NLSRT Memo No. 35

This was the study that led JPL to build new 34 m antennas. PMD

ANTENNA IMPLEMENTATION COSTS

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AMR-1
1/30/81

THE ISSUE

GIVEN THAT THE ANTENNAS FOR THE CONSOLIDATED NETWORKS ARE TO BE COLOCATED, SHOULD OLD ANTENNAS BE RELOCATED OR SHOULD NEW ANTENNAS BE BUILT?

APPROACH

EXAMINE THE COSTS AND OTHER PROS AND CONS OF:

(1) BUILDING NEW ANTENNAS FROM SCRATCH

VERSUS

(2) RELOCATING AND MODIFYING OLD ANTENNAS

INFORMATION SOURCES

1. A COST BREAKDOWN SUMMARY PREPARED BY R. J. WALLACE

2. A HARRIS CORPORATION PRELIMINARY ENGINEERING REPORT FOR THE LAAS STUDY

3. PERSONNEL FROM

    a. E-SYSTEMS, INC.

    b. FORD AEROSPACE WESTERN DEVELOPMENT LABORATORY

    c. HARRIS CORPORATION

    d. TORONTO IRON WORKS

4. A SCIENTIFIC-ATLANTA CATALOG

5. JPL PERSONNEL FROM OFFICE 430 AND DIVISIONS 35 AND 37

INFORMATION OBTAINED

COST VERSUS DIAMETER DATA

1. COMMITTED SITUATIONS
    a. ANTENNAS ALREADY BUILT
    b. ANTENNAS FOR WHICH FIRM COMMITMENTS TO BUILD HAD BEEN MADE

2. CAPABILITIES
    a. X-BAND
    b. K_u-BAND
    c. K_a-BAND

3. "INCLUSIONS"
    a. FOUNDATIONS
    b. PEDESTALS
    c. STRUCTURAL ELEMENTS
    d. MECHANICAL ELEMENTS
    e. DRIVES
    f. ANGLE READOUTS
    g. ERECTION AT SITE
    h. X-BAND QUALITY PANELS

4. "EXCLUSIONS"
    a. ELECTRONICS
    b. FEEDS

ANALYSIS

1. COST DATA WERE CONVERTED TO FY '80 DOLLARS USING PRICE DEFLATERS OR INFLATERS OF 10% PER ANNUM.

2. DATA WERE PLOTTED TO IDENTIFY PATTERNS. (LINEAR, LOG-LOG, AND SEMILOG PLOTS WERE USED.)

3 CURVES WERE FAIRED IN, TENDING TOWARD THE HIGH-COST SIDE WHERE THERE WAS AMBIGUITY.

4. COSTS FOR 34-METER AND 40-METER DIAMETER ANTENNAS WERE OBTAINED FROM THE CURVES.

ANTENNA IMPLEMENTATION COSTS

FY '80 $, millions

	34-m Converted X-band	34-m New X-band	40-m New X-band	34-m New K_a-band	40-m New K_a-band
One-time costs					
Design	0.7	1.3	1.5	2.1	2.1
Fabrication fixturing	-	0.1	0.16	0.12	0.23
Erection mobilization* (per complex)	-	0.05	0.08	0.06	0.12
Total one-time costs	0.7	1.55	1.9	2.4	2.7
Unit costs					
Relocation	1.0	-	-	-	-
JPL Engr. & Mgt.	1.0	1.0	1.0	1.0	1.0
Facilities	0.4	0.4	0.4	0.4	0.4
Antenna	3.4	3.25	5.1	3.9	6.6
Total unit costs	5.8	4.65	6.5	5.3	8.0
Total costs for 2 antennas per complex, 3 complexes	35.5	29.45	41.5	34.2	50.7
Total costs for 2 antennas each in Spain and Australia and 3 in California				39.5	
Contingencies, to be added	10%	10%	10-20%	10-20%	10-20%

* Differences in these numbers are probably insignificant.

PROS AND CONS FOR BUILDING ANTENNAS FROM SCRATCH (34-METER OR LARGER)

PROS FOR BUILDING FROM SCRATCH

REQUIRES LESS DSN DOWNTIME DURING NCP IMPLEMENTATION

REDUCES OVERALL PROGRAM RISK
- REDUCES THE AMOUNT OF INTERDEPENDENT SCHEDULING WITHIN NCP
- DECOUPLES NCP IMPLEMENTATON FROM STS AND TDRSS SCHEDULES AND RESIDUAL GSTDN COMMITMENTS

IS LIKELY TO OFFER BETTER PERFORMANCE

CAN COST LESS IF DESIGN COSTS ARE AMORTIZED OVER A SUFFICIENT NUMBER OF ANTENNAS

CAN POSSIBLY PROVIDE STRUCTURES FOR FUTURE K_a-BAND USE

MAY ACHIEVE SAVINGS IN CONTRACT MANAGEMENT BY GROUPING PROCUREMENTS

CAN POSSIBLY LEAD TO EARLIER SAVINGS OF OPERATIONS COSTS (REQUIRES EARLIER COMPLETION OF THE MONITOR AND CONTROL SUBSYSTEM THAN NOW PLANNED)

PROS AND CONS FOR BUILDING ANTENNAS FROM SCRATCH (34-METER OR LARGER), CONTINUED

CONS FOR BUILDING FROM SCRATCH

REQUIRES MORE DESIGN EFFORT UP FRONT (BUT DOES NOT NECESSARILY LENGTHEN THE OVERALL SCHEDULE)

MAY POSSIBLY REQUIRE SLIGHTLY HIGHER CONTINGENCIES FOR THE FIRST ARTICLE

CONCLUSION

BUILDING NEW ANTENNAS IS A BETTER INVESTMENT THAN RELOCATING AND MODIFYING EXISTING ANTENNAS