RSOC

FLIGHT DESIGN & DYNAMICS / 330

SUBJECT:

STS-32 / LDEF RETRIEVE
DAY-OF-RENDEZVOUS
ONBOARD OPERATIONS

NAME:
JAMES OBERG
R16C / 282-2806

DATE: MAY 4, 1990

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STS-32 / LDEF RETRIEVE DAY-OF-RENDEZVOUS ONBOARD OPERATIONS

INITIATION OF RENDEZVOUS OPERATIONS

RR / ST2 / NCC

LONG TI versus "HOT" APPROACH

MIDCOURSE BURNS

TERMINAL PHASE TRAJECTORY

PROP USAGE

VISIBILITY

COMPLETION

OPEN ITEMS

INITIATION OF RENDEZVOUS OPERATIONS

NOMINAL ENTRY INTO RENDEZVOUS FDF
at MET 2/19:11 (PET -4:30)

NO SYSTEMS ISSUES IMPACTING PROCEDURES

AXIS-BY-AXIS NC BURN PERFORMED IN TARGET TRACK

NOMINAL STAR TRACKER ST1 PASS, 177 MARKS

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RR / ST2 / NCC

RR LOCKON IMMEDIATE AT 140 KFT
GPO/ONAV/INCO DETERMINED RANGE TO REMAIN WITHIN MAX 27.2 NM
DESIRED PROCEDURE TO TAKE RANGE DATA AS SOON AS AVAILABLE

NCC EVOLUTION

<--- GROUND NAV ---><---------- ONBOARD NAV ---------->

POST-NC ("NAILED') | LATER TRACKING (NO KNOWN CAUSE) | FIRST RR DATA | PRELIM SOL (PRE-ST2) | INTERMED SOL | ON GROUND (BAD RR) | FINAL SOL (POST REPAIR) | TIG (LAMBERT)

PROBLEMS:

INADEQUATE TEAM RECOGNITION OF HOW BAD FLTR SV WAS,
AND HOW SLOWLY IT WAS GETTING BETTER
INADEQUATE TEAM APPRECIATION OF ACCURACY OF GROUND SOLUTION

GPO FELT THAT ON-BOARD SOLUTION, EVEN IF WRONG, WOULD PRODUCE
A MANAGEABLE (FAMILIAR FROM SIMS) LONG Ti CASE

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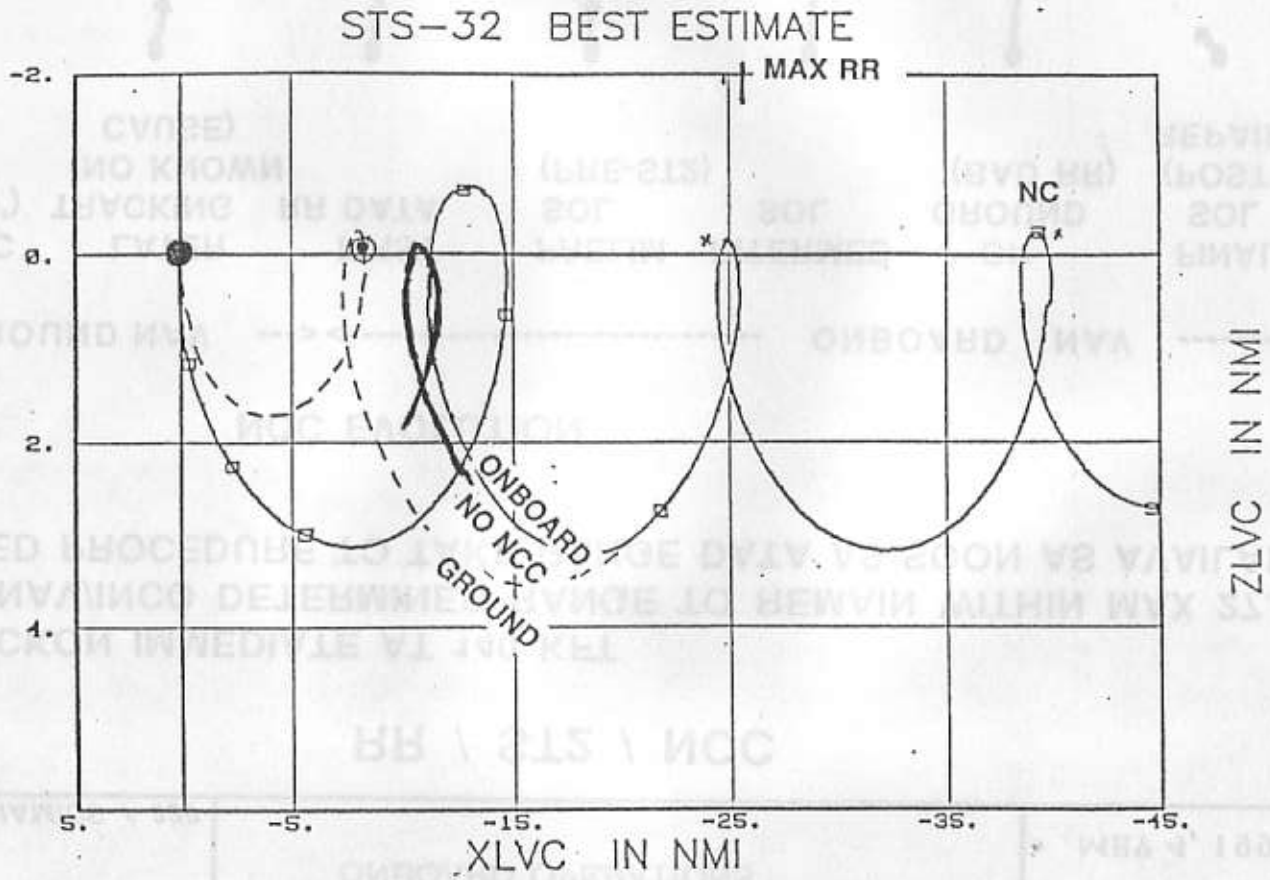
GROUND versus ONBOARD NCC SOLUTION



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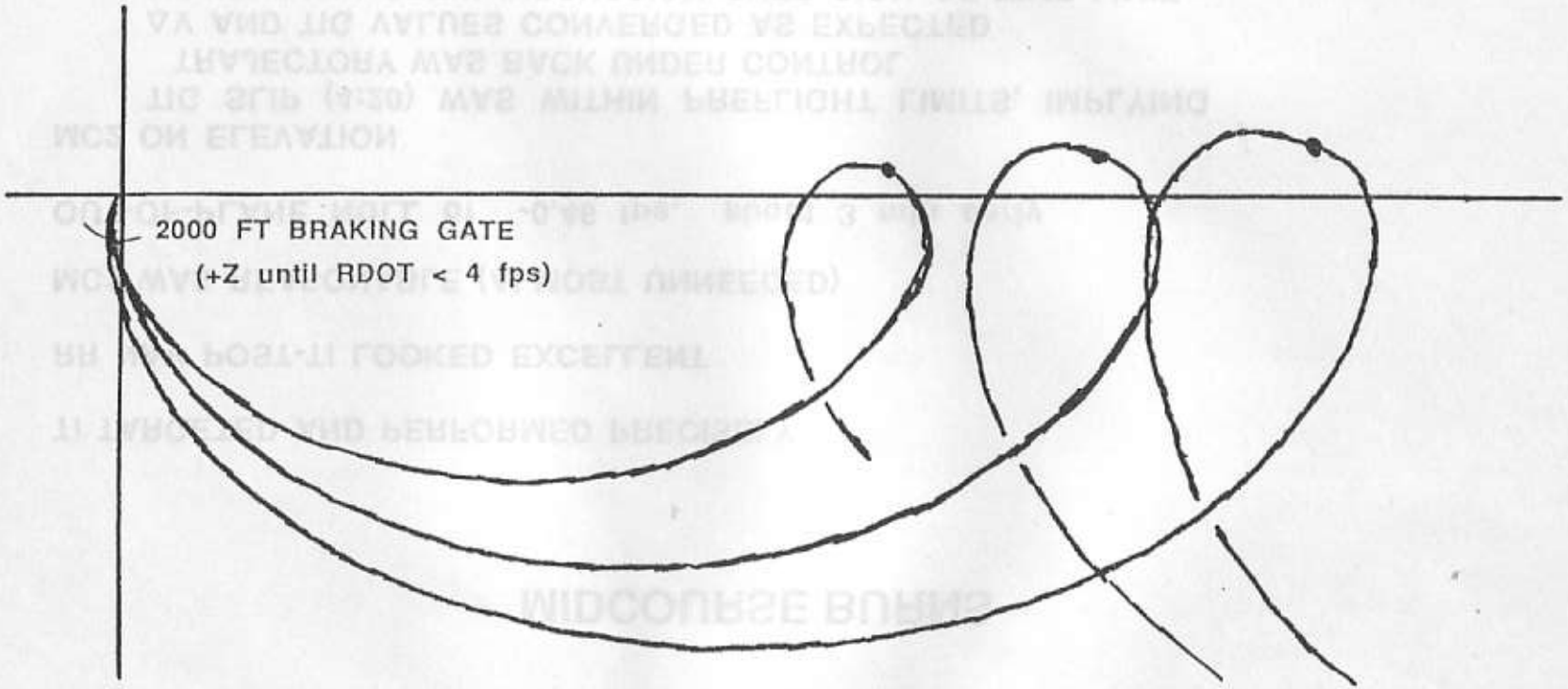
LONG TI versus "HOT" APPROACH



FIRST MANUAL BRAKING GATE:

NOMINAL:	5.8 fps @ 2000 ft	DV = 1.8 fps
12-NM Ti:	8-9 fps @ 2000 ft	DV = 4-5 fps

MIDCOURSE BURNS

Ti TARGETED AND PERFORMED PRECISELY

RR NAV POST-Ti LOOKED EXCELLENT

MC1 WAS REASONABLE (ALMOST UNNEEDED)

OUT-OF-PLANE NULL of -0.46* fps, about 3 min early

MC2 ON ELEVATION
- TIG SLIP (4:20) WAS WITHIN PREFLIGHT LIMITS, IMPLYING TRAJECTORY WAS BACK UNDER CONTROL
- ΔV AND TIG VALUES CONVERGED AS EXPECTED
- MOMENTARY CREW DISCUSSION OVER SIGN OF TIME LIMIT
- FINAL ΔV MAGNITUDE (-.7/0/1.7) WAS REASONABLE
- PERFORMED MUCH FARTHER OUT

MC3, 4 NOMINAL

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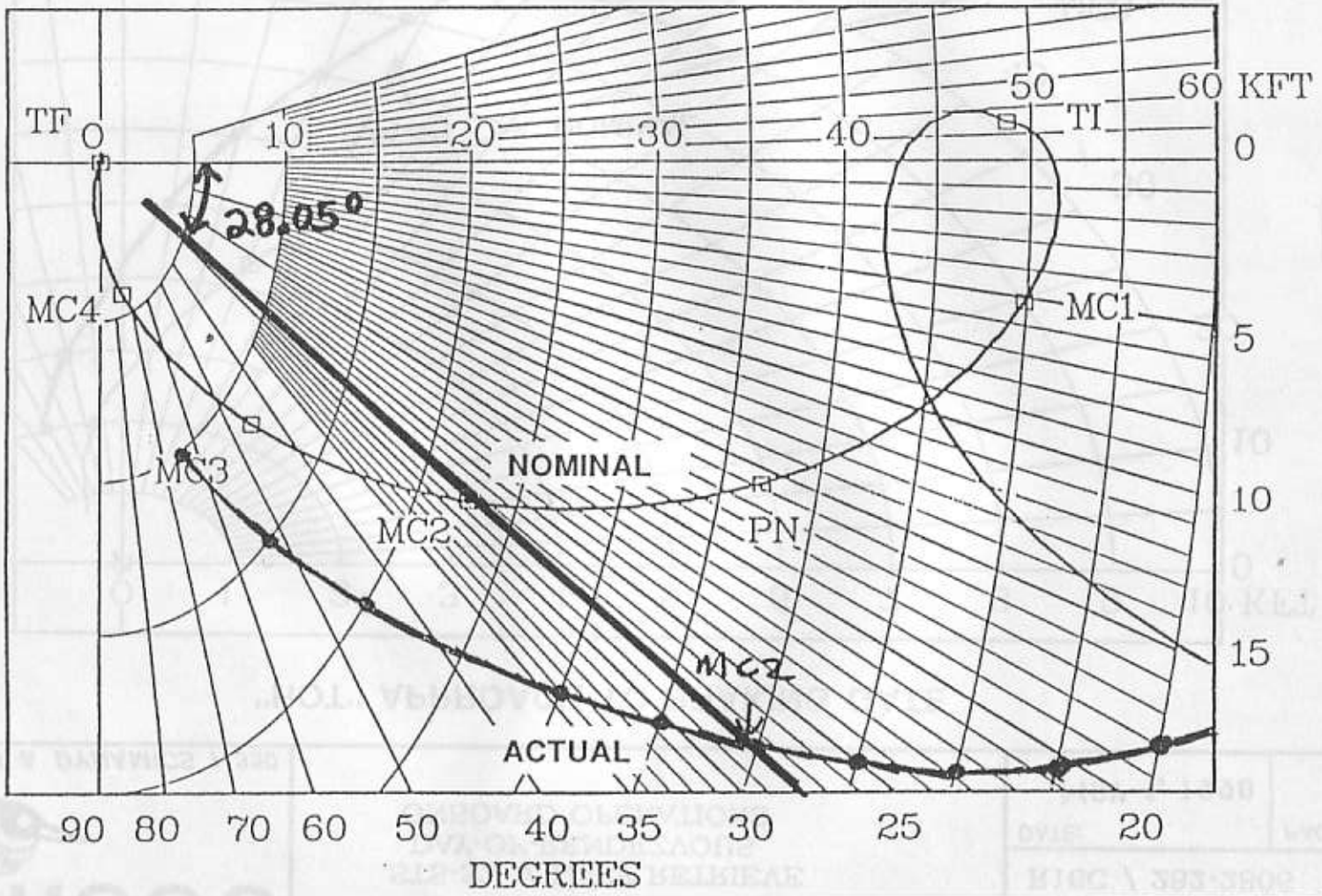
MC2 PERFORMED "ON ELEVATION"



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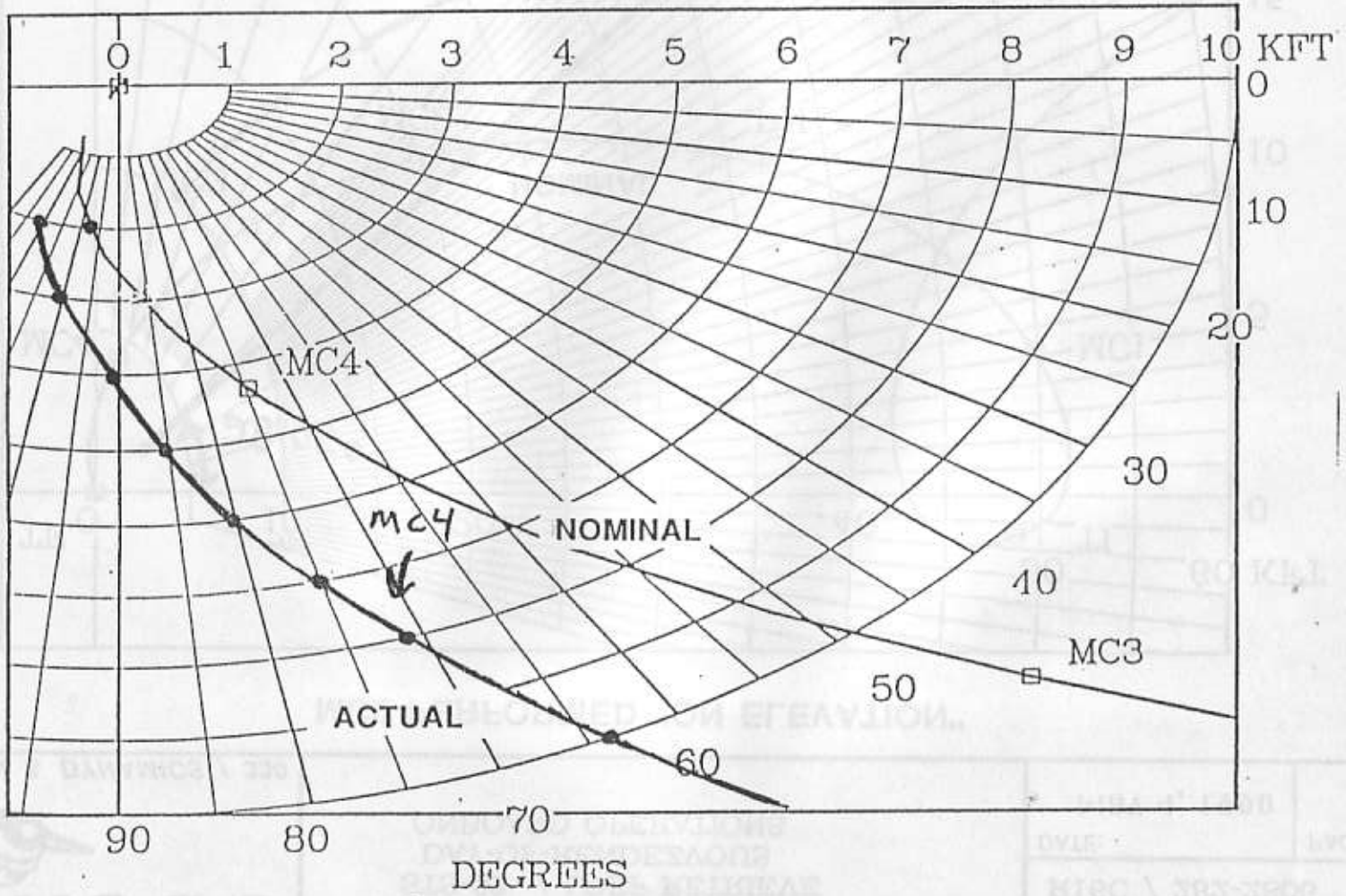
"HOT" APPROACH TO BRAKING GATE



OPTIONS FOR "HOT" APPROACH

A. INSERT EARLIER GATE — RESULTS IN VBAR CROSSING FARTHER OUT (SEEN IN SIM, DISCUSSED AND REJECTED)

B. NOMINAL PROCEDURES — DO BIGGER BURN AT FIRST GATE

OUTCOME:

- FD INFORMED OF EXPECTED DYNAMICS (DOUBLE NORMAL-SIZE BURN) POST-MC2
- PAYLOAD CONTAMINATION DISCUSSED WITH PL, NO CONCERNS
- PLUME TORQUING CONCERNS DISCUSSED BY TEAM, GPO
  CONCLUDED WOULD NOT BE OF SIGNIFICANT CONCERN
  (POSTFLIGHT ANALYSIS CONFIRMED LARGE SAFETY MARGIN)
- CREW BEGAN BRAKING AT ABOUT 2500 ft
- BY 2000 ft WERE RIGHT ON THE NOMINAL APPROACH RATE (4 fps)
  BUT SEVERAL HUNDRED FEET OFF IN +X DUE TO "HOT" TRAJECTORY

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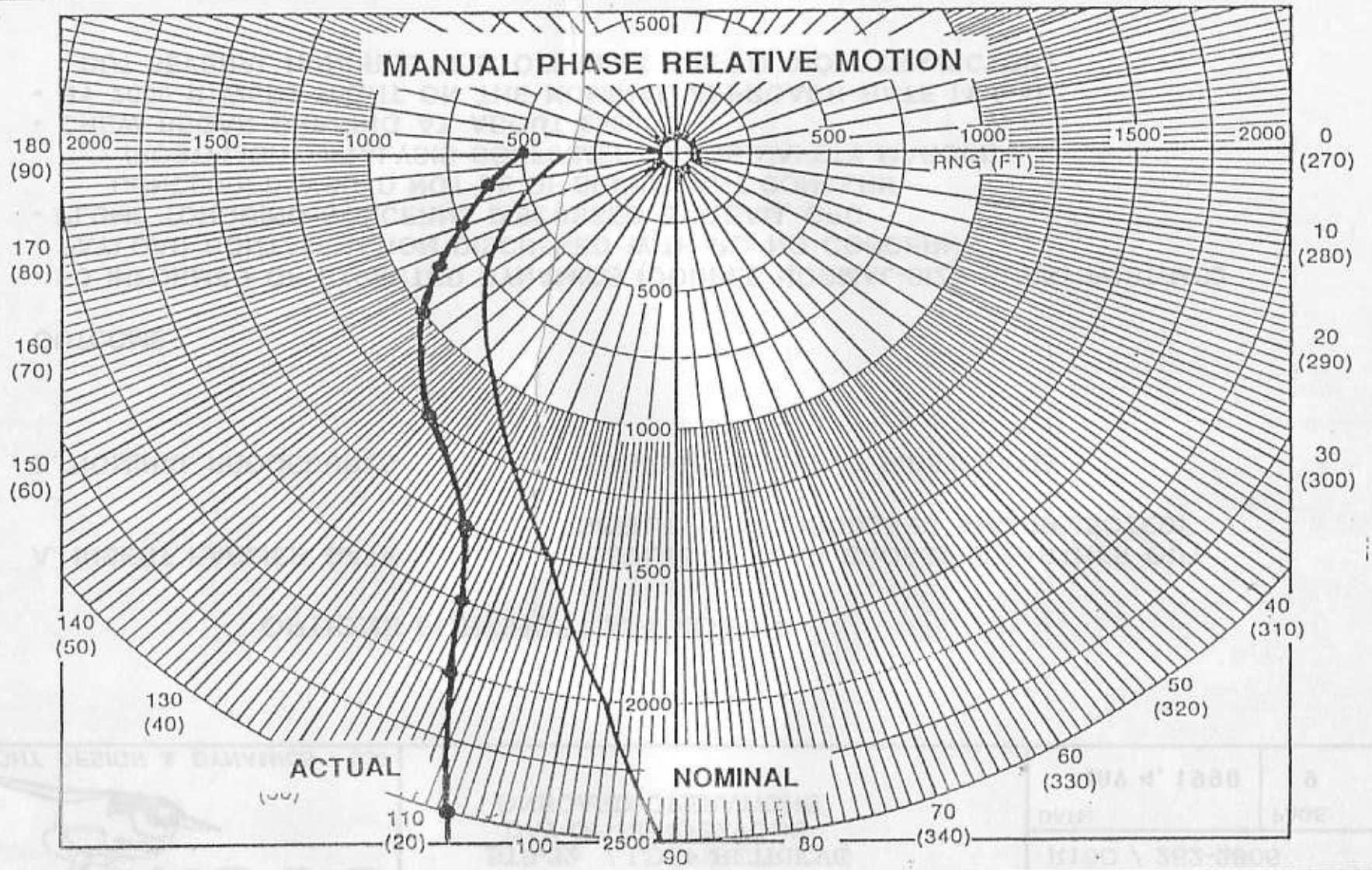

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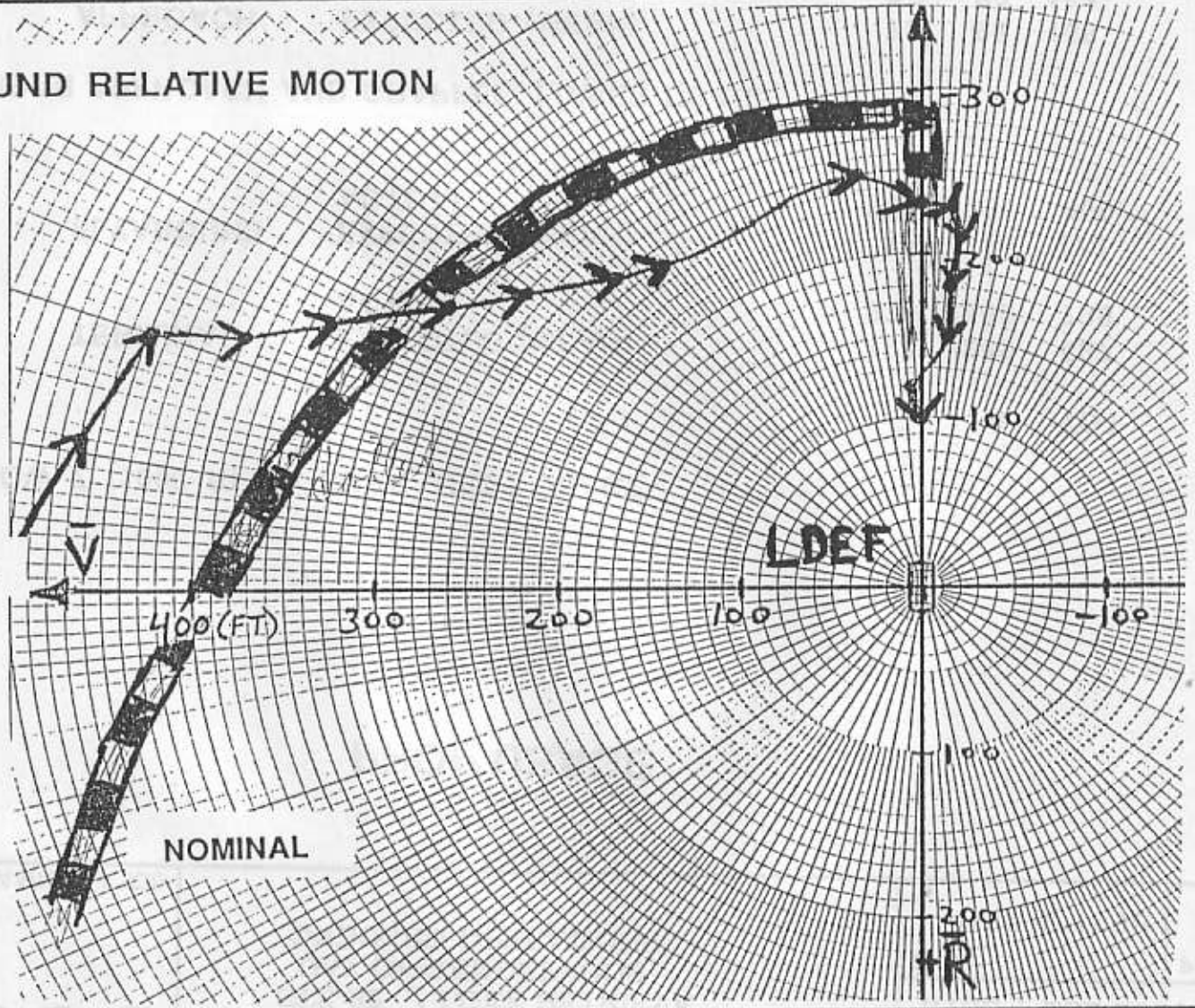
FLYAROUND RELATIVE MOTION



PROP USAGE

LOW Z (1000 ft) TO RBAR, HIGH USAGE

		F	A	TOT
TERMINAL	EXPECTED (MEAN)	197	240	437
	ACTUAL	330	400	730
FLYAROUND	EXPECTED (MEAN)	92	81	173
	ACTUAL	238	231	469

RBAR APPROACH AND GRAPPLE, LOWER USAGE

APPROACH	EXPECTED (MEAN)	70	98	168
	ACTUAL	75	89	164

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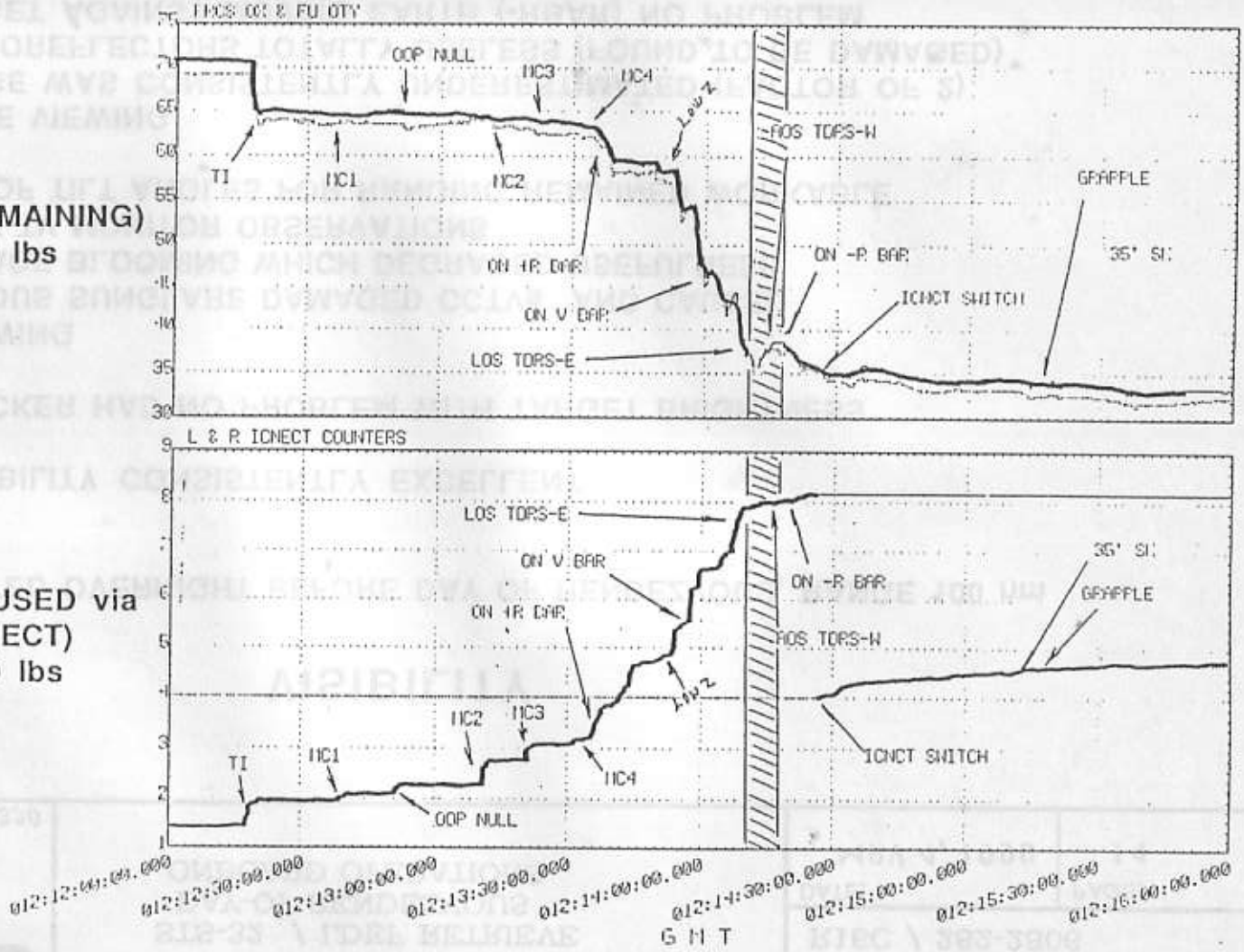
PROPELLANT TIME HISTORY

F RCS (PERCENT REMAINING)
1 % = approx 20 lbs

AFT RCS (PERCENT USED via OMS INTERCONNECT)
1 % = approx 130 lbs



VISIBILITY

TGT SPOTTED OVERNIGHT BEFORE DAY OF RENDEZVOUS, RANGE 100 nm

COAS VISIBILITY CONSISTENTLY EXCELLENT

STAR TRACKER HAD NO PROBLEM WITH TARGET BRIGHTNESS

CCTV VIEWING
- SERIOUS SUNGLARE DAMAGED CCTVs AND CAUSED IMAGE BLOOMING WHICH DEGRADED USEFULNESS OF TV MONITOR OBSERVATIONS
- USE OF TILT ANGLES FOR RANGING REMAINED WORKABLE

NAKED EYE VIEWING
- RANGE WAS CONSISTENTLY UNDERESTIMATED (FACTOR OF 2)
- RETROREFLECTORS TOTALLY USELESS (FOUND TO BE DAMAGED)
- TARGET AGAINST MOVING EARTH (-RBAR) NO PROBLEM

NIGHT VIEWING
- PLB LIGHTS GOOD TO 250 ft (OBSERVED) AND PROBABLY TO 400 ft (ESTIMATED)
- STREAMLIGHT WAS AVAILABLE BUT NOT USED (NO NEED)