.04		17.81
3500.											17.37	29.47	23.79		17.37
3000.											17.14	26.99	23.67		17.14
2500.											16.32	25.14	23.58		16.32
											16.70	23.71	22.94		16.70

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FIGURE 3 - DESIGN BOUNDARIES



0 TRAJECTORY PROFILE SHAPING

00 DEFINED BY DESIGN OR ILOADA TABLE

00 FIVE MAJOR PHASES

000 PRE-ENTRY

000 TEMPERATURE CONTROL

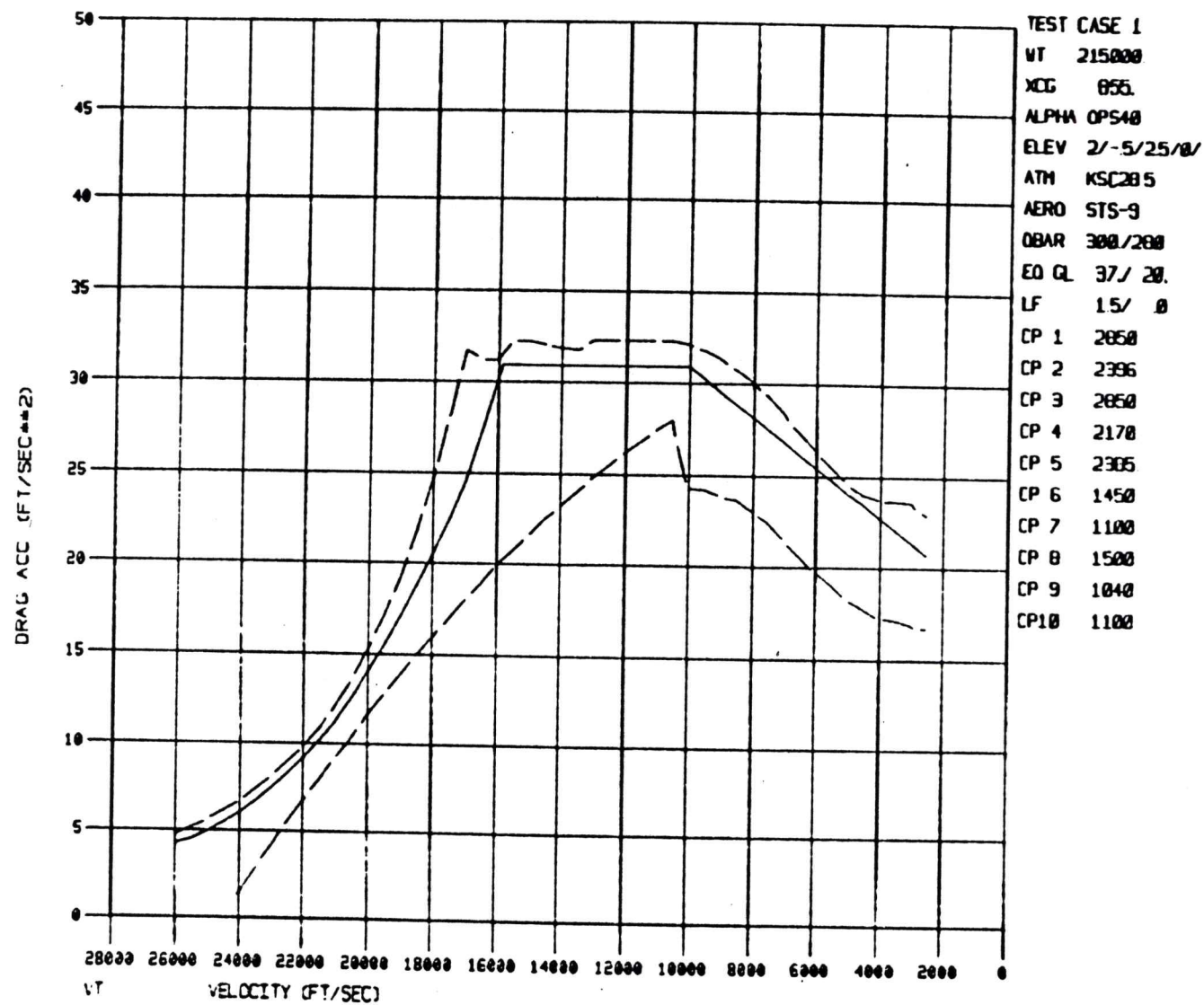
000 EQUILIBRIUM GLIDE

000 CONSTANT DRAG

000 TRANSITION

00 PROFILE GENERATED BY FIT OR PROFILE COMMAND (FIGURE 4)

FIGURE 4 - DESIGN DRAG PROFILE



0 ENTRY INTERFACE TARGETING

00 INITIALIZED BY PVINIT FUNCTION (FIGURE 5)

00 DEFINED BY TARGET TABLE

00 PURPOSE IS TO DEFINE PROPER EI STATE VECTOR (FIGURE 6)

FIGURE 5 - POSITION-VELOCITY INITIALIZATION FUNCTION

```

ENTRY          1026 HOURS 13 APR 1985
ENTRY  )PUINIT
XYZI    -.15062815+08    -.37687443+07    .87570441+07
XYZID    .80133420+04    -.23724987+05    .60500034+04
XYZE    -.18694034+08    -.53035325+07    .87570441+07
ERA EI    -4.66 DEG TO    -1114.27 SEC RANGE 4422.14 NM
FLAND    -164.16 DEG PHID    24.40 DEG PSII    74.57 DEG
ENTRY  )

```

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FIGURE 6 - ENTRY TARGET GENERATOR SAMPLE OUTPUT

```

EI TARGETING MODE 1 - - - SPECIFIED APOGEE ALTITUDE
UI = 25762.2 FT/SEC      VEL DELTA MAX = 100.00      EI ALTITUDE = 400000.0
APOGEE = 150.0 NM      UREF = 23000.0 FT/SEC      RTUREF = 2646.8 NM
LANDING SITE LONG = -80.7060      LATD = 28.6329
AZIMUTH = 149.99      ALTITUDE = -199.40

ETG MODE IS APPROXIMATE GAMMA-FREE      UI = 25762.2
N6 = 15
EIFPA = -1.081438      VELOS = 23499.5 TIME = 497.28 H = 247978.2 IOSFLG = 1 DOS = -.10 ROLCMD = -9.82 LATD = 28.73 1 N = 15
EIRANGE = 4660.24 EIFPA = -1.081438 RNGERR = -234.03 UREF = 23499.47 RTUREF = 2727.51 RANGE = 2493.48 DOS = -.0987 N = 15

N6 = 15
EIFPA = -1.081438      VELOS = 23454.2 TIME = 506.88 H = 247662.1 IOSFLG = 1 DOS = -.10 ROLCMD = -17.43 LATD = 28.82 1 N = 15
EIRANGE = 4669.57 EIFPA = -1.081438 RNGERR = -9.94 UREF = 23454.17 RTUREF = 2701.32 RANGE = 2691.38 DOS = -.0955 N = 15

END OF PREDICTION PHASE
END OF CORRECTION PHASE
***** NORMAL ETG TERMINATION *****
UI = 25762.20 FT/SEC      EI LATITUDE = 23.16143 DEG
EIFPA = -1.081438 DEG      EI LONGITUDE = -168.49888 DEG
EIRANGE = 4669.570 NM      EI AZIMUTH = 72.71752 DEG
ETG MODE IS APPROXIMATE GAMMA-FREE      UI = 25761.0
N6 = 15
EIFPA = -1.079349      VELOS = 23455.8 TIME = 506.88 H = 247679.0 IOSFLG = 1 DOS = -.10 ROLCMD = -15.23 LATD = 28.82 1 N = 15
EIRANGE = 4671.12 EIFPA = -1.079349 RNGERR = -1.65 UREF = 23455.79 RTUREF = 2702.25 RANGE = 2700.60 DOS = -.0973 N = 15

END OF PREDICTION PHASE
END OF CORRECTION PHASE
***** NORMAL ETG TERMINATION *****
UI = 25760.98 FT/SEC      EI LATITUDE = 23.15323 DEG
EIFPA = -1.079349 DEG      EI LONGITUDE = -168.52570 DEG
EIRANGE = 4671.118 NM      EI AZIMUTH = 72.70638 DEG
25760.98      25762.20      -.01884      -.01887      21314972.2      21314964.7
ETG MODE IS PRECISE      GAMMA-FIXED      UI = 25761.3
EIRANGE = 4671.83 EIFPA = -1.079514 RNGERR = -.76 UREF = 23456.82 RTUREF = 2702.85 RANGE = 2702.09 DOS = -.0988 N = 15

END OF PREDICTION PHASE
EIRANGE = 4673.92 EIFPA = -1.079514 RNGERR = -2.23 UREF = 23397.64 RTUREF = 2669.07 RANGE = 2666.84 DOS = -.0981 N = 15
EIRANGE = 4674.33 EIFPA = -1.079514 RNGERR = -.43 UREF = 23398.09 RTUREF = 2669.33 RANGE = 2668.89 DOS = -.0964 N = 15

END OF CORRECTION PHASE
***** NORMAL ETG TERMINATION *****
UI = 25761.31 FT/SEC      EI LATITUDE = 23.13620 DEG
EIFPA = -1.079514 DEG      EI LONGITUDE = -168.58135 DEG
EIRANGE = 4674.330 NM      EI AZIMUTH = 72.68328 DEG

***** EI-5 SOLUTION *****
UI = 25587.72 FT/SEC      LAT = 15.70771 DEG
GAMI = -1.09090 DEG      LONG = 172.23287 DEG
RT = 5838.67 NM      AZ = 65.82837 DEG
HD = 541784. FT

***** EI STATE LOADED INTO INTEG TABLE

```

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0 TRAJECTORY SIMULATION

00 DEFINED MAINLY BY INTEG TABLE

00 SUMMARY DISPLAY CONTAINS MAJOR PARAMETERS (FIGURE 7)

00 PLOT AND TABULATION CAPABILITIES BUILT IN (FIGURE 8)

FIGURE 7 - SIMULATION SUMMARY

ENTRY PROFILE SUMMARY TN 1

ENTRY >
 VEHICLE WEIGHT AT EI 215000.0 POUNDS
 CENTER OF GRAVITY 855.0 INCHES
 ANGLE OF ATTACK OPS40
 ELEVON SCHEDULE 2/-5/2.5/0/
 ATMOSPHERE 1962 STANDARD
 AERO DATA FILE FM6-A06718*AR3DPREOP

PROFILE CONSTANTS

UA1	.2100000+05	UA2	.2759930+05	UA	.2673415+05
AK	-.2881920+01	AK1	-.4263263+01	ALFM	.3100000+02
UTRAM	.1000000+05	ETRAM	.5473645+08	UB1	.1700000+05
US1	.2076997+05	DF	.2006401+02	EEF4	.2000000+07
UQ	.5000000+04	RPT1	.2879000+02	D230	.2449997+02
GS1	.0000000	GS2	.1000000-04	GS3	.0000000
GS4	.0000000	PREBNK	.0000000		

ANGLE OF ATTACK COEFFICIENTS

UVALP	CALP0	CALP1	CALP2
1 3500.00	.39999993+01	.40000003-02	.00000000
2 4500.00	.32343788+01	.44374984-02	-.62499825-07
3 5200.00	.45000033+01	.38749993-02	.00000000
4 6800.00	.23874955+01	.46875011-02	-.78125070-07
5 7200.00	.60000033+01	.36249995-02	.00000000
6 8800.00	-.20325006+02	.10937501-01	-.50781257-06
7 9200.00	.19000000+02	.10999999-02	.00000000
8 10800.00	-.33899982+02	.13499997-01	-.62499985-06
9 26000.00	.39000000+02	.00000000	.00000000
10	.39000000+02	.00000000	.00000000

DEORBIT DEFINITION

INCLINATION .2850+02 DEG
 CROSSRANGE .6000+03 NAUTICAL MILES
 INIT ROLL DIRECTION L
 APOGEE ALTITUDE .1500+03 NAUTICAL MILES

ENTRY INTERFACE OR INITIAL STATE

LAT	.2325297+02	LONG	-.1681981+03	AZ	.7284273+02
ALT	.3999979+06	UI	.2576139+05	UE	.2439939+05
GAMI	-.1079649+01	GAME	-.1139924+01	RT	.4652156+04

THERMAL PROTECTION SYSTEM SUMMARY

TPS MODEL USED NEW10
 MAX SURFACE TEMPERATURES AT REL. VELOCITY

CP 1	.2825+04	22600.57
CP 2	.2204+04	16540.61
CP 3	.2817+04	22600.57
CP 4	.2130+04	15550.94
CP 5	.2305+04	22912.15
CP 6	.1388+04	22912.15
CP 7	.8838+03	3602.61
CP 8	.9454+03	3602.61
CP 9	.8532+03	15017.46
CP10	.1117+04	14780.67

BACK FACE TEMP (URT 350 DEG F)
 PANEL 2 -.9007+01 6592.48
 MAX HT RATE .6356+02 22600.57
 TOTAL HT LD .5962+05

UREF-DEPENDENT THERMAL CONSTANTS

UREF 23000.00
 QCC .4052+05
 QTCE .0000

DTFFSC .8352+03

MAX QBAR .2259+03 2991.44
 MAX LD FCTR .1464+01 15076.78

MAX HINGE MOMENTS

INB ELUN -.4373+06 3989.56
 OUT ELUN -.1785+06 2499.91
 BDY FLAP -.4899+06 15076.78
 SPDBRAKE .5286+06 2499.91

DEVIATION OF UNLIMITED ALPHA COMMAND FROM
 SCHEDULE AT VE GREATER THAN 23500 FT/S
 MIN OF .000 OCCURS AT .0FT/S

MINIMUM EQUILIBRIUM GLIDE MARGINS

BETWEEN 24000 FPS AND 4000 FPS
 MIN MARGIN .474 ACTUAL DRAG 30.913 VELOCITY 10032.27
 BETWEEN 24000 FPS AND 15000 FPS
 MIN MARGIN 1.965 ACTUAL DRAG 11.585 VELOCITY 20777.96
 REF MARGIN BETWEEN 24000 FPS AND 15077. FPS
 REF MARGIN 2.010 REF DRAG 11.637 VELOCITY 20777.96

TAEM INTERFACE DATA

LAT	.2866194+02	LONG	-.8148050+02	AZE	.7923791+02
ALT	.8437033+05	UE	.2499914+04	BANK	.3743913+02
DELAZ	-.8045824+01	RT	.6085868+02	ALPHA	.1559978+02
QBAR	.2150035+03	ENERGY	.1816731+06	GAME	-.5918169+01
ELEVON	.4131367+00	BDVFLP	-.1819560+01	PSHAT	.2976334+03
RTURN	.2223847+05	YSGNT	-.1000000+01	IMDTAR	0
IRUID	1	IUHED(1)	1	IUHED(2)	0
MEP	0	WEIGHT	.2150000+06	XCG	.8550000+03

FIRST NON ZERO ROLL COMMAND DISPLAY

ISLECT 2 CYCLE 16 ROLL COMMAND -20.75

EVENT SUMMARY	TIME (SEC)	SPEED (FT/SEC)	NM TO LS
ENTRY INTERFACE	.00	24399.39	4652.16
INIT TEMP CONTROL PH	305.28	24439.28	3456.55
INIT EQ GLIDE PHASE	1044.48	16966.65	887.77
INIT CONST DRAG PHAS	1086.72	15846.30	775.17
INIT TRANSITION PHAS	1280.64	9915.81	370.89
ENTRY/TAEM INTERFACE	1612.80	2499.91	60.86
ROLL REVERSAL	TIME (SEC)	SPEED (FT/SEC)	CMD (DEG)
	1	1209.60	12077.64 55.98
	2	1424.64	6102.59 -41.08
	3	1576.32	3124.97 39.68

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0 DATABASE TRACKER

- 00 CAN STORE PERTINENT SIMULATION DATA ON A FILE (FIGURE 9)
- 00 PURPOSE IS TO COMPARE WITH OTHER SIMULATION RESULTS (FIGURE 10)
- 00 CASES CAN BE LISTED AND COMPARED (FIGURE 11)
- 00 A CATEGORY TABLE IS HELPFUL TO DEFINE THE CASES (FIGURE 12)

FIGURE 9 - CASE DEFINITION TABLE

CASE DEFINITION				
: FLIGHT DESCRIPTION— DDS DEMONSTRATION				
: CATEGORY	: INDEX	: DESCRIPTOR	: REAL NOS.	: VALUE
:SOURCE	: 2	: DDS	: WEIGHT	: .215000+06
:PHASE	: 3	: EOM-DS	: X-CG	: -.109300+04
:GUID	: 2	: ENTRY	: V-CG	: -.400000+00
:I-LOAD	: 4	: 39 ALPHA	: Z-CG	: -.373200+03
:RUNWAY	: 9	: KSC15	: X-RANGE(L-)	: -.600000+03
:ATHOS	: 35	: A-KC28DAPR84	: APOGEE ALT	: .150000+03
:AERO	: 12	: PREOP/DFAD	: PERIGE ALT	: .150000+03
:AERODISPERSH	: 2	: NONE	: NOTE: REAL NOS. CANNOT BE : ALTERED IN DBSTOR.	
:UINDS	: 2	: NONE		
:ELEVON SCHED	: 6	: STANDARD		
:SPDBRK SCHED	: 2	: 87.4		
:ORBIT INC	: 2	: 28.45		
:TARGET LINE	: 2	: NONEOM		
:OMS-OPTION	: 3	: NOM/NOM		

FIGURE 10 - CASES IN SORT QUEUE

CASES IN SORT QUEUE

CASE	FLT DESCRIPTION	SOURCE	PHASE	GUID	I-LOAD	RUNWAY	ATMOS	AERO	AERODISPERSN	WINDS	ELEVON SCHED	SPDBRK SCHED
11	DDDS DEMONSTRATION	2	3	2	5	9	35	12	2	2	6	2
40		2	3	2	4	9	35	12	2	2	6	2

CASE	ORBIT INC	TARGET LINE	OMS-OPTION	WEIGHT	X-CG	Y-CG	Z-CG	X-RANGE(--L)	APOGEE ALT
11	2	2	2	.215000+06	-.109300+04	-.400000+00	-.373200+03	-.600000+03	.150000+03
40	2	2	2	.215000+06	-.109300+04	-.400000+00	-.373200+03	-.600000+03	.150000+03

CASE PERIGEE ALT

```

11 .150000+03
40 .150000+03

```

FIND>

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FIGURE 11 - PERFORMANCE DATA

PERFORMANCE DATA

PARAMETER	CASE 11	CASE 40
CP1-TEMP-MAX	.279732+04	.282479+04
CP2-TEMP-MAX	.215368+04	.220395+04
CP3-TEMP-MAX	.277762+04	.281728+04
CP4-TEMP-MAX	.210584+04	.213026+04
CP5-TEMP-MAX	.229397+04	.230477+04
CP6-TEMP-MAX	.138766+04	.138770+04
CP7-TEMP-MAX	.929992+03	.883776+03
CP8-TEMP-MAX	.993731+03	.945395+03
CP9-TEMP-MAX	.821988+03	.853209+03
BKFACE-TEMP	-.100268+02	-.900656+01
HT-RATE-MAX	.620415+02	.635613+02
HT-LOAD-TOT	.585620+05	.596243+05
MIN-EGH-MAR	.168294+01	.196453+01

DO YOU WANT TO CONTINUE (Y/N)?
 SEQUENCE TABLE IS EXHAUSTED, MODE IS BEING SET TO MAN
 FIND)

FIGURE 12 - CATEGORY TABLE EXAMPLE

CATEGORY TABLE - ENTRY

INDEX	SOURCE	PHASE	GUID	I-LOAD	RUNWAY	ATMOS	AERO	AERODISPERSN	WINDS	ELEVOM SCHED
1	OTHER	OTHER	OTHER	OTHER	OTHER	OTHER	OTHER	OTHER	OTHER	OTHER
2	DDS	EQM-AS	ENTRY	EG01FX01TA32	1A0G10	162 STANDARD	PRE-STS-1	NONE	NONE	1/-6/-4/-8/2
3	SUDS	EQM-DS	TAEM	EG01FX02-TAL	1A0G28	1A-KC28AJAN84	STS1-PFLT	HI-L/D-35-UR		1/0/-2/2
4		AOA	IA/L	139 ALPHA	1EDU15	1A-KC28AFEB84	STS1-MODPFLT	HI-L/D-35-TL		1-3/0/-2/4
5		IATO	IGRTLS	140 ALPHA	1EDU17	1A-KC28AMAR84	STS2-PFLT	LO-L/D-35-UR		1/0/-2/4
6		TAL	TAL		1EDU22	1A-KC28AAPR84	STS2-MODPFLT	LO-L/D-35-TL		STANDARD
7		RTLS			1EDU23	1A-KC28AMAY84	BASE-PREOP	HI-FADG		
8					1FFM25	1A-KC28AJUN84	PREOP/4FAD	LO-FADG		
9					1KSC15	1A-KC28AJUL84	PREOP/4FAD+S	HI-FAD9		
10					1KSC33	1A-KC28AUG84	PREOP/6FAD	LO-FAD9		
11					1NOR03	1A-KC28ASEP83	PREOP/6FAD+S			
12					1NOR21	1A-KC28AOC783	PREOP/9FAD			
13					1NOR17	1A-KC28ANOU83	PREOP/9FAD+S			
14					1NOR35	1A-KC28ADEC83				
15					1UBG12	1A-ED28AJAN84				
16					1UBG30	1A-ED28AFEB84				
17					1YOF01	1A-ED28AMAR84				
18					1YOF19	1A-ED28AAPR84				
19					1ZZA13	1A-ED28AMAY84				
20					1ZZA31	1A-ED28AJUN84				
21					180KSC	1A-ED28AJUL84				
22					180EDU	1A-ED28AUG84				
23					180NOR	1A-ED28ASEP84				
24						1A-ED28AOC784				
25						1A-ED28ADEC84				
26						1A-ED28ADEC84				
27						1A-ST51NJAN81				
28						1A-ST51NAPRC4				
29						1A-ST51AAPRC3				
30						1A-NR28AJAN84				
31						1A-NR28AFEB84				
32						1A-NR28AMAR84				
33						1A-NR28AAPR84				
34						1A-NR28AMAY84				
35						1A-KC28DAPR84				



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PRODUCT MANAGEMENT

DM/DAVID L. LADRACH
DM/RICHARD M. MOORE

MAY 28, 1985



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- PRODUCT SCHEDULING
 - PRODUCED WEEKLY
 - CONTENTS
 - CFP, OFF, SCHEDULES
 - EVENTS/ACTIVITIES FROM MOD MRMS MEETING
 - LATE/SOON REPORT
 - CURRENT FDRD WEEKLY UPDATE
 - LISTING OF FLIGHT TEAM PERSONNEL
- CURRENTLY MAINTAINED ON SPF/TSO DATA BASE
- SCHEDULE TRACK AND STATUS
 - OVER 330 EVENTS/FLIGHT
 - 280 PER OFF CYCLE
 - 50 PER CFP CYCLE
- 17 FLIGHTS CURRENTLY IN WORK WITH SURGES TO 29 (COUNTING OPTIONS)



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- PROVIDE SINGLE POINT CONTACT FOR THE DIVISION PRODUCTS/INTERFACES
- MAINTAIN DIVISION SCHEDULES/MAIL LISTS
- FOCAL POINT
 - ICD DEVELOPMENT
 - PRODUCTION PROBLEMS
 - DATA AUTOMATION
 - PRODUCT REQUESTS
 - REMANIFEST OPTIONS
- PROVIDE A SINGLE POINT RECEPTION AND DELIVERY OF ALL PRODUCTS IN AND OUT OF THE DIVISION
- MAINTAIN RECORD COPIES OF ALL PRODUCTS/FLIGHT IN AND OUT OF THE DIVISION



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- PURPOSE

- DESCRIPTION

PRODUCT SCHEDULING
PRODUCT HANDLING
ICD DEVELOPMENT

- STAFFING

- GOALS

- ACCOMPLISHMENTS

- PROBLEMS



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- PRODUCT HANDLING
 - CURRENTLY USES BARRIOS PERSONNEL
 - EACH HANDLER MUST PROCESS, DELIVER, RECORD, TRACK, AND ASSEMBLE ALL PRODUCTS COMING INTO OR LEAVING THE DIVISION.
 - INTERFACES WITH THE FLIGHT INTEGRATOR
 - START IN CFP L-MINUS 455 DAYS. FINISH 2-3 WEEKS AFTER LAUNCH.
 - PEAK ACTIVITY OFF CYCLE
 - CONTINUAL TRAINING
- ICD DEVELOPMENT
 - RESPONSIBLE FOR WORKING DIVISION'S ICD'S WITH MCC, SMS, AND SPF FOR DATA TRANSFER.



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- 1 NASA MONITOR
- 1 AF
- BARRIOS
 - PRODUCT MANAGEMENT
 - 1 MANAGER
 - 1 ICD INTERFACE
 - 7 PRODUCT COORDINATORS
 - SCHEDULE MANAGEMENT
 - 2 - MAINTAIN AND DISTRIBUTE
SCHEDULES
GLOSSARY
MAIL LISTS



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- MAJOR FACILITY FLIGHT RECONFIGURATION; MCC, SPF, PASS - PATTERN DATA TRANSFER AFTER SMS DATA TAPE
- FLIGHT PRODUCTION SYSTEM - CENTRAL DATA BASE
- MASS PROPERTIES DATA FLOW - STANDARDIZE AND SIMPLIFY
- SCHEDULING ASSESSMENT - DEVELOP CAPABILITY TO DO AUTO SCENARIO ASSESSMENT
- REASSESS PRODUCT REQUIREMENTS AND SCHEDULES WITH USER COMMUNITY - MOVE SCHEDULED DELIVERIES AS CLOSE TO LAUNCH AS PRACTICAL - ELIMINATE PRODUCTS AND OR PRODUCT CONTENT - ONGOING ACTIVITY.
- BUILD FLOW DIAGRAM OF ALL PRODUCT INTERFACES WITHIN FDDD.



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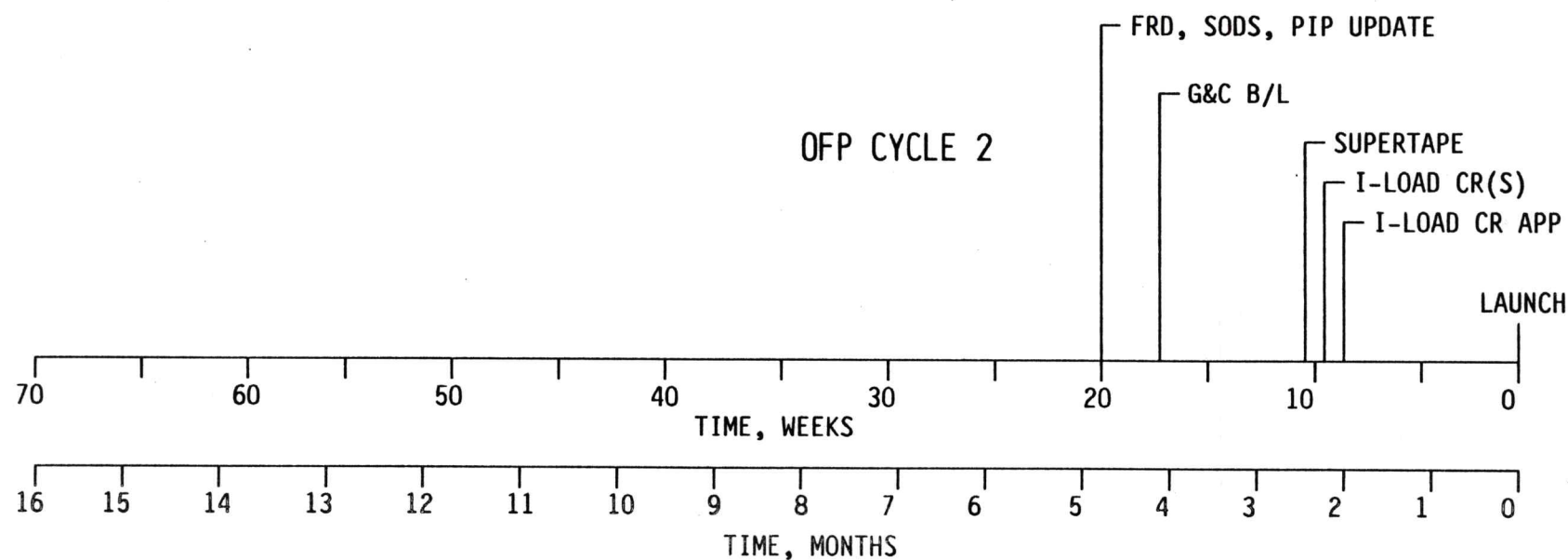
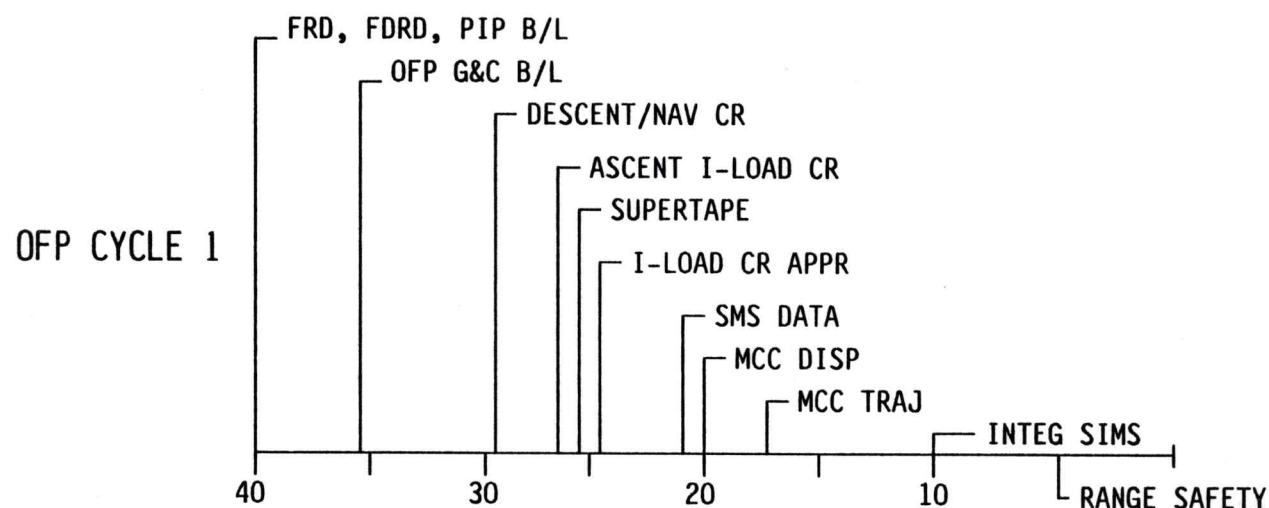
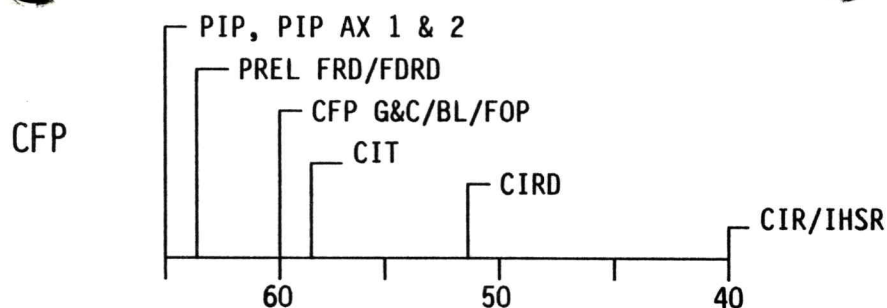
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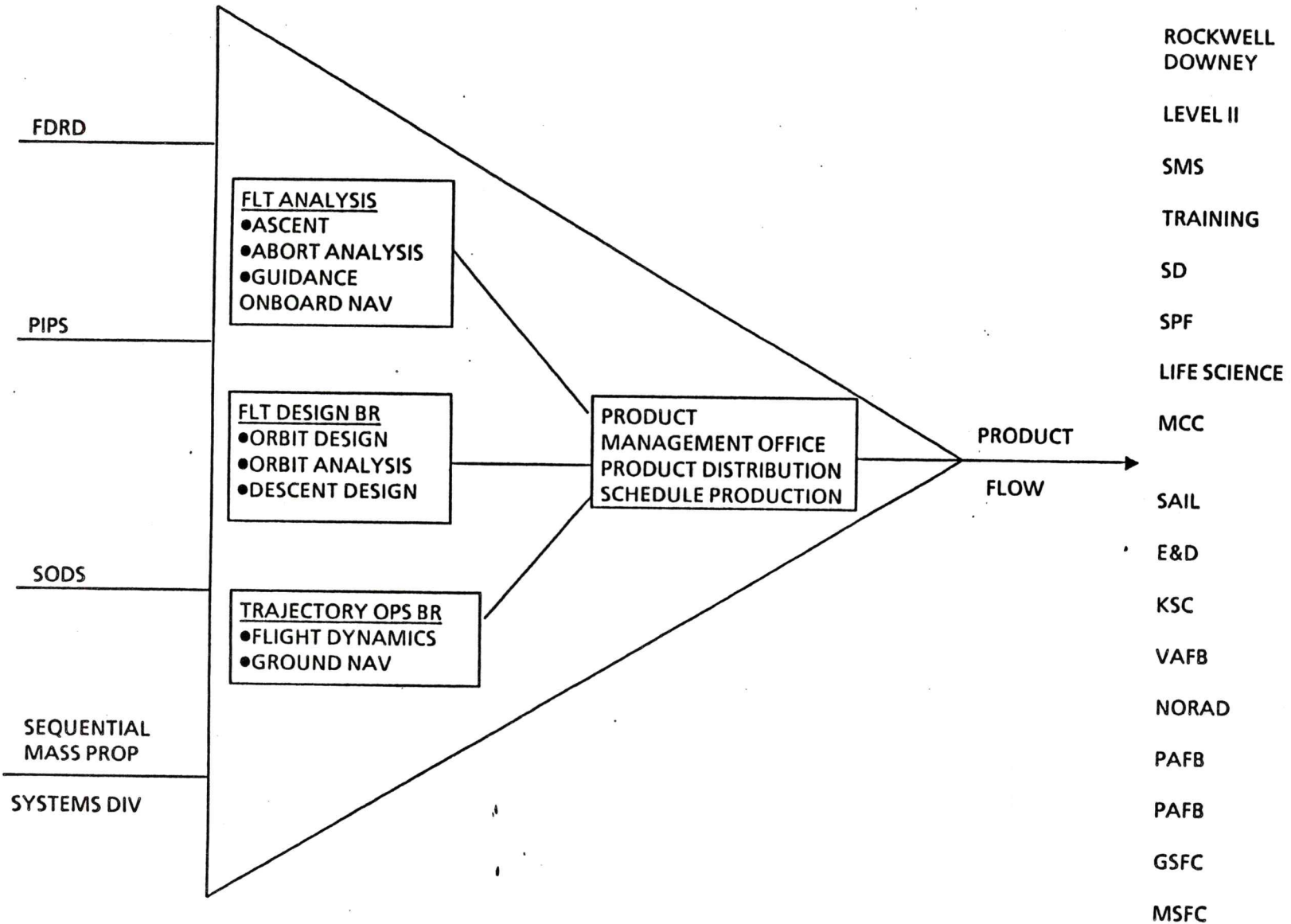
- DEVELOPED AUTOMATED SCHEDULING DATA BASE
- HELPED ESTABLISH THE TEAM MANAGEMENT CONCEPT FOR THE DIVISION
- ESTABLISHED WEEKLY REPRESENTATION WITH LEVEL II, MCC, AND SPF FOR PRODUCTION ISSUES/NEEDS.
- DEVELOPED DETAILED TRAINING PLANS FOR NEW PEOPLE AS WELL AS ON-GOING TRAINING.
- DEVELOPED GROUND FLOOR SCHEDULING FOR MISSION INTEGRATION OFFICE.

FLIGHT DESIGN TEMPLATE 51-A to 61-H

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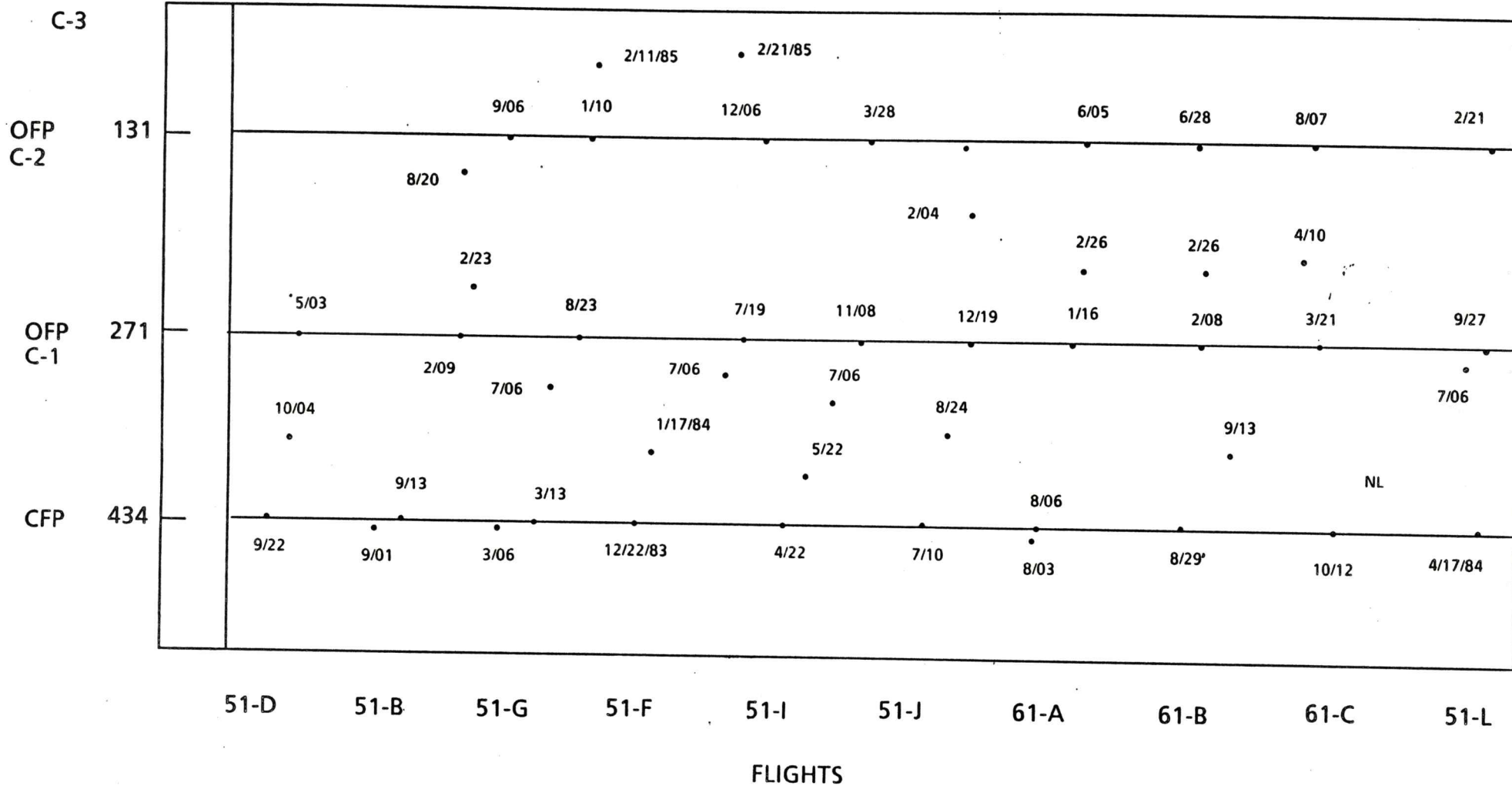


FLIGHT DESIGN DYNAMICS DIVISION PRODUCTION FLOW



SODS HISTORY

L-MINUS DAYS



FLIGHT DESIGN TOOLS
AND ASSOCIATED RESOURCES

CARL R. HUSS/R. L. BENBOW
MDTSCO/DM
MAY 20, 1985

MDTSCO-HOUSTON

MCDONNELL DOUGLAS



FLIGHT DESIGN TOOLS
AND ASSOCIATED RESOURCES
DISCUSSION SUBJECTS

- 0 OVERVIEW OF MAJOR S/W SYSTEMS
 - 00 WHAT ARE THEY?
 - 00 WHAT ARE THEY USED FOR?
 - 00 WHAT HOST DO THEY RUN ON?
- 0 STATUS OF TRANSITION FROM MPAD/MSD TO FDDD/MOD.
- 0 STAFFING SITUATION
- 0 STATUS ASSESSMENT AND ISSUES FOR EACH SYSTEM
- 0 SUMMARY OF STATUS AND ISSUES
- 0 PLANS AND ACTIVITIES

MAJOR S/W SYSTEMS OVERVIEW

<u>SYSTEM</u>	<u>DESCRIPTION</u>	<u>USE</u>	<u>HOST</u>
SPACE VEHICLE DYNAMIC SIMULATION (SVDS)	• A COLLECTION OF ABOUT 150 MODULES FROM WHICH CAN BE SELECTED THOSE NECESSARY TO SIMULATE ANY OR ALL PHASES OF THE SHUTTLE FLIGHT. • CAN BE USED AS A 3 DOF OR 6 DOF. • HAS MULTIPLE VEHICLE CAPABILITY	• GENERATES MOST OF THE BASIC DATA USED FOR FLIGHT DESIGN PRODUCTS. • USED TO VERIFY ONBOARD S/W ADDITIONS AND CHANGES. • USED TO VERIFY I-LOAD DESIGN. • USED IN ALL FLIGHT DESIGN FUNCTIONAL ACTIVITIES INCLUDING LAUNCH SUPPORT.	• UNIVAC EXEC 8 • HP9000 UNIX (JUNE 1985)
FLIGHT DESIGN SYSTEM-X (FDS-X)	• A COLLECTION OF ABOUT 100 MODULES WHICH CAN BE USED IN A 3 DOF SIMULATION OF ONORBIT ACTIVITIES.	• USED FOR BASIC CONCEPTUAL ORBITAL DESIGN; (ATTITUDE AND POINTING TIMELINE, MANEUVER TIMELINE, GROUND TRACK, STATION COVERAGE, RENDEZVOUS ANALYSIS, SOME CONSUMABLES ANALYSIS, LAUNCH WINDOWS, DEORBIT TARGETING.) • ONORBIT WORK IS BEING TRANSITIONED FROM SVDS TO FDS-X	• PERKIN ELMER P.E.O.S.+ EXT. (FEB 1985) • HP9000 UNIX (FINAL DELIVERY APR 87)
FLIGHT DESIGN SYSTEM-Y (FDS-Y)	• A PREDETERMINED SET OF 6 DOF SVDS SHUTTLE FLIGHT PHASE SIMULATIONS. • A COLLECTION OF ABOUT 60 POST PROCESSOR PROGRAMS • INITIATED VIA PERKIN ELMER FDS COMPUTER OR DIRECTLY AS AN SVDS SIMULATION.	• USED TO GENERATE SOME ASCENT FLIGHT PROFILE PRODUCTS. • GENERATES MANY ONORBIT PRODUCTS ACTUALLY USED FOR A SPECIFIC MISSION; (ATTITUDE TIMELINE, MANEUVER TIMELINE, RENDEZVOUS ANALYSIS, ETC.) • GENERATES SOME DESCENT PRODUCTS.	• UNIVAC EXEC 8

MAJOR S/W SYSTEMS OVERVIEW (CONT'D)

<u>SYSTEM</u>	<u>DESCRIPTION</u>	<u>USE</u>	<u>HOST</u>
ASCENT DESIGN SYSTEM (ADS)	● A COLLECTION OF ABOUT 100 INDIVIDUAL PROGRAMS WHICH CAN BE USED FOR ANALYSIS, I-LOAD GENERATION, AND CONCEPTUAL DESIGN. ● PROGRAM COMPLEXITY VARY FROM TRAJ. OPTIMIZATION TO SIMPLE UTILITY PROGRAMS ● 3-DOF CAPABILITY ● ENCOMPASSES 8 LARGE PROGRAMS (I.E., SHAPER, SVDS, DTM/ETG) ● ABOUT 25 PERCENT OF PROGRAMS ARE CONTROLLED BY USE OF AN ADS EXECUTIVE PROCESSOR.	● ASCENT PERFORMANCE ANALYSIS ● I-LOAD GENERATION ● ASCENT CONCEPTUAL DESIGN ● RANGE SAFETY DATA ○ ABORT CAPABILITY ASSESSMENT	● UNIVAC EXEC 8 ● HP9000 UNIX (BASIC CAPABILITY WILL BE DELIVERED 6-15-85)
DESCENT DESIGN SYSTEM (DDS)	● A GROUP OF ABOUT 11 MAJOR PROCESSORS ● 3 DOF CAPABILITY ● INTERACTIVE ANALYSIS CAPABILITY ● ELECTRONIC DATA TRANSFER ● WITHIN DDS ● FOR PRODUCT DELIVERY ● PROGRAM COMPLEXITY VARIES FROM SVDS TO SIMPLE UTILITY ROUTINES.	● INTERACTIVE DESCENT ANALYSIS ● I-LOAD GENERATION ● DESCENT PRODUCT GENERATION	● UNIVAC EXEC 8 ● HP9000 UNIX (BASIC CAPABILITY TO BE DELIVERED DEC, 1985)
NAVIGATION	● A COLLECTION OF ABOUT 60 PROCESSORS ● MOST PROCESSORS ARE USED SEPARATELY	● PROVIDE REALTIME MISSION NAVIGATION SUPPORT FOR ALL FLIGHT PHASES ● VERIFY TRACKING SCHEDULES ● SUPPORT FLIGHT TECHNIQUES ● PRODUCE MCC SUPPORT PRODUCTS ● SONAV (SHUTTLE ORBIT NAVIGATION) TRAINING	● UNIVAC EXEC 8 ● SONAV TRAINER ON HP9000 UNIX

STATUS OF TRANSITION OF CONTROL FROM MPAD/MSD TO FDDD/MOD

0 SPACE VEHICLE DYNAMIC SIMULATION (SVDS)

00 MILESTONE 4.4 WITH OI6 AND OI7 REQUIREMENTS WILL BE DELIVERED TO FDDD ON JUNE 15, 1985. UNIVAC AND HP9000 VERSIONS WILL BE DELIVERED AT THAT TIME.

00 USER AND S/W MAINT, AND MOD. DOCUMENTATION WILL BE DELIVERED IN DEC. 85.

0 FLIGHT DESIGN SYSTEM X (FDS-X)

00 PERKIN ELMER VERSION WAS DELIVERED IN FEB. 1985.

00 UNIX VERSION WILL BE UPDATED AND DELIVERED IN APR. 1987 (MPAD EFFORT).

0 FLIGHT DESIGN SYSTEM Y (FDS-Y)

00 BASED ON SVDS MILESTONE 4.3, A VERSION WAS AVAILABLE IN FEB. 1985.

00 SOME PROCESSORS BEING CONVERTED TO ANSI STANDARD

000 OTHER CONVERSION WILL BE PERFORMED AS NEEDED



STATUS OF TRANSITION OF CONTROL FROM MPAD/MSD TO FDDD/MOD

0 ASCENT DESIGN SYSTEM (ADS)

00 UNIVAC EXEC 8 VERSION WILL BE DELIVERED ON JUNE 15, 1985

00 UNIX VERSION WILL BE DELIVERED ON JUNE 15, 1985

0 DESCENT DESIGN SYSTEM (DDS)

00 FDDD USER UNIVAC VERSION TRANSITIONED AT TIME OF REORGANIZATION

00 UNIX VERSION BASED ON LATE 1984 CAPABILITIES WILL BE DELIVERED IN DEC. 1985 (MPAD EFFORT)

0 NAVIGATION

00 FDDD USER UNIVAC VERSION TRANSITIONED AT TIME OF REORGANIZATION.

00 SONAV (SHUTTLE ORBIT NAVIGATION TRAINER) UNIX (HP 9000) VERSION WILL BE DELIVERED IN AUG. 1985.

FM/DM S/W SUPPORT STAFFING (MDTSCO)

ACTIVITY	FM STAFFING	DM STAFFING		
	<u>DEC 84</u>	<u>FEB 85</u>	<u>JUNE 85</u>	<u>DEC 85</u>
SVDS ASCENT SIMULATIONS	12.2	-	-	-
SVDS ORBITAL SIMULATIONS	5.6	-	-	-
FDS MAINT. AND MODS	6.8	3.6	3.6	3.6
ADS-MAINT. AND MODS.	6.0	-	3.0	3.0
DDS-MAINT. AND MODS	7.0	-	-	8.5
DDS CONVERSION	8.0	-	-	-
NAVIGATION S/W	17.5	-	-	-
CONTROL MODE FLT. DESIGN S/W SUPPORT	1.0	1.0	1.0	1.0
FDS DOD SUPPORT	4.0	1.4	1.4	-
S/W PRODUCT CONTROL (CM,QA,SA)	13.5	2.6	3.6	6.0
	<u>81.6</u>	<u>8.6</u>	<u>12.6</u>	<u>22.1</u>

FM S/W SUPPORT STAFFING AS OF DEC 84 (OTHER THAN MDTSCO)

<u>ACTIVITY</u>	<u>C.S.C</u>	<u>TRW</u>	<u>BARRIOS</u>	<u>MITRE</u>	<u>CIVIL SERVANT</u>
SVDS ASCENT SIMULATIONS	10	-	5.5	-	4.5
SVDS ORBITAL SIMULATIONS					
FDS MAINT. & MODS.	13	-	4	-	10 INCLUDES U.S.A.F.
FDS DEVELOPMENT	2.0	-	-	-	-
ADS - MAINT, AND MODS, CONV. TO ANSI STANDARD	-	-	-	-	1.2 INCLUDES U.S.A.F.
DDS - MAINT. AND MODS.	-	-	-	-	1
DDS CONV. TO ANSI STANDARD	-	-	3	-	1.0 INCLUDES U.S.A.F.
NAVIGATION S/W	1.7	6.5	-	-	5
FDS CONVERSION TO ANSI STANDARD	-	-	5.5	2	-
S/W PRODUCT CONTROL (GM, QA, SA)	4.5	-	3.2	-	.5
	<u>46.5</u>	<u>6.5</u>	<u>21.2</u>	<u>2</u>	<u>23.2</u> (INCLUDES 2.2 U.S.A.F)
CURRENT DM STAFFING	11.8	-	4	-	5 (3 U.S.A.F.)

STATUS ASSESSMENT AND ISSUES FOR EACH SYSTEM

SPACE VEHICLE DYNAMIC SIMULATION (SVDS)

STATUS

- 0 MINIMAL REQUIREMENTS AND CONFIGURATION CONTROL SINCE NOV. 1984. FDDD STARTING TO REESTABLISH CONTROL THROUGH NEW CONTROL BOARD.
- 0 S/W MAINT. AND MODS WILL BE PERFORMED BY MDTSCO AND C.S.C. UNDER FM/MPAD CONTROL UNTIL JUNE 15, 1985.
- 0 MOST DOCUMENTATION OUT OF DATE AND INCOMPLETE. THIS WILL BE PARTIALLY CORRECTED WITH FM DOCUMENTATION DELIVERY IN DEC. 1985.
- 0 RESPONSIBILITY TRANSITIONS TO FDDD ON JUNE 15, 1985

ISSUES

- 0 DOCUMENTATION IS INADEQUATE. THE DEC. 1985 DELIVERY WILL NOT COMPLETELY RECTIFY THE CONDITION. THIS RESULTS FROM AN HISTORICAL LACK OF MANPOWER.
- 0 FROM PRODUCTION STANDPOINT THE PROGRAM IS IN DIRE NEED OF REVAMPING/STREAMLINING. THE PROGRAM WAS BUILT TO SUPPORT DEVELOPMENT PHASE OF SHUTTLE PROGRAM. MANPOWER DOES NOT EXIST TO MODIFY PROGRAM.
- 0 INSUFFICIENT SUSTAINING ENGINEERING MANPOWER FOR RESPONSIVE MAINT, AND MOD. ACTIVITIES. THIS RESULTS IN USERS MODIFYING PROGRAMS TO PERFORM MUCH OF FLIGHT DESIGN ACTIVITIES.

STATUS ASSESSMENT AND ISSUES FOR EACH SYSTEM (CONT.)

FLIGHT DESIGN SYSTEM

FDS-X

STATUS

- 0 MINIMAL REQUIREMENTS AND CONFIGURATION CONTROL SINCE FEB. 1985. FDDD STARTING TO REESTABLISH CONTROL THROUGH NEW CONTROL BOARD.
- 0 S/W MAIN. AND MODS. IS PERFORMED BY MDTSCO, C.S.C., BARRIOS, AND CIVIL SERVICE.
- 0 MOST DOCUMENTATION IS COMPLETE AND UP TO DATE. DOCUMENTATION IS PERFORMED BY MDTSCO, C.S.C. AND CIVIL SERVICE.
- 0 RESPONSIBILITY TRANSITIONED TO FDDD IN FEB 1985

ISSUES

- 0 CIVIL SERVICE EXPERTISE REMAINS IN MPAD/MSD.
- 0 TOO MANY ORGANIZATIONS ARE INVOLVED IN MAINT. AND MOD. ACTIVITIES.
- 0 FDS S/W DEV. SYSTEM REMAINS IN MPAD. PRODUCTION SYSTEMS (2 BLACK & 1 RED) UNDER FDDD CONTROL ARE UTILIZED FOR PRODUCTION WORK. THE OPERATING SYSTEM IS CONFIGURED TO LOCK OUT NON-PRODUCTION WORK. FDDD CONTROLLED SYSTEMS CAPACITY INSUFFICIENT TO SUPPORT PRODUCTION AND DEVELOPMENT.
- 0 MPAD HAS NOT TURNED OVER SOURCE CODE TO FDDD. THIS IS IN WORK.

STATUS ASSESSMENT AND ISSUES FOR EACH SYSTEM (CONT.)

FLIGHT DESIGN SYSTEM

FDS-Y

STATUS

- 0 MINIMAL REQUIREMENTS AND CONFIGURATION CONTROL SINCE FEB. 1985. FDDD STARTING TO REESTABLISH CONTROL THROUGH NEW CONTROL BOARD.
- 0 S/W MAINT. AND MODS. IS PERFORMED BY C.S.C.
- 0 DOCUMENTATION IS POOR IN SEVERAL AREAS. MPAD/MSD DEC. 1985 DOCUMENTATION DELIVERY WILL HELP ALLEVIATE THE POOR AREAS.
- 0 RESPONSIBILITY TRANSITIONED TO FDDD IN FEB. 1985

ISSUES

- 0 PERKIN ELMER/UNIVAC INTERFACE HAS MINIMAL UTILITY DUE TO INTERFACE RELIABILITY PROBLEMS. USERS DIRECTLY INTERFACE WITH UNIVAC IN AN SVDS MODE. THIS RESULTS IN UNNECESSARY EFFORT IN PERKIN ELMER FDS EXECUTIVE MAINT. AND MOD.
- 0 DEC 1985 DOCUMENTATION DELIVERY WILL NOT PROVIDE ALL THAT IS REQUIRED FOR MAINT. AND MOD. ACTIVITIES. INSUFFICIENT MANPOWER IS AVAILABLE TO FULLY DOCUMENT SYSTEM.

STATUS ASSESSMENT AND ISSUES FOR EACH SYSTEM (CONT.)

ASCENT DESIGN SYSTEM (ADS)

STATUS

- 0 MINIMAL REQUIREMENTS AND CONFIGURATION CONTROL SINCE NOW, 1985. FDDD STARTING TO REESTABLISH CONTROL THROUGH NEW CONTROL BOARD.
- 0 S/W MAINT. AND MODS, IS PERFORMED BY MDTSCO.
- 0 CURRENT DEV. BEING PERFORMED BY A COMBINED MDTSCO FM USER AND S/W DEV. GROUP.
- 0 DOCUMENTATION IS IN FAIR CONDITION.
- 0 RESPONSIBILITY WILL BE TRANSFERRED TO FDD IN JUNE, 1985.

ISSUES

- 0 INSUFFICIENT SUSTAINING ENGINEERING MANPOWER TO PROVIDE RESPONSIVE MAINT. AND MODS. SUPPORT. RESULTS IN USERS MODIFYING PROGRAMS TO PERFORM MUCH OF ASCENT FLIGHT DESIGN.
- 0 NO DOCUMENTATION RESOURCES IN MOD OR MSD.

STATUS ASSESSMENT AND ISSUES FOR EACH SYSTEM (CONT.)

DESCENT DESIGN SYSTEM (DDS)

STATUS

- 0 REQUIREMENTS AND CONFIGURATION CONTROL ESSENTIALLY TRANSITIONED WITH REORGANIZATION. FDDD STARTING TO ESTABLISH MORE FORMAL CONTROL THROUGH NEW CONTROL BOARD.
- 0 S/W MAINT. AND MODS IS PERFORMED BY MDTSCO USERS USING CLASSICAL S/W MAINT. & MODS. PROCEDURES.
- 0 MDTSCO S/W DEV. RESOURCES CONTROLLED BY FM ARE CONVERTING DDS TO ANSI STANDARD. INITIAL DELIVERY WILL BE IN DEC. 1985.
- 0 DOCUMENTATION IS IN GOOD CONDITION. DOCUMENTATION WAS PROVIDED IN THE MAIN BY THE MDTSCO USER GROUP.
- 0 RESPONSIBILITY WILL BE TOTALLY TRANSITIONED TO FDDD IN DEC. 1985.

ISSUES

- 0 CONVERSION OF DDS TO ANSI STANDARD IS BASED ON DDS CAPABILITIES AS OF LATE 1984. THERE IS INSUFFICIENT MANPOWER TO KEEP CONVERSION ACTIVITIES CURRENT WITH OPERATIONAL VERSION. FY86 RESOURCES WILL BE REQUIRED TO UPDATE ANSI STANDARD VERSION OF DDS.



STATUS ASSESSMENT AND ISSUES FOR EACH SYSTEM (CONCLUDED)

NAVIGATION

STATUS

- 0 SHUTTLE OPERATIONS REQUIREMENTS AND CONFIGURATION CONTROL ESSENTIALLY TRANSITIONED TO FDDD IN FEB 1985. FDDD STARTED TO ESTABLISH MORE FORMAL CONTROL THROUGH NEW CONTROL BOARDS.
- 0 SHUTTLE NAVIGATION OPERATIONS RESPONSIBILITY TRANSITIONED TO FDDD IN FEB. 1985.
- 0 S/W MAINT. AND MODS. RESPONSIBILITY RESIDES WITH MPAD/MDTSCO SUSTAINING ENGINEERING. OTHER CONTRACTOR ORGANIZATIONS ARE INVOLVED TO MINOR EXTENT.
- 0 DOCUMENTATION IS NOT UP TO DATE BUT MPAD DELIVERY IN SEPT. 1985 WILL PROVIDE IMPROVED DOCUMENTATION.
- 0 SONAV TRAINER DEVELOPMENT (HP9000) IS SCHEDULED FOR DELIVERY BY MPAD IN SEPT 1985.

ISSUES

- 0 NO MANPOWER IN FY86 POP FOR MAINT. & MOD IN MSD OR M O D.
- 0 NO CY85 MANPOWER IN FDDD FOR MAINT. AND MOD. ACTIVITIES.
- 0 MSD MANPOWER ASSIGNED TO DOCUMENTATION ACTIVITIES.

SUMMARY OF STATUS AND ISSUES

- 0 FDDD IS STARTING TO REESTABLISH REQUIREMENTS AND CONFIGURATION CONTROL OF ALL S/W THROUGH NEW CONTROL BOARDS
- 0 APPLICATION S/W DOCUMENTATION IS CURRENTLY NOT IN THE BEST OF SHAPE. MPAD PLANNED DOCUMENTATION DELIVERIES NEAR END OF CY85 SHOULD GREATLY IMPROVE THIS SITUATION. FDDD HAS NO CY85 MANPOWER TO DEVOTE TO DOCUMENTATION.
- 0 S/W RELATED MANPOWER RESOURCES AVAILABLE TO FDDD IN CY85 ARE INSUFFICIENT FOR TOTALLY RESPONSIVE SUSTAINING ENGINEERING MAINT. AND MOD. SUPPORT.
 - 00 HISTORICALLY THIS HAS BEEN PRIMARY CAUSE FOR PROPAGATION OF USER DEVELOPMENT OF S/W.
- 0 S/W RELATED MANPOWER RESOURCES REQUIREMENTS ARE INCREASED BY VARIETY OF H/W SYSTEMS AND OPERATING SYSTEMS.
- 0 FDDD WILL NOT BE IN CONTROL OF ALL FLIGHT DESIGN SYSTEMS UNTIL END OF CY85.

RECOMMENDED CY85 ACTIVITIES

- 0 SUPPORT FDDD CONTROL BOARD ACTIONS WITH SUSTAINING ENGINEERING RESOURCES TO THE EXTENT POSSIBLE.
- 0 DEFINE S/W, STANDARDS, GROUND RULES, SCHEDULES NECESSARY TO BRING MDTSCO S/W MAINT. AND MODS. WORK UNDER THE MDTSCO SUSTAINING ENGINEERING ORGANIZATION.
 - 00 COMPLETE PLANNING BY END OF FY85
 - 00 IMPLEMENT STARTING IN FY86
 - 00 PRIORITIES ARE AS FOLLOWS:
 - (1) PRODUCTION S/W.
 - (2) FLIGHT TRAJECTORY DESIGN S/W
 - (3) FLIGHT DESIGN ANALYSIS AND CONCEPTUAL DESIGN S/W
- 0 DEVELOP PRODUCTION DATA BASE S/W REQUIREMENTS AND MANAGEMENT PLANS.
 - 00 INCLUDES:
 - 1) DETERMINING DATA BASE S/W
 - 2) MANAGEMENT PROCEDURES
 - 3) CONTROL GROUND RULES
 - 4) MAINT. AND MOD. RESPONSIBILITY
 - 5) SCHEDULE FOR IMPLEMENTATION

RECOMMENDED CY85 ACTIVITIES (CONCLUDED)

0 INSTITUTIONALIZE DEVELOPMENT OF PRODUCTION SYSTEM S/W

- 00 INCLUDES:
- 1) COLLECT NECESSARY S/W AND PLACE UNDER CONFIGURATION CONTROL
 - 2) STREAMLINE TOOLS AND PROCEDURES
 - 3) DEVELOP AND DOCUMENT PRODUCT GENERATION PROCEDURES
 - 4) DEVELOPING AND DOCUMENTING Q.A. PROCESS AND PROCEDURES

0. CONTINUE EVALUATION OF DISTRIBUTED ASCENT COMPUTING SYSTEM (DACS).

- 00 INCLUDING:
- 1) DEMONSTRATE THAT SIGNIFICANT WORK CAN BE OFF LOADED FROM UNIVAC TO INFLUENCE DPSD FY85 DECISION TO UPGRADE TO 1194.
 - 2) ACCUMULATE SUFFICIENT EXPERIENCE TO INFLUENCE FY87 BUDGET SUBMISSION
 - 3) DEVELOP DETAILED PROJECT PLAN FOR DACS UPGRADE, STARTING IN FY87.



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FLIGHT DESIGN "COST PER FLIGHT" DATA

DM/JON C. HARPOLD

APRIL 17, 1985



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FLIGHT DESIGN COST PER FLIGHT DATA

NAME:

DM/J. C. HARPOLD

DATE:

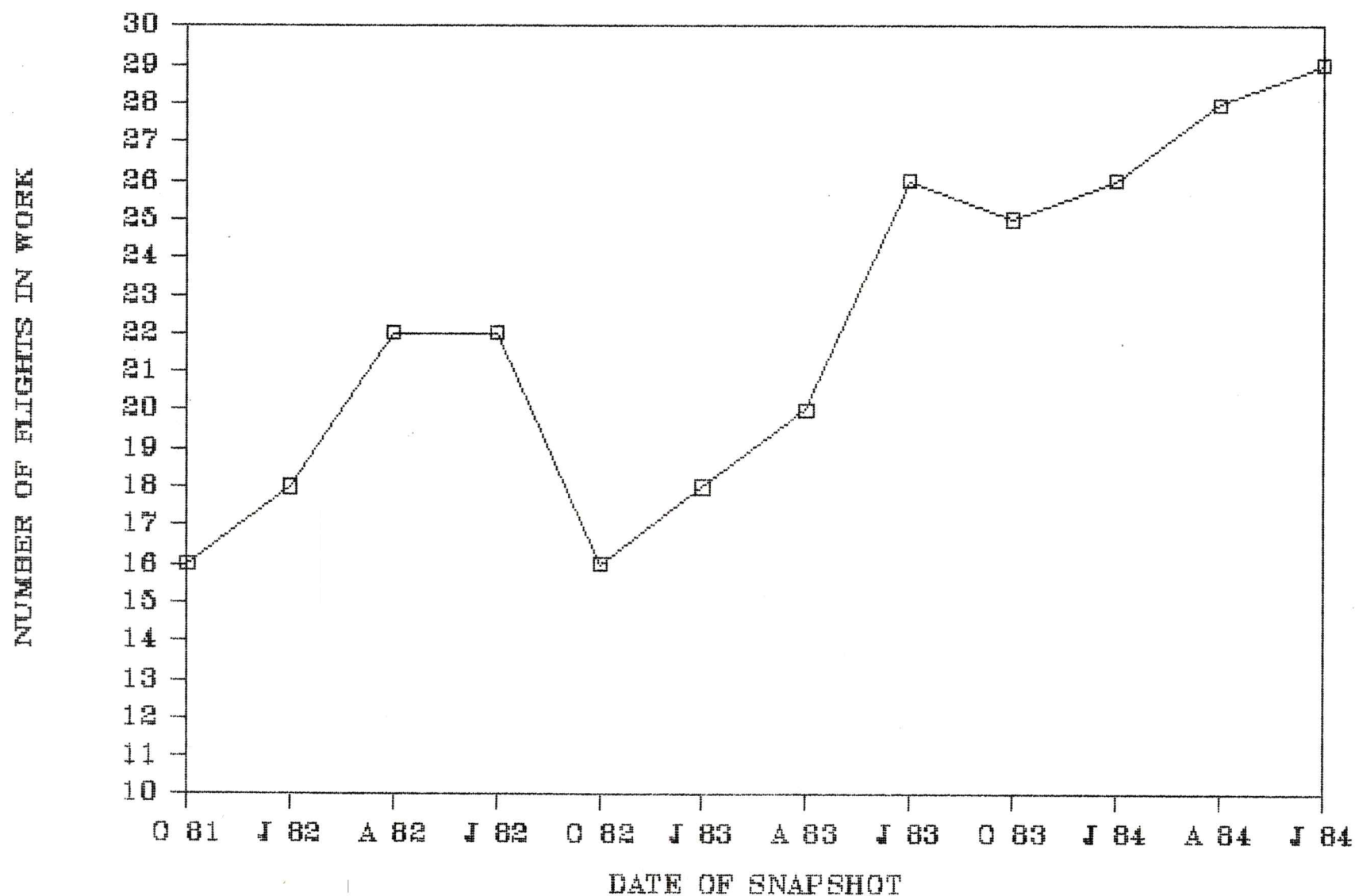
4/17/85

PAGE

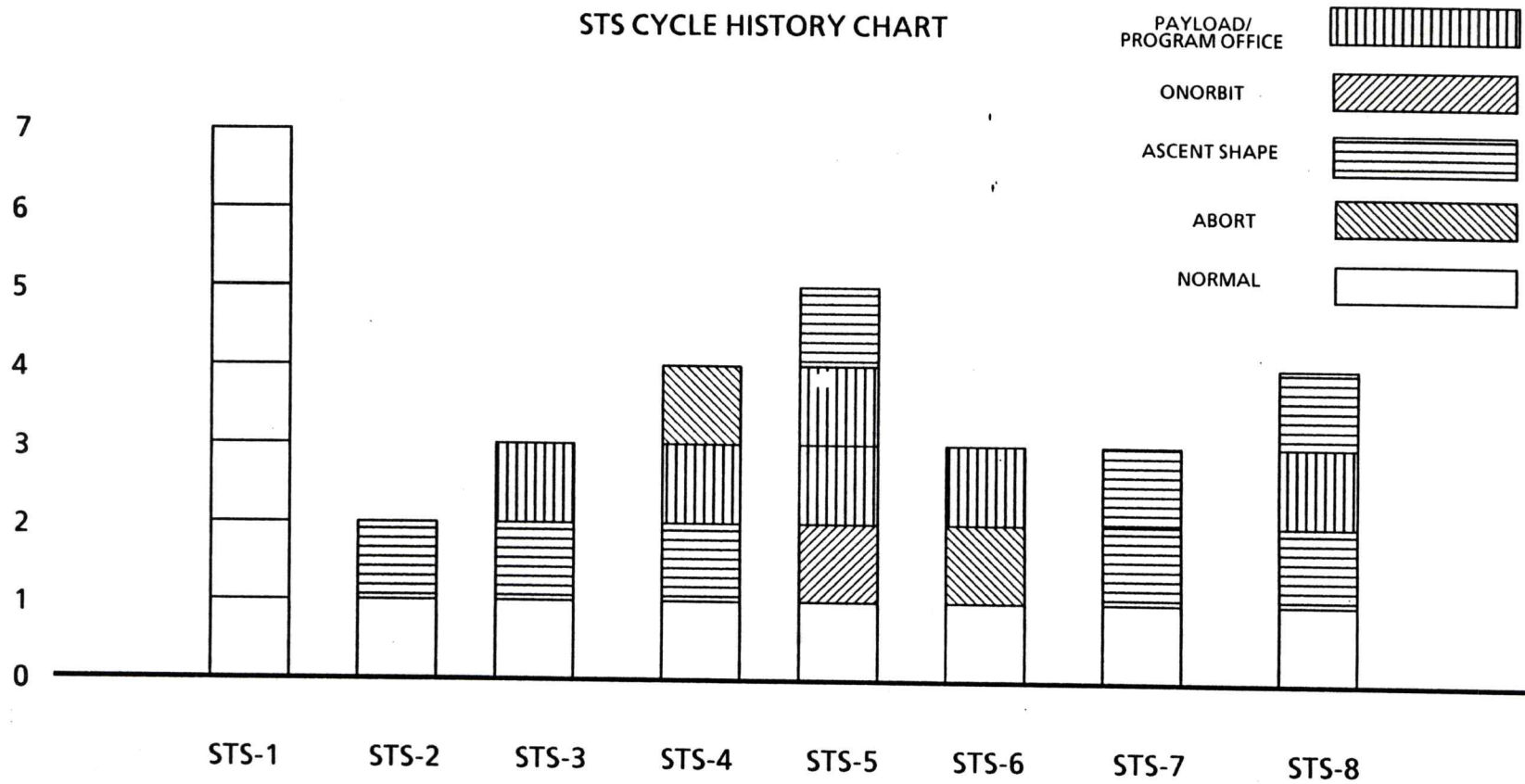
- BASED ON MPAD CHARGE HISTORIES
 - COMPILED BY CSC

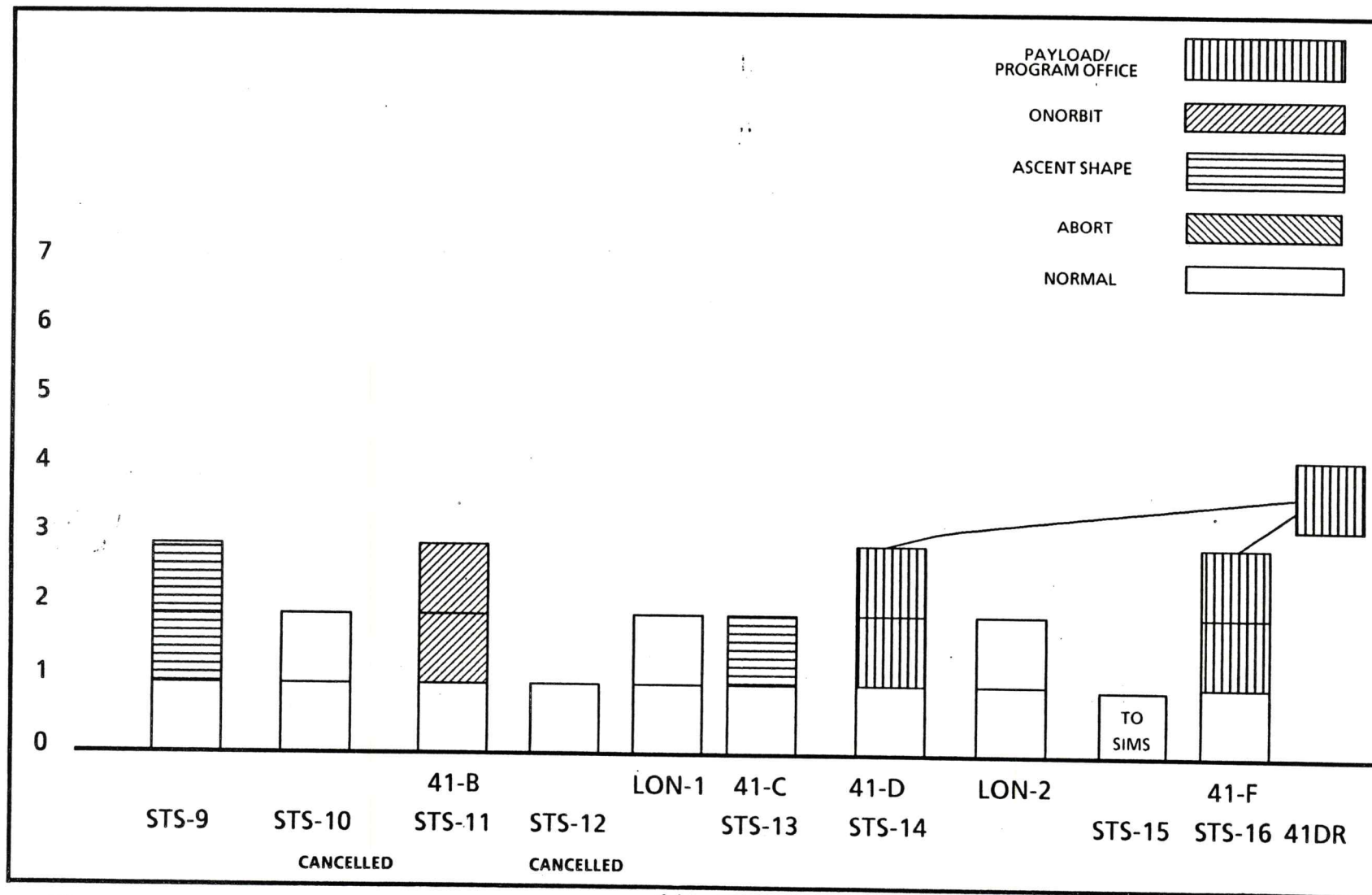
- INCLUDES ONLY FLIGHT-SPECIFIC CHARGES
 - DOES NOT INCLUDE OPERATING BASE CHARGES
 - DEVELOPMENT WORK
 - SUSTAINING ENGINEERING
 - COMPUTER TOOLS M&M

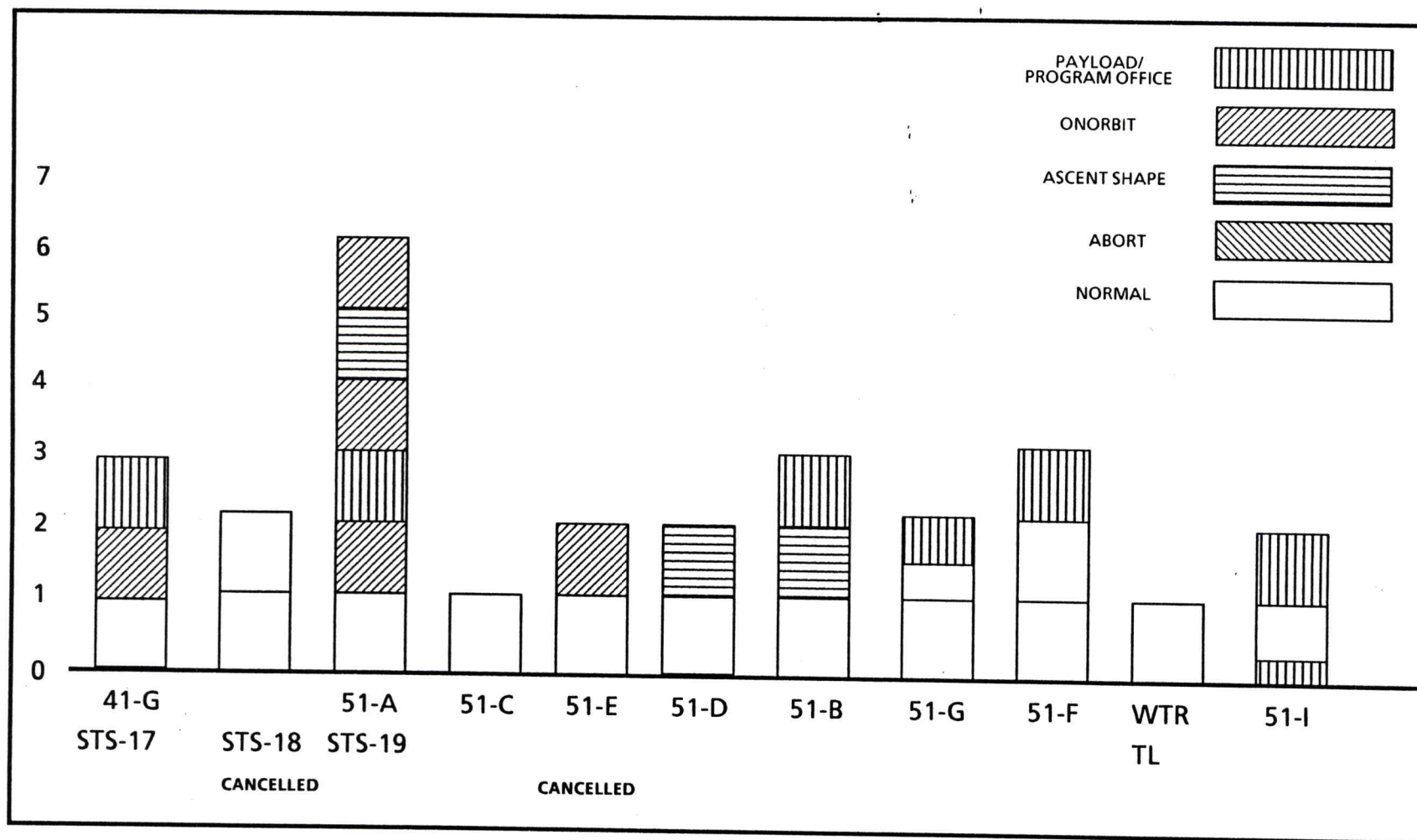
NUMBER OF FLIGHTS IN WORK



STS CYCLE HISTORY CHART







STS CYCLE HISTORY CHART

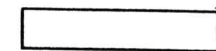
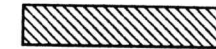
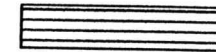
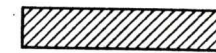
PAYLOAD/
PROGRAM OFFICE

ONORBIT

ASCENT SHAPE

ABORT

NORMAL



7

6

5

4

3

2

1

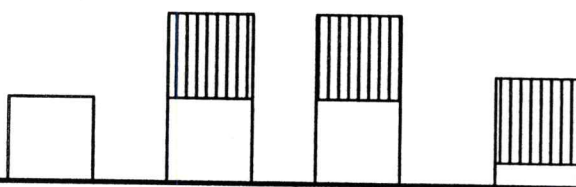
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51-J

61-A

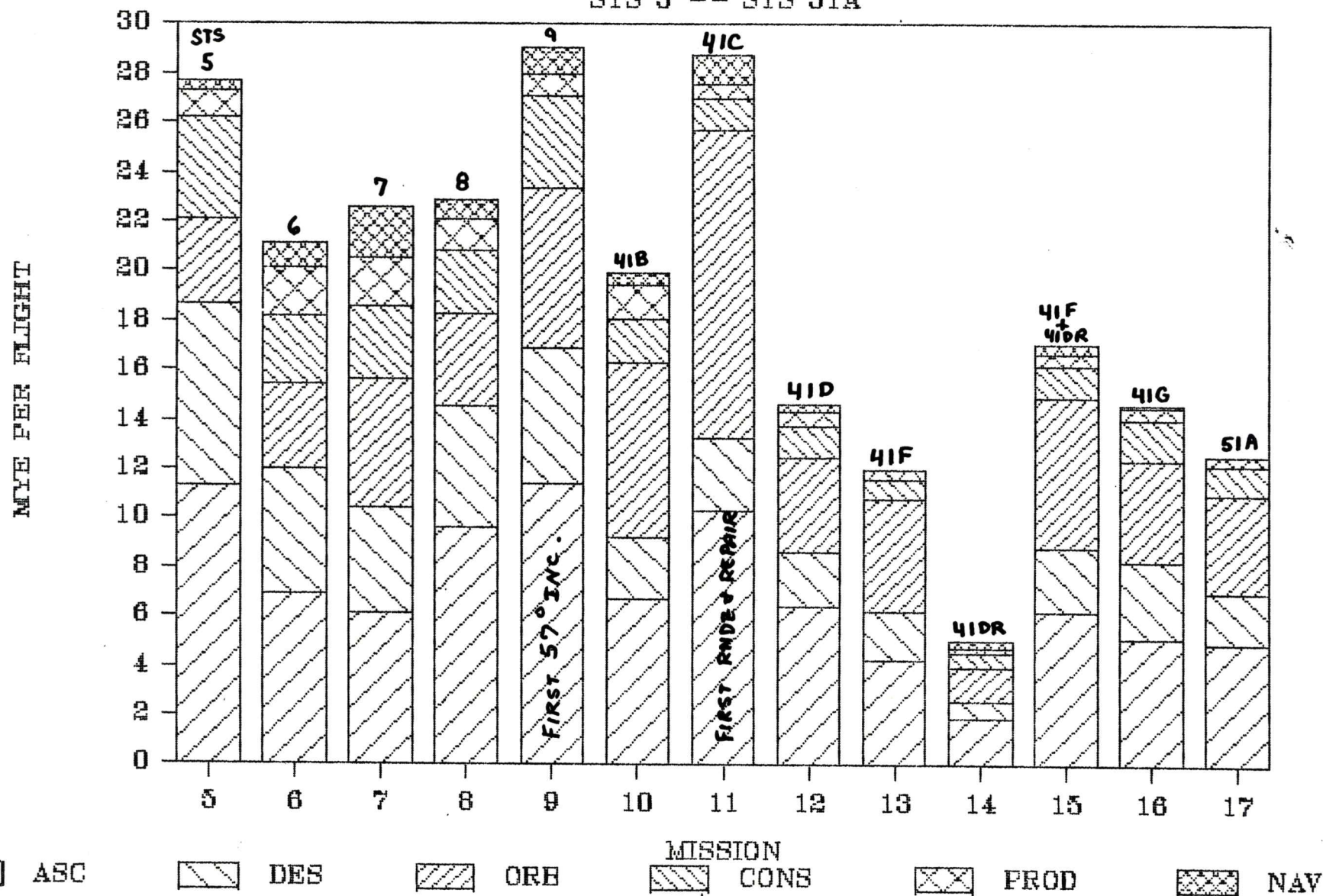
61-B

61-C



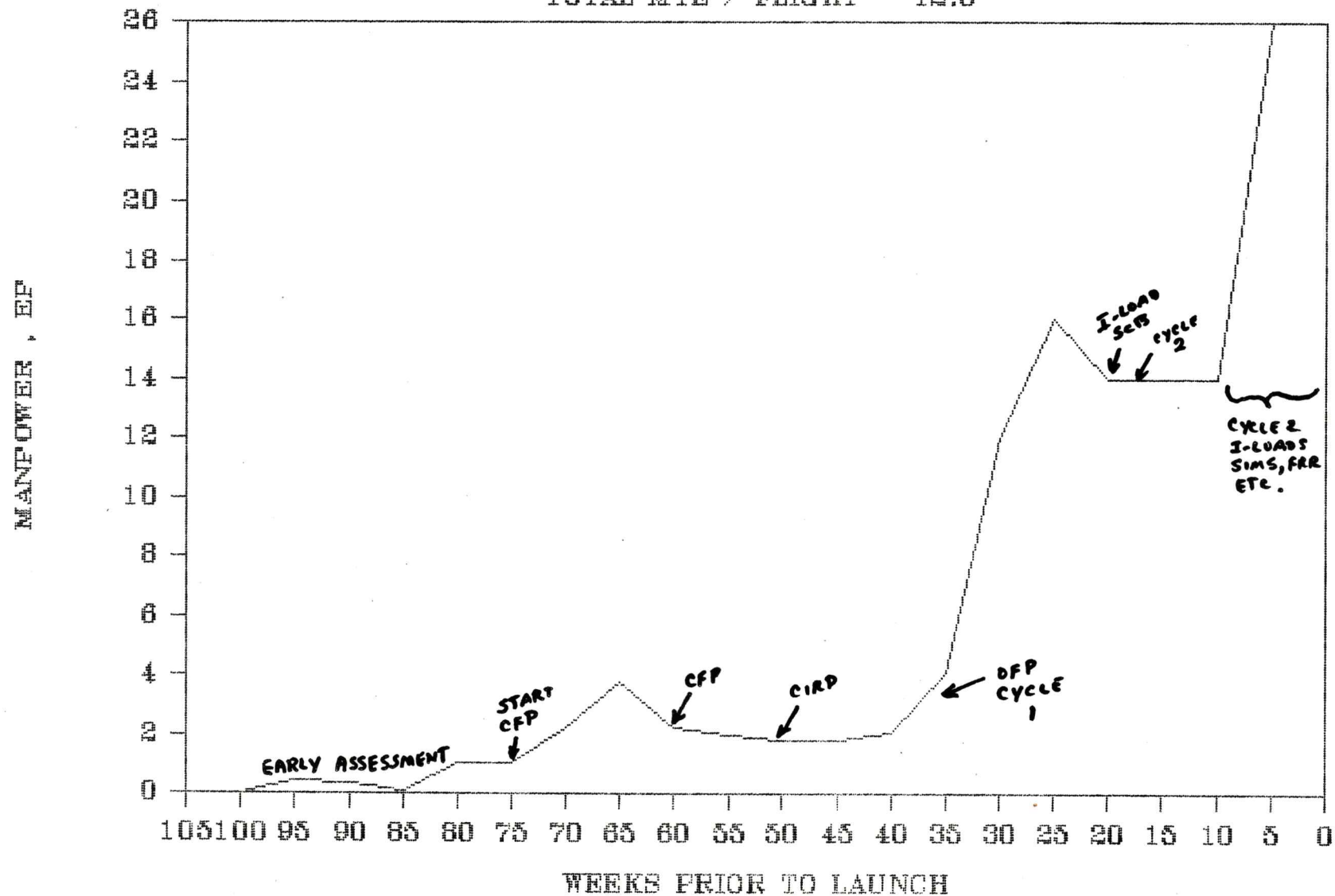
FLIGHT DESIGN MANPOWER PER FLIGHT

STS 5 -- STS 51A



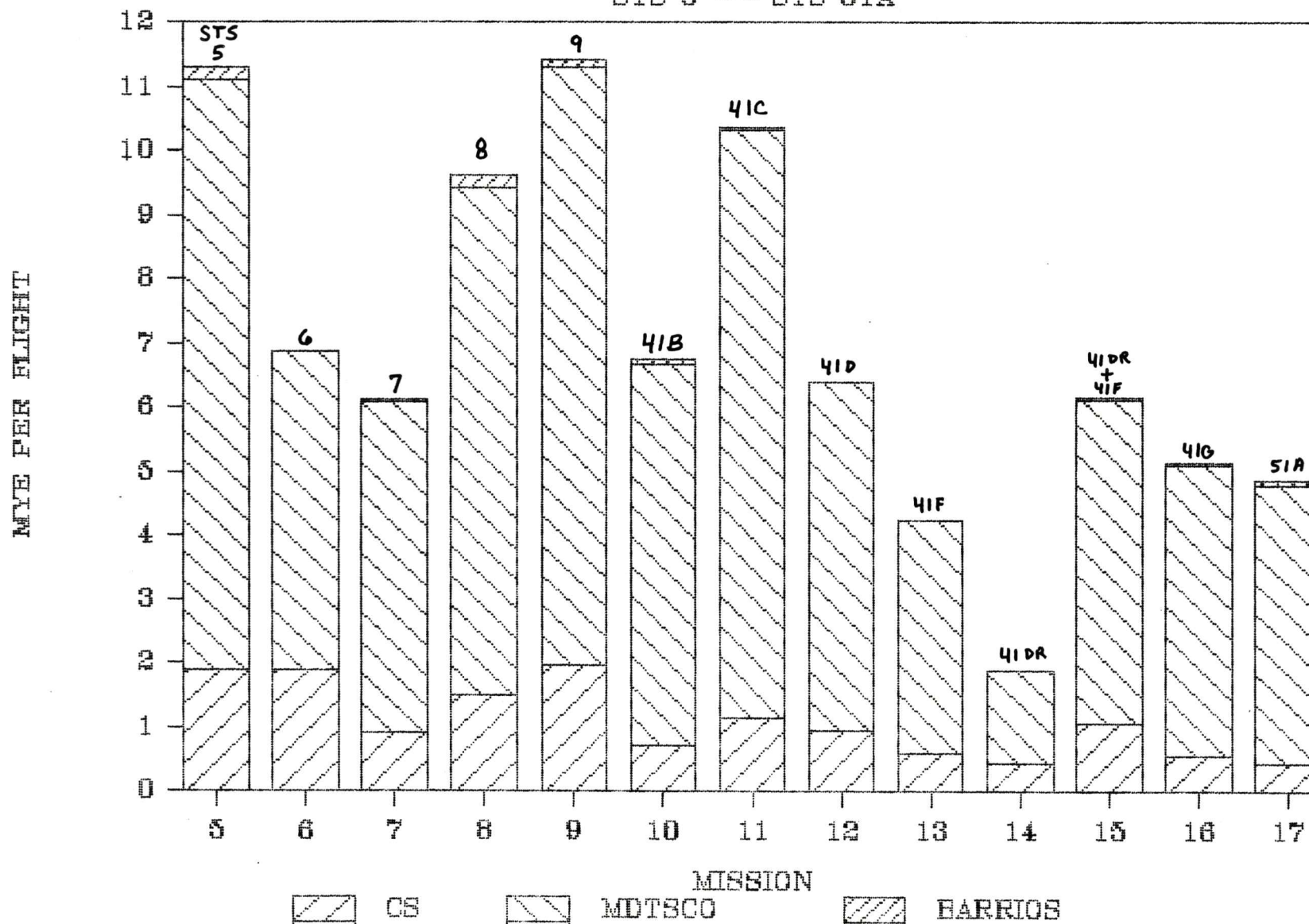
FLIGHT DESIGN MANPOWER TEMPLATE

TOTAL MYE / FLIGHT - 12.5



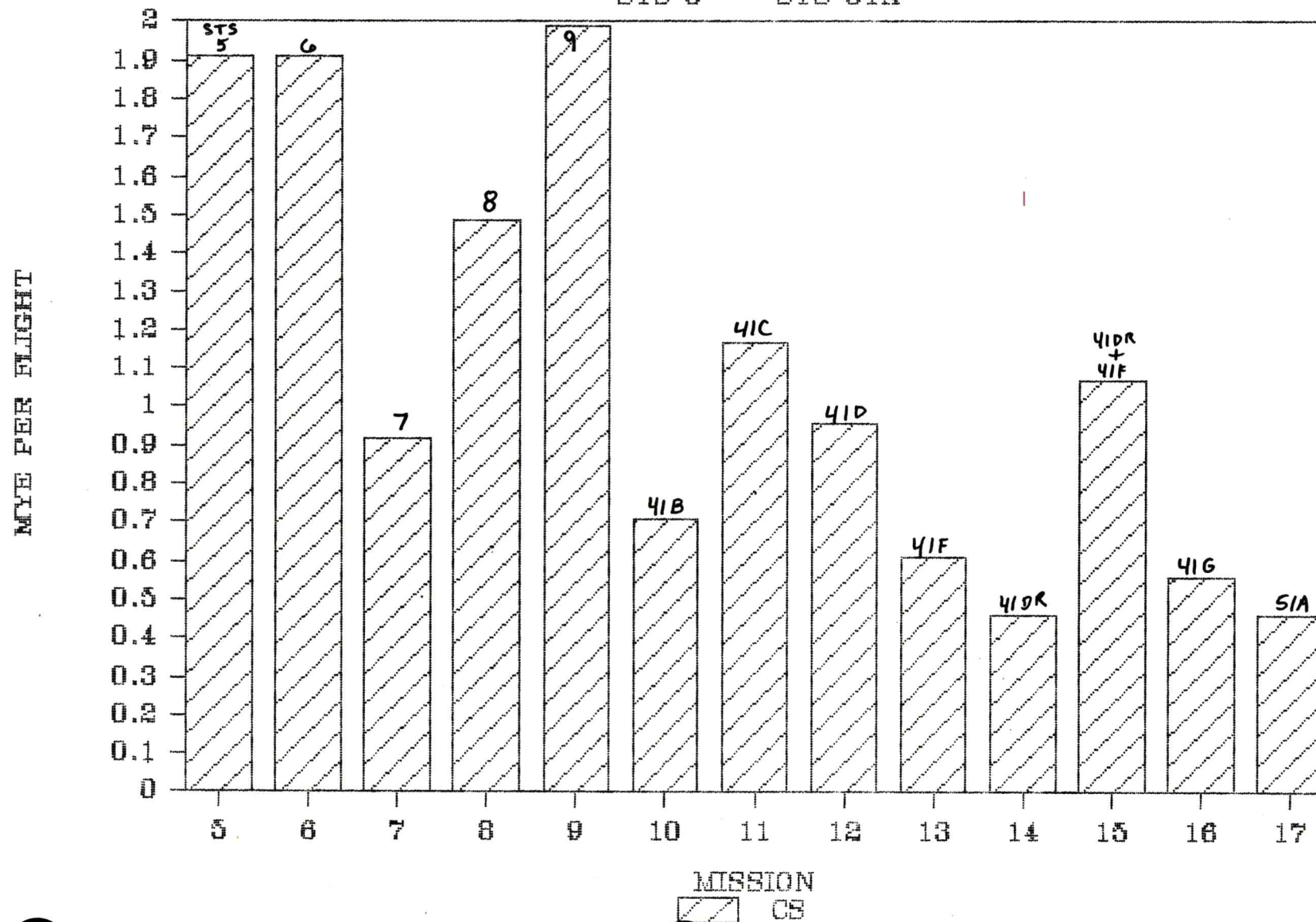
ASCENT FLIGHT DESIGN MANPOWER

STS 5 -- STS 51A



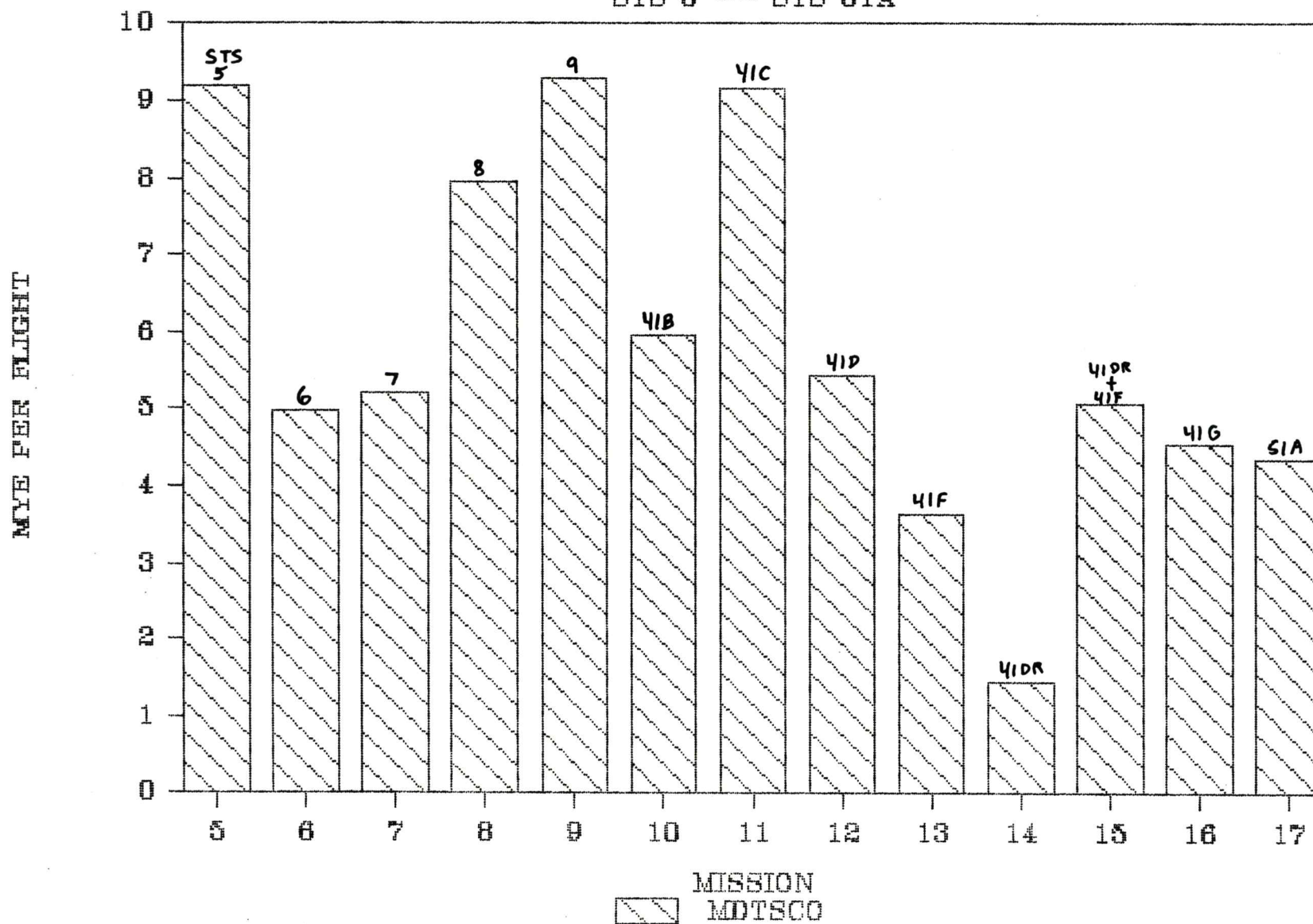
ASCENT FLIGHT DESIGN MANPOWER

STS 5 -- STS 51A



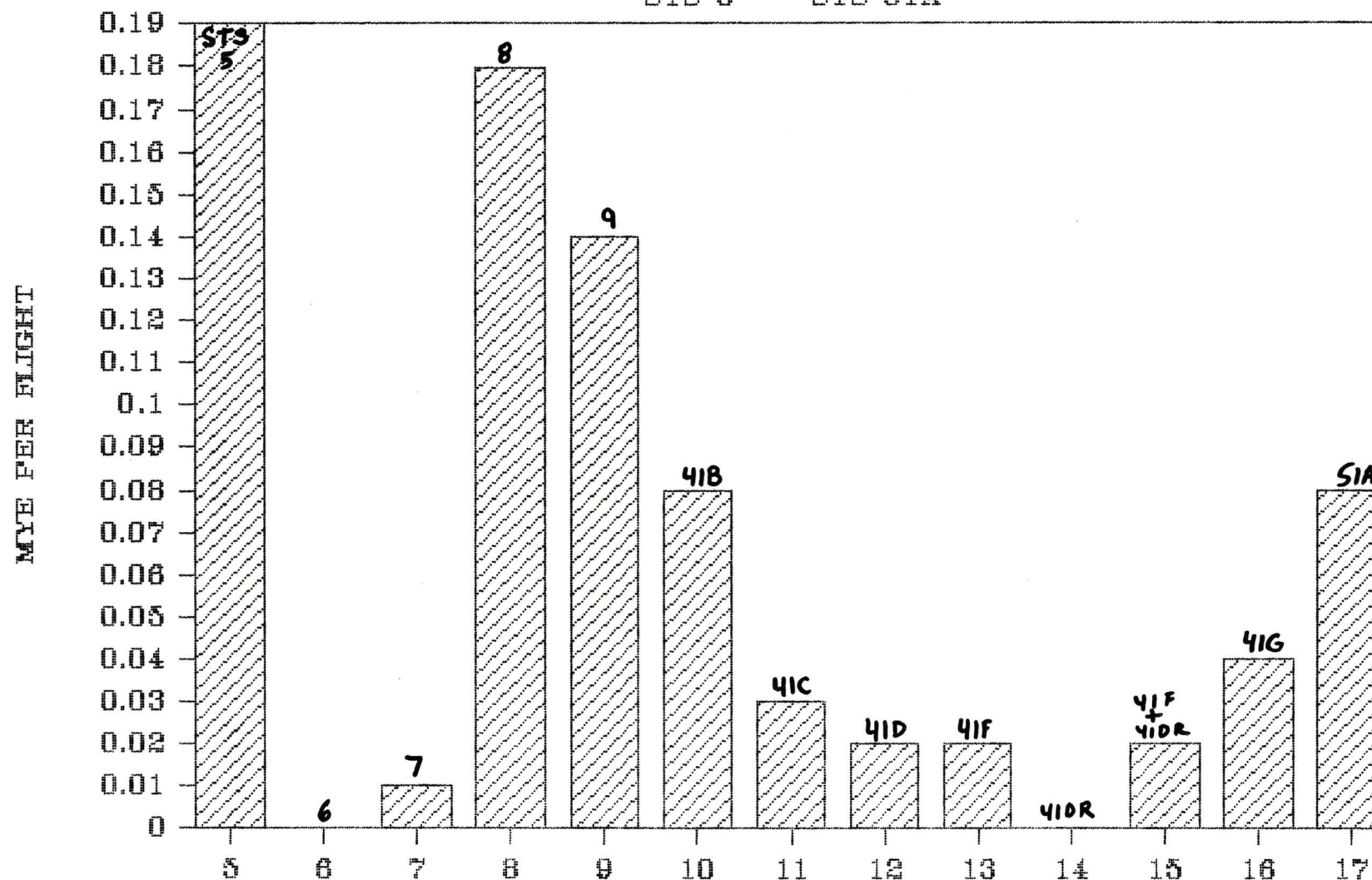
ASCENT FLIGHT DESIGN MANPOWER

STS 5 -- STS 51A



ASCENT FLIGHT DESIGN MANPOWER

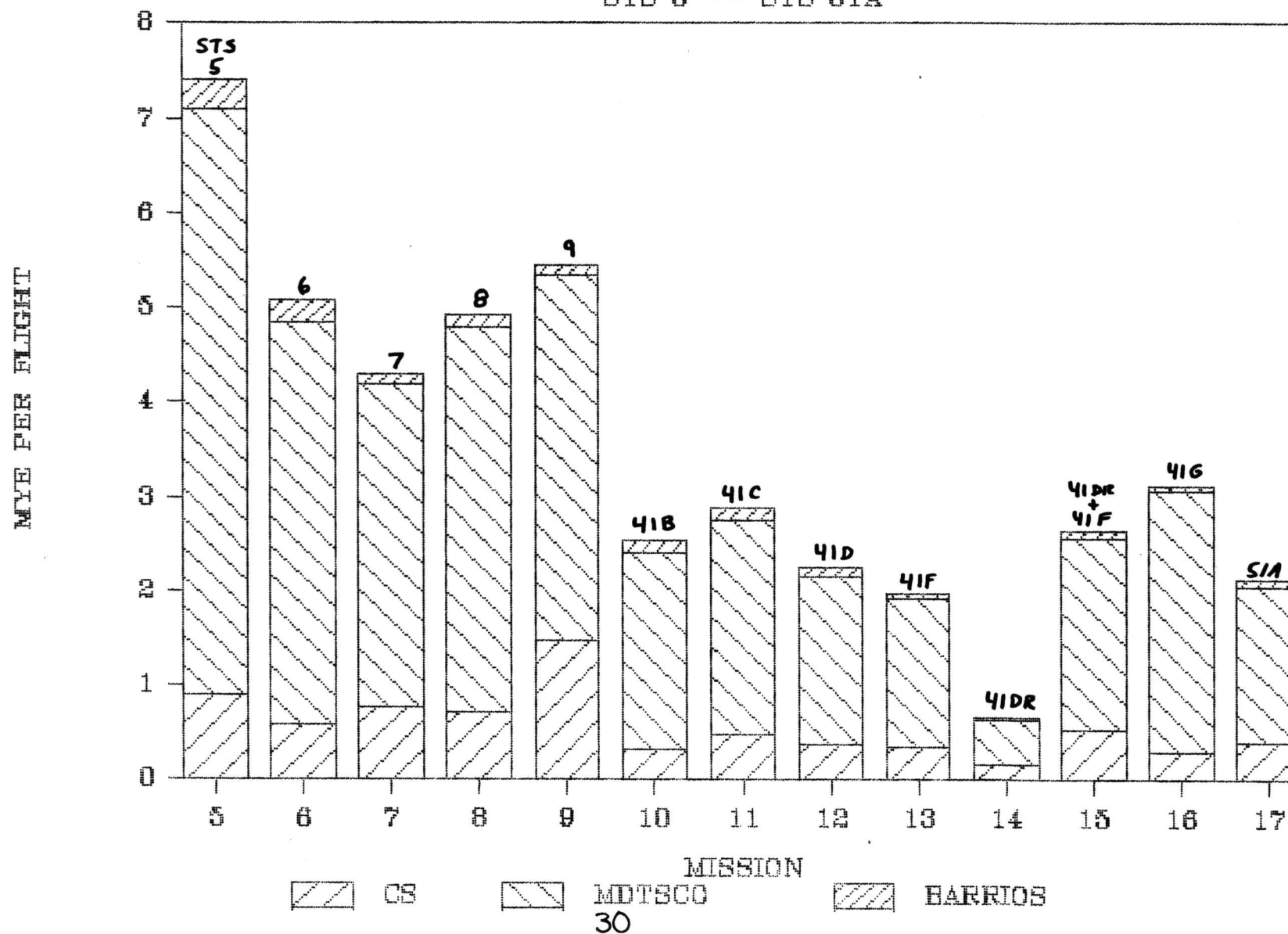
STS 5 -- STS 51A



MISSION
BARRIOS

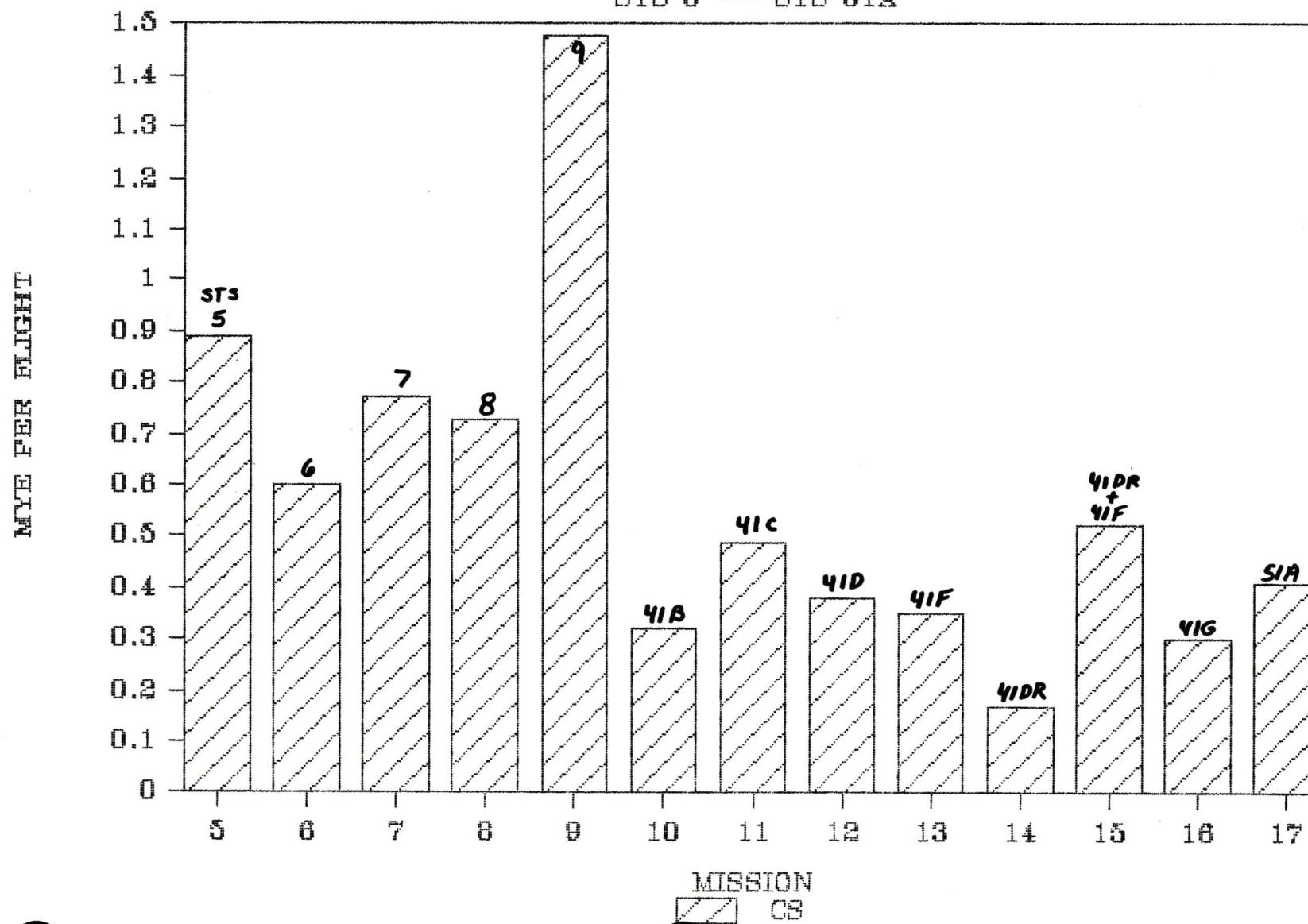
DESCENT FLIGHT DESIGN MANPOWER

STS 5 -- STS 51A



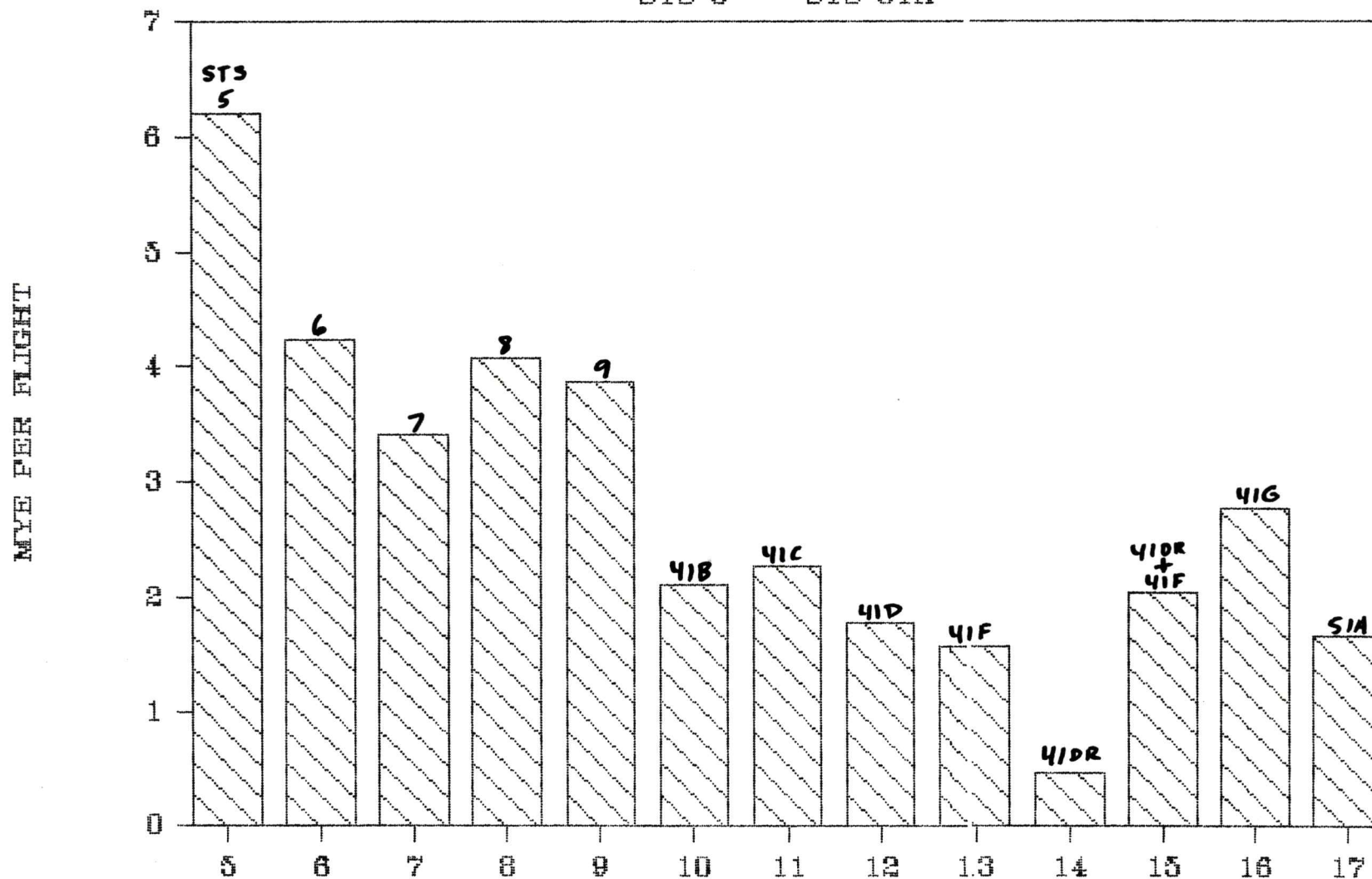
DESCENT FLIGHT DESIGN MANPOWER

STS 5 -- STS 51A



DESCENT FLIGHT DESIGN MANPOWER

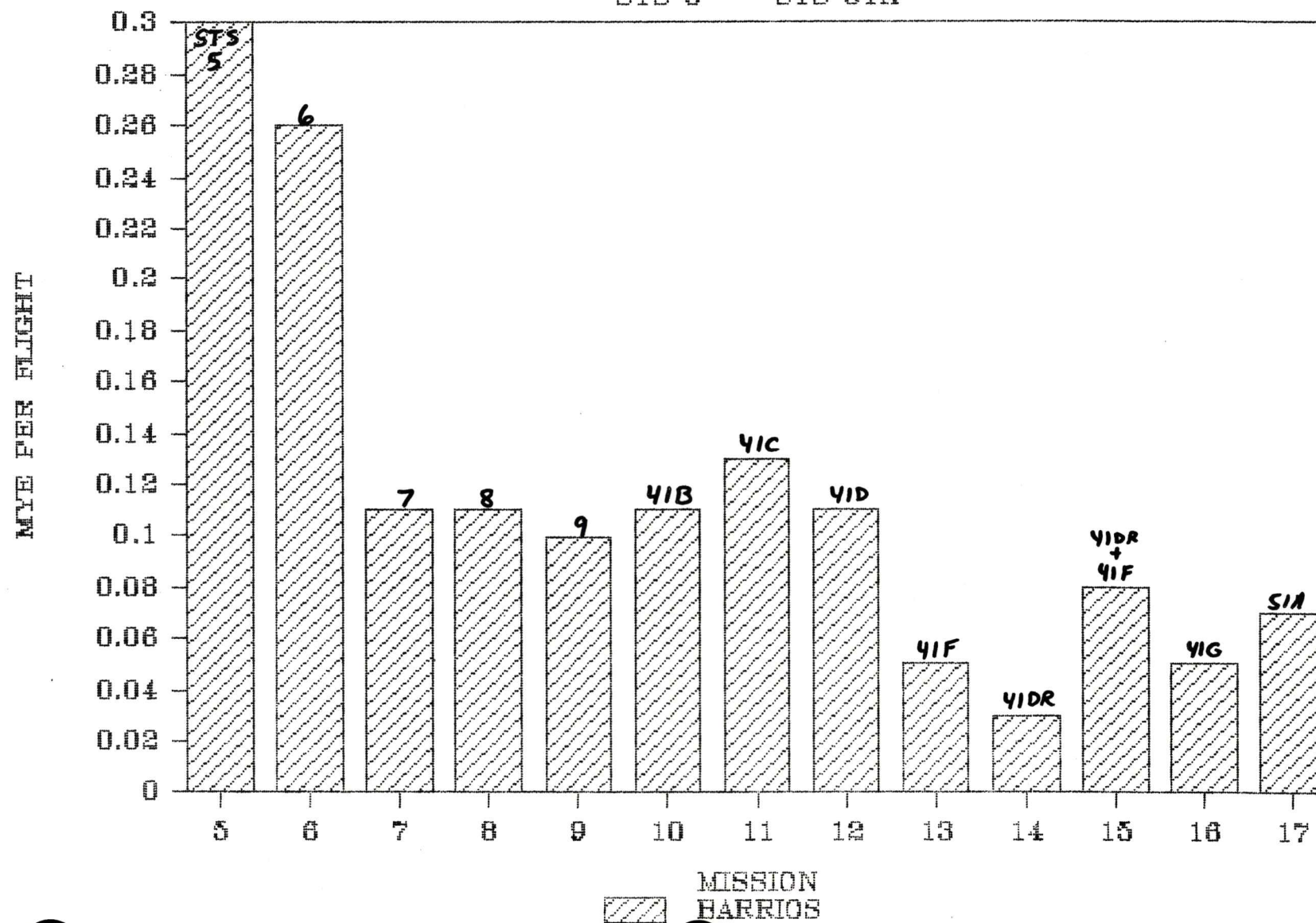
STS 5 -- STS 51A



MISSION
MDTSCO

DESCENT FLIGHT DESIGN MANPOWER

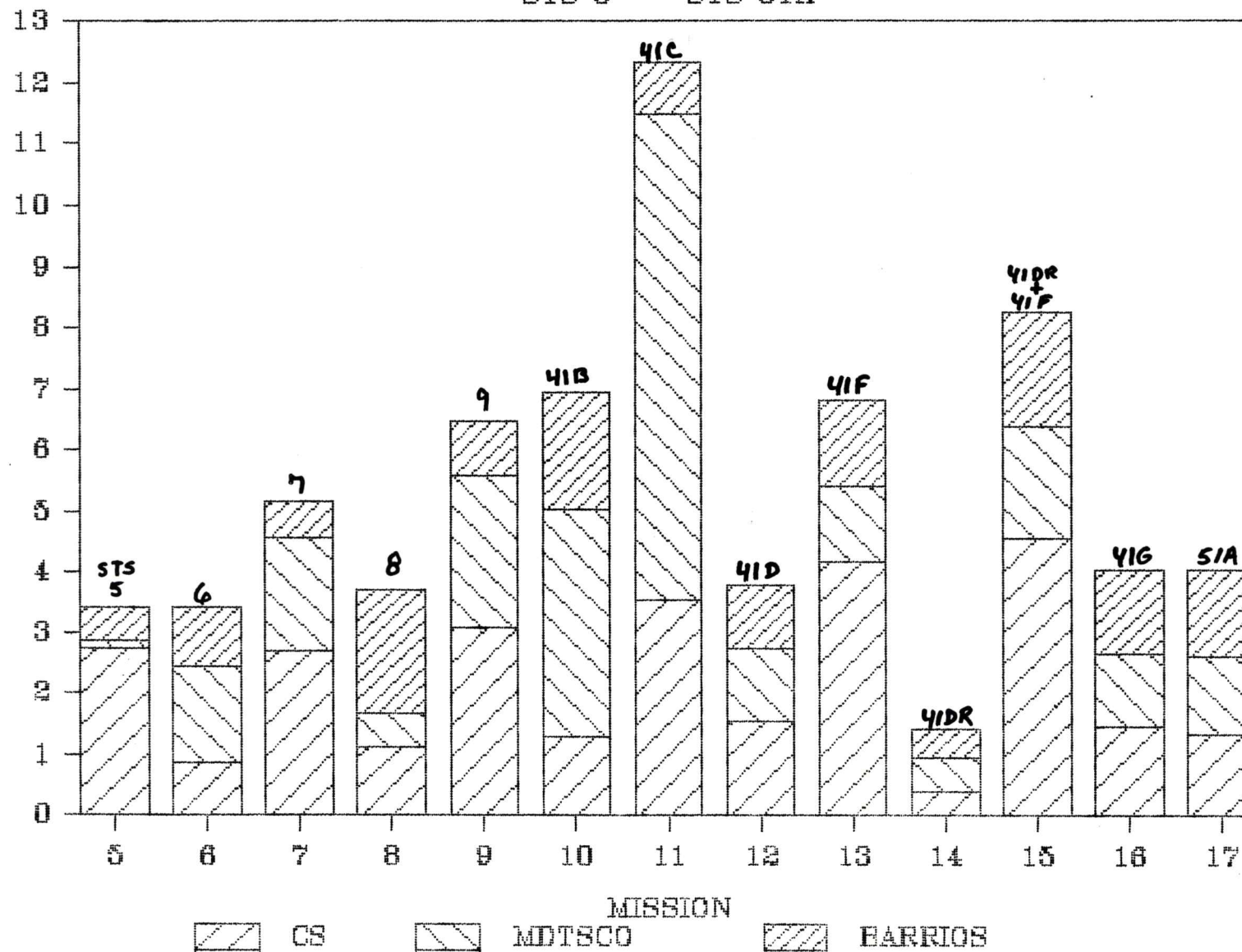
STS 5 -- STS 51A



ORBIT FLIGHT DESIGN MANPOWER

STS 5 -- STS 51A

MYE PER YEAR



MISSION



CS



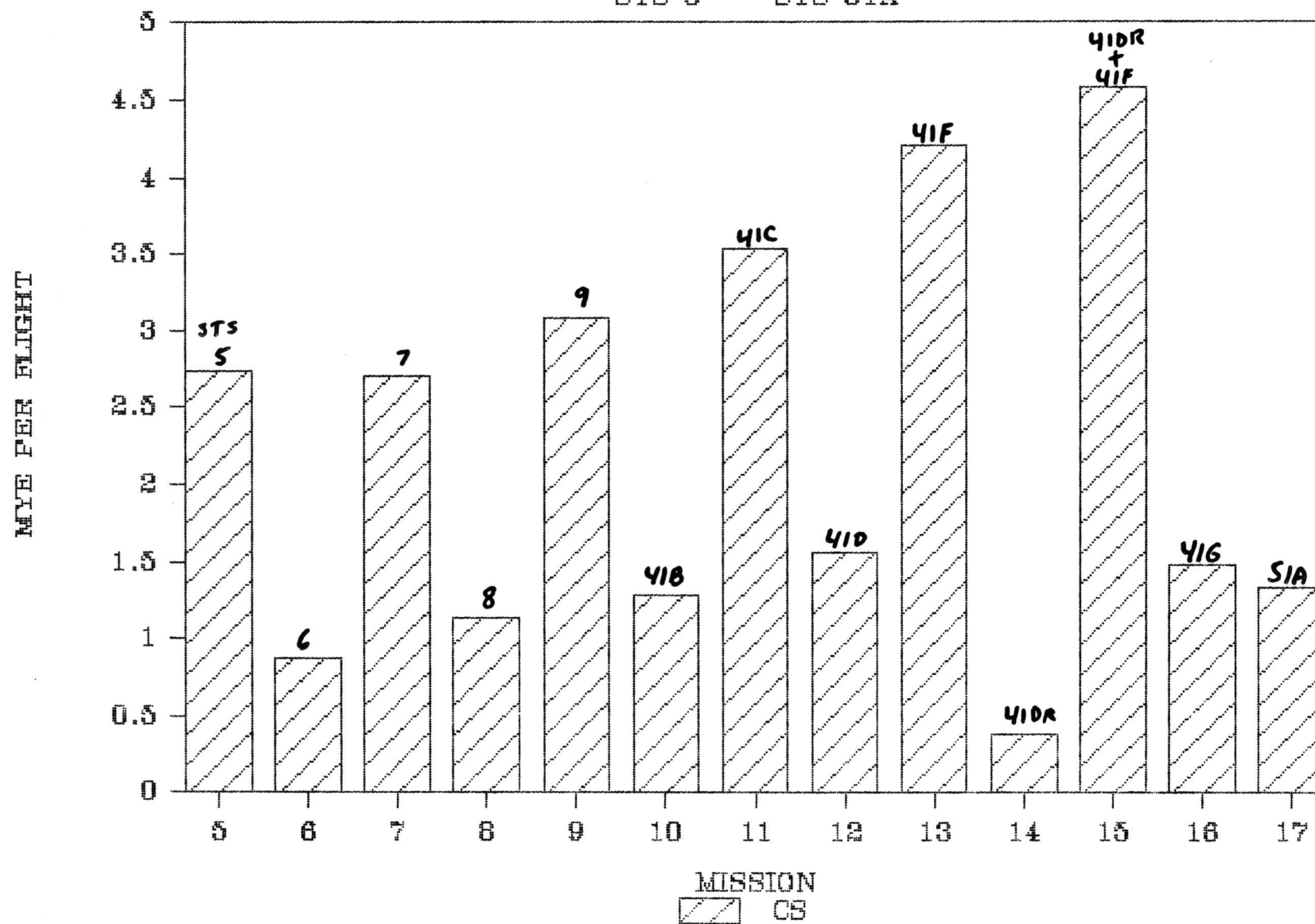
MDTSCO



EARRIOS

ORBIT FLIGHT DESIGN MANPOWER

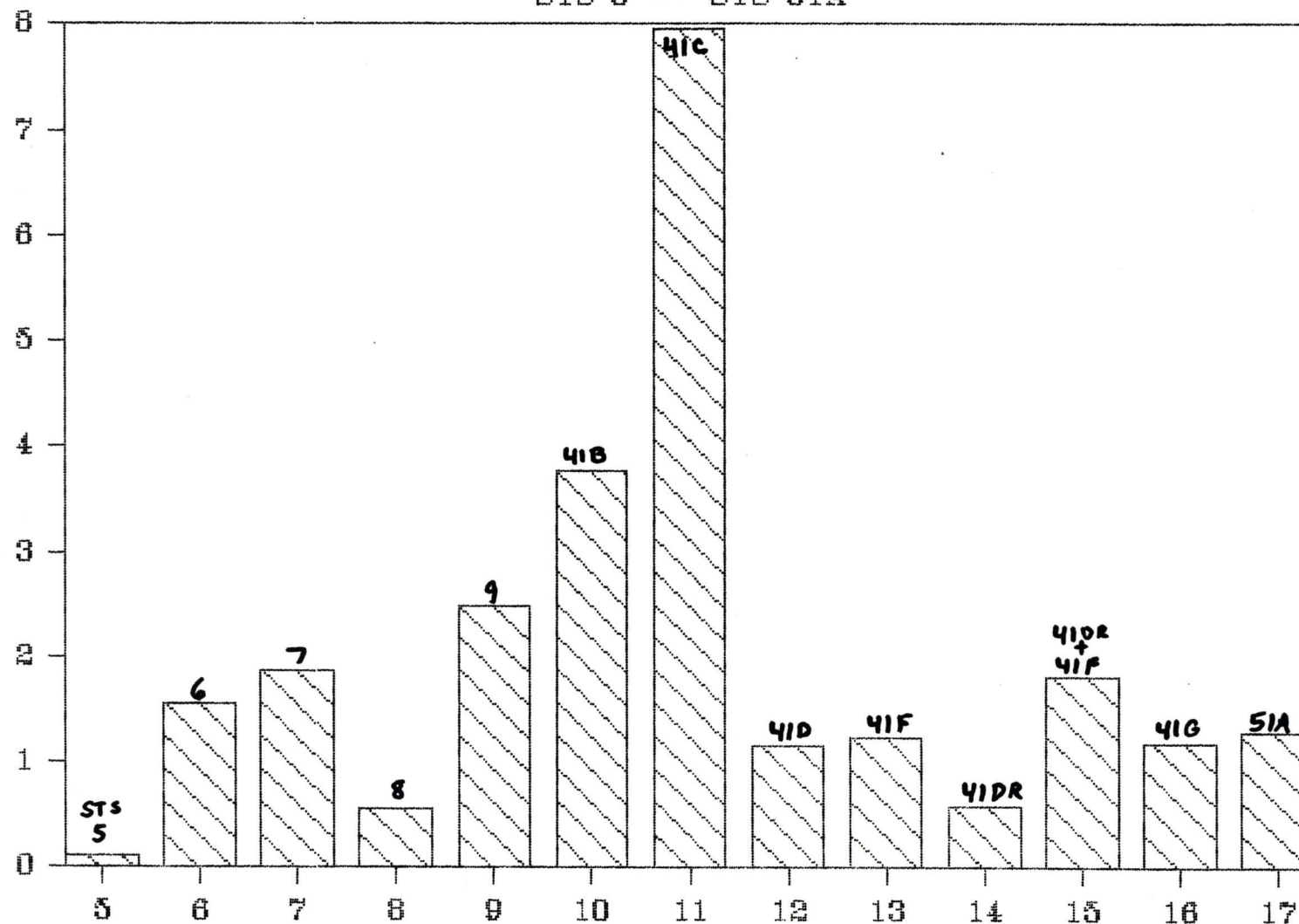
STS 5 -- STS 51A



ORBIT FLIGHT DESIGN MANPOWER

STS 5 -- STS 51A

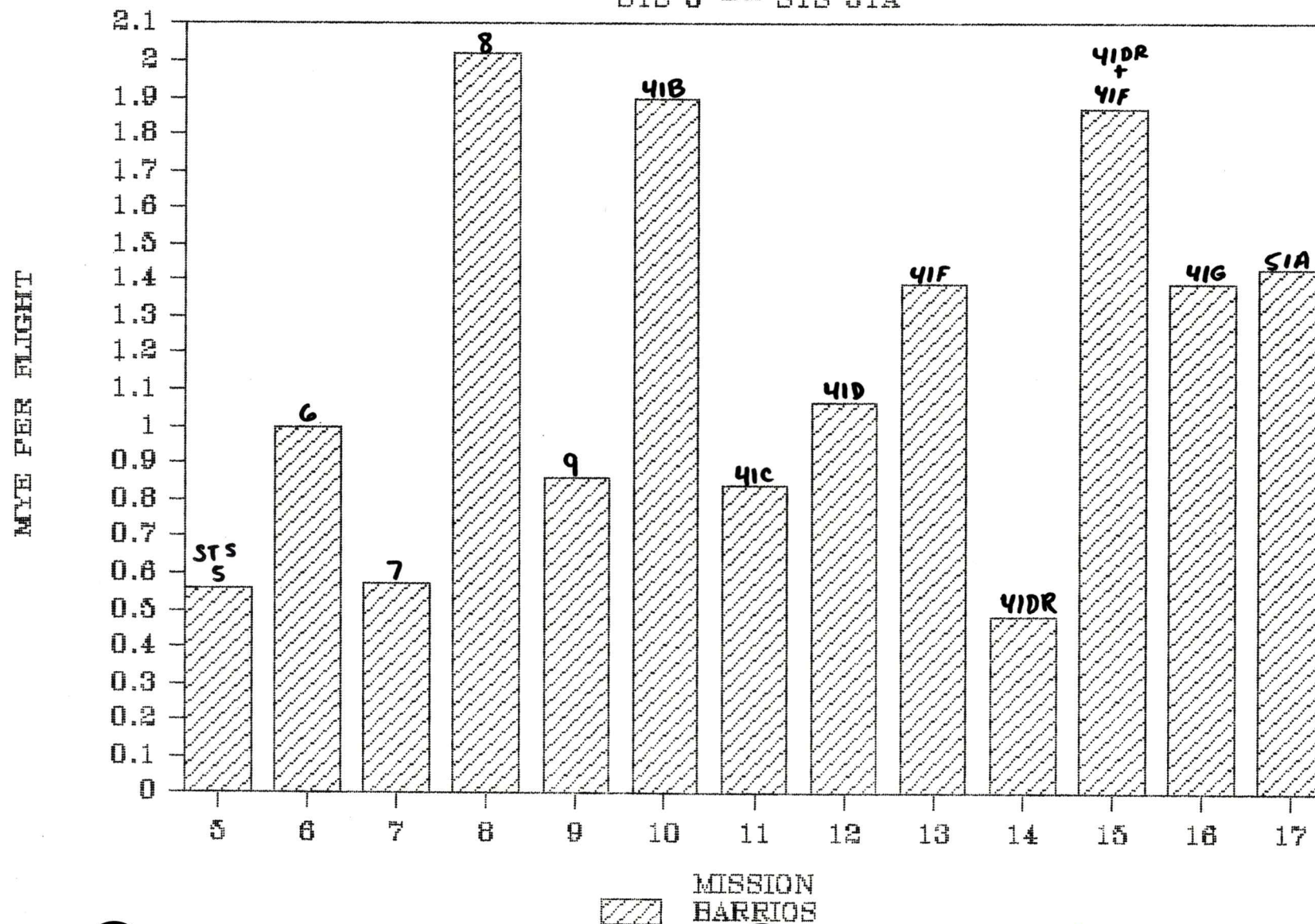
MYE PER FLIGHT



MISSION
MTSCO

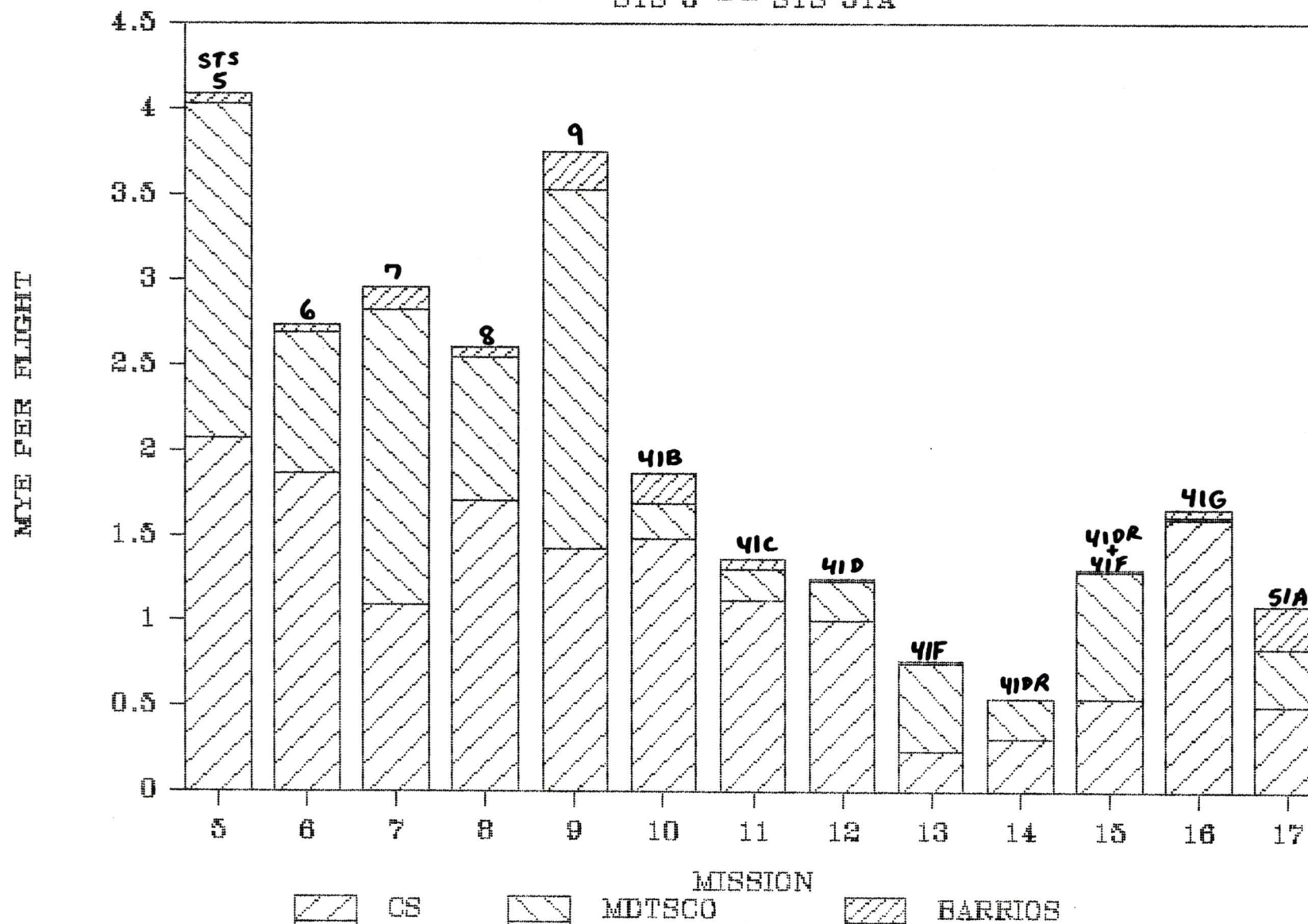
ORBIT FLIGHT DESIGN MANPOWER

STS 5 -- STS 51A



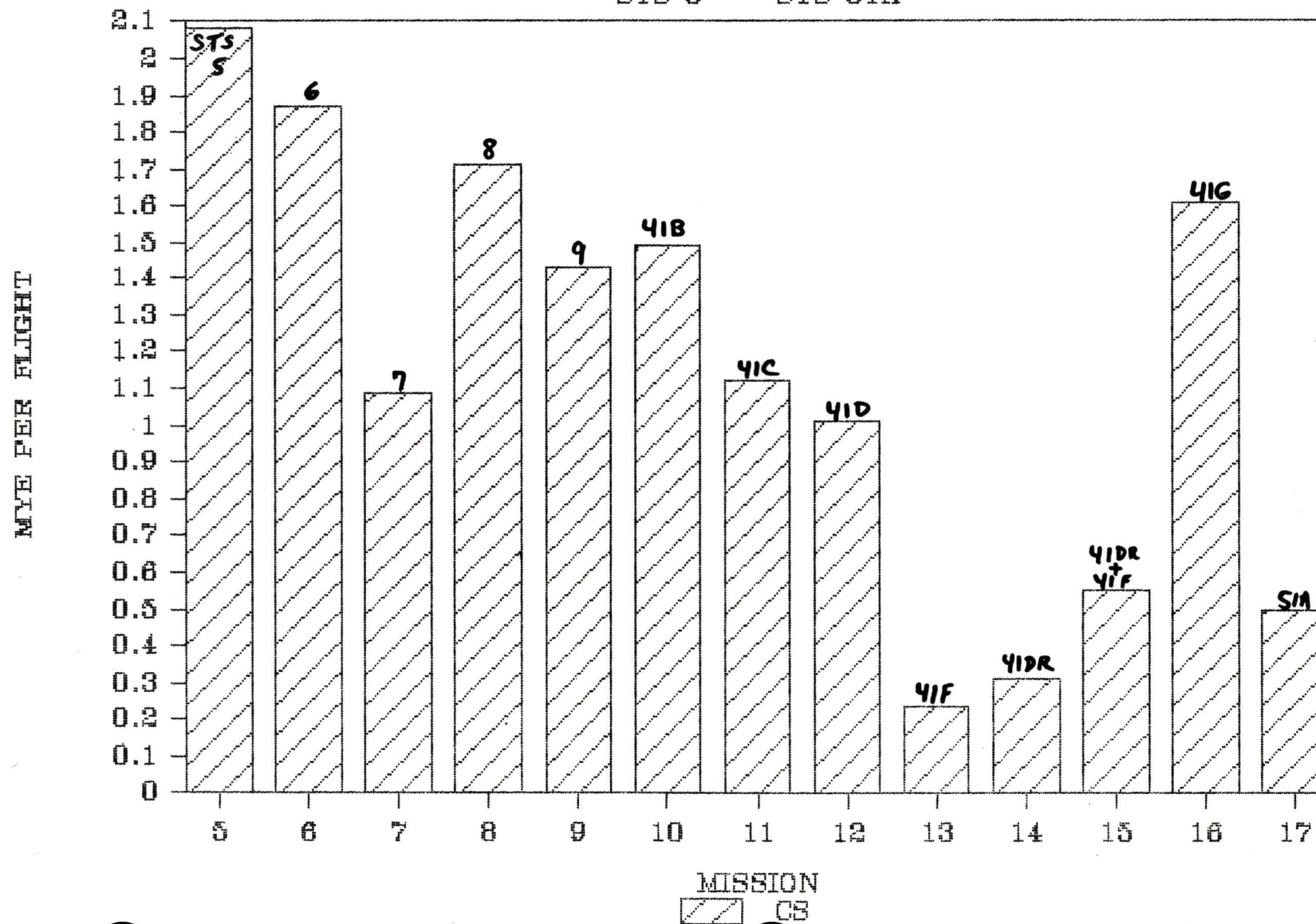
CONSUMABLES MANPOWER

STS 5 -- STS 51A



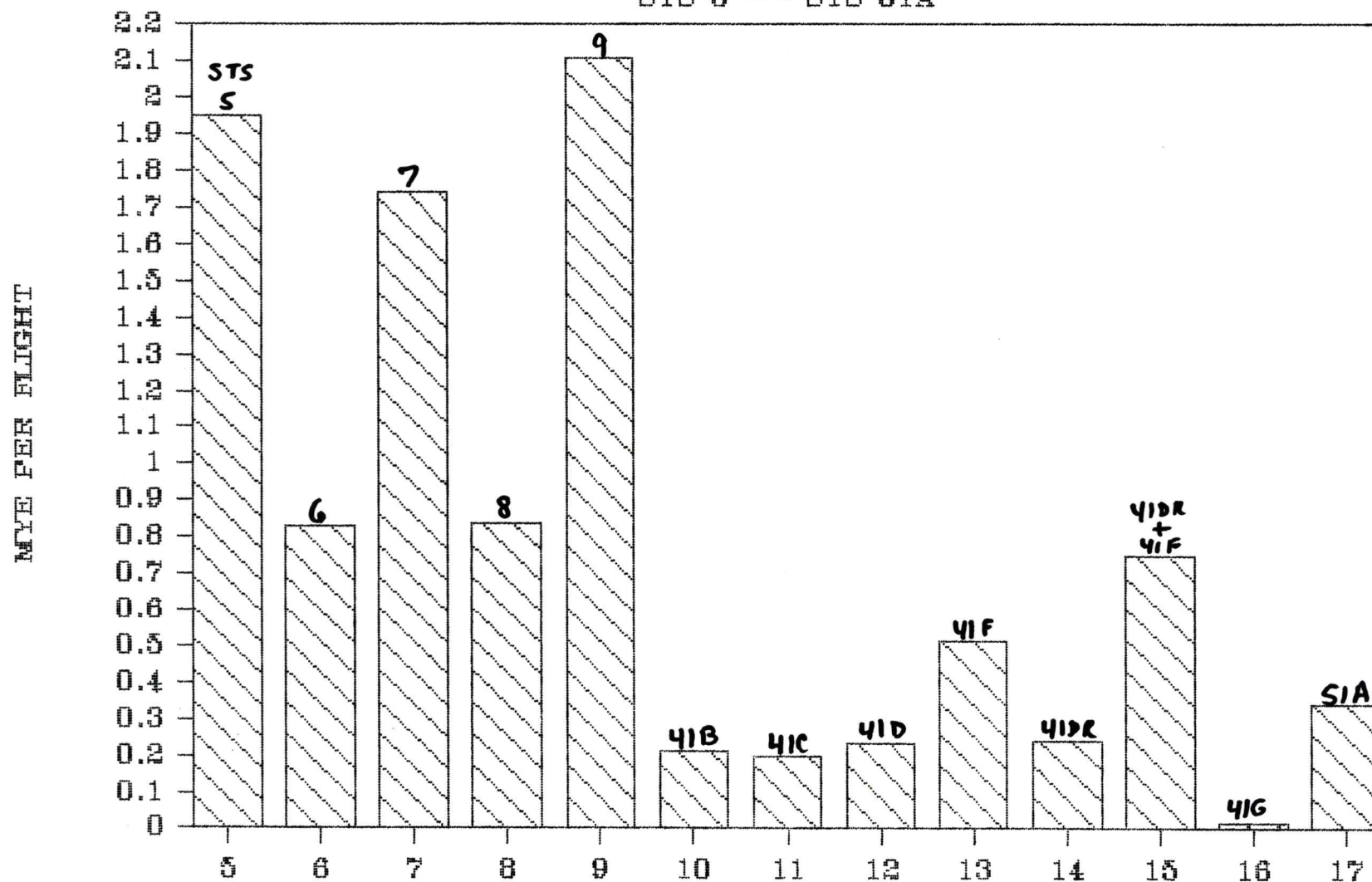
CONSUMABLES MANPOWER

STS 5 -- STS 51A



CONSUMABLES MANPOWER

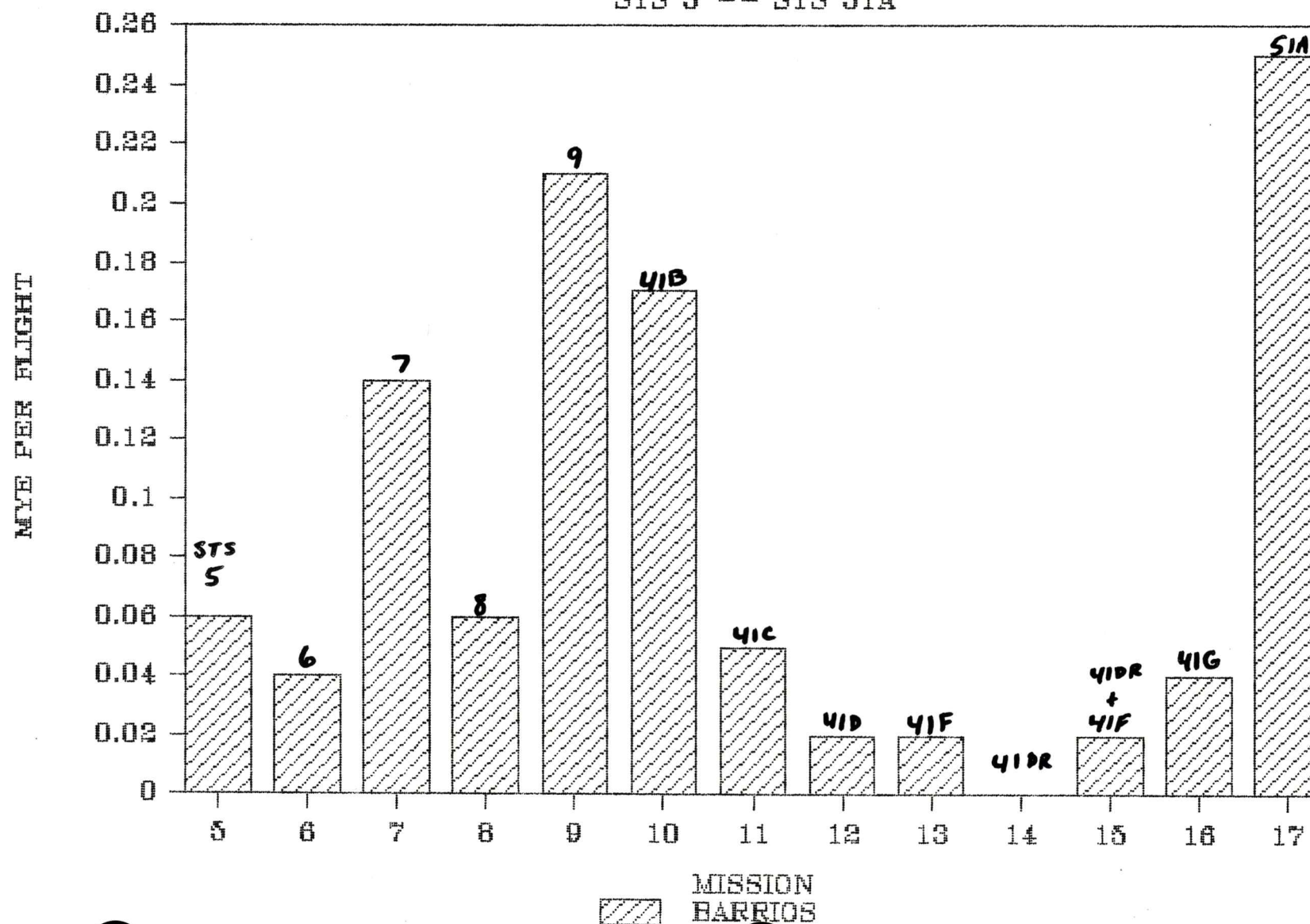
STS 5 -- STS 51A



MISSION
MDTSCO
40

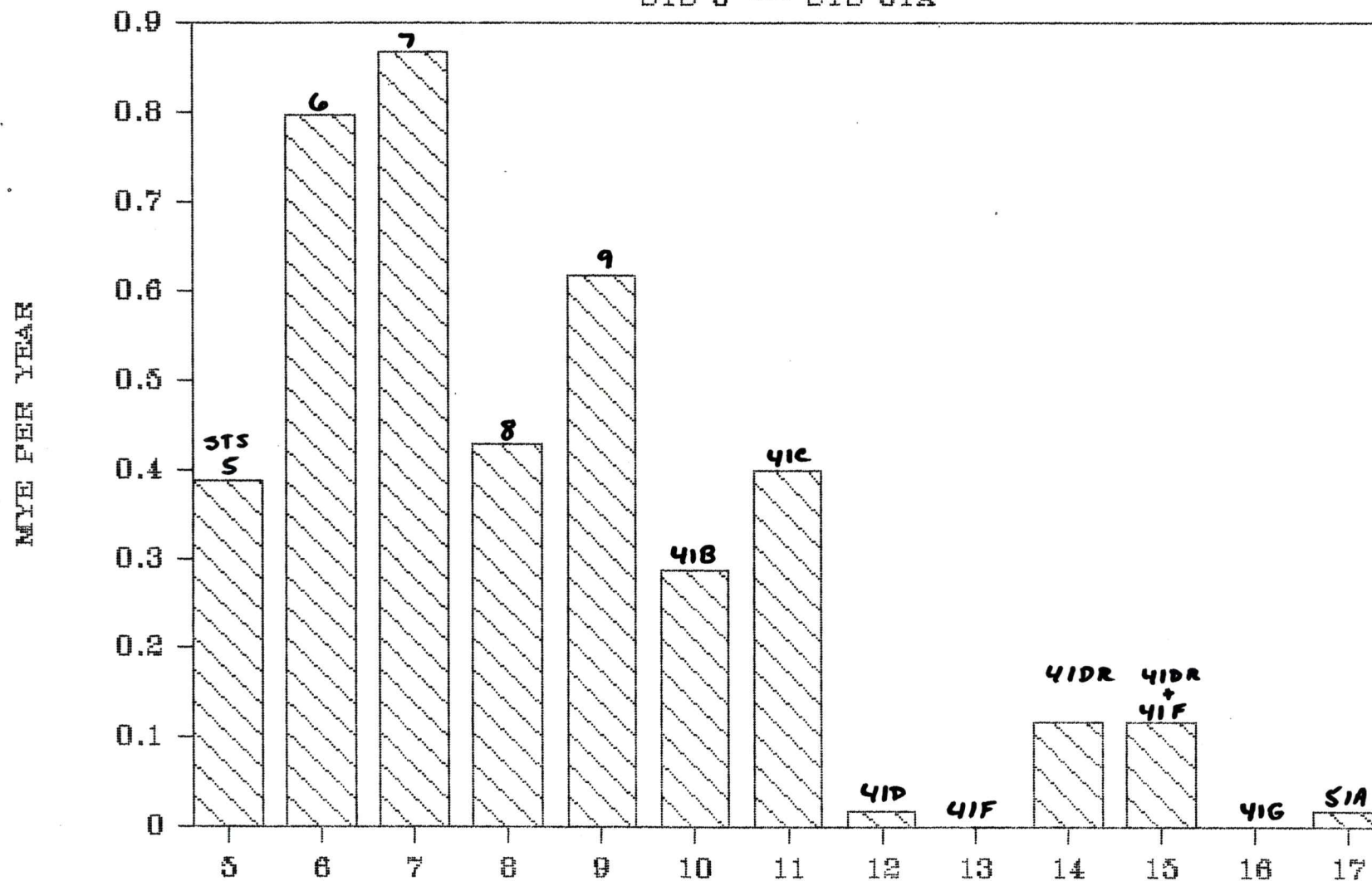
CONSUMABLES MANPOWER

STS 5 -- STS 51A



NAVIGATION MANPOWER PER FLIGHT

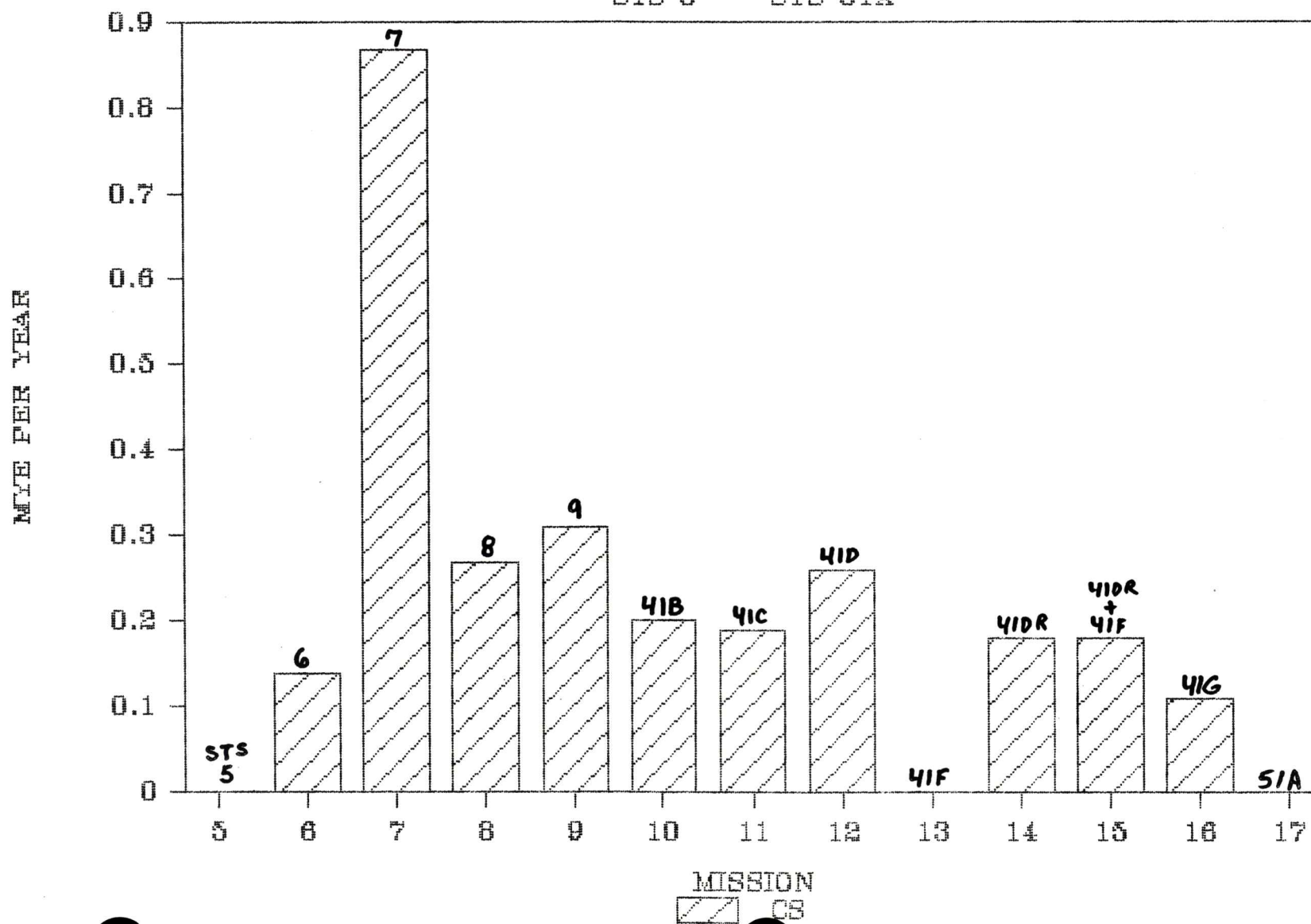
STS 5 -- STS 51A



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MDTSCO

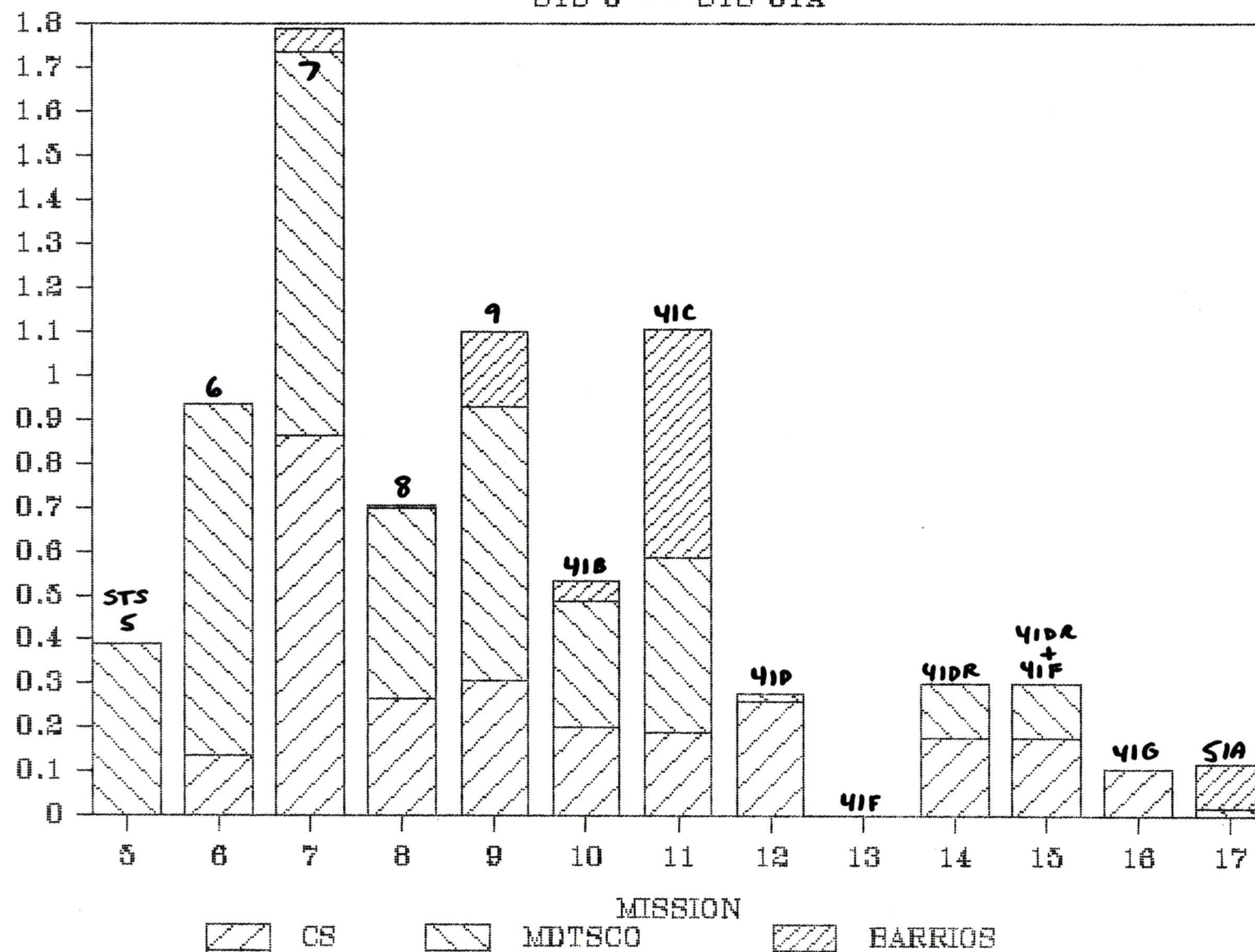
NAVIGATION MANPOWER PER FLIGHT

STS 5 -- STS 51A



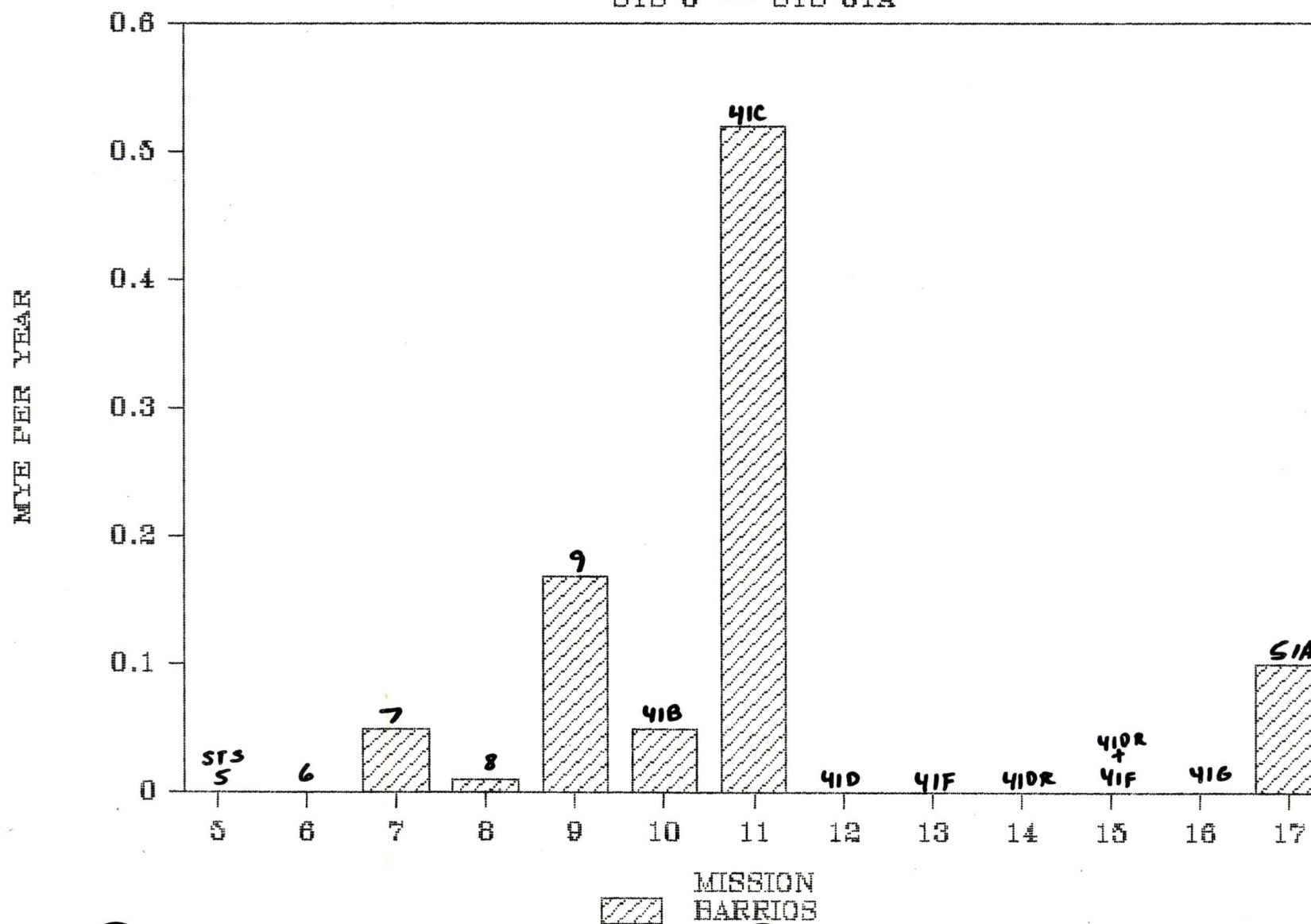
NAVIGATION MANPOWER PER FLIGHT

STS 5 -- STS 51A



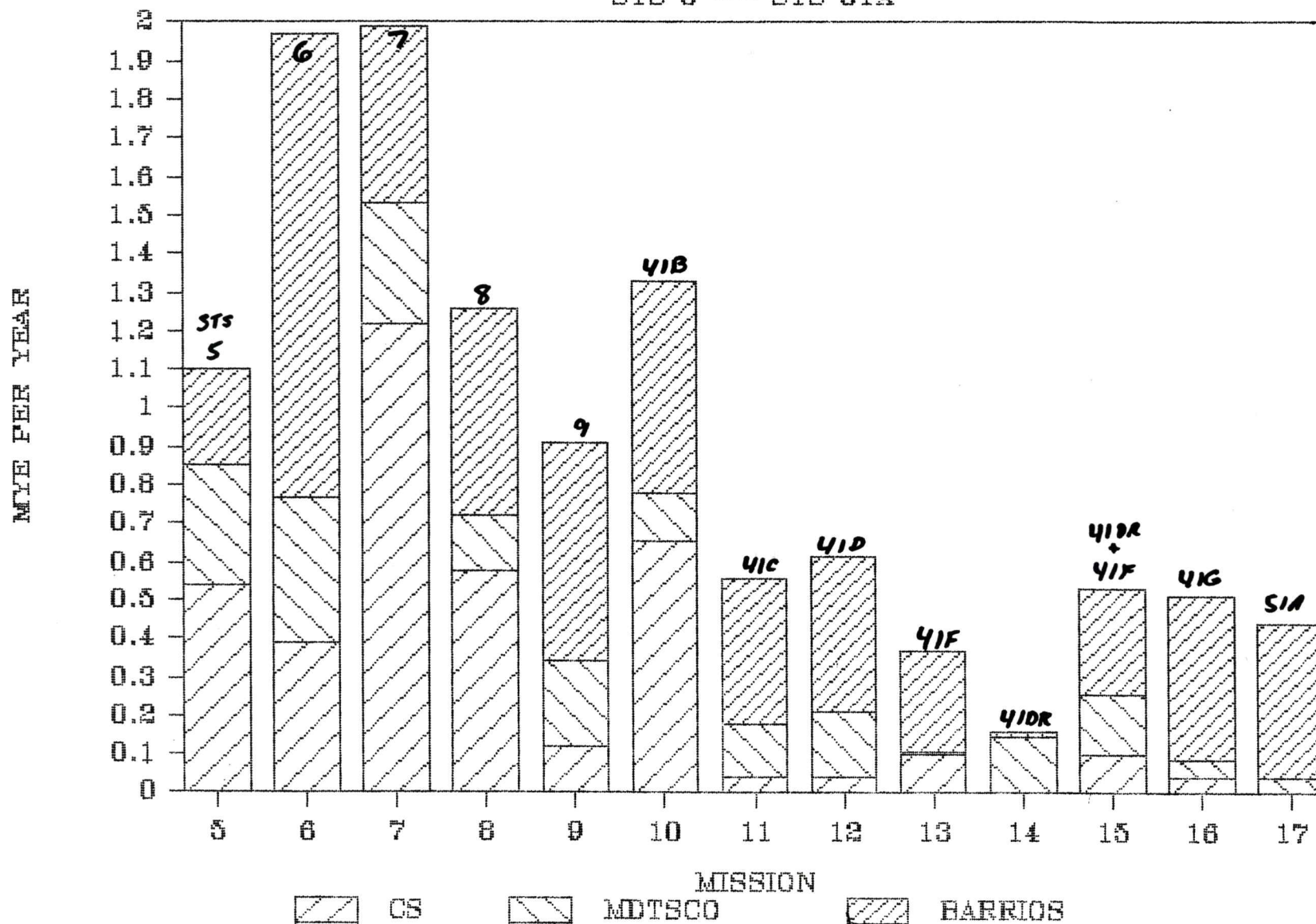
NAVIGATION MANPOWER PER FLIGHT

STS 5 -- STS 51A



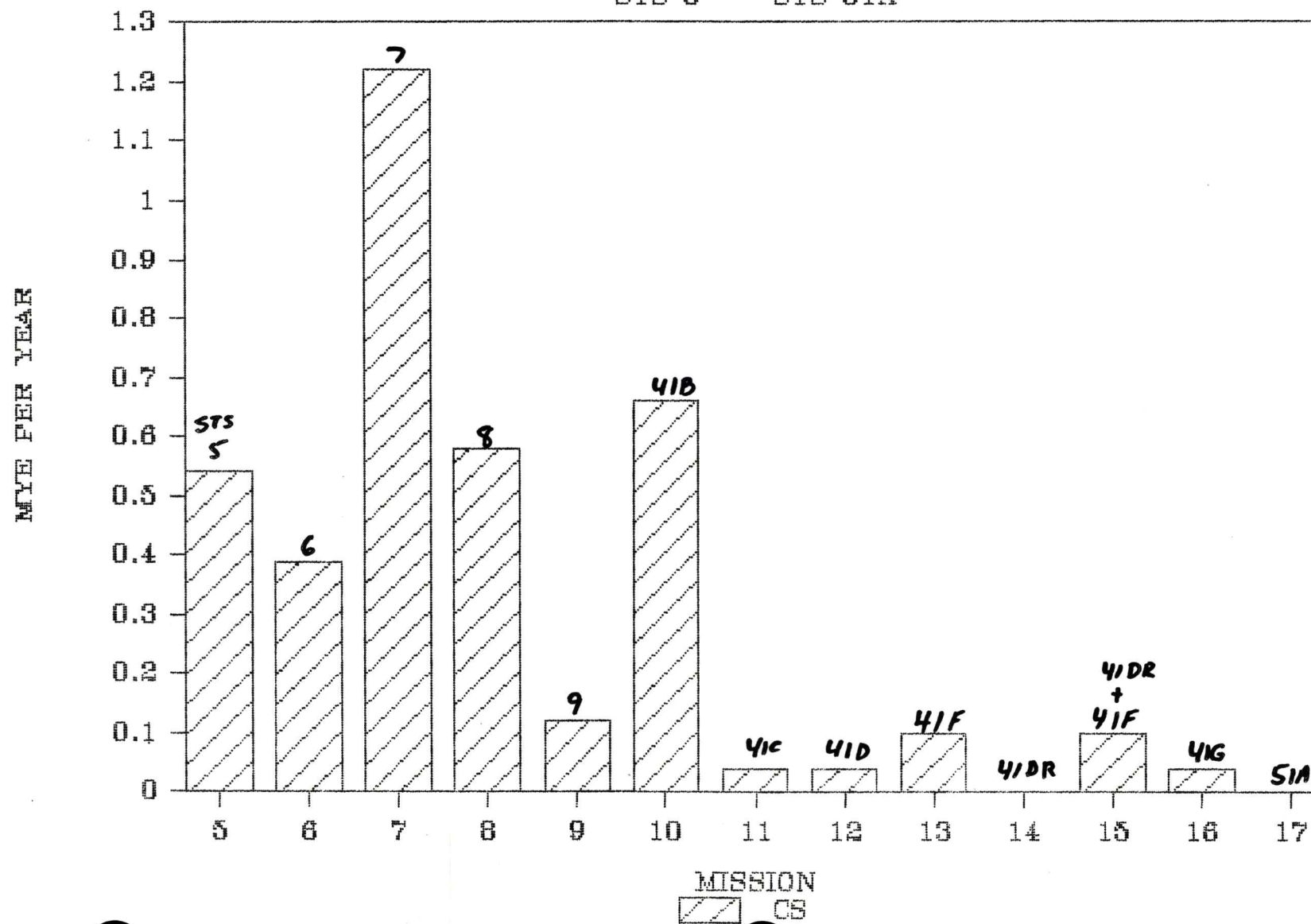
PRODUCT HANDLING MANPOWER PER FLIGHT

STS 5 -- STS 51A



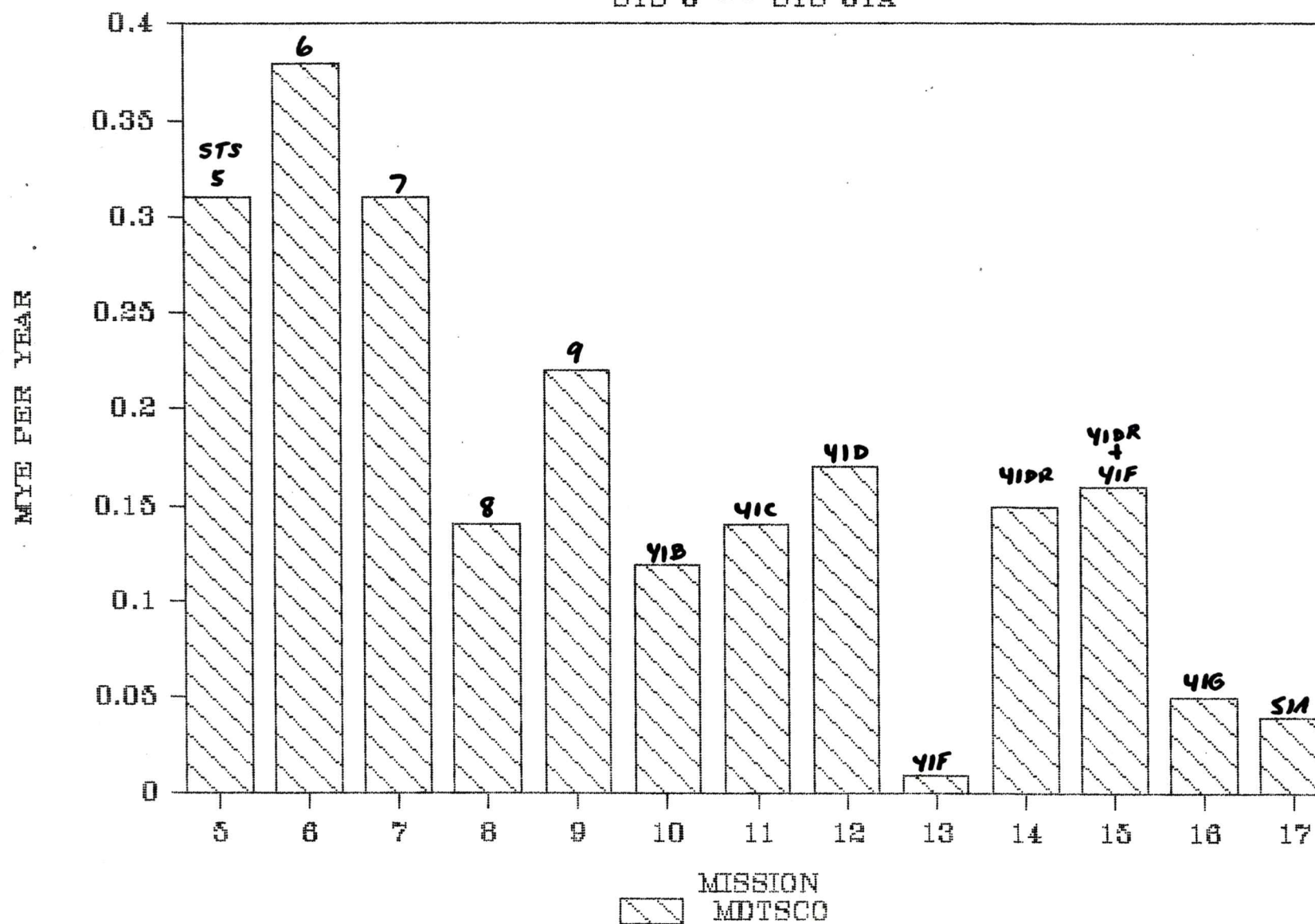
PRODUCT HANDLING MANPOWER PER FLIGHT

STS 5 -- STS 51A



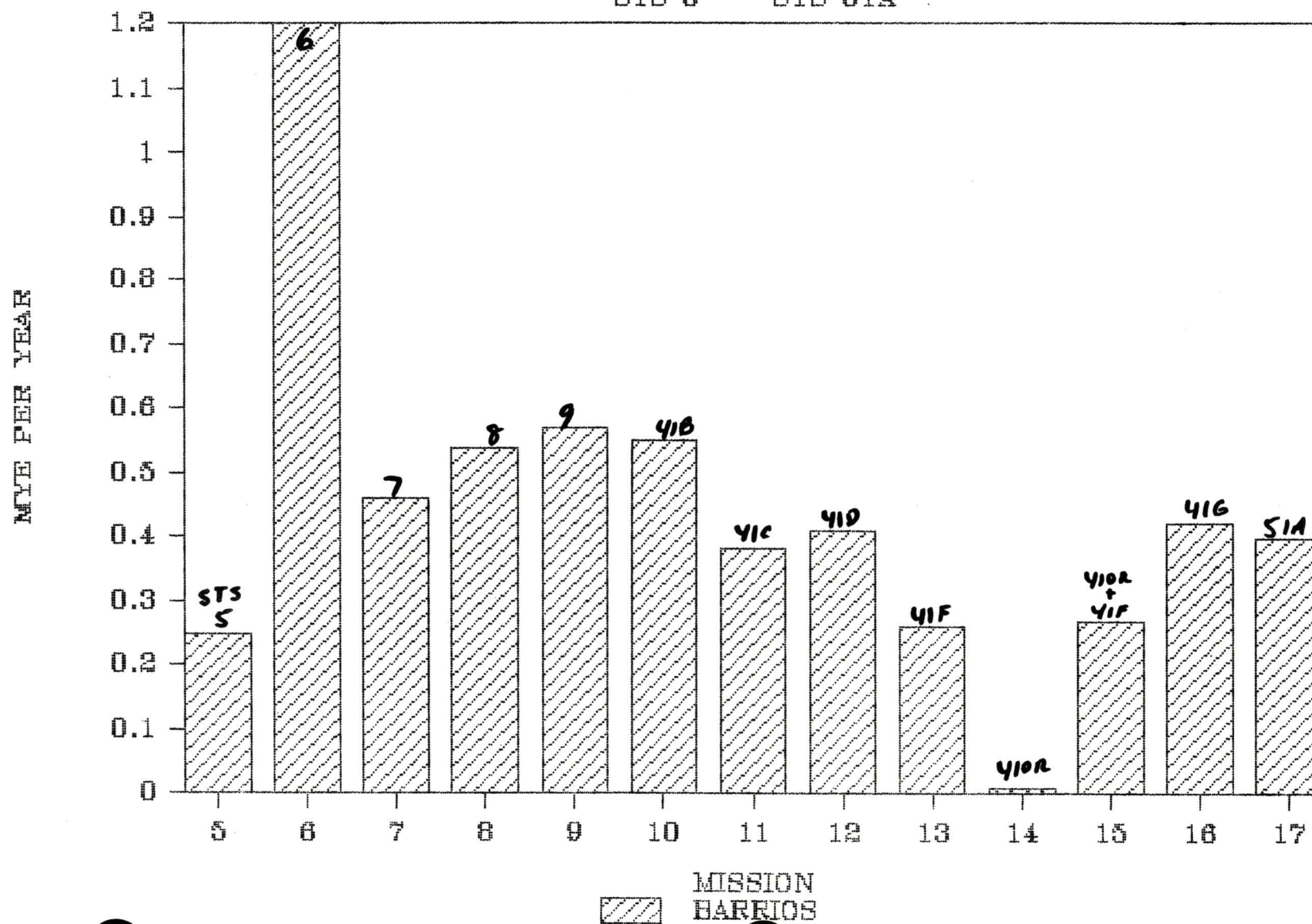
PRODUCT HANDLING MANPOWER PER FLIGHT

STS 5 -- STS 51A



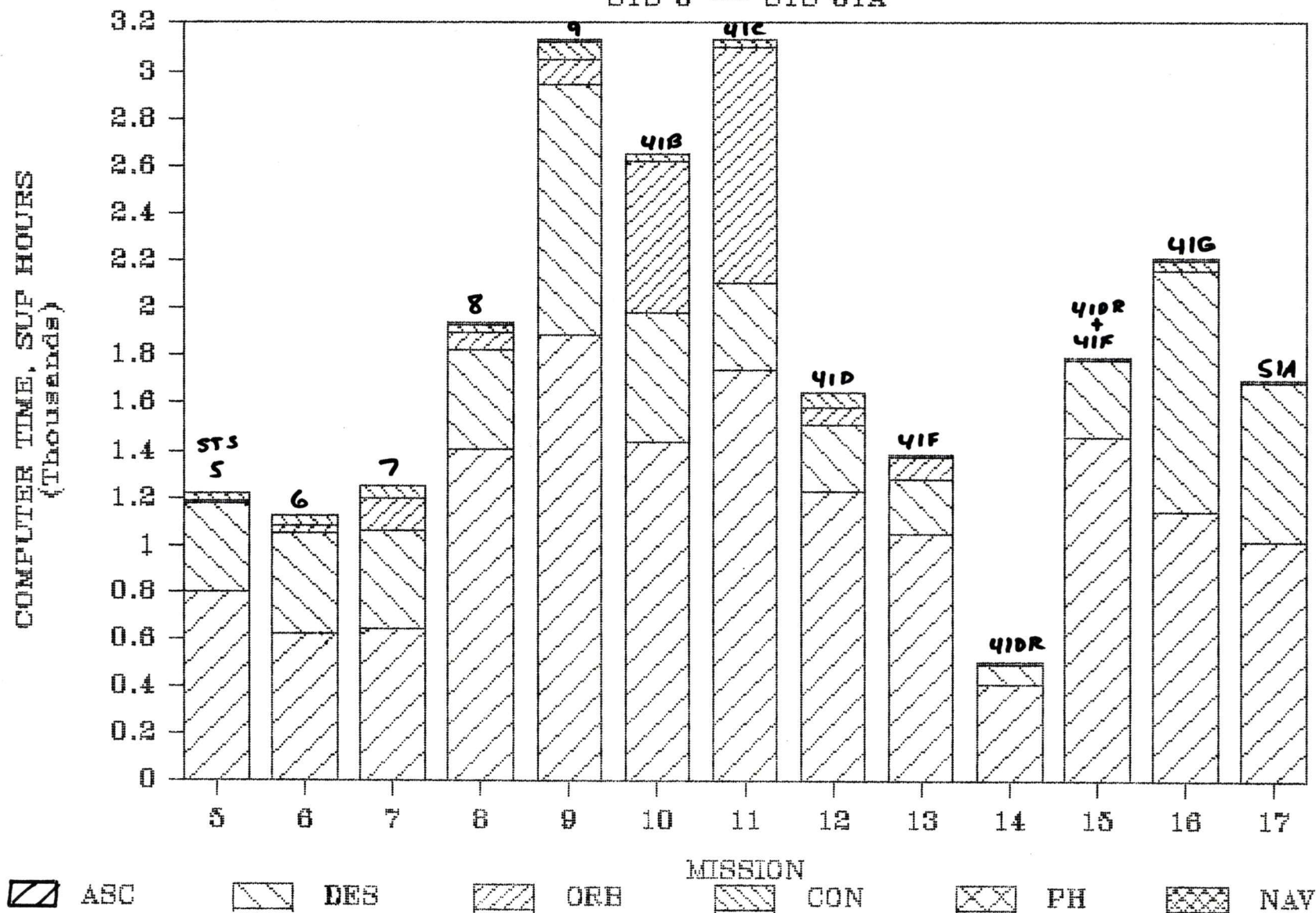
PRODUCT HANDLING MANPOWER PER FLIGHT

STS 5 -- STS 51A



FLIGHT DESIGN COMPUTER TIME USAGE

STS 5 -- STS 51A





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- MOST FLIGHT DESIGN WORKSTATIONS HAVE SHOWN SIGNIFICANT REDUCTION IN COSTS PER FLIGHT AS A RESULT OF STANDARDIZATION ACTIVITIES.
- ASCENT IS BEHIND OTHER AREAS BECAUSE OF CONTINUING REDEFINITION OF ORBITER CAPABILITY.
- PROPOSED DM MUR CATEGORIES SHOULD PROVIDE GOOD FLIGHT COSTS AND OPERATING BASE COSTS.



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PROPOSED FLIGHT DESIGN MUR CATEGORIES

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CATEGORY

TITLE

011191	TRAJECTORY DESIGN COMPUTER SYSTEMS M&M
011192	TRAJECTORY DESIGN PRODUCTS - CFP
011193	TRAJECTORY DESIGN PRODUCTS - OFP
011194	TRAJECTORY DESIGN - MANIFEST SUPPORT
011195	TRAJECTORY DESIGN - FLIGHT-SPECIFIC SUPPORT
011196	TRAJECTORY DESIGN - GENERAL ANALYSIS
011197	TRAJECTORY DESIGN - COMMIT TO FLIGHT
011198	TRAJECTORY DESIGN - I-LOAD DEFINITION
011199	TRAJECTORY DESIGN - MCC RECONFIGURATION



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ROLES OF
FDDD, I-LOAD OWNERS, AND
OTHER PARTICIPANTS IN I-LOAD PROCESS

DM/MEL ROTHER
MAY 28, 1985



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DM/M. R. ROTHER

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5/28/85

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- DM'S ROLE IN I-LOAD PROCESS
 - FLIGHT OPERATIONS PANEL
 - I-LOAD COORDINATION MEETINGS
 - MISSION DEFINITION CR'S

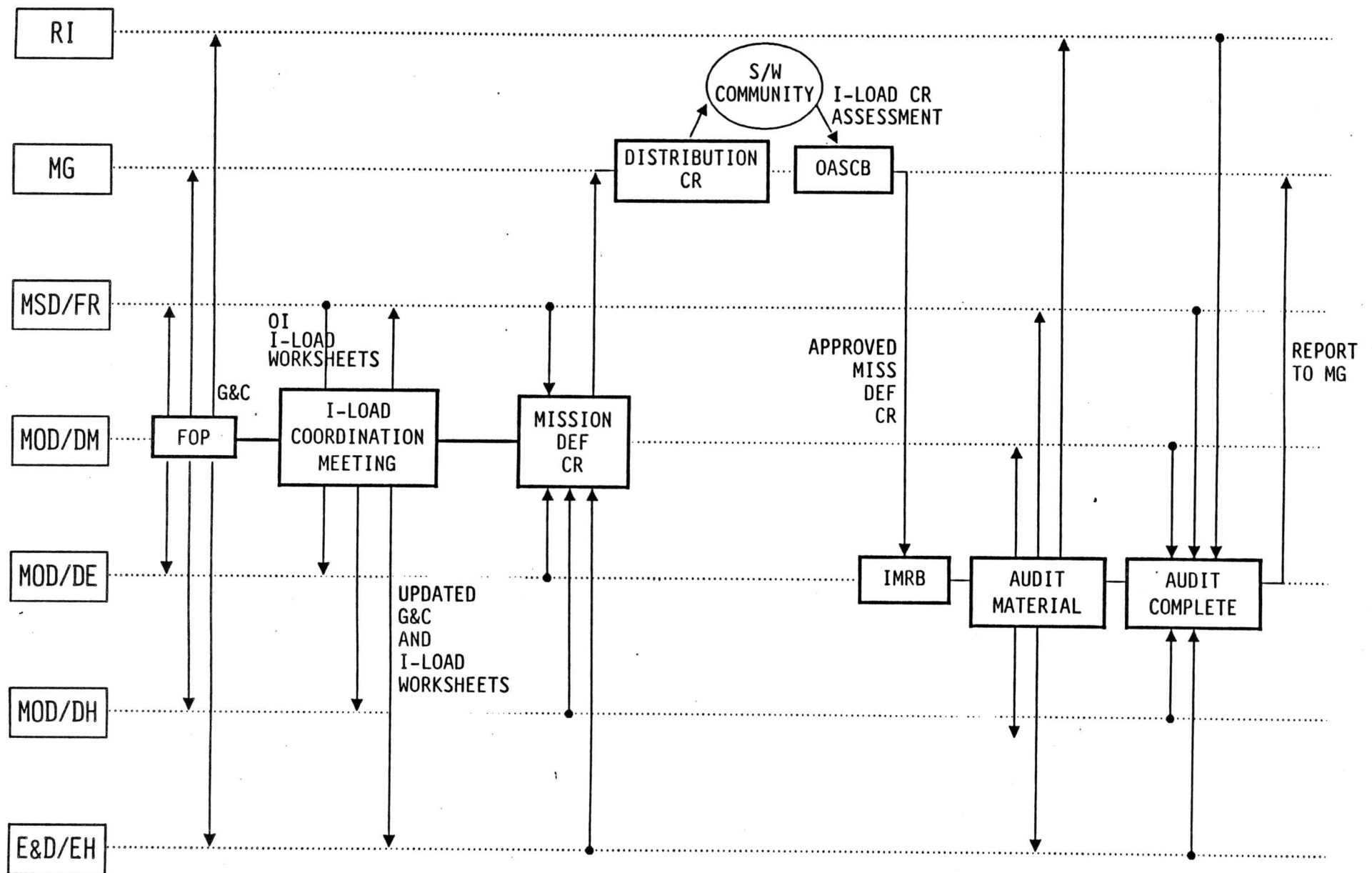
- NON-MOD PARTICIPANTS IN I-LOAD PROCESS
 - SPACECRAFT SOFTWARE DIVISION (MSD/FR)
 - JSC I-LOAD OWNERS
 - RI I-LOAD OWNERS
 - AVIONICS OFFICE (MG)

- I-LOAD AUDITS
 - DE'S ROLE
 - I-LOAD OWNERS' ROLE

- HOW PROCESS HAS EVOLVED AND PROBABLE FUTURE CHANGES

I-LOAD DEFINITION ACTIVITIES

DM/M. R. ROTHER, 5/28/85



MOD CATEGORIES REQUIRED FOR OI06 FLT

CYCLE DATA

DATE: 05-16-85

JSC OWNER
(SIGNATURE)

CATEGORIES

CATEGORY NAMES

OCC #'S

OCC NAMES

DEWOLF, L.

DE

GREMILLION, M.

MID0

MISSION ID

VID0

VEHICLE ID

SMA0

BFS MISC FDA

(OI06)

SMB0

BFS ON-ORBIT FDA LIMITS

(OI06)

SMC0

BFS CRYO FDA LIMITS

(OI06)

SMD0

BFS ASCENT/ENTRY LL

(OI06)

SME0

BFS ASCENT/ENTRY UL

(OI06)

SMF0

BFS APU FUEL QTY COMP

(OI06)

SMG0

BFS HYD H2O QTY COMP

(OI06)

SMH0

BFS S-BAND ANTENNA MNGMT.

(OI06)

SMI0

BFS FLASH EVAP BOIL ACT.

(OI06)

SMJ0

BFS CABIN PRESSURE

(OI06)

ZF32

FIXED I-LOADS - GREMILLION

(OI06)

ZF42

FIXED I-LOADS - GREMILLION, CONTD.

HENDERSON;POCKLING

YD10

TO BE DELETED, PART 1

HENDERSON, E.

AAD0

ASCENT ATO DUMP CONTROLS

(OI06)

ADM0

SSME PITCH PARALLEL

MOD CATEGORIES REQUIRED FOR OI06 FLT

CYCLE DATA

DATE: 05-16-85

JSC OWNER
(SIGNATURE)

CATEGORIES

CATEGORY NAMES

OCC #'S

OCC NAMES

AFD0	ASCENT RTLS FUEL DISSIPATION	(OI06)
AMC0	ASCENT MISSION UNIQUE MASSES	(OI06)
APS0	ASCENT PSEUDO MECO TARGETS	(OI06)
ARC0	ASCENT MISSION DEPENDENT RENDEZVOUS	(OI06)
ART0	ASCENT RTLS PPD AND MECO TARGETS	(OI06)
ASE0	ASCENT ELEVON ANGLES	(OI06)
ATA0	ASCENT FIRST STAGE TREF	(OI06)
ATM0	ASCENT SECOND STAGE TRIMS	(OI06)
AVI0	ASCENT VARIABLE IY	(OI06)
A1N2	ASCENT FIRST STAGE NOMINAL	(OI06)
A1P0	ASCENT FIRST STAGE ENGINE-OUT	
A1S1	ASCENT FIRST STAGE THROTTLE SCHEDULES	(OI06)
A1T1	ASCENT FIRST STAGE AGT	(OI06)
A2A1	ASCENT SECOND STAGE AOA/ATO	(OI06)
A2M1	ASCENT SECOND STAGE MECO	(OI06)
A2N1	ASCENT SECOND STAGE IY	(OI06)
A2P1	ASCENT SECOND STAGE SSME POWER	(OI06)
A2R3	ASCENT SECOND STAGE RTLS	(OI06)
A2T2	ASCENT SECOND STAGE TAL	(OI06)

MOD CATEGORIES REQUIRED FOR 0106 FLT CYCLE DATA

DATE: 05-16-85

JSC OWNER (SIGNATURE)	CATEGORIES	CATEGORY NAMES		OCC #'S	OCC NAMES
	A3A1	ASCENT POST-MECO AOA	(0106)		
	A3N1	ASCENT POST-MECO NOMINAL	(0106)		
	A3T0	ASCENT POST-MECO ATO			
	QAC0	CONTINGENCY RCS DUMP			
	QAT0	ATO PRE MECO DUMPS	(0106)		
	QFD1	CONTINGENCY OMS DUMP	(0106)		
	QRB0	SRB SEP BACKUP TIME			
	QRM0	RTLS POST MECO DUMPS	(0106)		
	QRP0	RTLS PRE MECO DUMPS	(0106)		
	QTM0	TAL POST MECO DUMP	(0106)		
	QTP0	TAL PRE MECO DUMPS	(0106)		
	QTR0	TAL ENTRY & AFT RCS DUMP	(0105)		
	XS41	SPF DERIVED ASCENT PARAMETER	(0106)		
	YD52	TO BE DELETED, PART 5	(0106)		
	ZFE2	FIXED I-LOADS - BORDANO	(0106)		
	ZF11	FIXED I-LOADS - BORDANO, CONTD.	(0106)		
	ZF22	FIXED I-LOADS - BORDANO, CONTD.	(0106)		
HITE,G.	ATD0	ASCENT TRAJECTORY DISPLAY			

MOD CATEGORIES REQUIRED FOR 0106 FLT CYCLE DATA

DATE: 05-16-85

JSC OWNER (SIGNATURE)	CATEGORIES	CATEGORY NAMES	OCC #'S	OCC NAMES
	ATP1	ASCENT TRAJECTORY DISPLAY PROCESSING(0106)		
	ETD1	ENTRY TRAJECTORY DISPLAY PROCESSING (0106)		
	ET10	ENTRY TRAJECTORY DISPLAY 1		
	ET20	ENTRY TRAJECTORY DISPLAY 2		
	ET30	ENTRY TRAJECTORY DISPLAY 3		
	ET40	ENTRY TRAJECTORY DISPLAY 4		
	ET50	ENTRY TRAJECTORY DISPLAY 5		
	VE10	VERT SIT 1 DISPLAY, OPS 3		
	VE20	VERT SIT 2 DISPLAY, OPS 3		
	VR10	VERT SIT 1 DISPLAY, OPS 1		
	VR20	VERT SIT 2 DISPLAY, OPS 1		
	VSA0	VERT SIT DISPLAY, ALPHA-MACH		
	VSC0	VERT SIT DISPLAY, COMMON		
	XS10	SPF DERIVED DISPLAY LABELS		
	ZFG0	FIXED I-LOADS - HITE		
POCKLINGTON, R.	AML0	ASCENT MLS SITES (0106)		
	A010	ASCENT AREA TABLE #01 (0106)		
	A020	ASCENT AREA TABLE #02 (0106)		

MOD CATEGORIES REQUIRED FOR OI06 FLT CYCLE DATA

DATE: 05-16-85

<u>JSC OWNER</u> (SIGNATURE)	<u>CATEGORIES</u>	<u>CATEGORY NAMES</u>	<u>OCC #'S</u>	<u>OCC NAMES</u>
	A030	ASCENT AREA TABLE #03	(OI06)	
	A040	ASCENT AREA TABLE #04	(OI06)	
	A050	ASCENT AREA TABLE #05	(OI06)	
	DN10	DRAG COEFFICIENT FOR NAVDAD, OPS1		
	DN30	DRAG COEFFICIENT FOR NAVDAD, OPS3		
	DRC0	DRAG CONSTANT FOR NAVIGATION		
	DRN0	DRAG COEFFICIENT FOR NAVIGATION		
	EML0	ENTRY MLS SITES	(OI06)	
	EPH0	SOLAR EPHEMERIS PARAMETERS		
	E010	ENTRY AREA TABLE #01	(OI06)	
	E020	ENTRY AREA TABLE #02	(OI06)	
	E030	ENTRY AREA TABLE #03	(OI06)	
	E040	ENTRY AREA TABLE #04	(OI06)	
	E050	ENTRY AREA TABLE #05	(OI06)	
	E060	ENTRY AREA TABLE #06	(OI06)	
	E070	ENTRY AREA TABLE #07	(OI06)	
	E080	ENTRY AREA TABLE #08	(OI06)	
	E090	ENTRY AREA TABLE #09	(OI06)	
	E100	ENTRY AREA TABLE #10	(OI06)	

MOD CATEGORIES REQUIRED FOR 0I06 FLT CYCLE DATA

DATE: 05-16-85

JSC OWNER
(SIGNATURE)

CATEGORIES

CATEGORY NAMES

OCC #'S

OCC NAMES

E110	ENTRY AREA TABLE #11	(0I06)
E120	ENTRY AREA TABLE #12	(0I06)
E130	ENTRY AREA TABLE #13	(0I06)
E140	ENTRY AREA TABLE #14	(0I06)
E150	ENTRY AREA TABLE #15	(0I06)
IRA1	IMU RM, ASCENT	
IRE1	IMU RM, ENTRY	
IRO1	IMU RM, ORBIT	
NVB0	NAVBASE AT LAUNCH SITE	
OTA0	ORBIT TACAN ANTENNA	
OTC0	ORBIT TACAN SITES, 001 THRU 180	
OTD0	ORBIT TACAN SITES, 181 THRU 250	
PAE0	ASCENT EXPONENTIAL ATMOSPHERE	
PE20	ENTRY TWO-LAYER ATMOSPHERE	
PE41	ENTRY FOUR-LAYER ATMOSPHERE	
POA0	ORBIT ATMOSPHERE	
PR20	RTLS TWO-LAYER ATMOSPHERE	
PR40	RTLS FOUR-LAYER ATMOSPHERE	
RDZ0	RENDEZVOUS NAVIGATION	

MOD CATEGORIES REQUIRED FOR OI06 FLT CYCLE DATA

DATE: 05-16-85

JSC OWNER
(SIGNATURE)

CATEGORIES

CATEGORY NAMES

OCC #'S

OCC NAMES

TEP1 TEPOCH AND DAY OF LAUNCH MATRIX

XS60 SPF DERIVED HAC CENTERS

XS71 SPF DERIVED DRAG CONSTANT

YD22 TO BE DELETED, PART 2 (OI06)

YD60 TO BE DELETED, PART 6 (OI05)

ZFB1 FIXED I-LOADS - BEAN (OI05)

ZFC0 FIXED I-LOADS - BLUCKER

ZFJ0 FIXED I-LOADS - HENRY

ZFS0 FIXED I-LOADS - ORBIT TACAN (OI05)

ZFT1 FIXED I-LOADS - MONTEZ (OI06)

ZFV0 FIXED I-LOADS - POCKLINGTON

ZFY1 FIXED I-LOADS - BLUCKER, CONTD.

SMITH, E.

GDE0 ENTRY GUIDANCE

GDT0 ENTRY GUIDANCE, TRAJECTORY ANCHOR

GRM0 GRTLS TAEM MISSION UNIQUE (OI05)

GT12 TAEM GUIDANCE, OPS1 (OI06)

GT31 TAEM GUIDANCE, OPS3 (OI06)

OAT0 ORBIT ATTITUDE

MOD CATEGORIES REQUIRED FOR OI06 FLT CYCLE DATA

DATE: 05-16-85

JSC OWNER (SIGNATURE)	CATEGORIES	CATEGORY NAMES		OCC #'S	OCC NAMES
	OT10	ORBIT TARGETING, SLOTS 1-19			
	OT20	ORBIT TARGETING, SLOTS 20-40			
	ZFI0	FIXED I-LOADS - HARPOLD			
	ZFM1	FIXED I-LOADS - JENNESS	(OI06)		
	ZFW0	FIXED I-LOADS - DUPONT	(OI06)		
WEST, J.	GLC1	AUTOLAND GUIDANCE, COMMON	(OI05)		
	GL11	AUTOLAND GUIDANCE, OPS1	(OI05)		
	GL31	AUTOLAND GUIDANCE, OPS3	(OI05)		
	ZFH1	FIXED I-LOADS - DYER	(OI05)		
WILLIAMS, R.	BFS0 (1)	ASCENT BFS PARAMETERS	(OI06)		

to be
made K-Loads

ENG CATEGORIES REQUIRED FOR OI06 FLT CYCLE DATA

DATE: 05-16-85

JSC OWNER (SIGNATURE)	CATEGORIES	CATEGORY NAMES	OCC #'S	OCC NAMES
JACKSON, W.	DAQ0 (1)	ADTA DEFAULT ALPHA AND QBAR PROFILE		
	PEN0 (2)	ENTRY NON-STANDARD ATMOSPHERE		
	ZFK0 (1)	FIXED I-LOADS - JACKSON		
LAW, H.	HUD1 (4)	HEADS-UP DISPLAY		
LINDSAY, K.	FSW0 (1)	FSW ROOTED DAP JET PRIORITIES		
	OA10 (7)	ORBIT ANGULAR INCREMENTS, PAYLOAD POSN 1		
	OA20 (5)	ORBIT ANGULAR INCREMENTS, PAYLOAD POSN 2		
	OA30 (3)	ORBIT ANGULAR INCREMENTS, PAYLOAD POSN 3		
	OA40 (2)	ORBIT ANGULAR INCREMENTS, PAYLOAD POSN 4		
	OA50 (1)	ORBIT ANGULAR INCREMENTS, PAYLOAD POSN 5		
	OMIO (1)	ORBIT MASS AND INERTIA		
	OPRO (1)	ORBIT PRIMARY RCS JETS		
	OSE0 (1)	ORBIT STATE ESTIMATOR GAINS		
	OVJ0 (1)	ORBIT VERNIER JET SELECT		
	OVR0 (1)	ORBIT VERNIER RCS JETS		
	ZFP0 (1)	FIXED I-LOADS - LINDSAY		
MCSWAIN, G.	ADE1 (2)*	ELEVON LOAD RELIEF CONTROLS		
		* 12 occ. prior to ϕ I-6		

(OI06)

ENG CATEGORIES REQUIRED FOR 0106 FLT CYCLE DATA

DATE: 05-16-85

JSC OWNER
(SIGNATURE)

CATEGORIES

CATEGORY NAMES

OCC #'S

OCC NAMES

MCWHORTER, L.

ADFO (1) GUIDANCE & F.C. INTERFACING GAINS & LIMITS
 ADGO (4) ASCENT DAP GAINS AND FILTERS
 JDBO (3) AEROJET DAP BENDING FILTERS
 JDCO (1) AEROJET DAP COMMAND FILTERS
 JDDO (2) AEROJET DAP SPEEDBRAKE
 JDGO (4) AEROJET DAP CG'S
 JD10 (2) AEROJET DAP AEROSURFACE SCHEDULES, OPS1
 JD20 (10) ENTRY ALTERNATE ELEVON SCHED, OPS3 (0105)
 JD31 (9) ENTRY NOMINAL ELEVON SCHED, OPS3 (0105)
 PTIO (7) PTI DEFINITIONS
 ZF71 (2) FIXED I-LOADS - MCWHORTER
 ZF80 (2) FIXED I-LOADS - MCWHORTER, CONTD.
 ZF92 (2) FIXED I-LOADS - MCWHORTER, CONTD. (0106)

MOORE, T.

XS30 (2) SPF DERIVED STEEP GLIDESLOPE PROFILES
 ZFU1 (1) FIXED I-LOADS - MOORE (0106)
 ZSU2 (1) FIXED I-LOADS - MOORE, CONTD. (0106)

THIBODEAU, J.

IH10 (11) IMU CALIBRATION PARAMETERS, SLOT 1

ENG CATEGORIES REQUIRED FOR OI06 FLT CYCLE DATA

DATE: 05-16-85

JSC OWNER
(SIGNATURE)

CATEGORIES

CATEGORY NAMES

OCC #'S

OCC NAMES

IH20	(11)	IMU CALIBRATION PARAMETERS, SLOT 2
IH30	(11)	IMU CALIBRATION PARAMETERS, SLOT 3
IH42	(7)	IMU RELATIVE ATTITUDES(MB) & LIMITS (OI05)
IM12	(21)	IMU ATTITUDE SENSITIVITIES, SLOT 1 (OI06)
IM22	(19)	IMU ATTITUDE SENSITIVITIES, SLOT 2 (OI06)
IM32	(20)	IMU ATTITUDE SENSITIVITIES, SLOT 3 (OI06)
INV0	(1)	IMU NAV GYROCOMPASS TRANSFORMATION AND SI
IPR0	(3)	IMU NAV BASE TRANSFORMATIONS TO CASE & BODY
ISP0	(2)	IMU SITE PARAMETERS (OI05)
STT0	(7)	STAR TRACKER SOP
ZFA1	(1)	FIXED I-LOADS - IMU

_____	_____
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_____	_____

PRE-SELECTION CATEGORIES REQUIRED FOR ALL OI06. (CR 79027C)

DATE: 4-26-85

JSC OWNER	CATEGORIES AND NAMES		OCC #	OCC NAME
BOYD, W. (EP)	ZFDO	FIXED I-LOADS - BOYD	001	BASE OCCURRENCE
	ZSDO	SCRUB I-LOADS - BOYD	001	BASE OCCURRENCE
DEWOLF, L. (FR)	ZS03	SCRUBBED I-LOADS - ALL K-LOADS (OI06)	301	BASIC OI6, CR69648
GREMILLION, M.	ZS30	SCRUB I-LOADS - GREMILLION	001	BASE OCCURRENCE
HENDERSON, E.	SRC1	SRB CHAMBER PRESSURES (OI06)	102	CONSTANT PC XDUCER CAL BIAS, CR69907
	ZS10	SCRUB I-LOADS - BORDANO	002	INERTIAL ADI UPDATE TO M50, CR69978A
JACKSON, W. (EH)	ZSK0	SCRUB I-LOADS - JACKSON	001	BASE OCCURRENCE
JANNEY, J. (ES)	AVCO	ASCENT VENT DOOR CONTROL	001	BASE OCCURRENCE
	ZFF0	FIXED I-LOADS - JANNEY	001	BASE OCCURRENCE
	ZSF0	SCRUB I-LOADS - JANNEY	001	BASE OCCURRENCE
JENKINS, L. (EP)	QHE0	USABLE HELIUM FOR RCS QUANTITY MONITOR	001	RCS QTY MON FOR ALL VEHICLES, CR59835
	ZFLO	FIXED I-LOADS - JENKINS	001	BASE OCCURRENCE
	ZSLO	SCRUB I-LOADS - JENKINS	001	BASE OCCURRENCE
KUBIAK, E. (EH)	OMF0	OMS ENGINE FORWARD GAINS	001	BASE OCCURRENCE
	OMS0	OMS ENGINE TRIMS	001	BASE OCCURRENCE
	OMT0	OMS ENGINE OPS TRIMS	002	I/L UNITS/CONFIG CHG-IMRB(8), CR69413
	TDH0	TRANS DAP MANEUVER RATES	001	BASE OCCURRENCE
	TDPO	TRANS DAP, PAYLOAD DEPENDENT	001	BASE OCCURRENCE
	TVB0	TVC BANDWIDTH	001	BASE OCCURRENCE
	TVC0	TVC COMMAND LIMITS	001	BASE OCCURRENCE
	ZFH0	FIXED I-LOADS - KUBIAK	001	BASE OCCURRENCE
	ZSNO	SCRUB I-LOADS - KUBIAK	001	BASE OCCURRENCE
LEWIS, T. (EH)	ZFO0	FIXED I-LOADS - LEWIS	001	BASE OCCURRENCE
	ZS00	SCRUB I-LOADS - LEWIS	001	BASE OCCURRENCE
LINDSAY, K. (EH)	ZSP0	SCRUB I-LOADS - LINDSAY	001	BASE OCCURRENCE
LITTLETON, O. (EH)	SAA0	ORBITER ACCELEROMETER ASSY	001	BASE OCCURRENCE
	SRB1	SRB RATE GYROS	101	CATEGORY CHANGE, CR69315
	SRG0	ORBITER RATE GYROS	001	BASE OCCURRENCE
	ZFQ0	FIXED I-LOADS - LITTLETON	001	BASE OCCURRENCE
	ZSG0	SCRUB I-LOADS - LITTLETON	001	BASE OCCURRENCE
	ZSQ0	SCRUB I-LOADS - LITTLETON, CONTD.	001	BASE OCCURRENCE
MCSWAIN, G. (EH)	ZFR0	FIXED I-LOADS - MCSWAIN	001	BASE OCCURRENCE
	ZFZ0	FIXED I-LOADS - MCSWAIN, CONTD.	001	BASE OCCURRENCE
	ZSR0	SCRUB I-LOADS - MCSWAIN	002	I/L UNITS/CONFIG CHG-IMRB(20), CR69425
MCHHORTER; KUBIAK (EH)	D31	TO BE DELETED, PART 3	101	DELETE RLIM I/L, CR69118
MCHHORTER, L. (EH)	ZS70	SCRUB I-LOADS - MCHHORTER	001	BASE OCCURRENCE
MODLIN, T. (ES)	ZSS0	SCRUB I-LOADS - MODLIN	001	BASE OCCURRENCE
POCKLINGTON, R.	ZSB0	SCRUB I-LOADS - BEAN	001	BASE OCCURRENCE
	ZSC0	SCRUB I-LOADS - BLUCKER	001	BASE OCCURRENCE
	ZSJ0	SCRUB I-LOADS - HENRY	001	BASE OCCURRENCE
	ZST0	SCRUB I-LOADS - MONTEZ	002	UPDATE K_EDIT BARO, CR69874
	ZSV0	SCRUB I-LOADS - POCKLINGTON	001	BASE OCCURRENCE
	ZSY0	SCRUB I-LOADS - BLUCKER, CONTD.	002	IMU RM UPDATE, CR69213
PREVETT; MCSWAIN	ZSZ0	SCRUB I-LOADS - PREVETT; MCSWAIN	001	BASE OCCURRENCE
PREVETT, D. (EP)	QME0	SSME OPERATIONS, SEQUENCING	002	LOX L.L. C/O SENSOR IN ORB, CR69184
	ZSH0	SCRUB I-LOADS - PREVETT	001	BASE OCCURRENCE
SMITH, E.	ZSM0	SCRUB I-LOADS - JENNESS	002	M50 IDENT QUAT, CR69654
STOKES, R. (FM)	ZFX0	FIXED I-LOADS - STOKES	001	BASE OCCURRENCE
	ZSX1	SCRUB I-LOADS - STOKES (OI06)	101	BASE OI6, CR69744
THIBODEAU, J. (EH)	ZSA0	SCRUB I-LOADS - IMU	001	BASE OCCURRENCE
VERNON, J. (EH)	STC0	SRB TVC COMMAND SOP	001	BASE OCCURRENCE
	ZF51	FIXED I-LOADS - VERNON (OI06)	101	OI06 BASE OCCURRENCE, CR69722A
	ZF61	FIXED I-LOADS - VERNON, CONTD. (OI06)	101	BASIC OI6 OCCURRENCE, CR79086
	ZS50	SCRUB I-LOADS - VERNON	001	BASE OCCURRENCE
	ZS60	SCRUB I-LOADS - VERNON, CONTD.	001	BASE OCCURRENCE
WEST, J.	ZSH0	SCRUB I-LOADS - DYER	001	BASE OCCURRENCE

ENG CATEGORIES REQUIRED FOR OI06 FLT 61-A CYCLE 1 DATA

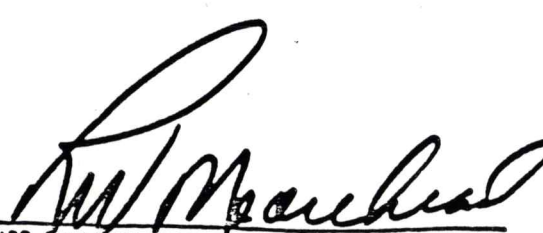
DATE: 04-01-85

JSC OWNER (SIGNATURE)	CATEGORIES	CATEGORY NAMES	OCC #'S	OCC NAMES
<i>G. M. Savin</i>	ADFO	GUIDANCE & F.C. INTERFACING GAINS & LIMITS	<u>001</u>	<u>Base Occurrence</u>
	ADGO	ASCENT DAP GAINS AND FILTERS	<u>003</u>	<u>St. C. Cav SRBS, CR69785</u>
MCWHORTER, L.	JDBO	AEROJET DAP BENDING FILTERS	<u>003</u>	<u>HEAVYWT BBF</u>
	JDCO	AEROJET DAP COMMAND FILTERS	<u>001</u>	<u>BASE OCCUR</u>
<i>L. M. White</i>	JDDO	AEROJET DAP SPEEDBRAKE	<u>002</u>	<u>AERO DATA GRTLS SUP</u>
	JDGO	AEROJET DAP CG'S	<u>002</u>	<u>AEROJET DAP CG'S</u>
	JD10	AEROJET DAP AEROSURFACE SCHEDULES, OPS1	<u>002</u>	<u>UPDATED GRTLS ELEV. SCH.</u>
	JD20	ENTRY ALTERNATE ELEVON SCHED, OPS3 (OI05)	<u>020</u>	<u>OPERATIONAL FWD C.G.</u>
	JD31	ENTRY NOMINAL ELEVON SCHED, OPS3 (OI05)	<u>121</u>	<u>OPERATIONAL MID C.G.</u>
	PTIO	PTI DEFINITIONS	<u>008</u>	<u>SIS 51-B PTI I-LOAD</u>
	ZF71	FIXED I-LOADS - MCWHORTER	<u>102</u>	<u>RUPPER GAIN CHANGE</u>
	ZF80	FIXED I-LOADS - MCWHORTER, CONTD.	<u>002</u>	<u>GRTLS LOW GBAR</u>
	ZF92	FIXED I-LOADS - MCWHORTER, CONTD. (OI06)	<u>202</u>	<u>EARLY RUDDER H/O</u>
MOORE, T.	XS30	SPF DERIVED STEEP GLIDESLOPE PROFILES	<u>001</u>	<u>Base Occurrence</u>
<i>Thomas E. Moore</i>	ZFU1	FIXED I-LOADS - MOORE (OI06)	<u>101</u>	<u>Base Occurrence, CR69872C</u>
	ZSU2	FIXED I-LOADS - MOORE, CONTD. (OI06)	<u>201</u>	<u>Base CT-L, CR69872C, IDRS4-150</u>
THIBODEAU, J.	IH10	IMU CALIBRATION PARAMETERS, SLOT 1	<u>**002</u>	<u>OV-103 occurrence</u>

FRJ 4/17/85

Thomas P. Lina 4/5/85
ENG COORDINATOR SIGNATURE

1000
79372
012

PAGE 1 OF <u>1</u>		ORBITER SOFTWARE CHANGE REQUEST		NUMBER	
REFERENCE:		REC'D		PCIN #	
				CR <u>793</u> ⁷³	
TITLE:				ORIGINATOR ORG PHONE	
STS 61-A TAL WEATHER ALT OCCURRENCE SELECTION				MEL ROTHER DM X3321	
				DATE 4-9-85	
SOFTWARE AFFECTED:				CR AFFECTS:	
☒ Primary ☒ BFS ☐ Other				NO YES NO. OF PARAMETERS	
DOCUMENTS AFFECTED:				☐ ☒ I-LOADS ☒ ☐ DOWNLIST ☒ ☐ MMDB ☒ ☐ CARDS ☐ ☐ ☐ ☒ ☐ HARDWARE DISP MSGI SW	
JSC 19350 VOL II					
PRINCIPAL FUNCTIONS AFFECTED: (NUMBER AND NAME)					
N/A					
CHANGE DESCRIPTION (INCLUDE PARAGRAPH AND PAGE NUMBER.)					
DEFINE OCCURRENCE SELECTION LIST FOR THE I-LOAD IDS FOR THE TAL WEATHER ALTERNATE FOR STS 61-A.					
<u>CATEGORY</u>		<u>OCCURRENCE</u>		<u>CONCURRENCE</u>	
A2T2		206		<i>[Signature]</i>	
				<u>Mel Rother</u> SOFTWARE REQUIREMENTS MANAGER	
				<u>4-9-85</u> DATE	
REASON FOR CHANGE AND IMPACT, IF NOT INCORPORATED:					
REQUIRED FOR IDS BUILD.					
BOARD DISPOSITION		EFFECTIVITY		ACTION REQD:	
PRI BFS OTHER ☒ ☒ ☐ Approved ☐ ☐ ☐ Disapproved ☐ ☐ ☐ Withdrawn		RELEASE ☒ PRI <u>61A</u> ☒ BFS <u>61A</u> ☒ Other <u>DMB</u>		 BOARD CHAIRMAN <u>9/1/85</u> DATE	



NASA
Lyndon B. Johnson Space Center

**MISSION
OPERATIONS
DIRECTORATE**

SUBJECT:

**GROUND NAVIGATION
PROJECT OVERVIEW**

NAME:

DM63/DICK OSBURN

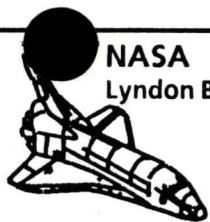
DATE:

4/9/85

PAGE

1

- GROUND NAV FUNCTION DESCRIPTION
- PERSONNEL
- CHARTER
- REVIEW OF CURRENT ACTIVITIES
- RESOURCE OVERVIEW
- PROBLEMS - CONCERNS



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DIRECTORATE**

SUBJECT:

GROUND NAV FUNCTION

NAME:

DM63/DICK OSBURN

DATE:

PAGE
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THE GROUND NAV GROUP'S PRIMARY FUNCTION IS TO PROVIDE REAL-TIME GROUND NAVIGATION SUPPORT FOR STA FLIGHTS.

- STAFF THE GROUND NAV MPSR
- RECEIVE AND PROCESS GROUND TRACKING DATA TO MAINTAIN A CURRENT "BEST" ESTIMATE OF ORBITER (AND TARGET, IF REQUIRED) POSITION AND VELOCITY
- MAINTAIN A KNOWLEDGEABLE ESTIMATE OF THE UNCERTAINTY OF CURRENT POSITION AND VELOCITY ESTIMATES
- ADVISE THE FDO IN ALL AREAS CONCERNING GROUND NAVIGATION
- PROVIDE STATE VECTOR INPUTS TO EPHEMERIS UPDATES AS REQUIRED

OTHER GROUND NAV FUNCTIONS ARE DIRECTED TOWARD THE PREPARATION FOR OR SUPPORT OF THE ABOVE PRIMARY FUNCTION.



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OPERATIONS
DIRECTORATE**

SUBJECT:

PERSONNEL

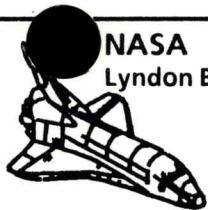
NAME:

DM63/DICK OSBURN

DATE:

PAGE
3

- CIVIL SERVICE - GROUND NAV SECTION
 - R. K. (DICK) OSBURN
 - FLORA LOWES
 - JON WEAVER
 - WILL YORK
- AIR FORCE
 - CAPT RICHARD KIDD
 - LT DOUG WREATH
- MDTSCO
 - 19.5 CURRENT HEAD COUNT
 - CLARK HACKLER - MANAGER
 - DICK THEIS
 - RON LACARNA TASK MANAGERS
 - TOM RICH
 - JEANETTE FRENCH
- TRW
 - ≈ 11 CURRENT STAFFING
 - OWEN BERGMAN - PROJECT MANAGER
- BARRIOS
 - 8 HEAD COUNT
 - MICHELLE MOORE - MANAGER



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Lyndon B. Johnson Space Center

**MISSION
OPERATIONS
DIRECTORATE**

SUBJECT:

GROUND NAV CHARTER

NAME:

DM63/DICK OSBURN

DATE:

PAGE

4

- FLIGHT SUPPORT
 - PREFLIGHT PLANNING
 - SIM AND REAL-TIME SUPPORT
 - POSTFLIGHT WRAP-UP
- POSTFLIGHT DATA PRODUCTS
- GENERIC GROUND NAV PROCEDURES
- TRAINING
- NAVIGATION ANALYSIS
- MCC SOFTWARE DEVELOPMENT SUPPORT
- OFF-LINE SOFTWARE M - M



NASA
Lyndon B. Johnson Space Center

**MISSION
OPERATIONS
DIRECTORATE**

SUBJECT:

PREFLIGHT PLANNING

NAME:

DM63/DICK OSBURN

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FUNCTION

TIMEFRAME

PERFORMANCE STUDIES

- REVIEW PIP(S) FOR NAV REQUIREMENTS
- REVIEW TRACKING AVAILABLE, ATTITUDE TIMELINES,
EVENT TIMELINES. ASSESS STATE VECTOR ACCURACY
FOR CRITICAL NAV PHASES

UP TO L-2 YRS

L-6 MONTHS

AGAIN IF TIMELINES CHANGE

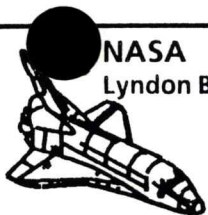
DEVELOP FLIGHT-UNIQUE PROCEDURES IF REQUIRED

L-6 MONTHS TO L-3 MONTHS

DEVELOP TRACKING NETWORK REQUIREMENTS

L-3 MONTHS TO L-2 MONTHS

- WORK WITH FDO, TRACK ON REQUIREMENTS
AND SCHEDULING



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SUBJECT:

PREFLIGHT PLANNING

NAME:

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FUNCTION

TIMEFRAME

FLIGHT TECHNIQUES SUPPORT

AS REQUIRED

- MEETING SUPPORT

- ACTIONS AS REQUIRED

MCC I-LOADS AND RECONFIGURATION

- ICD INPUTS

L-120 DAYS

- JACCHIA TABLE UPDATE

L-49 DAYS

- MCC DATA PACK

L-141 DAYS

LIFETIME STUDIES

AS REQUIRED

- AOA

- CONTINGENCIES

ATMOSPHERIC K-FACTOR DETERMINATION L-1 DAY



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SUBJECT:

SIM AND REAL-TIME SUPPORT

NAME:

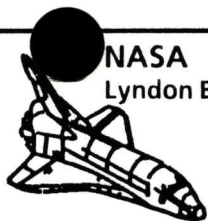
DM63/DICK OSBURN

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- ASCENT AND ENTRY
 - THREE NAV CONSOLE POSITIONS: NAV
INDAT
STATE
- CURRENTLY ONLY ONE CS AND ONE MDTSCO ENGINEER QUALIFIED FOR NAV POSITION
- CROSS-TRAINING OF EXPERIENCED ORBIT NAV ENGINEERS IN PROCESS - FIRST SUPPORT OF NAV POSITION 9/85
- SUPPORT L-4 HOURS THRU OMS-1, DEORBIT BURN THRU WHEELS STOP
- ON CALL FOR CONTINGENCY DEORBIT



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SIM AND REAL-TIME SUPPORT

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- ORBIT
 - PER SHIFT SUPPORT OF UP TO 4 ENGINEERS, 2 PARAPROFESSIONALS
 - TYPICAL SUPPORT TEAM IS ONE ENGINEER, 1 PARA
 - 24-HOUR SUPPORT, OMS-1 THRU DEORBIT BURN
 - FOUR MISSION TEAMS ROTATE SUPPORT
 - 1 CS, 2 DOD, 5 MDTSCO, 6 BARRIOS ON EACH TEAM
 - SEVERAL DUAL ASSIGNMENTS
- SCHEDULING
 - TEAMS ASSIGNED TO A LAUNCH OPPORTUNITY
 - CRITICAL SKILLS ASSIGNED TO A FLIGHT
- AUTOMATION PROPOSAL IN WORK
 - COULD REDUCE CONSOLE STAFFING FOR STANDARD FLIGHTS BY 40-50%
- DUAL OPS PLAN
 - SINGLE CONSOLE, DUAL MED-SUPPORT



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POSTFLIGHT WRAP-UP

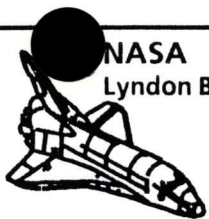
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- POST-MISSION REPORT
 - DOCUMENTS FLIGHT RESULTS WHICH MAY BE REQUIRED FOR SUBSEQUENT ANALYSIS, ANOMALY INVESTIGATIONS, PERFORMANCE EVALUATION, OR USER SUPPORT.
 - PARTIALLY AUTOMATED - STREAMLINING IS CONTINUING
 - PRODUCED BY BARRIOS
- PERFORMANCE EVALUATION
 - NOT NORMALLY REQUIRED FOR STANDARD FLIGHTS
 - REQUIRED FOR NEW CAPABILITIES, NEW PROCEDURES
 - TDRSS
 - WTR
- ANOMALY INVESTIGATION
 - AS REQUIRED
 - E. G., 41-C ENERGY GROWTH



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POSTFLIGHT DATA PRODUCTS

NAME:

DM63/DICK OSBURN

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- POSTFLIGHT ATTITUDE AND TRAJECTORY HISTORY (PATH)
 - OPTIONAL SERVICE PRODUCT
 - CURRENTLY REQUIRED FOR 60% OF FLIGHTS
 - PRODUCED BY TRW - NAS 9-16479
 - WILL BE COMPLETION FORM UNDER STSOC
- ASCENT/DESCENT BET INPUTS
 - SHORT LIST OF VECTORS, TIMING INFORMATION
 - BY-PRODUCT OF NOMINAL CONSOLE SUPPORT
- ON-ORBIT STATE VECTORS
 - PROVIDED ON REQUEST TO VARIOUS JSC AND EXTERNAL USERS (POST-MISSION REPORT)
- ACHIEVED ACCURACY DOCUMENTATION
 - PARKING ORBIT SHAPE
 - DEPLOY VECTOR ACCURACY



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GENERIC GROUND NAV PROCEDURES

NAME:

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- DOCUMENTATION UPDATE IN PROGRESS
 - HIGH-PRIORITY ACTIVITY
 - TARGET DATE 8/15/85
 - REFLECT NEW STREAMLINING EFFORTS, PARAPROFESSIONAL SUPPORT, TDRSS PROCEDURES, SYSTEM MATURITY
 - 2 MYE EFFORT



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TRAINING

NAME:

DM63/DICK OSBURN

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- ONGOING TRAINING
 - SOURCES
 - SIMS
 - STAND-ALONE MCC TIME
 - IN-HOUSE TRAINING TOOLS AND COURSE WORK
 - USE OF MOD TRAINING MATERIALS
 - CURRENT EMPHASIS
 - CROSS-TRAINING OF ASCENT/DESCENT AND ORBIT ENGINEERS
 - TRAINING OF 2 AIR FORCE ENGINEERS
 - TRAINING OF 5 NEW MDTSCO ENGINEERS
 - UPGRADING OF BARRIOS SKILLS AND SUPPORT LEVELS
 - USE OF IN-HOUSE TRAINING TOOLS (SONAV, HSGNTS)
- TRAINING PLAN DEVELOPMENT AND DOCUMENTATION
 - HIGH-PRIORITY ACTIVITY
 - TARGET DATE 8/15/85
 - INVOLVES FORMALIZING ALL TRAINING PROGRAMS AND MATERIALS
 - 4 MYE EFFORT



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NAVIGATION ANALYSIS

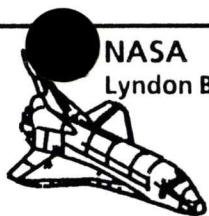
NAME:

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- NEW CAPABILITY DEVELOPMENT
 - TDRSS CERTIFICATION
 - JSC CO-CHAIRMANSHIP - TDRSS ORBIT DETERMINATION AND NAVIGATION WORKING GROUP (TODNWG)
 - WORK HAS BEEN COMPLETED FOR 1-TDRS. REPORT IN PROGRESS. PROCEDURES IN USE FOR STS NAVIGATION.
 - 2-TDRS EFFORT ON HOLD. BASELINED AS 2-3 FLIGHT EFFORT.
 - WTR FLIGHTS
 - LAUNCH
 - HIGH-INCLINATION ORBIT
 - NEW DATA TYPES
 - AFSCF S-BAND DATA (SGLS)
- MCC UPGRADES
 - NUMEROUS PROPOSALS IN PROGRESS. BEING WORKED FOR PRESENTATION AS A GROUP TO INSURE PROPER PRIORITIZATION OF LIMITED FUNDS.
 - AUTO-NAV PROPOSAL FOR ONORBIT IN PROCESS
- PROCEDURE DEVELOPMENT AND REFINEMENT
- STREAMLINING
- PHYSICAL MODEL DEVELOPMENT
 - ORBITER VENTING



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SUBJECT:

MCC SOFTWARE DEVELOPMENT

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DM63/DICK OSBURN

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- MCC NAVIGATION SOFTWARE DEVELOPMENT SUPPORT
 - CURRENT SYSTEM
 - MITS
 - ERRP
- DM63 PROVIDES:
 - FUNCTIONAL REQUIREMENTS
 - DISPLAY REQUIREMENTS
 - CONTROL REQUIREMENTS
 - VERIFICATION SUPPORT
- MPAD PROVIDES FORMULATION UNLESS REQUIRED EXPERTISE CURRENTLY EXISTS WITHIN DM63 OR CONTRACTOR SUPPORT



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OFFLINE SOFTWARE M - M

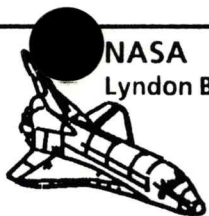
NAME:

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- ALL STS SOFTWARE SCHEDULED FOR TRANSFER FROM MPAD 10/1/85
- SOME PROGRAMS ALREADY TRANSFERRED
 - HOPE
- RESOURCES WILL BE A PROBLEM FOR SOME TOOLS
 - SONAV
 - HSGNTS



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SUBJECT:

RESOURCE OVERVIEW*

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PROJECT	REQUIRED	CS	DOD	CURRENT MYE				TOTAL
				M	B	TRW		
FLIGHT SUPPORT	18.5	1.0	1.0	10.0	6.5	---	18.5	
POSTFLIGHT DATA PRODUCTS	10.0	0.2	---	0.5	--	12.0	12.7	
GENERIC GROUND NAV PROCEDURES	3.0	0.5	0.5	1.5	0.5	---	3.0	
TRAINING	6.0	0.5	0.5	4.0	1.0	---	6.0	
NAVIGATION ANALYSIS	6.0	0.3	---	3.2	--	---	3.5	
MCC SOFTWARE DEVELOPMENT SUPPORT	3.5	0.3	---	0.5	--	---	0.8	
OFFLINE SOFTWARE M - M	7.0	0.2	---	0.3	--	---	0.5	
 TOTAL	 54.0	 3.0	 2.0	 20.0	 8.0	 12.0	 45.0	

* AS OF 4/1/85



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PROBLEMS AND CONCERNS

NAME:

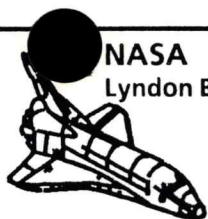
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- CIVIL SERVICE STAFFING
- OVERALL STAFFING - SOFTWARE M - M
MCC DEVELOPMENT
NAV ANALYSIS
- TRAINING TOOLS
 - SONAV
 - HSGNTS



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SONAV OVERVIEW

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- DESCRIPTION
 - HP9000 VERSION OF MCC NAVIGATION SOFTWARE
- UTILIZATION
 - TRAINING
 - LIGHT ANALYSIS
- DEVELOPMENT PHASES
 - PHASE 1
 - PROOF OF CONCEPT
 - FULL ORBIT DETERMINATION CAPABILITY
 - ABOUT 50% OF REAL-TIME INTERFACES
 - COMPLETION OF MPAD 9/85
 - PHASE 2
 - FULL TRAINING CAPABILITY
 - COMPLETION TBD
 - PHASE 3
 - MCC WORKSTATION APPLICATION
 - AUTOMATE AND AUGMENT REAL-TIME MCC CAPABILITIES
 - REQUIREMENTS NOT YET IDENTIFIED

TRAJECTORY OPERATIONS
PROJECT OVERVIEW PRESENTATION

PRESENTED BY:
MR. BOBBY CONNER, SUPERVISOR
TRAJECTORY OPERATIONS UNIT
(713) 280-7702

TRAJECTORY OPERATIONS UNIT
(TRACK/DYNAMICS)
PROJECT OVERVIEW

- 0 CHARTER
- 0 REVIEW OF CURRENT ACTIVITIES
- 0 RESOURCE OVERVIEW
- 0 PROBLEMS/CONCERNS

TRAJECTORY OPERATIONS CHARTER

- O FLIGHT SUPPORT
- O PRE-FLIGHT DATA PRODUCTS
- O POST-FLIGHT DATA PRODUCTS
- O GENERIC TRAJECTORY OPERATIONS PROCEDURES
- O TRAINING
- O MCC GROUND HARDWARE/SOFTWARE SUPPORT
- O OFF LINE SUPPORT

FLIGHT SUPPORT OVERVIEW

- 0 PRE-FLIGHT PLANNING
 - 00 FLIGHT UNIQUE PROCEDURE DEVELOPMENT
 - 00 TRACKING NETWORK SCHEDULING
 - C-BAND (DOD/NASA)
 - S-BAND (STDN)
 - SGLS (RTS)
 - TDRS
 - 00 GROUND TECHNIQUES SUPPORT
 - 00 FLIGHT TECHNIQUES SUPPORT
- 0 SIM AND REAL TIME CONSOLE SUPPORT
- 0 POST-FLIGHT SUPPORT
 - 00 POST-MISSION REPORT
 - 00 PERFORMANCE EVALUATION
 - 00 ANOMALY INVESTIGATION

FLIGHT SUPPORT PRE-FLIGHT PLANNING

FUNCTION

TIMEFRAME

FLIGHT UNIQUE PROCEDURE DEVELOPMENT

0	NOMINAL TRACKING PLAN	L-6 MON TO L - 1 MON
0	RENDEZVOUS TRACKING PLAN	L-6 MON TO L - 1 MON
0	PAYLOAD TRACKING	L-3 MON TO L - 1 MON
0	SPECIAL CONSOLE PROCEDURES	L-3 MON TO L - 1 MON
0	SPECIAL SOFTWARE UPDATE/PATCHES	L-3 MON TO L/O

GROUND TECHNIQUE SUPPORT

0	NETWORK DATA FLOW/TESTING	L-2 MON TO L/O
0	GROUND SOFTWARE TESTING (IVT)	L-3 MON TO L - 1 MON
0	SUPPORT OPERATIONS PLANNING GROUPS	L-6 MON TO L/O
0	SUPPORT BLDG. 30/ BLDG 5 C/O	L-6 MON TO L/O

FLIGHT TECHNIQUES SUPPORT

0 MEETING SUPPORT

(AS REQUIRED)

0 ACTIONS

TRAJECTORY OPERATIONS INPUT TO FLIGHT PREPARATION

<u>DESCRIPTION</u>	<u>DUE</u>	<u>COMMENTS</u>
MCC CONSOLE DATA PACK	L - 141 Days	DUE DATE CAN BE MOVED LEFT OR RIGHT WITHOUT IMPACT.
STATION CHARACTERISTIC TABLE	L - 90 Days	DUE DATE CAN BE MOVED LEFT OR RIGHT BASED ON CRP'S ABILITY TO UPDATE MISSION LOAD.
TRACKING SCHEDULE	L - 2 WEEKS	CAN BE UPDATED IN REAL TIME DURING MISSION.
SOFTWARE PARAMETER UPDATES (MED INPUT)	L - 2 MONTHS	CAN BE UPDATED RIGHT TO L/O WITHOUT IMPACT.

FLIGHT SUPPORT - SIM AND REAL TIME SUPPORT

0 ASCENT AND ENTRY

00 TWO CONSOLE POSITION:

- DYNAMICS - 2 EACH CONTROLLERS
- TRACK - 2 EACH CONTROLLERS

00 CURRENTLY ALL DYNAMICS CONTROLLERS, EXCEPT ONE AIR FORCE ARE FORD AEROSPACE. FOUR DYNAMICS CONTROLLERS, INCLUDING ONE AIR FORCE ARE CERTIFIED FOR LAUNCH OPERATIONS.

00 EIGHT CONTROLLERS, INCLUDING ONE AIR FORCE ARE CERTIFIED FOR DEORBIT OPERATIONS.

00 EIGHT TRACK CONTROLLERS, ALL FORD AEROSPACE, ARE CERTIFIED FOR ASCENT AND ENTRY.

00 INTENSIVE TRAINING PROGRAM IN PROGRESS - TWO ADDITIONAL DYNAMICS CONTROLLERS ARE IN THE TRAINING PIPE LINE FOR ASCENT. TRAINING TO BE COMPLETE 1 JANUARY 1986.

00 DYNAMICS/TRACK CROSS TRAINING PROGRAM IN PROGRESS. PRESENTLY FOUR CONTROLLERS ARE CERTIFIED FOR BOTH POSITIONS. GOAL IS TO HAVE FOUR ADDITIONAL CONTROLLERS CERTIFIED BY 1/1/86.

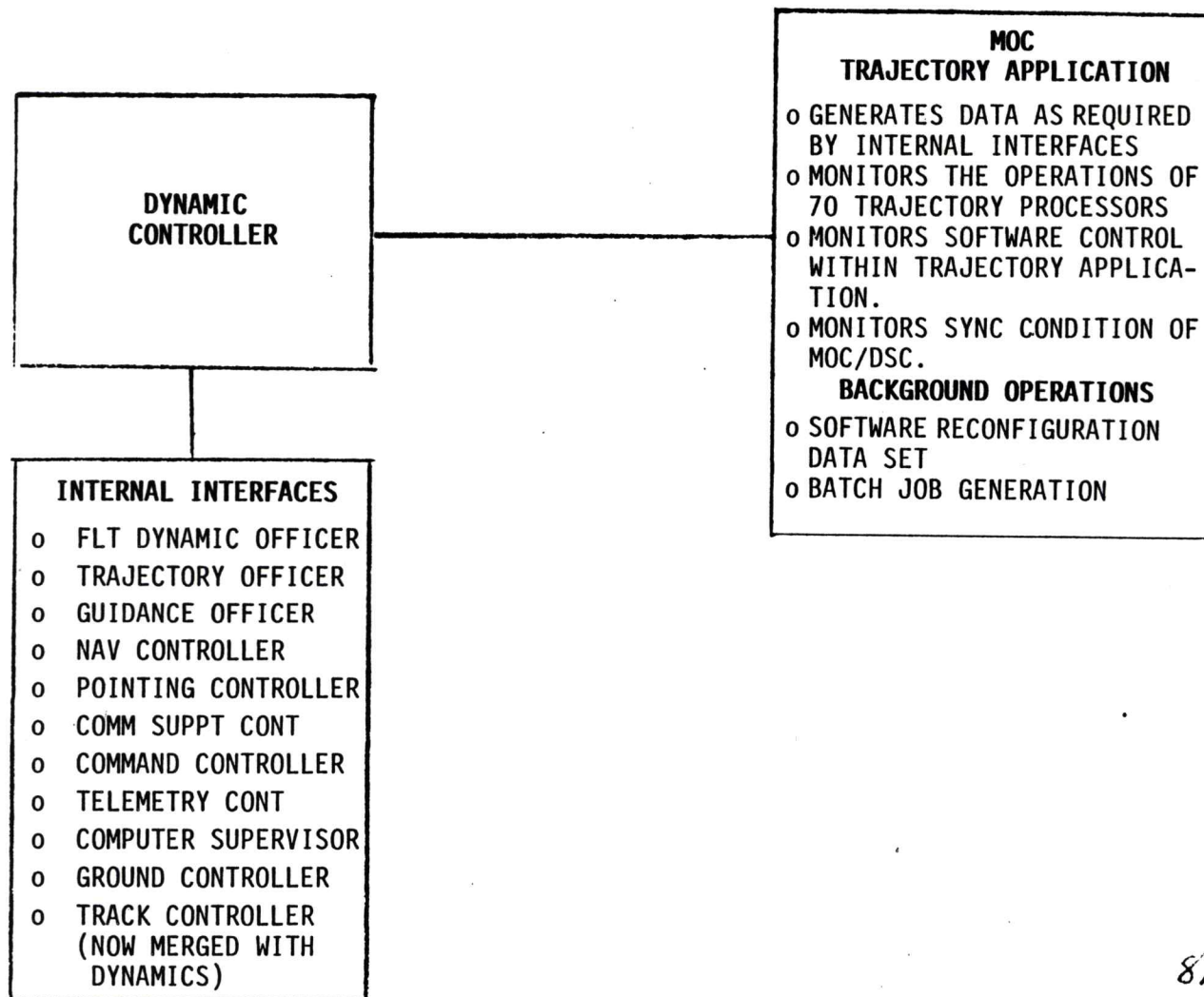
FLIGHT SUPPORT - SIM AND REAL TIME SUPPORT (CONTINUED)

- 0 SUPPORT - ASCENT - DYNAMICS L-6 HR TO ORBIT OPS
TRACK L-30 HR OR ORBIT OPS
- 0 SUPPORT - ENTRY - DYNAMICS LANDING - 8 HR TO WHEELS STOP.
TRACK LANDING - 8 HR TO WHEELS STOP.

FLIGHT SUPPORT - SIM AND REAL TIME SUPPORT

- 0 ORBIT
- 0 PRESENT
 - 00 ONE DYNAMIC, ONE DYNAMIC/TRACK, ONE TRACK
 - 00 THREE SHIFTS PER DAY
 - FIFTEEN FORD, ONE AIR FORCE
 - 00 SCHEDULING
 - TEAMS ARE ASSIGNED EIGHT HOUR SHIFTS, FIVE DAYS PER WEEK.
 - OVERTIME PAY-IN EXCESS OF FORTY HOURS PER WEEK.
- 0 FUTURE DUAL OPS
 - 00 TWO OPERATORS, BOTH CROSS-TRAINED DYNAMICS AND TRACK OR ONE DYNAMICS AND ONE CROSS-TRAINED PER SHIFT, PER FLIGHT.
 - 00 FIVE SHIFTS PER DAY.
 - 00 SEVEN TEAMS
 - FIFTEEN FORD, ONE AIR FORCE
 - 00 SCHEDULING
 - TEAMS ASSIGNED EIGHT HOUR SHIFTS, FIVE DAYS PER WEEK.
 - OVERTIME PAY IN EXCESS OF FORTY HOURS PER WEEK.

DYNAMICS CONTROLLER

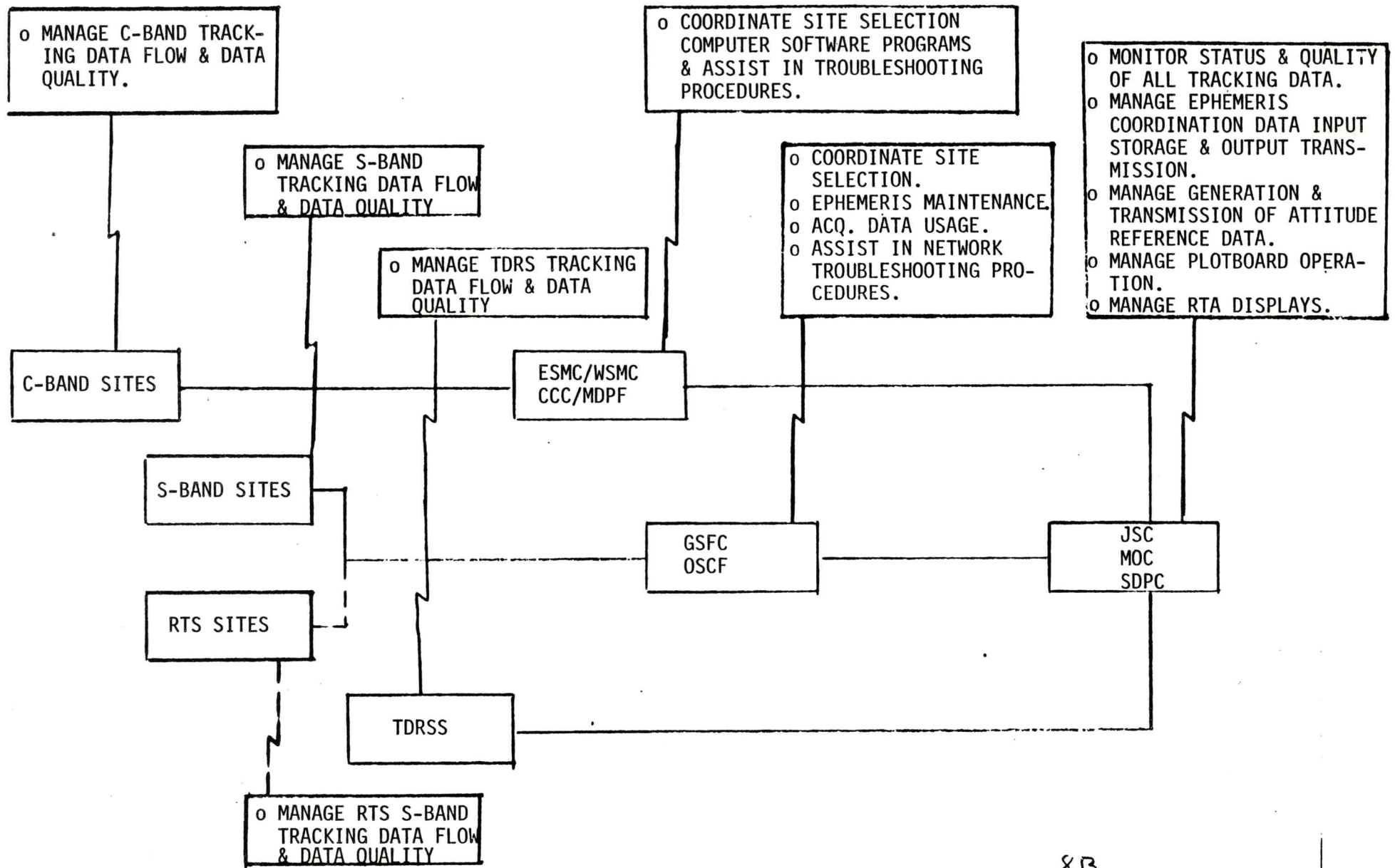


8A

NOTE: ALL DYNAMICS CONTROLLER INTERFACES ARE "IN-HOUSE MCC ONLY.

TRACKING CONSOLE

PRIMARY RESPONSIBILITIES



FLIGHT SUPPORT - POST FLIGHT

- O POST-MISSION REPORT
 - OO DOCUMENTS FLIGHT RESULTS, ANOMALIES, PERFORMANCE EVALUATION, AND USER SUPPORT.
 - OO PRODUCED BY FORD CONSOLE OPERATORS.
- O PERFORMANCE EVALUATION
 - OO NOT NORMALLY REQUIRED FOR STANDARD FLIGHTS.
 - OO REQUIRED FOR NEW CAPABILITIES, NEW PROCEDURES.
 - TDRS
 - SGLS (AFSCF RTS)
 - VANDENBERG LAUNCH AND LANDING
- O ANOMALY INVESTIGATION
 - OO AS REQUIRED

POST-FLIGHT SUPPORT

- O POST-MISSION REPORT
COMPILED FROM LOGS, HARDCOPIES AND DELOGS BY CONSOLE OPERATORS.
- O PERFORMANCE EVALUATION
PARTICIPATE IN THE E&M POST-MISSION DEBRIEFING.
- O ANOMALY INVESTIGATION
AS REQUIRED.

GENERIC TRAJECTORY OPERATIONS PROCEDURES

0 DOCUMENTATION UPDATE IN PROGRESS .

00 HIGH PRIORITY ACTIVITY

00 TARGET DATE 9/85

00 REFLECTS THE FOLLOWING:

- DUAL OPERATIONS
- TWO TDRSS NETWORK
- VANDENBERG LAUNCH CAPABILITIES
- USE OF SGLS (RTS) AS A TRACKING SOURCE.
- STREAMLINE EFFORTS

00 TWO MYE EFFORT

TRAINING

- 0 ONGOING TRAINING
 - 00 SOURCES
 - SIMS
 - IV TESTING
 - USE OF MOD TRAINING MATERIALS
 - IN HOUSE TRAINING TOOLS
 - VIDEO TAPES
 - WORKBOOKS
- 0 CURRENT EMPHASIS
 - 00 CROSS TRAINING ALL TRACK AND DYNAMICS CONTROLLERS, INCLUDING ONE AIR FORCE.
 - 00 UPGRADING SKILLS OF ALL DYNAMICS FOR ASCENT PHASE.
- 0 TRAINING PLAN DEVELOPMENT AND DOCUMENTATION
 - 00 HIGH PRIORITY ACTIVITY
 - 00 TARGET DATE 7/85
 - 00 INVOLVES FORMALIZING ALL TRAINING PROGRAMS
 - 00 TWO MYE

MCC GROUND HARDWARE/SOFTWARE SUPPORT

- o TDRS CERTIFICATION
 - oo TECHNICAL ADVISE TO TDRSS ORBIT DETERMINATION AND NAVIGATION WORKING GROUP (TODNWG).
 - oo WORK COMPLETED FOR SINGLE TDRSS.
 - oo TWO TDRSS EFFORT ON HOLD.
- o WTR LAUNCH
 - oo CHECKOUT OF WTR LAUNCH AND LANDING SYSTEM. A/C PHASE TO START ON/ABOUT 8 MAY 85.
 - oo FINAL CHECKOUT ON/ABOUT 1/86.
- o SGLS (RTS) TRACKING DATA CHECKOUT
 - oo IN FORMULATION STAGES.
 - oo FIRST CHECKOUT ON/ABOUT 1/86.
- o WORKSTATION (ERRP)
 - oo LEVEL A WORK COMPLETE.
 - oo LEVELS B/C WORK IN PROGRESS.

OFFLINE SUPPORT

- O TECHNICAL EXPERTISE ON RADAR TARGET CROSS SECTION AND CURRENT NETWORK CAPABILITIES.
- O "STRAWMAN" TRACKING PLAN FOR VARIOUS WTR LAUNCH INCLINATIONS.
- O DATA FORMATS UPDATES AND VERIFICATION.

PROBLEMS/CONCERNS

- 0 TIMELY AND ACCURATE DELIVERY OF DATA PRODUCTS FROM FLIGHT DESIGN AND CRP.
- 0 SMS AND MCC ON SAME DELIVERY CYCLE.
- 0 TRANSITION BETWEEN HOW WE DO BUSINESS TODAY AND THE WORKSTATION ERA - TRYING TO SUPPORT SIMS/MISSIONS AND OTHER CHECKOUTS AND PHASING OVER TO WORKSTATION.
- 0 VANDENBERG CHECKOUT IN A TIMELY MANNER, WHILE SUPPORTING SIMS AND MISSIONS. WILL BE PUSHING THE POWER CURVE ON PEOPLE.
- 0 DUAL FLIGHT IN CONJUNCTION WITH WORKSTATION PHASE IN AND VANDENBERG CHECKOUT WILL PUSH TO LIMIT ON ALL RESOURCES - PEOPLE, HARDWARE AND SOFTWARE.



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SUBJECT:

**FLIGHT DESIGN INFLUENCE IN THE TRAJECTORY
OPERATIONS BRANCH**

NAME:

H. A. BARNES

DATE:

4/9/85

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ALMOST ALL OF OUR PRODUCTS ARE TRAJECTORY SPECIFIC AND HIGHLY SENSITIVE TO LAUNCH SLIPS, MISSION REMANIFESTS, AND CYCLE UPDATES.

- ALMOST ALL PROGRAMS/DATA OUTPUT ARE DEPENDENT UPON INPUT FROM THE SUPERTAPE/OPERATIONAL FLIGHT PROFILE - IF THEY SLIP, WE SLIP.
- ANY SINGLE PRODUCT CAN BE TURNED AROUND IN 2-3 DAYS, BUT THE COMBINED TASK OF RECOVERING FROM A LAST MINUTE TRAJECTORY UPDATE (E.G. REMANIFEST) IS 2-4 WEEKS, DEPENDING ON FLIGHT COMPLEXITY.
- TRACK/DYNAMICS CAN RESPOND TO TRAJECTORY AND/OR NETWORK CHANGES WITHIN 2-3 DAYS.
- "MPAD MAJOR MILESTONES TABLE" SHOWS INTEGRATED SIMS AT L-70 DAYS; REALITY IS MUCH LATER, POSSIBLY DOWN TO L-20 DAYS.



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SUBJECT:

SPECIFIC DATA ACQUISITION PROBLEMS

NAME:

H. A. BARNES

DATE:
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- MANY OF OUR PRODUCTS AND ACTIVITIES ARE DEPENDENT UPON SODS (SHUTTLE OPERATIONAL DATA SUBMITTALS) - ESPECIALLY WEIGHT, CG'S, SSME PERFORMANCE, ETC.). THESE ARE DISTRIBUTED ON AN INDEPENDENT SCHEDULE AND CAN CAUSE A FLIGHT DESIGN CYCLE UPDATE, SOMETIMES VERY NEAR LAUNCH, WHICH IMPACT ARD BIASES AND PRODUCTS MOST ESPECIALLY.
- ESPECIALLY NEED ARD BIAS TABLES PRIOR TO SIMS FROM ASCENT FLIGHT DESIGNERS, BUT NEVER GET DATA BEFORE LAUNCH -2 WEEKS. THESE INPUTS AFFECT THE MODE BOUNDARY CALLS MADE BY FDO IN SIMS.
- WEATHER ALTERNATE TAL BOUNDARIES ARE ALSO RECEIVED VERY LATE.
- SINGLE ENGINE ABORT BOUNDARIES ARE NEVER RECEIVED FOR CYCLE 1 PRODUCTS. S.E. PERFORMANCE DATA IS NOT STRICTLY SCHEDULED OR DELIVERED. CYCLE 1 DATA FOR SPECIFIC FLIGHT USUALLY JUST REITERATES PREVIOUS FLIGHT DATA. THEREFORE, FDO'S FORCED TO PRODUCE ASCENT SUMMARY SHEETS FOR FLIGHT DIRECTORS AND CAPCOM'S BASED UPON BOOTLEGGED DATA.
- STATION CHARACTERISTICS TABLE ENTRIES ARE DEPENDENT UPON GSFC/FLIGHT DYNAMICS FACILITY AND GROUND NAVIGATION SECTION. (TRACK/DYNAMICS)
- SOFTWARE INPUTS TO CRP (CONFIGURATION REQUIREMENTS PROCESSING) ARE NOT ALWAYS FOR THE SAME SOFTWARE DELIVERY. THIS PROBLEM MUST BE CORRECTED WITH A "D-14" DATA SET. (TRACK/DYNAMICS)



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SUBJECT:

**SPECIFIC DATA ACQUISITION PROBLEMS
(CONT'D)**

NAME:

H. A. BARNES

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4/9/85

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- EARTH OBSERVATION SITE APPROVAL FROM PROJECT OFFICE ALWAYS RECEIVED VERY LATE I.E., FROM 2 WEEKS TO 1 DAY BEFORE MACHINES ARE SHIPPED TO KSC. (SPOC)
- SINCE CG DATA IS OFTEN LATE OR CHANGES DUE TO REMANIFESTING OR ADDITIONAL VEHICLE WEIGH-INS, THE SUIT TECHS AT THE CAPE MUST TRANSFER LAST MINUTE HP41CV FLIGHT TAPES OR MAKE FLIGHT LOAD UPDATES. (HP41CV/SPOC)

TRAINING DRY OPERATIONS OVERVIEW

ACTIVITY OR PRODUCT

L-MONTHS

L-DAYS

15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

ASSIGN SECTION LEADS

SUPPORT FORMAL PROGRAM MTGS

- ATTEND MOD CIR DRY RUN
- CIR
- FOR (PITCH REQ'D)
- MISSION INTEGRATION CONTROL BOARD

UPDATE MCC CONFIGURATION PRODUCTS

- JACCHIA TABLE
- ICD INPUTS
- SHUTTLE PROCESSING LIST (MRL) - RDCS
- DATA PACK - RDCS
- COMM PANEL - RDCS
- SHUTTLE DISPLAY RECONFIGURATION SYSTEM

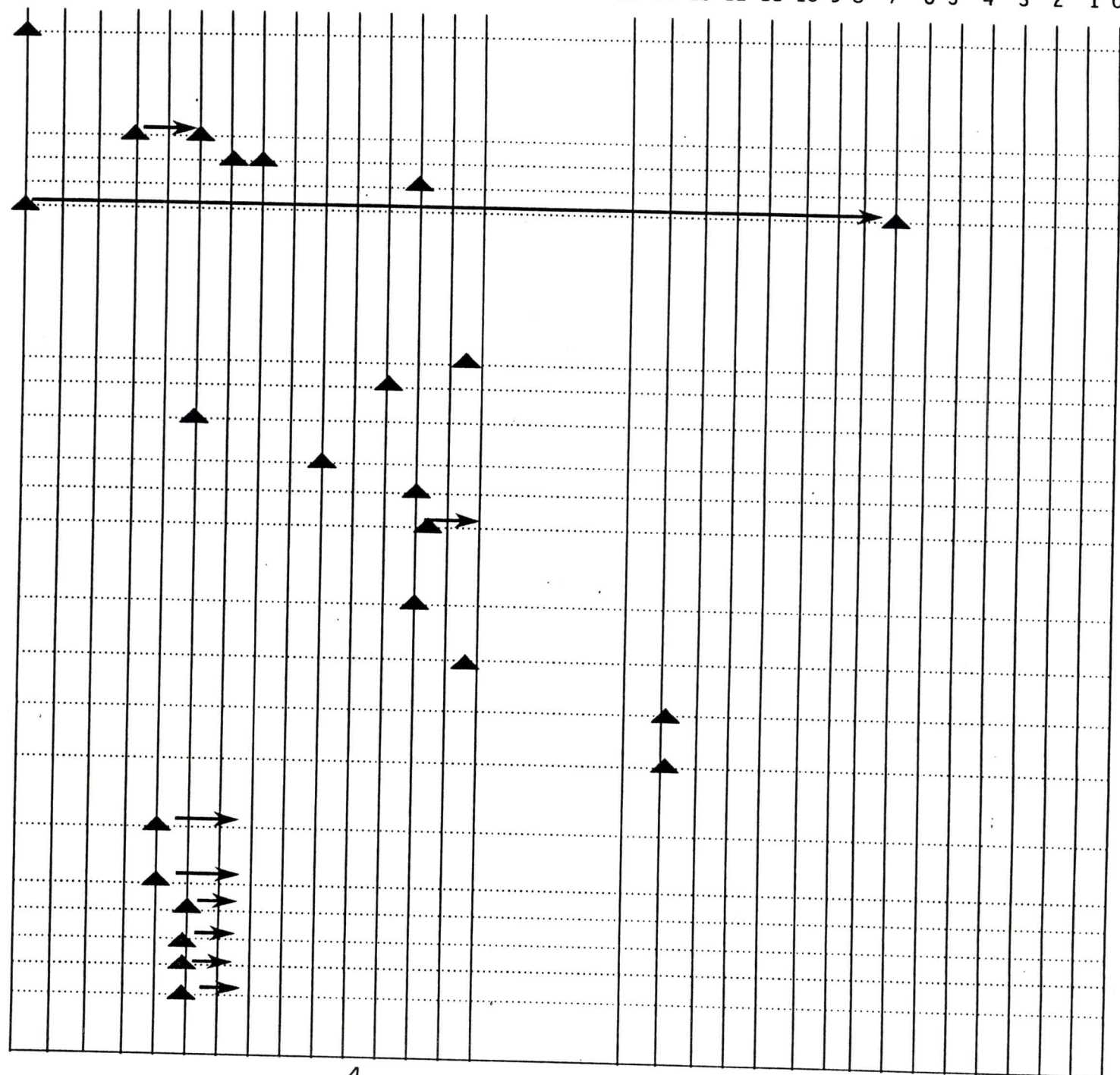
PUBLISH MANNING LIST

SUBMIT TRAINING ROSTER FORM

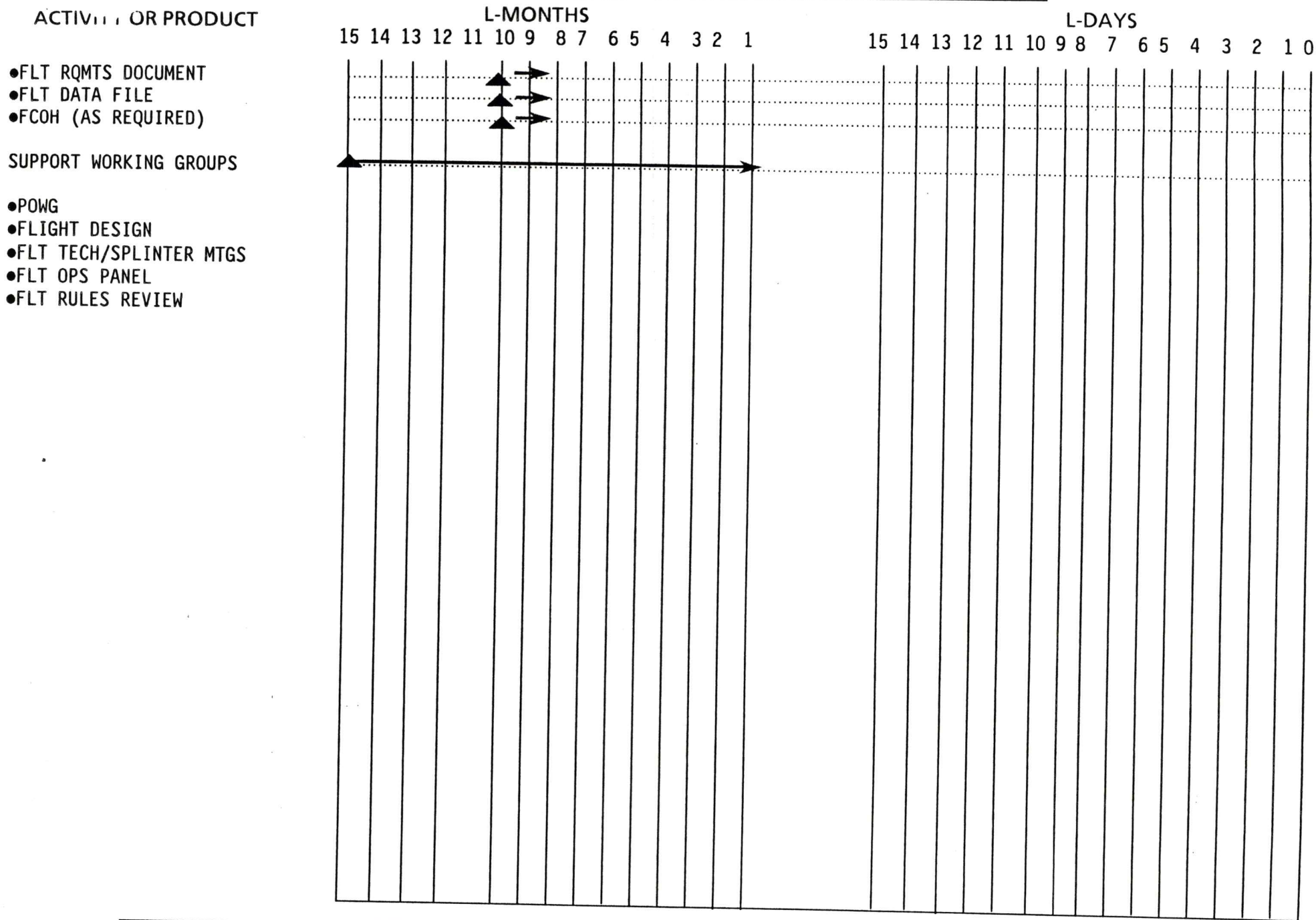
VERIFY CRITICAL PROGRAMS READY FOR FLIGHT SUPPORT CERTIFICATION FOLDERS DUE

REVIEW PREFLIGHT DOCUMENTATION

- PIP
- GND RULES & CONSTRAINTS
- FLT PLANNING ANNEX
- FLT OPS SUPPORT ANNEX
- JOINT OPS INTEGRATION PLAN



TRAJECTORY OPERATIONS OVERVIEW CONT'D



RDOS - RECONFIGURATION DATA CONTROL SUBSYSTEM

ACTIVITY OR PRODUCT

DATA FROM/TO

2-MONTHS

L-DAYS

8 7 6 5 4 3 2 1 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

CRITICAL INPUTS

1. Receive SUPERTAPE
2. Receive DEORBIT target sheets

From DM5 (E. Smith)
From DM5

ASCENT/ARD INITIALIZATION

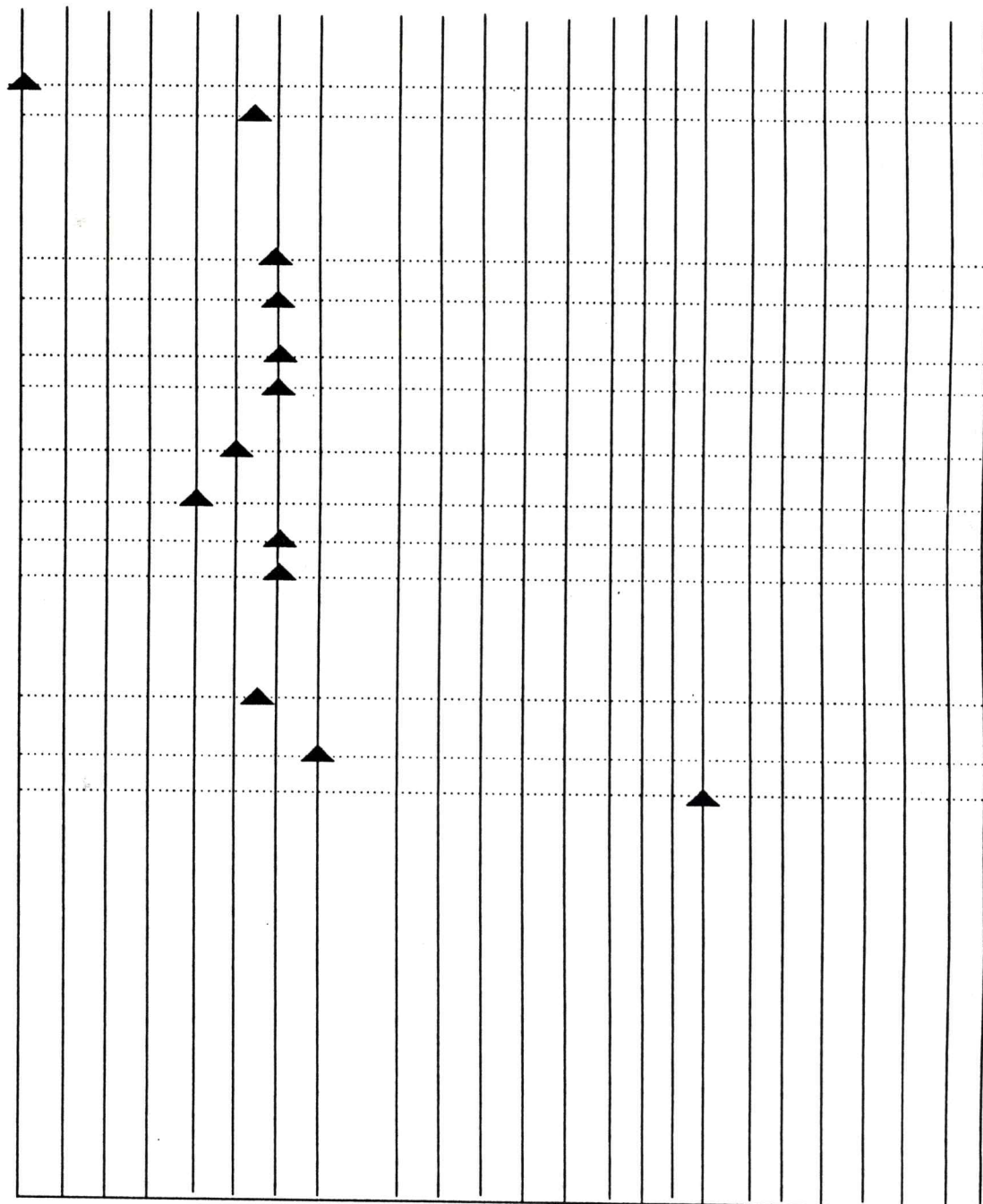
3. ARD BIAS Table
4. OMS target matrix for prime/WX ALT LDG sites
5. Stuck throttle perf
6. AOA target data (EDW, NOR, KSC) for WX ALT.
7. SODS update-MASS PROP, SSME PERF, MPS
8. ICD data - OMS targets
9. Adaptive guidance table
10. No-COMM mode boundaries

From DM3
From DM3
From DM3
From DM3
From MD2
From DM3
From DM3
From DM3

ORBIT/PAYLOAD

11. Customer deploy targets/ data
12. Payload performance data
13. Consumables mtg w/Hischke (final vehicle WT/CG's)

From Payload customer
From customer
From MD2



FDO/TRAJ TIMELINE CONT'D

ACTIVITY OR PRODUCT

DATA FROM/TO

L-MONTHS 8 7 6 5 4 3 2 1 20 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

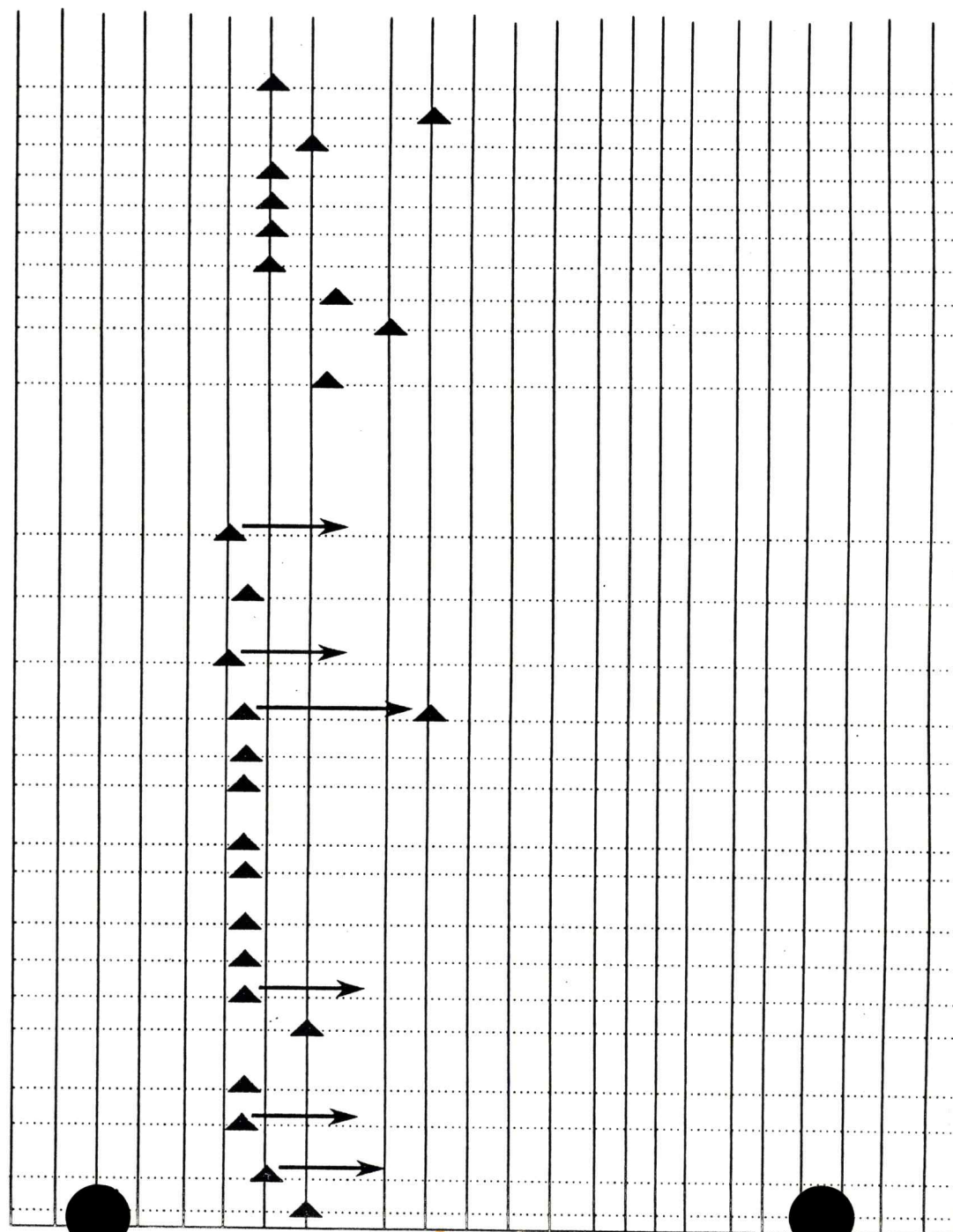
L-DAYS

OTHER REQ'D INPUTS

- | | |
|-----------------------------------|--------------------|
| 14. Tracking/NAV evaluation | From GNAV/DYNAMICS |
| 15. Launch hold chart | From DM3 |
| 16. HDOT at staging for RTLS | From DM3 |
| 17. OMS tank leak data | From DF/PROP |
| 18. OMS helium leak data | From DF/PROP |
| 19. Thrust limit data | From DF/BOOSTER |
| 20. S&C band coverage | From DM5 & DM3 |
| 21. Obtain winds timeline | From DM3 (Winds) |
| 22. RSO rules inputs to flt rules | From Cape RSO's |
| 23. Obtain codewords | From RSO's |

CRITICAL PRODUCTS OUTPUT

- | | |
|---|--------------------------------------|
| 1. Provide nodal vectors to customers | (Data from SUPERTAPE) |
| 2. Timeline for deploy and rendezvous | To payloads |
| 3. Provide SMS reset point data/vectors | To SMS NAV's & trench monitors (DG6) |
| 4. ATO options | To FD,FAO |
| 5. TAL/RTLS RV line | FDO sim support |
| 6. MECO underspeed for nominal | FDO sim support |
| 7. Pre-MECO dump chart | FDO sim support |
| 8. Engine out underspeed plot | FDO sim support |
| 9. De-orbit ΔV comps | To DF6/PROP |
| 10. Deploy/SEP vectors | To POINTING for FDF |
| 11. Perigee adjust curves | FDO sim support |
| 12. Distribute LOT (daily prime opp) | To LDG sites, et al. |
| 13. Mode boundary chart | To FD, flt techniques |
| 14. Flight specific rules updates | To flt rules review |
| 15. Contingency evaluations | (as required) |
| 16. Status vector schedule | To NORAD |



LSO TIMELINE

ACTIVITY OR PRODUCT

DATA FROM/TO

L-MONTHS

L-DAYS

8 7 6 5 4 3 2 1 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

CRITICAL INPUTS

1. NAVAIDS/Landing aids support plan

Data from Program Office message

CRITICAL PRODUCTS

2. PRD updates
3. WX pad schedule for block data
4. Ground support release schedule
5. NAVAIDS/Landing aids chart

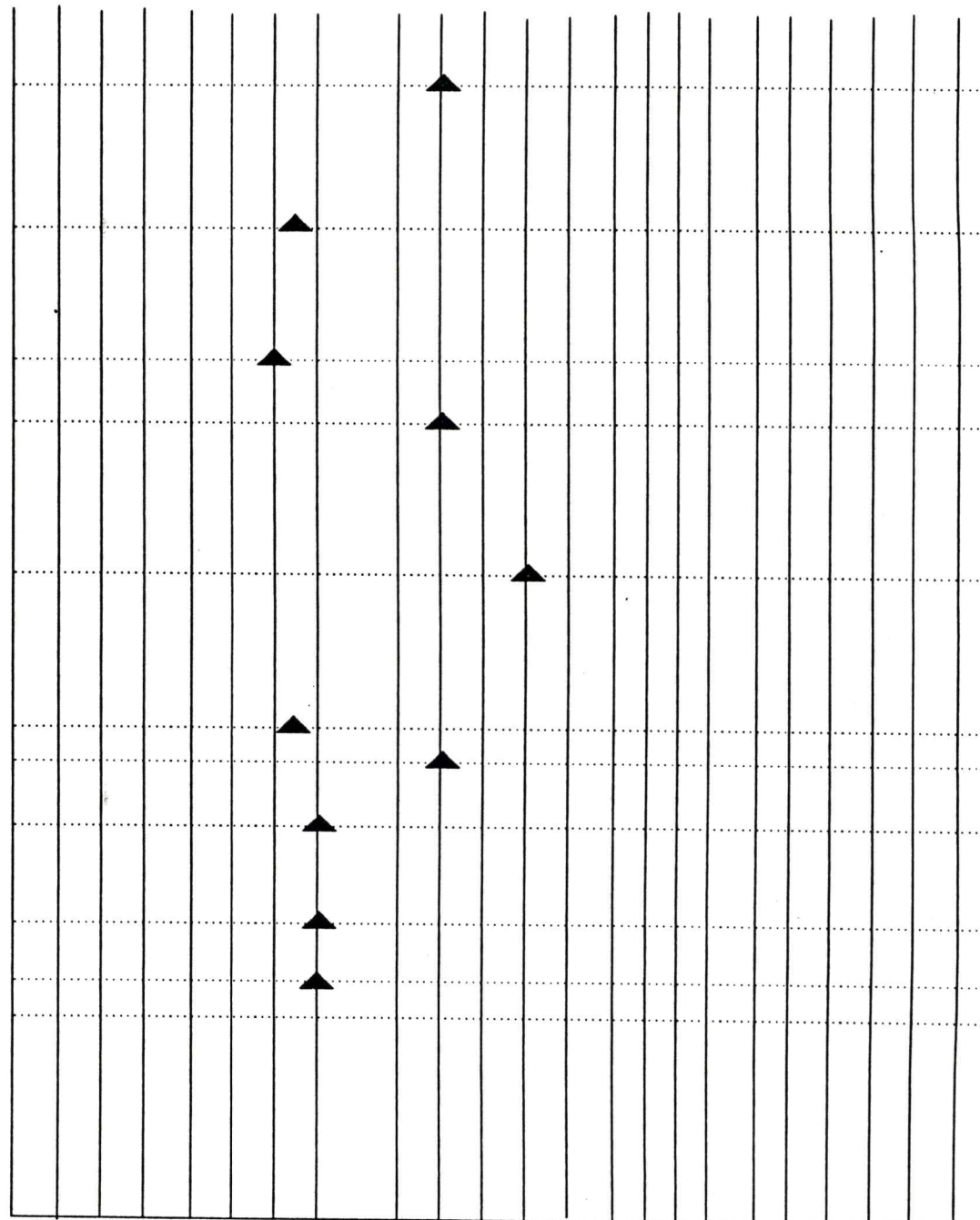
Updates to the:
Meteorological sec.
Recovery section for
Launch/Landing
Data to Weather,
FAO/PADS, LSO/FDO
Data for convoy
support at LDG sites
- PLS, SLS, CLS, and
DDMS for military
flts.
To Mission
Preparations Drawer

OTHER ACTIVITIES/RELEASES

6. Sun angle analysis
7. TAL COMM SCHEDULE
8. ARTCC's/FAA MEMO
9. Changes to LSO procedures
10. FDOCH updates
11. FCOH updates

To FDO
To TAL CAPCOM, GC's,
FDO
To Miami, LAX,
Albuquerque, FAA HQ
in Washington

(as required)
(as required)



GROUND NAVIGATION TIMELINE

ACTIVITY OR PRODUCT

DATA FROM/TO

L-MONTHS

L-DAYS

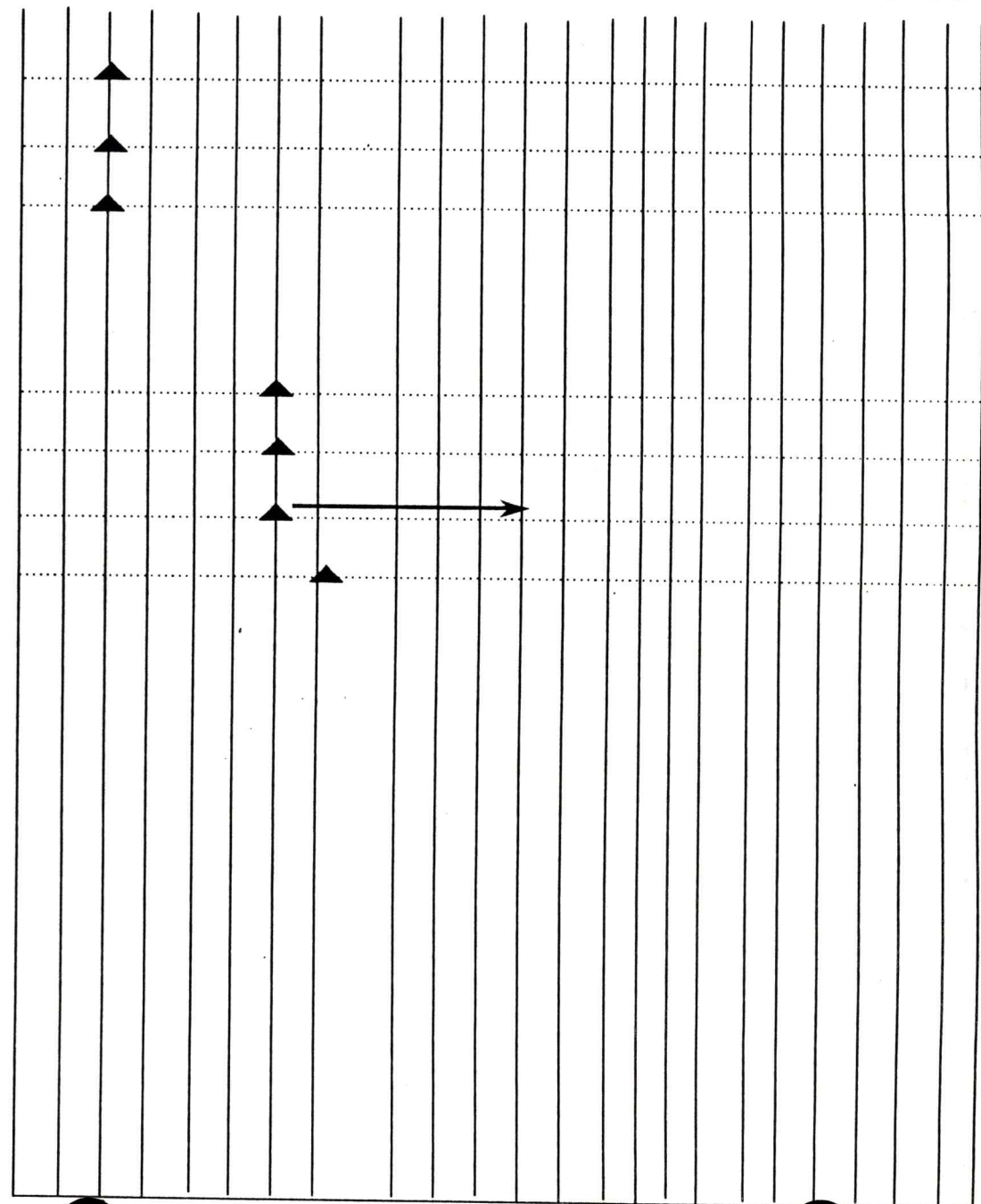
8 7 6 5 4 3 2 1 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

CRITICAL INPUTS

- | | |
|-------------------------|----------------|
| 1. Planned attitude T/L | From DM5 & DM3 |
| 2. Planned event T/L | From DM5 & DM3 |
| 3. NAV requirements | From PIP & FDO |

PRODUCTS/ACTIVITIES

- | | |
|----------------------------|---------------|
| 1. Contingency evaluations | (as required) |
| 2. NAV evaluation | GNAV to FDO |
| 3. Tracking network rqmts | GNAV to TRACK |
| 4. Lifetime studies | GNAV to FDO |
| 5. Atmosphere evaluation | Internal |



TRACK/DYNAMICS TIMELINE

ACTIVITY OR PRODUCT

DATA TO

10 9 8 7 6 5 4 3 2 1 0 20 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

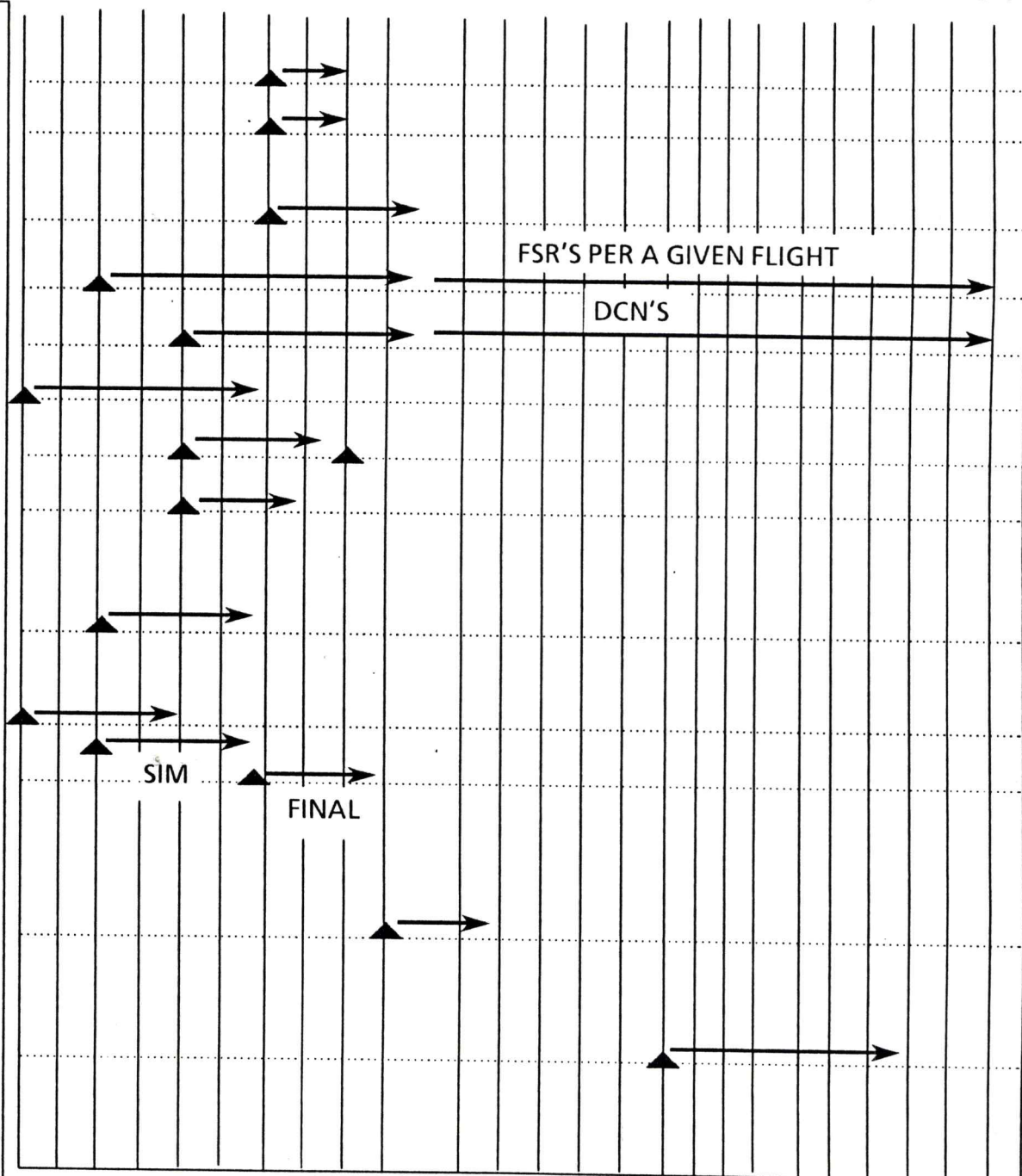
L-DAYS

REVIEW DOCUMENTATION

1. TRAJ RQMTS DOCUMENT To FS3
2. NETWORK OUTPUT MULTI-
PLEXER RQMTS To FS9
3. JSC/GSFC ICD 11534 To DE2
4. FLT/LAUNCH/LANDING PRD'S
5. GSFC 601 NOSP To DE2
6. MCOH VOL 1-5 To DE2
7. FCOH To DF
8. JOIP To DH6

DELIVERABLE ITEMS

1. STATION CHARACTERISTICS
TABLE To DE3/CRP
2. CONSOLE CONFIG UPDATES To DE3
3. SIM AND MISSION PSAT'S To DE2, SIM SUP,
GC'S, DM6, DM62,
DOD TRACK, and
GSFC/NOM
4. C-BAND SCHEDULING MESSGE GSFC/Scheduling
JSC/Scheduling,
DOD/TRACK
5. CONSOLE CHECKLIST To GC'S,FDO'S



SPOC TIMELINE

ACTIVITY OR PRODUCT

DATA FROM/TO

L-MONTHS

L-DAYS

8 7 6 5 4 3 2 1 17 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

CRITICAL INPUTS

1. RNP matrix, state vector, and Lift-off time
From SUPERTAPE (or computed internally)
2. STDN/TDRS sites
From OIO, INCO, CAP
3. Earth OBS sites
From SC/T. Aldinger
4. GPC state vector addresses
From DF2/J. Hooks
5. Average altitude
From Lead FDO
6. Inclination for aero data selection
From SUPERTAPE
7. Landing sites and runways
From LSO, FDF
8. MAX crossranges
From Flight Rules

CRITICAL PRODUCTS

FLIGHT LOADS for DE-ORBIT, WORLD MAP, and EARTH OBS programs

To SMS For sims

MAJOR EVENTS

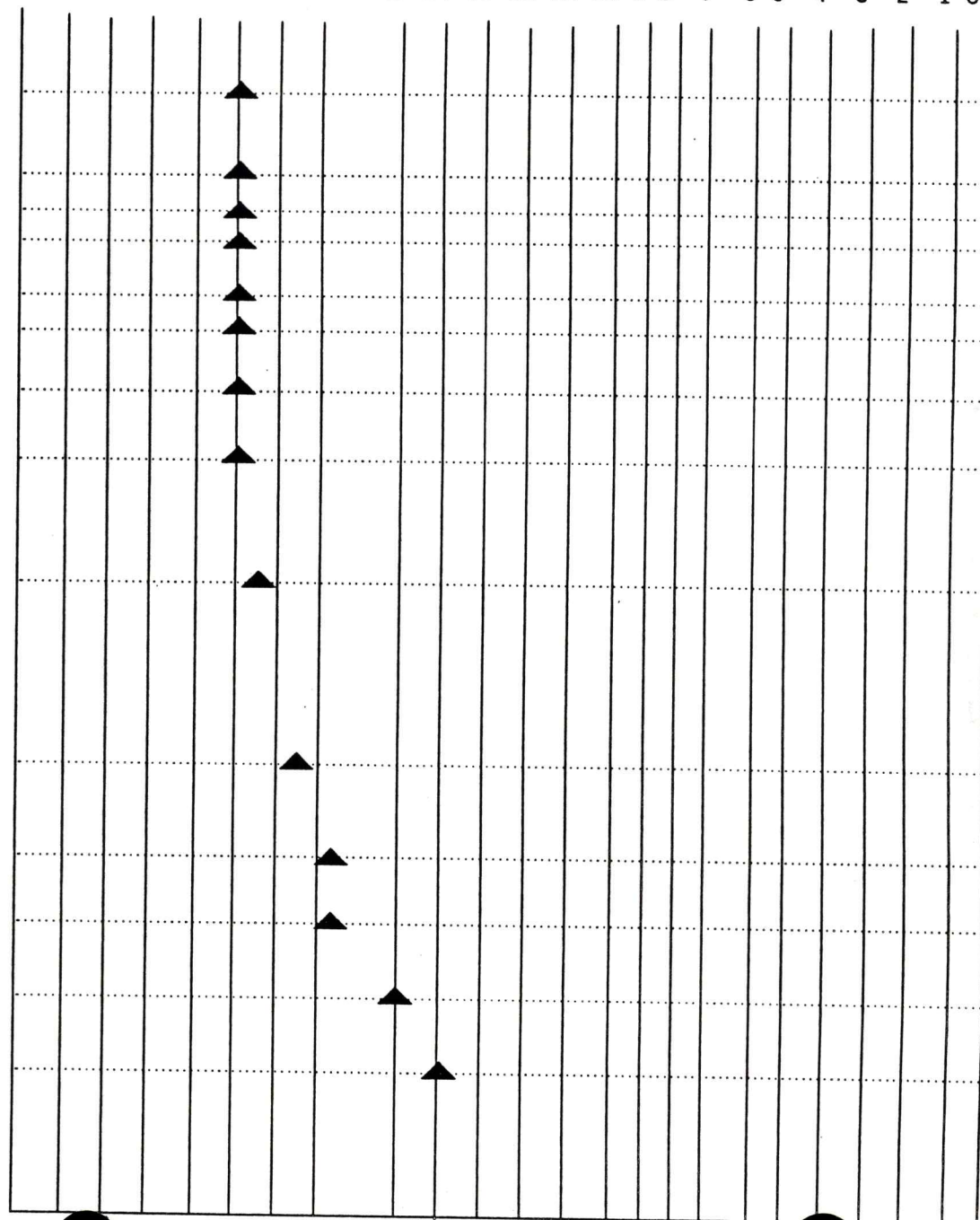
Flight software validation complete

Bench review

CPCB Proc Valid Review

Load flt software

Stow SPOC



HP41CV TIMELINE

ACTIVITY OR PRODUCT

DATA FROM/TO

L-MONTHS

L-DAYS

8 7 6 5 4 3 2 1 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

CRITICAL INPUTS (FLIGHT SPECIFIC)

1. CG Program: weights,
CG's, fuel quantities
2. AOS/DE-ORBIT/COM Programs
 - State vector and MET
 - Block data coefficients
 - State vector addresses
3. ORB Program: Star Pairs

From SODB amendments

From SUPERTAPE
From FM44/D. Ives
(DM5/J. Fields)
From DF2/J. Hooks
From Orbit Ops C/L

CRITICAL PRODUCTS

FLIGHT LOADS for CG, AOS,
DE-ORB, ORB, and COM
Programs

To SMS calculators for
sims

MAJOR EVENTS

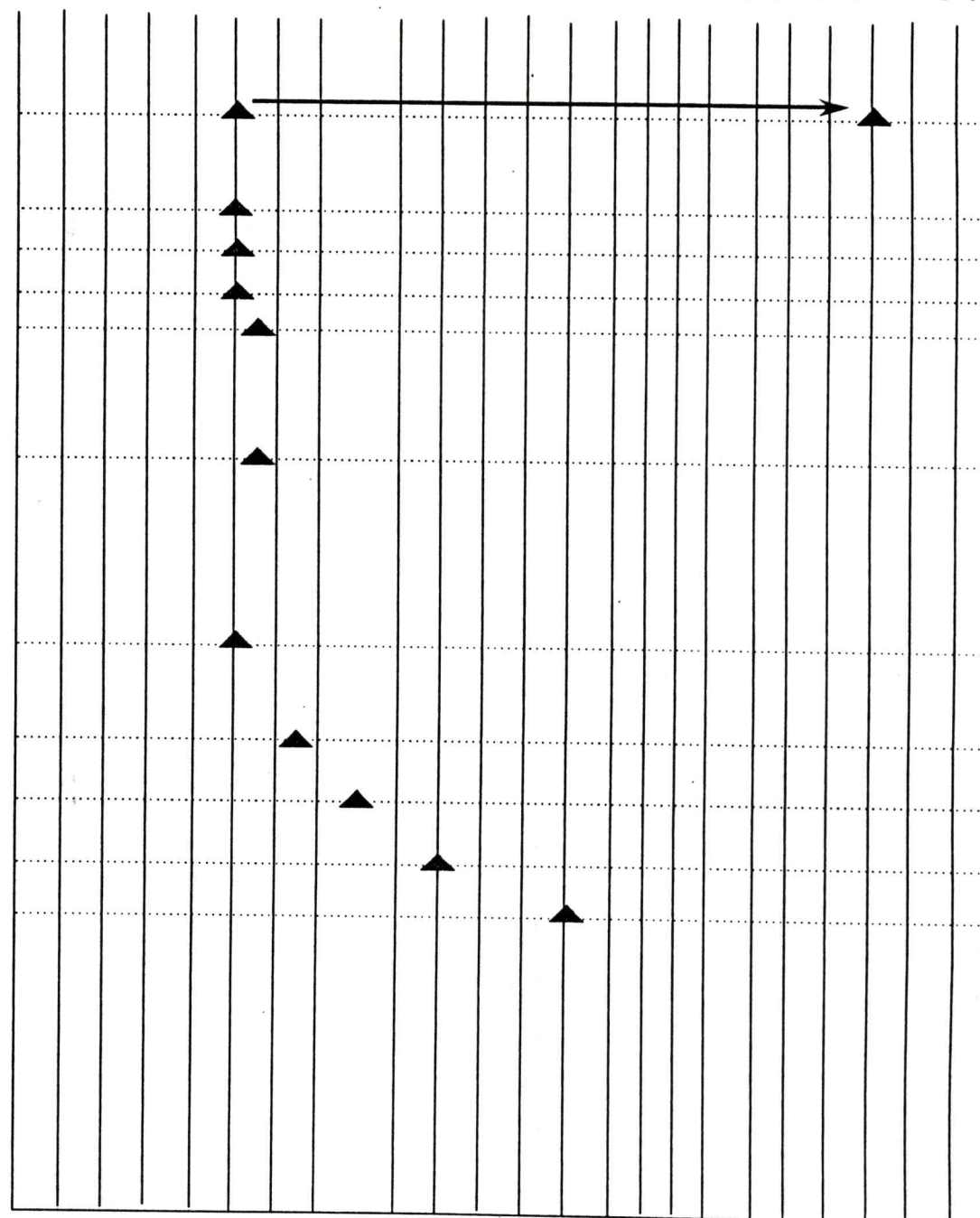
Crew equipment list
agreement

Complete FLT SW validation

CPCB Proc Valid Review

Load FLT software

Ship HP41's to Cape





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SUBJECT:

PRE-CIR INPUTS TO FLIGHT DESIGN FROM
FDO'S (BACKUP)

NAME:

H. A. BARNES

DATE:

4/9/85

PAGE

- PRE-CIR INPUTS TO FLIGHT DESIGN FROM FDO'S
 - LEAD FDO HAS REVIEW WITH FLIGHT DESIGN MANAGER FOR SPECIFIC FLIGHT
 - MISSION PLANS, GROUND RULES/CONSTRAINTS
 - RENDEZVOUS PLANNING AS WORKED WITH MDTSCO GROUP
 - SPECIFIC ITEMS AS APPLICABLE, SUCH AS
 - GROUND TRACKING FOR BURN SUPPORT
 - LOCATION OF IMU ALIGNMENTS THAT MAY IMPACT RENDEZVOUS
 - REVIEW OF STATE VECTORS/BURN TARGETS FOR PAYLOADS
 - CENTAUR BURNS
- FDO SIM/MISSION SUPPORT ANALYSIS CYCLE REALLY BEGINS WITH THE SUPERTAPE
 - PAYLOAD CUSTOMERS RECEIVE PAM (OR OTHER PAYLOAD) DEPLOY VECTORS FROM ORBIT FDO'S
 - THEY IN TURN SEND BACK DEPLOY TARGETS
 - TARGETS ARE GIVEN TO RMS, POINTERS FOR BURN MONITORING ON RMS CAMERAS
 - FDO'S GENERATE/DISTRIBUTE STANDALONE AND INTEGRATED SIM VECTORS, PADS (BURN AND DEPLOY)
 - DE-ORBIT ATTITUDE AND ΔV 'S GO TO THE FLIGHT DATA FILE (E.G., ENTRY CHECKLIST)
 - LOT HAS WORLDWIDE DISTRIBUTION
 - PAYLOAD COMMUNITY IS SUPPLIED WITH A TIMELINE CONTAINING TIMES FOR EXCHANGE OF STATE VECTORS, PRELIMINARY DEPLOY COMPS, TRACKING SITE AVAILABILITY, ETC.



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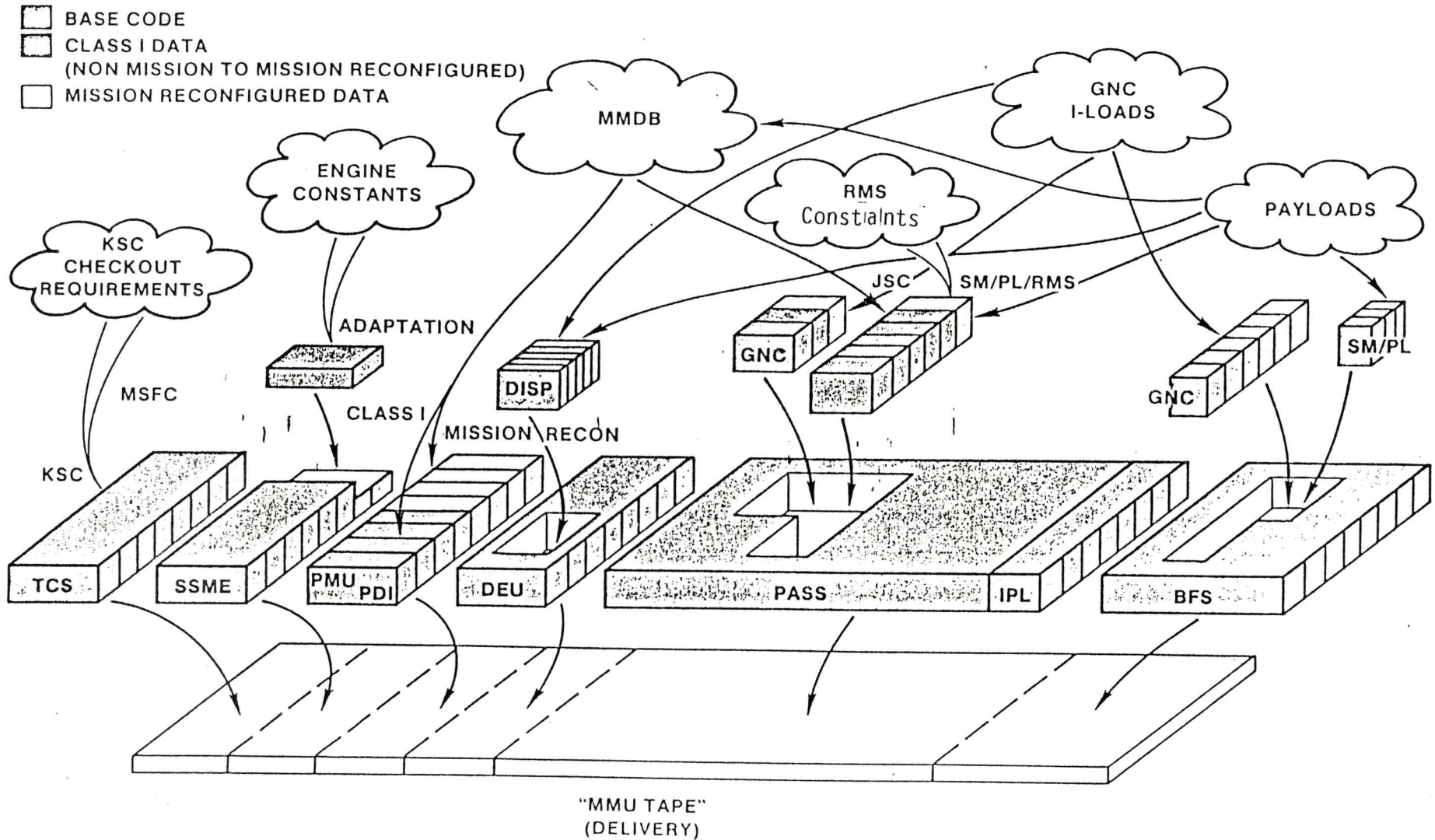
DATE:

5/17/85

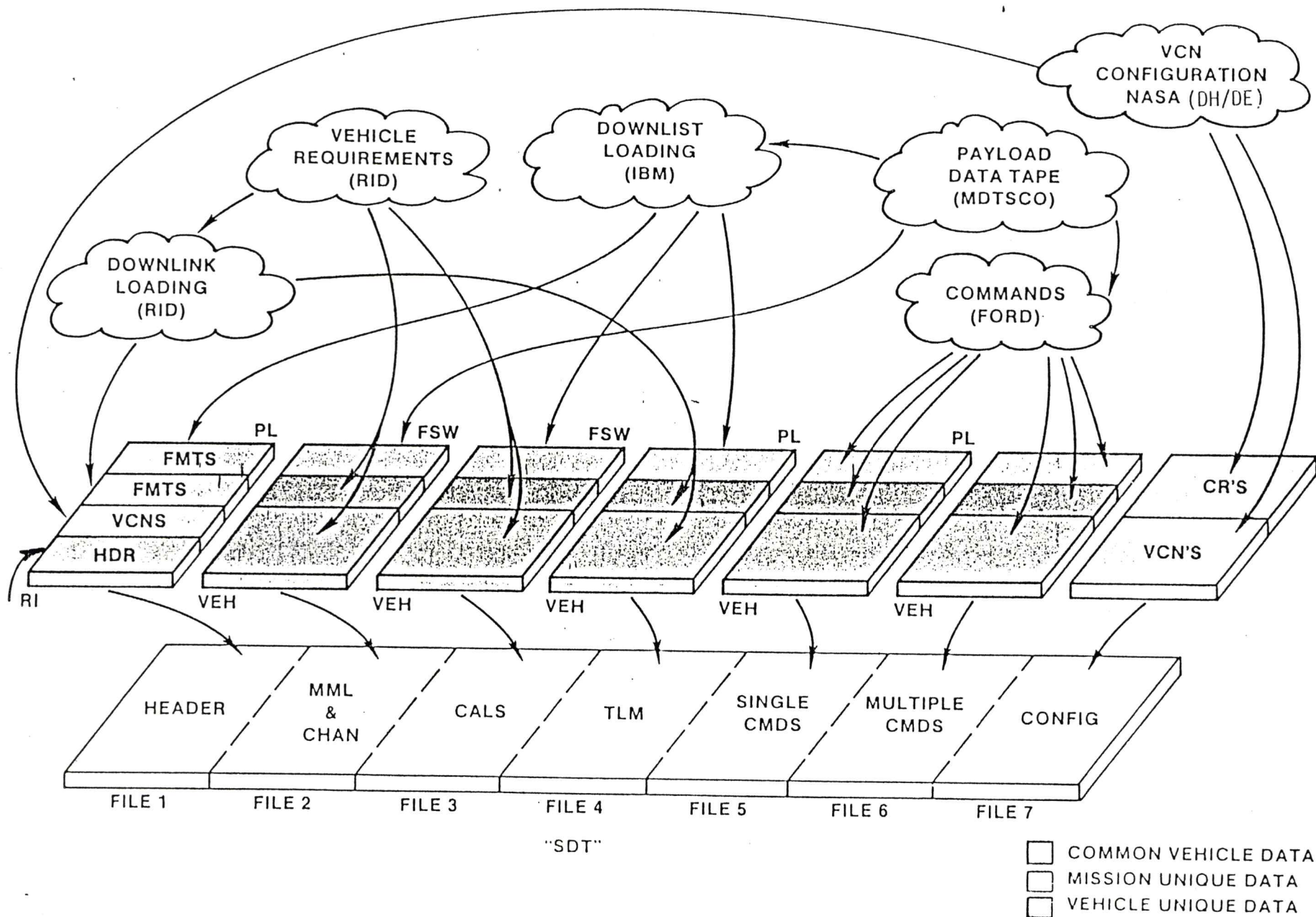
PAGE

DATA RECONFIGURATION PROCESS

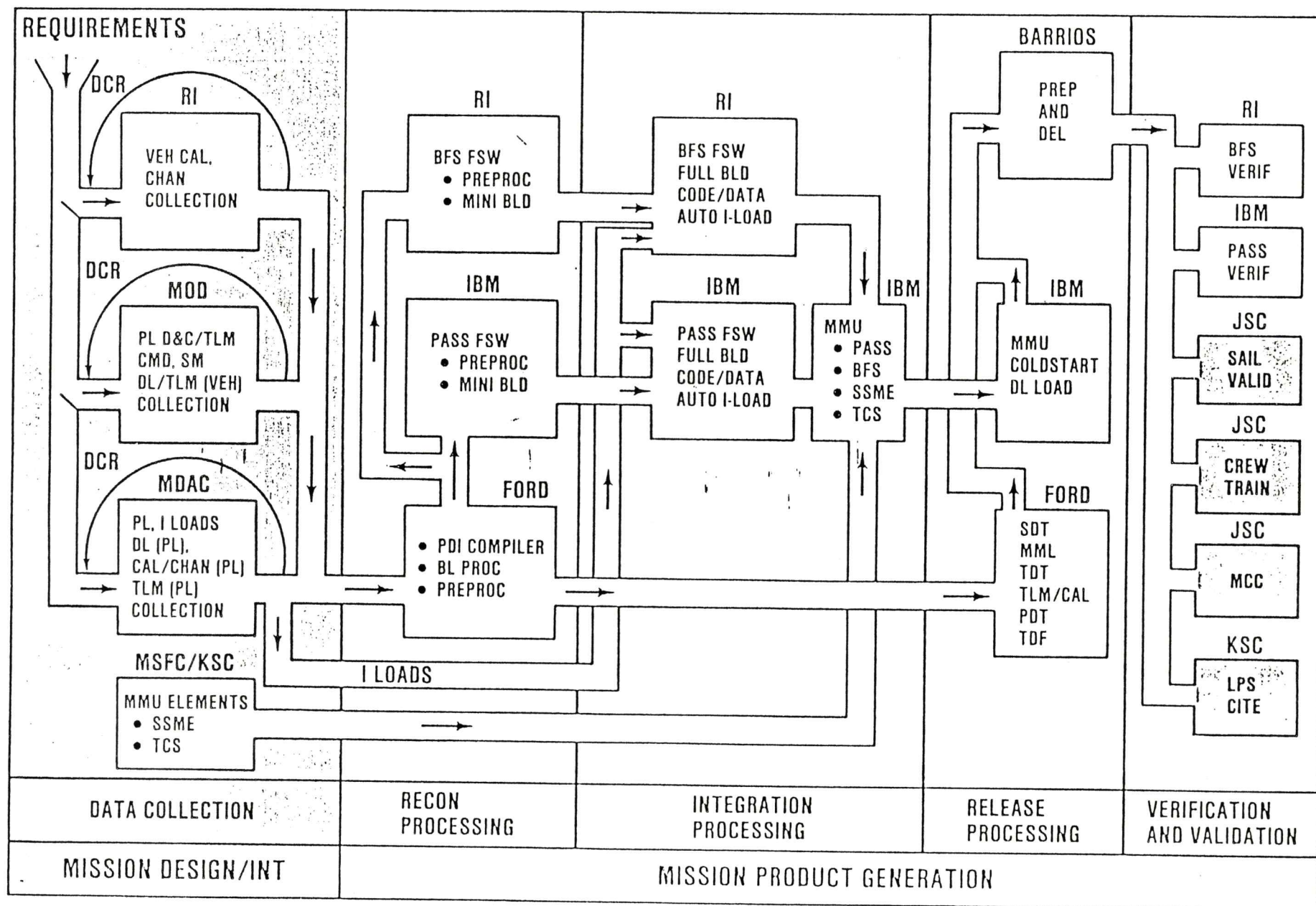
ORBITER SOFTWARE RECONFIGURATION



GROUND FACILITIES RECONFIGURATION DATA



SPF MISSION SUPPORT WORK ELEMENTS



ANNEX 4 MRMS MILESTONES 9-MONTH TEMPLATE

<u>L-DATE</u>	<u>MILESTONE PRODUCTS</u>
489	PAYLOAD INPUTS (C&D ANNEX)
452	BASIC PAYLOAD C&D ANNEX
382	C&D ANNEX REVIEW MEETING
348	CR SUBMITTAL - PAYLOADS (FINAL PDT)
334	CR APPROVAL - FINAL PDT
334	CR APPROVAL - TFL/DFL, TDT, PL
260	PAYLOAD D&C - DCR SUB
260	C&D ANNEX - DCR SUB
250	RMS LEVEL 'C' CR
243	CR APPROVAL C&D ANNEX AND TFL
236	CR APPROVAL - PAYLOAD D&C
236	CR APPROVAL - RMS LEVEL 'C'
222	LEVEL 'C' MISS DEF - DCR SUB
215	CR APPROVAL - LEVEL 'C' MISS
187	CR APPROVAL - FINAL SDT
187	CR APPROVAL - ORBITER COMMAND
117	CR SUBMITTAL - 10 % UPDATE
103	CR APPROVAL - 10 % UPDATE
102	LEVEL 'C' MISS DEF - DCR SUB
96	CR APPROVAL - LEVEL 'C' MISS DEF
61	CR APPROVAL - CERT SDT



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- MAST (MEASUREMENT AND STIMULI) DATA COLLECTION
 - PAYLOAD RECONFIGURATION
 - TELEMETRY
 - COMMAND
 - VEHICLE SYSTEMS MANAGEMENT (SM)
- I-LOADS (DH7 OWNER)
 - BFS SM (503) - CHANGING TO CONSTANTS (K-LOADS)
 - GNC FAULT DETECTION AND ANNUNCIATION (76) - RETURN OWNERSHIP TO SUBSYSTEM ENGINEER

GOAL

- STANDARDIZE VEHICLE RECONFIGURATION DATA TO MINIMIZE COST OF VEHICLE/PAYLOAD CHANGE

CATEGORY NAME:

FIXED I-LOADS - GREMILLION

(OI06)

DESCRIPTION:

TBS

CR LIST:

CATEGORY CR 69126A, CR 69494A, 69686A, 69630, 69647

DRIVERS:

NOT APPLICABLE

NUMBER OF GROUPS:

19

NUMBER OF PARAMETERS:

46

PRI NASA OWNER: GREMILLION,M.

NUMBER OF OCCURRENCES:

TO BE FIXED

BFS NASA OWNER: GREMILLION,M.

PASS SOURCE:

IMRB DATA BASE

PRI RI OWNER: THOMAS,C.

BFS SOURCE:

IMRB DATA BASE

BFS RI OWNER: THOMAS,C.

ZF3-13

PASS USAGE:	KEY	FSSR	MC	PF	TITLE
	187	20	1 3	G4.103	ENTRY-LANDING ADI PROCESSING
	192	20	1 3	G4.107	SURFACE POSITION INDICATOR PROCESSING
	195	20	1 3	G4.108	ENTRY-LANDING EVENT LIGHT PROCESSING
	198	20	1 2 3 8	G4.110	GN&C ANNUNCIATION INTERFACE
	207	20	1 3	G4.252	HEADS-UP DISPLAY
	216	20	2 3 8	G5.16	REDUNDANCY MGT-REACTION CONTRQL SYSTEM SPEC
	218	120	2	G5.19	RM ORBIT SPEC
	557	550	0	V5.1	VEHICLE CHECKOUT CONTROL DISPLAYS
	204	20	1	G4.154	VERTICAL SITUATION DISPLAY PROCESSING

BFS USAGE:	KEY	BOOK	MC	PRD PARA	COMPOOL	TITLE
	649	M3	1 3	3.3.1.10	SEQ_I_LOAD	:RCS QUANTITY GAGING SEQ. - BFS
	673	20	1 3	3.5.2.2	I_BFS_DC	:SPI BODY FLAP PROCESSING REQTS.
	695	20	1 3	4.112	I_BFS_DC	:GN&C ANNUNCIATION I-F (GAX)

CONTENTS:	GROUP NO.	NO. MSIDS	GROUP TITLE
	18701	2	ROLL AND PITCH ERROR SENSITIVITY GAINS
	19505	1	VELOCITY FOR GEAR LIGHT FLASH
	19802	5	TANK SCALE FACTORS
	19805	4	RCS TANK FACTORS
	19806	4	OMS VALVE POSITION SF'S
	19808	2	OMS AND RCS LIMITS
	20722	2	VELOCITY VECTOR DISPLAY FILTERS
	21801	1	RHC CONVERSION SCALE FACTOR (PCT-VDC)
	19201	2	BODY FLAP DEFLECTION LIMITS
	19506	1	SPEEDBRAKE LIMIT
	19809	1	OMS HIGH PRESSURE LIMIT
	19810	5	OMS LIMITS
	19811	2	RCS TEMP LIMITS
	19813	1	HINGE MOMENT FACTOR
	21601	2	RCS TANK SCALE FACTORS
	21605	3	RCS PRESSURE LIMITS
	55701	4	POSITION CONVERSION INPUTS
	19814	1	OMS AFT QUANTITY SCALE FACTOR
	20415	3	USED FOR COMP OF PULLOUT NZ COMMAND

OCCURRENCE CODES: #201

SELECTION CRITERIA: TBD

! ZF42

CATEGORY DEFINITION

DATE: 11-29-84 |

CATEGORY NAME: FIXED I-LOADS - GREMILLION, CONTD.

DESCRIPTION: TBS

CR LIST: CATEGORY CR 69126A, 69252, 69724B

DRIVERS: NOT APPLICABLE

NUMBER OF GROUPS: 12

NUMBER OF PARAMETERS: 30

NUMBER OF OCCURRENCES: TO BE FIXED

PASS SOURCE: IMRB DATA BASE

BFS SOURCE: IMRB DATA BASE

PRI NASA OWNER: GREMILLION,M.

BFS NASA OWNER: GREMILLION,M.

PRI RI OWNER: THOMAS,C.

BFS RI OWNER: THOMAS,C.

PASS USAGE:	KEY	FSSR	MC	PF	TITLE
	189	20	1 3	G4.106	AVVI
	195	20	1 3	G4.108	ENTRY-LANDING EVENT LIGHT PROCESSING
	198	20	1 2 3 8	G4.110	GN&C ANNUNCIATION INTERFACE
	206	20	1 3	G4.230	RCS ACTIVITY LIGHTS
	207	20	1 3	G4.252	HEADS-UP DISPLAY

BFS USAGE:	KEY	BODK	MC	PRD PARA	COMPOOL	TITLE
	619	M6	1 3	3.2.5.5	I_HIP_OUT	OUTPUT HIPS EFFECTORS
	695	20	1 3	4.112	I_BFS_DC	GN&C ANNUNCIATION I-F (GAX)

CONTENTS:	GROUP NO.	NO. MSIDS	GROUP TITLE
	19501	1	ALTITUDE FOR SB LIGHT FLASH
	19502	1	ALTITUDE FOR BF LIGHT FLASH
	19503	1	ALTITUDE FOR GEAR LIGHT FLASH
	19504	1	ALTITUDE FOR NAV LIGHT FLASH
	19801	1	GAX LIMITS
	19803	2	ELEVON LIMITS
	19807	4	OMS VALVE POSITION BIASES
	20716	3	HUD ROLLOUT PROFILE
	59971	13	FIXED PRIMARY DESIGN I-LOADS FOR NASA OWNER, GREMILLION, FSSR 20
	59931	1	FIXED COMMON DESIGN I-LOAD FOR NASA OWNER, GREMILLION, FSSR 20
	59984	1	FIXED PRIMARY DESIGN I-LOAD - GREMILLION, FSSR 20, OPS1
	59985	1	FIXED PRIMARY DESIGN I-LOAD - GREMILLION, FSSR 20, OPS3

OCCURRENCE CODES: #201

SELECTION CRITERIA: TBD

CATEGORY: ZF4

REV: 2

NAME: FIXED I-LOADS - GREMILLION, CONTD.

CR 79312 OMS BI-PRPLT VALVES POSITION STD CAL

DIRECTION

- PROGRAM MANAGEMENT HAS CONCURRED IN PLAN TO ELIMINATE VEHICLE TURNAROUND DATA DIFFERENCES, BOTH IN THE ON-BOARD SOFTWARE AND DOWNLINK DATA FORMAT.
- ELIMINATION OF DIFFERENCES WILL PROVIDE VEHICLE TURNAROUND/REMANIFEST WITH NO IMPACT TO ANY SOFTWARE/DOWNLINK DATA PRODUCTS.

CURRENT SOFTWARE

- PRESENT CALIBRATION DATA (BIAS AND SCALE FACTOR) FOR THE FOUR OMS BI-PROP VALVE POSITION OPEN PARAMETERS (LEFT 1 & 2 = V43H4655C AND 56C; RIGHT 1 & 2 = V43H5655C and 56C) WERE INCORPORATED BY CR19489A (PASS STS-8, BFS STS-5).
- CURRENT VALUES REPRESENT THE ACTUAL CALS OF OV-102 HARDWARE AT THAT TIME.

THIS CHANGE REQUEST

- ROCKWELL/DOWNEY HAS DEVELOPED STANDARD CALIBRATION DATA APPLICABLE TO ALL ORBITER VEHICLES.
- THIS CR WILL CREATE I-LOAD OCCURRENCES IN IMRB REFLECTING THE STANDARD CAL THAT CAN BE SELECTED FOR MISSION USE ON ALL VEHICLES.
- RECOMMEND APPROVAL OF THIS CR FOR MISSION DEFINITION SELECTION ON OI-6 AND SUB SOFTWARE FLIGHT DESIGN CYCLES.
- THIS CR WILL MAKE THE ON-BOARD SOFTWARE AGREE WITH THE APPROVED GROUND (MCC) SOFTWARE CALIBRATION DATA.

NOTE: RELATED CHANGES TO GROUND SYSTEM (MMDB) WERE DEFINED IN APPROVED DCR 35873A FOR STS 51-B & SUB.

DH7/W. L. Yeakey
03-21-85



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MAST (MEASUREMENT AND STIMULI) PRODUCTS

NAME:

DH7/T. W. EGGLESTON

DATE:

5/17/85

PAGE

• MAJOR MAST PRODUCTS

• PDT (PAYLOAD DATA TAPE)

- PAYLOAD TELEMETRY, COMMAND, AND FDA DATA

• TFL/DFL/FPL

- PCMMU (TFL) AND PDI (DFL/FPL) CODE

• TDT TELEMETRY DESCRIPTOR TAPE)

- DESCRIPTION OF THE STRUCTURE OF THE FLIGHT TELEMETRY FORMATS

• SDT (SHUTTLE DATA TAPE)

- PAYLOAD AND VEHICLE TELEMETRY AND COMMAND DATA

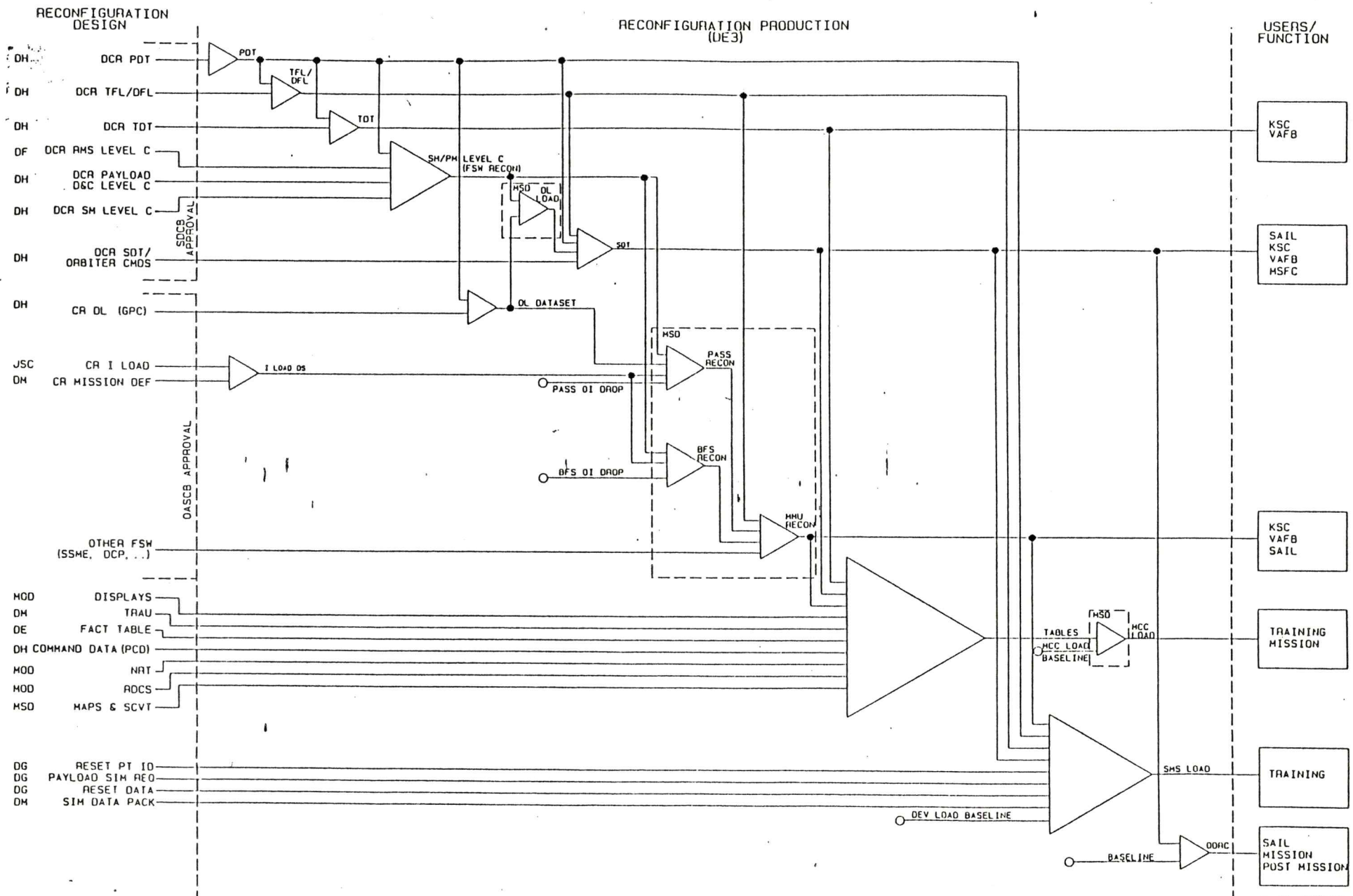
SM/PM LEVEL C DATA SET

- REQUIREMENTS FOR ONBOARD FDA AND HEALTH AND STATUS MONITORING OF THE PAYLOADS, VEHICLE AND RMS, AND ONBOARD DISPLAY AND COMMANDING OF THE PAYLOADS

• DOWNLIST DATA SET

- GPC PARAMETERS THAT ARE TELEMETERED TO THE GROUND

SHUTTLE RECONFIGURATION ACTIVITIES



T. F. GIBSON
4/05/85



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SUBJECT:

DATA COLLECTION DEPENDENCIES

NAME:

DH7/T. W. EGGLESTON

DATE:

5/17/85

PAGE

• PAYLOAD DATA

- PAYLOAD SUPPLIERS
- MOD - CREW INTERFACE (DISPLAYS, FDA, ETC.)
- LEVEL II/PAYLOAD OFFICE - MANIFEST/PAYLOAD SELECTION

• TELEMETRY DATA

- ROCKWELL/DOWNEY - ORBITER VEHICLE DESIGN/MOD'S
- MSFC - ET/SRB/ME DESIGN/MOD'S
- KSC - CHECKOUT REQUIREMENTS
- MOD - MISSION OPERATIONS
- PAYLOADS

• COMMAND DATA

- MOD - MISSION OPERATIONS
- ROCKWELL - ORBITER VEHICLE DESIGN/MOD'S
- KSC - CHECKOUT
- PAYLOADS



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SUBJECT:

DATA COLLECTION DEPENDENCIES

(CONT'D)

NAME:

DH7/T. W. EGGLESTON

DATE:

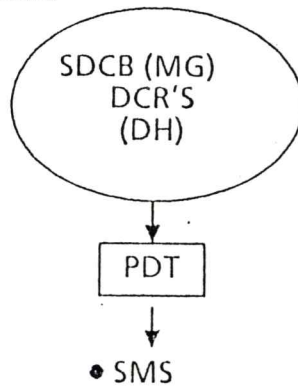
5/17/85

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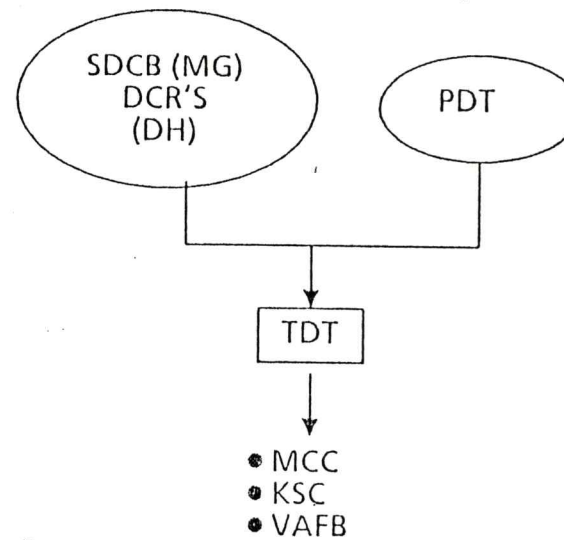
- SM/PM LEVEL C DATA
 - RI/DOWNEY - ORBITER VEHICLE DESIGN/MOD'S
 - MOD - MISSION OPERATIONS/CREW INTERFACE/RMS
 - PAYLOADS

• PRODUCT DEPENDENCIES/NON-MAST USERS

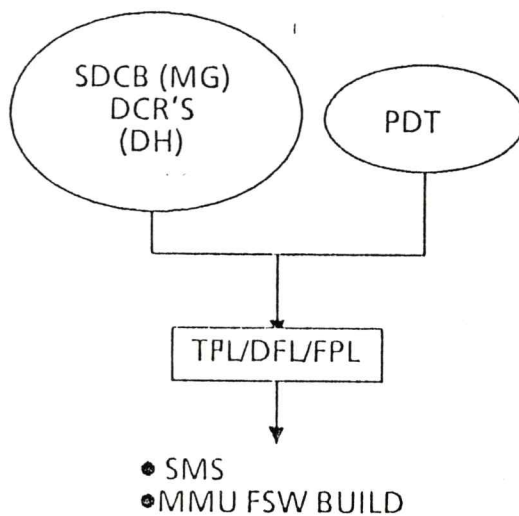
PDT



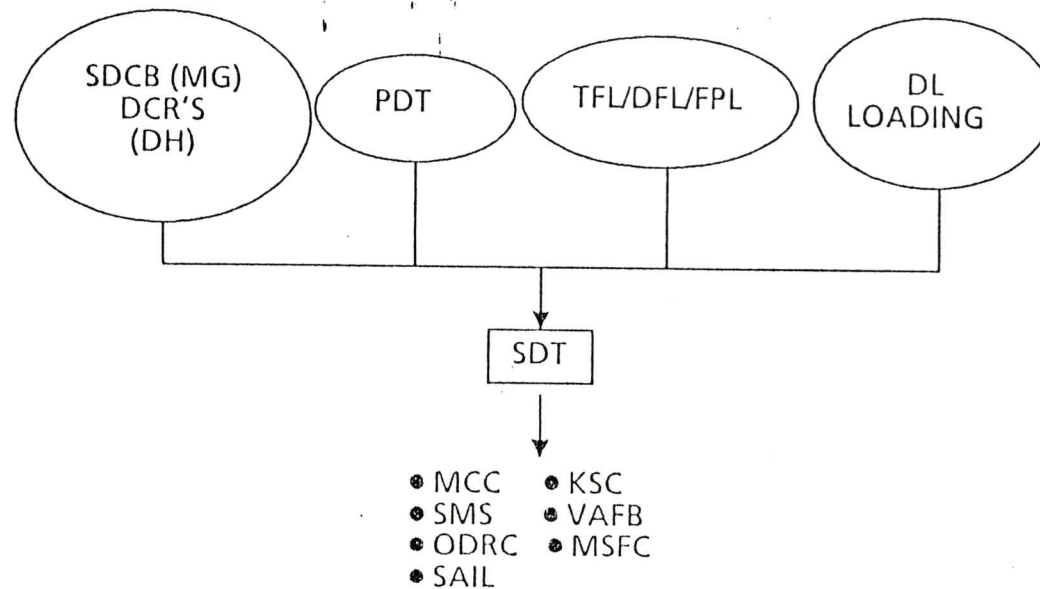
TDT



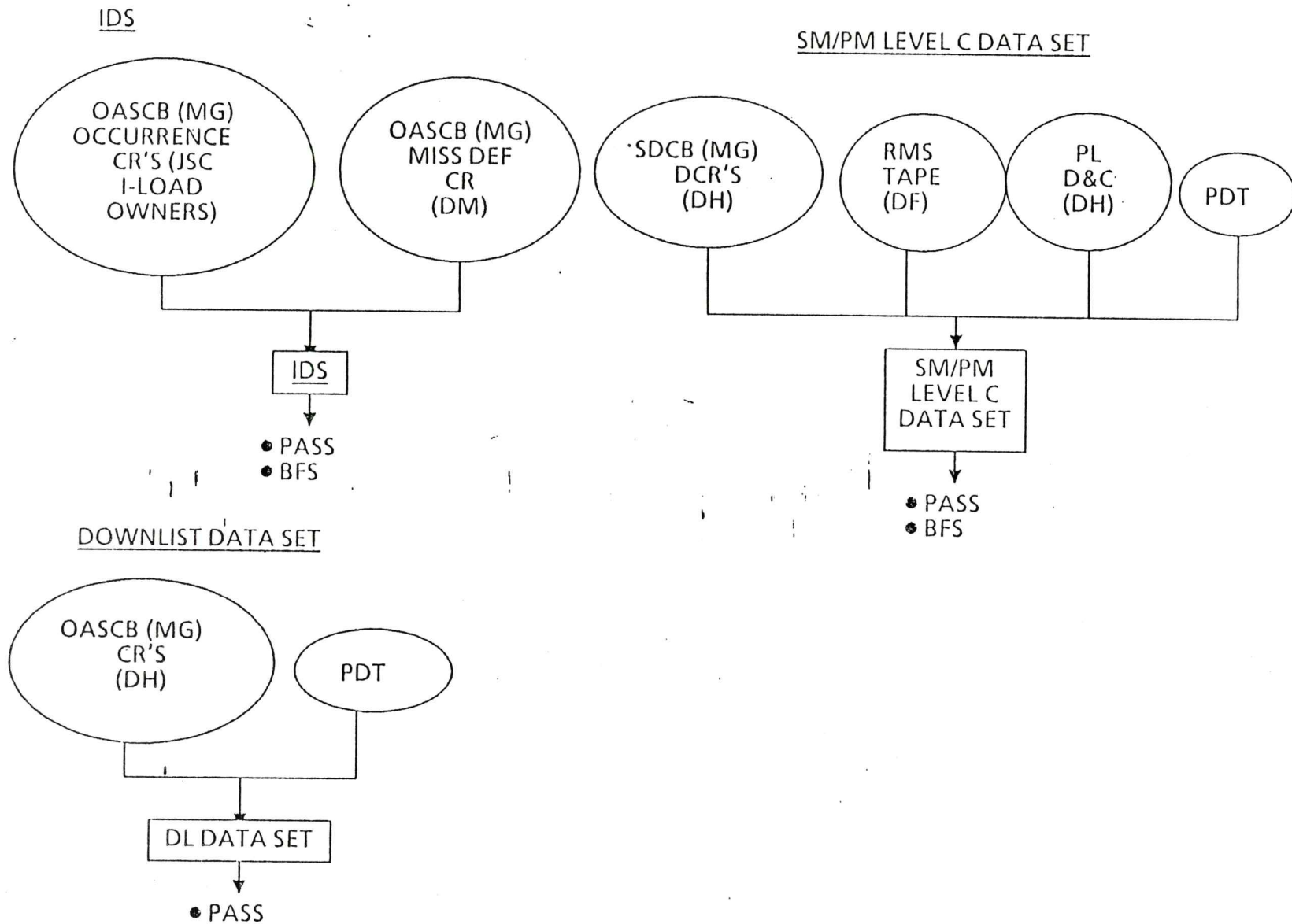
TFL/DFL/FPL



SDT



• PRODUCT DEPENDENCIES/NON-MAST USERS (CONT.)





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SUBJECT:

NAME:

DH7/T. W. EGGLESTON

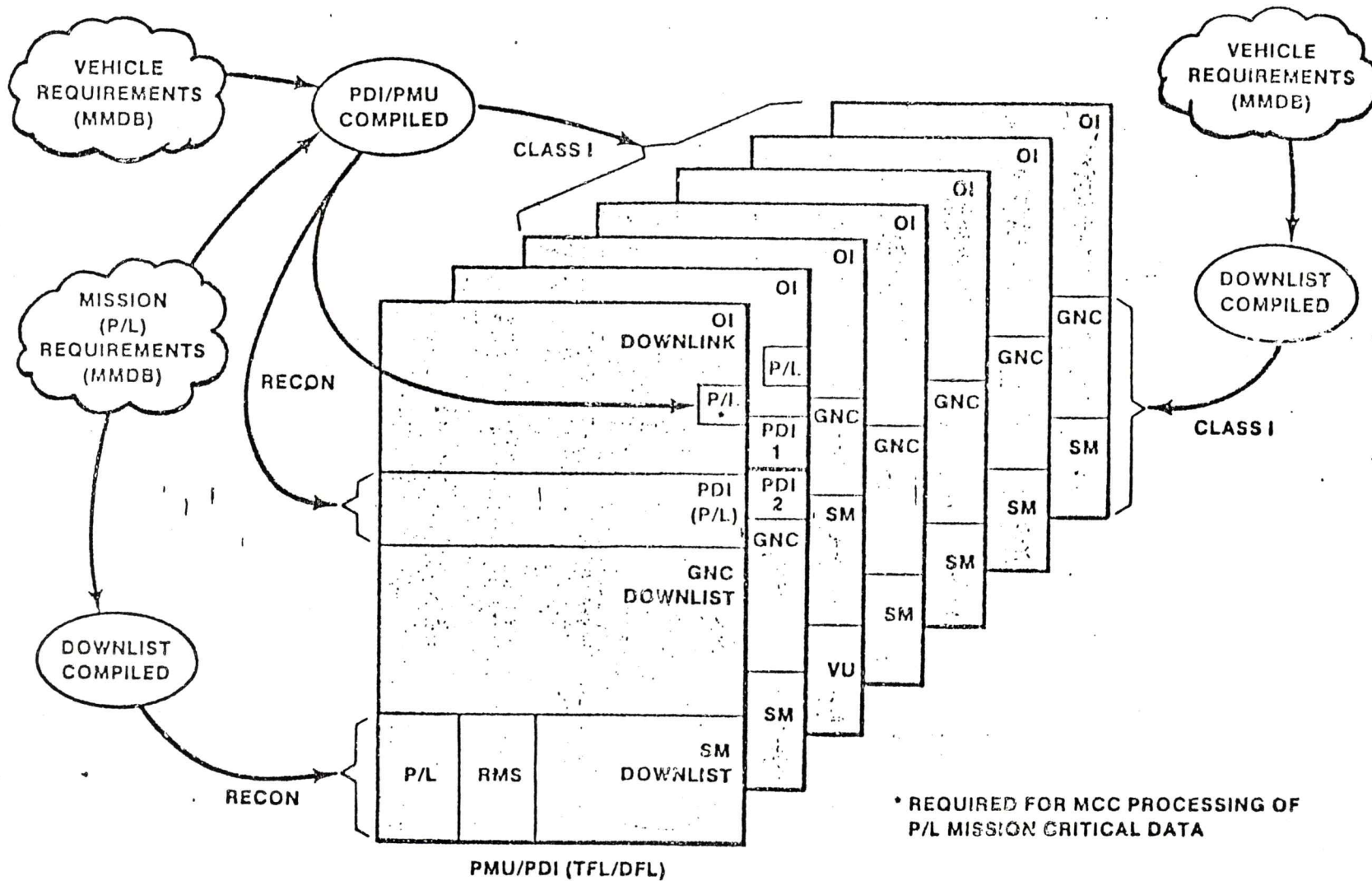
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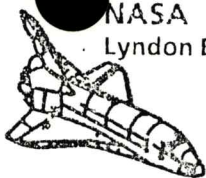
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DATA REQUIREMENTS STANDARDIZATION

TELEMETRY RECONFIGURATION





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- WHAT WE HAVE ALREADY ACCOMPLISHED
 - STANDARD TFL AND DOWNLIST STRUCTURE (VEHICLE)
 - STANDARD TFL AND DOWNLIST CONTENT (VEHICLE AND RMS)
 - STANDARD SHUTTLE VEHICLE CALIBRATIONS (EXCEPT FOR 32 MEASUREMENTS FOR WHICH ACTUAL CALIBRATIONS ARE REQUIRED)
- WHAT IS LEFT
 - PACKAGE DATA FOR MAJOR PAYLOADS IN STANDARD SETS (SPACELAB, PAM's, IUS, ETC.)
 - MAST II/STAR CONFIGURATION
 - NEGOTIATION WITH PAYLOAD SUPPLIERS UNDERWAY



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DATA VALIDATION PROCESS I



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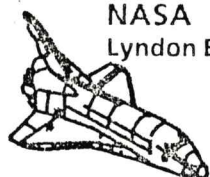
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- THE ACCURACY OF DATA IS DEPENDENT UPON
 - THE CORRECTNESS OF DATA PROVIDED BY DATA SUPPLIERS
 - THE ACCURACY OF TRANSLATING DATA INTO DATA BASE
 - THE QUALITY OF THE PROCESS INVOLVED IN PRODUCING PRODUCTS
- IN THE PAST WE HAVE HAD PROBLEMS WITH ALL OF THE ABOVE



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CURRENT (MAST I) SYSTEM

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- MAINTAINING DATA VALIDITY WITH THE MAST I SYSTEM IS VERY LABOR INTENSIVE AND SUBJECT TO FAILURE
- MULTIPLE PAPER REVIEWS ARE HELD TO ENSURE ACCURACY OF DATA REQUIREMENTS
 - COMMAND AND DATA (C&D) ANNEX REVIEW MEETING
 - CARGO INTEGRATION REVIEW (CIR)
 - SHUTTLE DATA CONTROL BOARD (SDCB)
- ENTRY OF DATA INTO DATA BASE IS CHECKED BY MULTIPLE AUDITS
- SOFTWARE VALIDATION PROGRAMS CHECK ACCURACY OF PRODUCTS
- EVEN WITH THE ABOVE CHECKS ERRORS STILL OCCUR BECAUSE MOST OF THE PROCESS IS MANUAL
- MAST II/STAR WAS DESIGNED TO IMPROVE THE DATA COLLECTION/VALIDATION PROCESS



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PM DATA FLOW - 1985

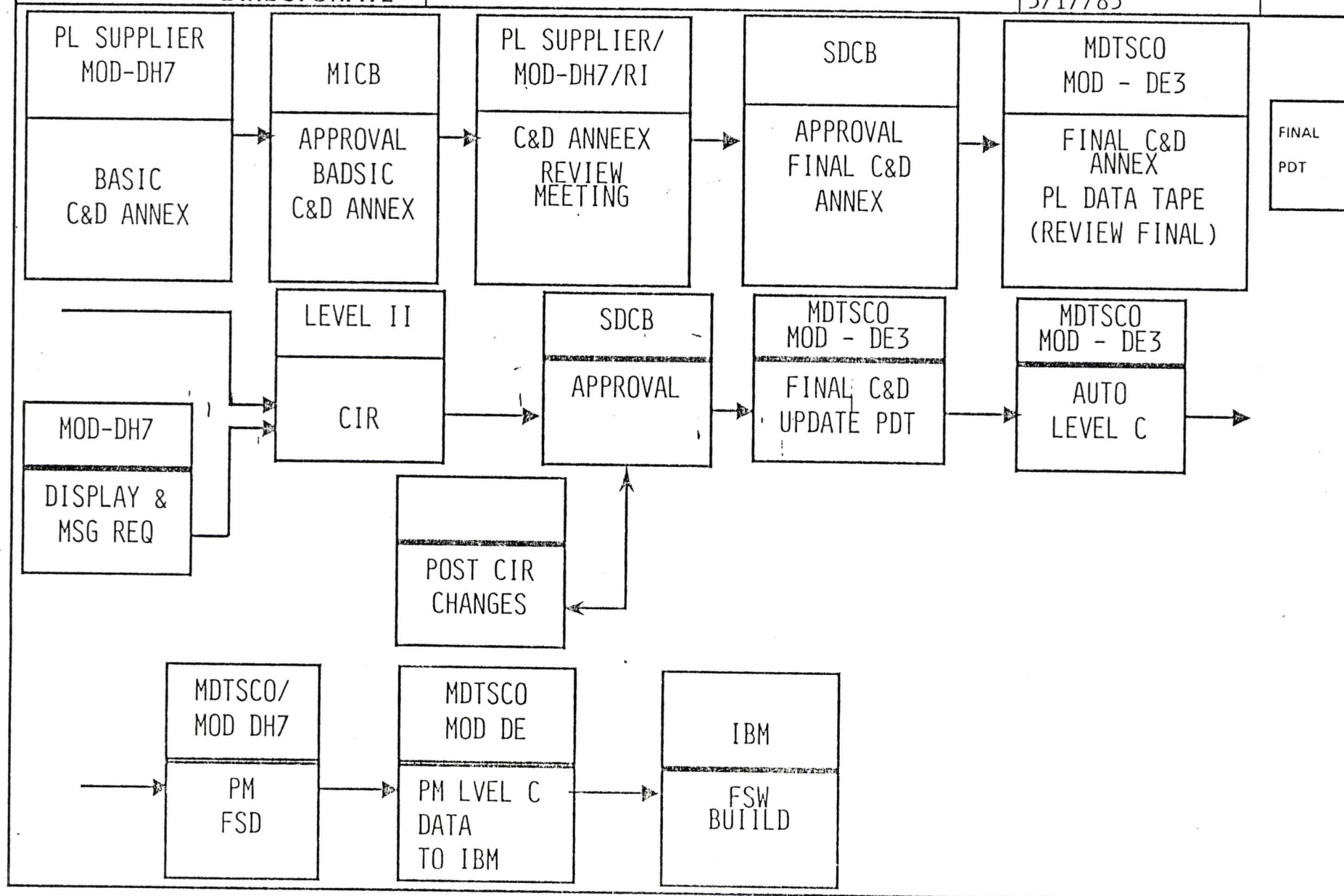
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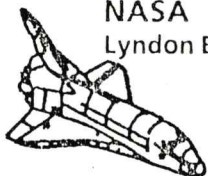
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SHUTTLE DATA TAPE (SDT) BUILD PROCESS

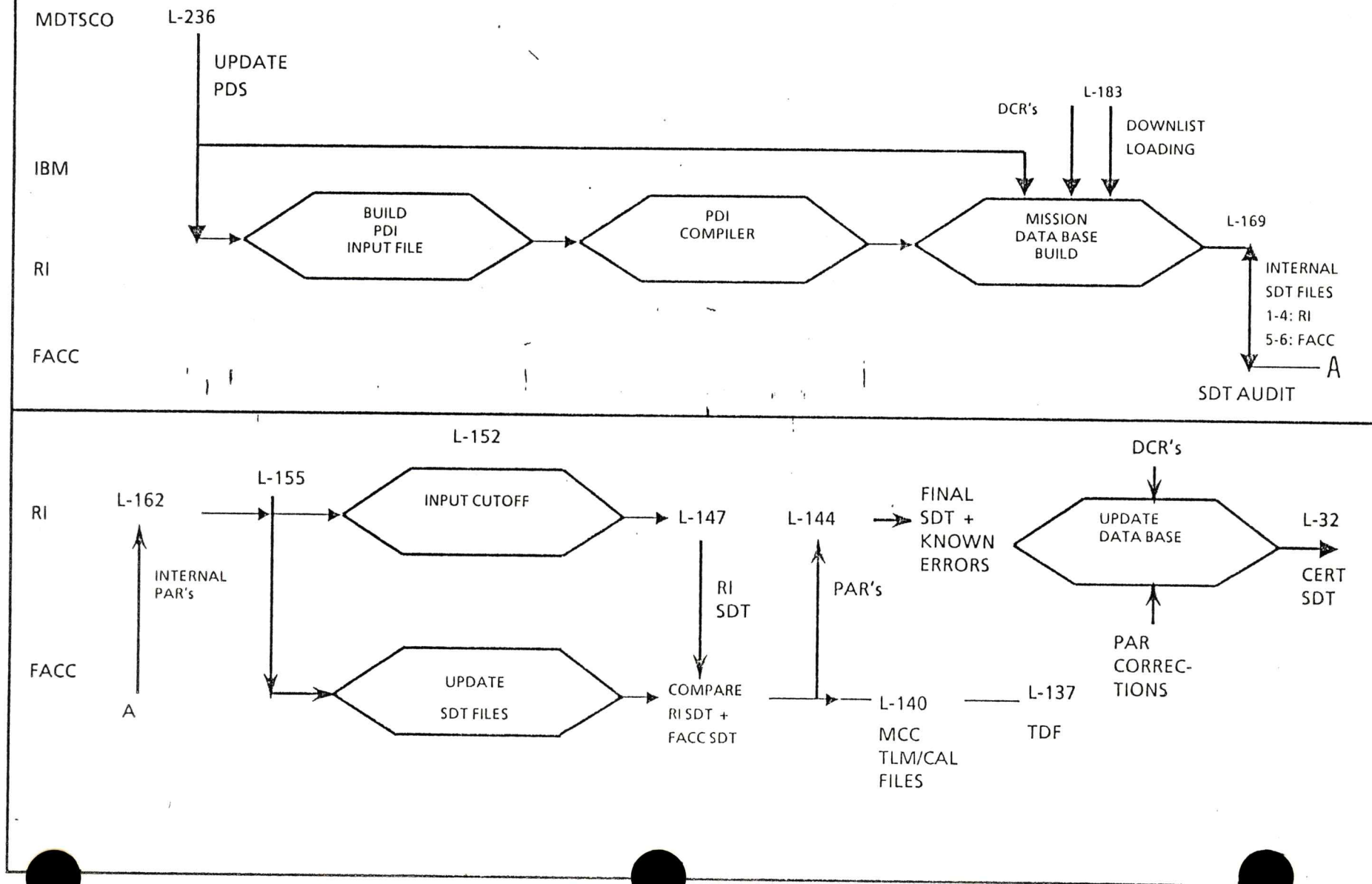
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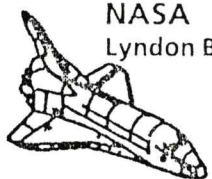
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PAYLOAD DATA TAPE (PDT) TELEMETRY DESCRIPTOR TAPE (TDT)

- DATA BASE CHANGE FILE IS CONSTRUCTED FROM PAPER DATA CHANGE REQUEST (DCR)
- DCR CHANGE FILE IS COMPARED AGAINST BASELINE DATA IN DATA BASE (IF AVAILABLE)
- DESK AUDIT USED TO VALIDATE DCR CHANGE FILE
- PDT IS VALIDATED BY ROCKWELL/DOWNEY UTILIZING AUTO-CHECK PROGRAM. TDT DOES NOT UNDERGO INDEPENDENT VALIDATION

SHUTTLE DATA TAPE (SDT)

- DATA BASE CHANGE FILE IS CONSTRUCTED FROM PAPER DCR INPUT
- CHANGE FILE LISTING IS NORMALLY PART OF APPROVED DCR
- DESK AUDIT USED TO VALIDATE ANY CHANGES RESULTING FROM DCR APPROVAL
- DCR CHANGE FILES, DOWNLIST LOADING, PDT, AND PDI COMPILER OUTPUT ARE USED TO BUILD MISSION DATA BASE
- SDT IS AN AUTOMATIC EXTRACT FROM THE MISSION DATA BASE
- SDT IS INDEPENDENTLY VALIDATED UTILIZING FORD (FACC) AUTO-CHECK PROGRAM. THIS PROGRAM PERFORMS CONSISTENCY CHECKS AND THUS WILL NOT FIND ALL ERRORS



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SM/PM LEVEL C DATA SET

- LEVEL C TSO DATA SET IS UPDATED ON A MISSION BASIS WITH APPROVED DCR's
- DESK AUDIT PERFORMED ON THE RESULTING MISSION DATA SET
- DATA SET IS VALIDATED WITH THE SM/PM PREPROCESSOR. PREPROCESSOR PERFORMS DATA CONSISTENCY AND FORMAT CHECKS

DOWNLIST DATA SET

- DOWNLIST TSO DATA SET IS UPDATED ON AN OI RELEASE BASIS WITH APPROVED SCR's
- DESK AUDIT PERFORMED ON THE RESULTING DATA SET
- PAYLOAD DOWNLIST DATA GENERATED FROM AUTO LEVEL C PROGRAM IS MERGED WITH OI DOWNLIST DATA SET
- RESULTING MISSION DOWNLIST DATA SET IS COMPARED TO OI DOWNLIST DATA SET USING DOWNLIST PREPROCESSOR
- DESK AUDIT PERFORMED ON RESULTING DELTAS



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SDT/MCC CONFIGURATION INCOMPATIBILITY

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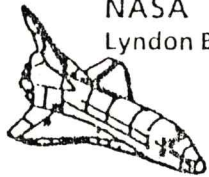
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SOLUTION

- FOR EACH FLIGHT PLAN TO COMPARE THE CERTIFIED SDT WITH THE TDF (FAAC RESPONSIBILITY) AND WITH THE FINAL SDT (RI RESPONSIBILITY)
- ALL DELTAS WILL BE ANALYZED AND BRIEFED TO MOD MANAGEMENT
- DH7 MISSION MANAGER WILL BE RESPONSIBLE FOR DEFINING AND UNDERSTANDING, AND REPORTING THE END-TO-END DATA CONFIGURATION STATUS
- IMPLEMENTATION STARTS WITH STS 51-G



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MAST (MEASUREMENT AND STIMULI) PRODUCTION

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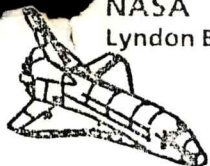
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- MAST II/STAR
 - ENHANCEMENTS
 - SOFTWARE TOOLS PERFORM DATA AUDITS AND CONSISTENCY CHECKS AT FRONT-END OF RECONFIGURATION PROCESS; I.E., AS PART OF DATA COLLECTION AND BASELINE CYCLE
 - DATA ENTRY ERRORS AFTER DATA BASELINE ELIMINATED
 - SOFTWARE TOOLS AUTOMATE PRODUCT GENERATION
 - RESULT IS PRODUCT QUALITY IMPROVEMENT AND SHORTEN RECONFIGURATION TEMPLATE
 - SCHEDULE
 - IOC JULY 1985



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MAST II/STAR AUDIT EXAMPLES

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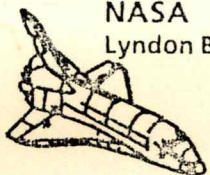
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- AUDITS WERE DESIGNED TO PREVENT DATA ENTRY ERRORS AND DATA CONSISTENCY PROBLEMS
- DATA TYPE AND CALIBRATION MUST BE CONSISTENT
 - ANALOG PARAMETER CALIBRATED
 - DISCRETE PARAMETER NOT CALIBRATED
- CALIBRATION DATA INTERNALLY CONSISTENT
 - ENGINEERING UNITS = PCM COUNTS X COEFFICIENTS
- TELEMETRY DATA INTERNALLY CONSISTENT
 - IF TLM FLAG = D (DOWNLIST) THEN TLM FORMAT NUMBER = 12, 13, 20, 21, 22, 23, 24, ETC.
- PARAMETER MUST EXIST IN PAYLOAD OR VEHICLE DATA BASE TO BE ON DISPLAY
- SCREEN AUDITS REQUIRE DATA TO BE FORMATTED CORRECTLY



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FUTURE DATA COLLECTION ENHANCEMENTS

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- AUTOMATE DATA COLLECTION PROCESS FOR POCC ANNEX 5
- FURTHER AUTOMATION OF PAYLOAD DATA COLLECTION PROCESS
 - BETTER PARTITIONING OF PAYLOAD DATA
 - ELECTRONIC DATA TRANSFER FROM SOME PAYLOAD SUPPLIERS
 - USER FRIENDLY DATA COLLECTION INTERFACES