Viking Mission Support

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DSN support for Viking continues to move forward into the implementation phase in accordance with new schedules developed to meet a new Viking requirement for advanced DSS readiness dates. Network configurations for the DSN Tracking System, DSN/Viking interfaces, and schedule revisions are discussed, and the continued investigation of the downlink interference effects caused by a dual carrier environment at DSS 13 is described.

I. Introduction

Over the past 2 months DSN support for Viking continued to move forward toward developing a definitive plan for implementation and operations. This activity was somewhat diverted by internal changes in the Tracking and Data Acquisition (TDA) Office organization, which required new definitions in working relationships between the DSN Managers, DSN Operations, DSN Systems Engineering, and the implementing divisions.

The outcome of this activity is depicted in Fig. 1, which shows the three clearly defined phases of DSN activity leading to commitment of DSN facilities to Project support. Existing schedules, interfaces, and documentation have had to be revised in the light of these new agreements.

II. Configuration

The DSN Tracking System configuration for Viking is shown in Fig. 2. Subsequent issues of this Technical Report will describe the remaining systems; namely, Command, Test, and Training.

It should be noted that, to meet the navigation requirements of the second spacecraft prior to its Mars orbit insertion, it is necessary to provide planetary ranging capability at one 26-m-diameter antenna station (DSS 12). This requirement is necessitated by the fact that the entire 64-m subnetwork is entirely occupied in meeting the needs of the first Viking Orbiter/Lander, which will, by that time, be involved in Mars landed operations.

III. Interfaces

The RF interfaces between the DSN and Viking Orbiter and Viking Lander have been fully defined, and the documents are awaiting final review and signoff. The document describing the interface between the DSN and the Viking Mission Control and Computing Center remains in the development stage.

IV. Schedules

As mentioned above, a substantial revision of the Level 3 and Level 5 DSN schedules for Viking has been necessary following Viking demands for advanced readiness dates for all DSSs to May 1, 1975. Previous schedules were based on launch and cruise readiness only, with full readiness for planetary operations to follow several months after launch.

The necessary schedule revisions have been accomplished and are now being compared with the relevant budget line items to ensure that implementation plans are consistent with Viking needs.

The Management Information Control System (MICS) and computer-based Work Authorization Document Schedule (WADSKED) are being used as tools in this process, which will lead to the development of a DSN Preparation Plan for Viking.

V. Problem Areas

The downlink interference problems caused by operation of dual carriers from a single antenna continue to be investigated at DSS 13. This developmental station has been completely reconfigured to provide a "test bed" which can be used for a detailed experimental study of these intermodulation product (IMP) effects. At this time, the reconfiguration is complete and is being checked out by verifying some of the earlier results obtained at DSS 14. Work is to continue toward a major review in late December 1972.

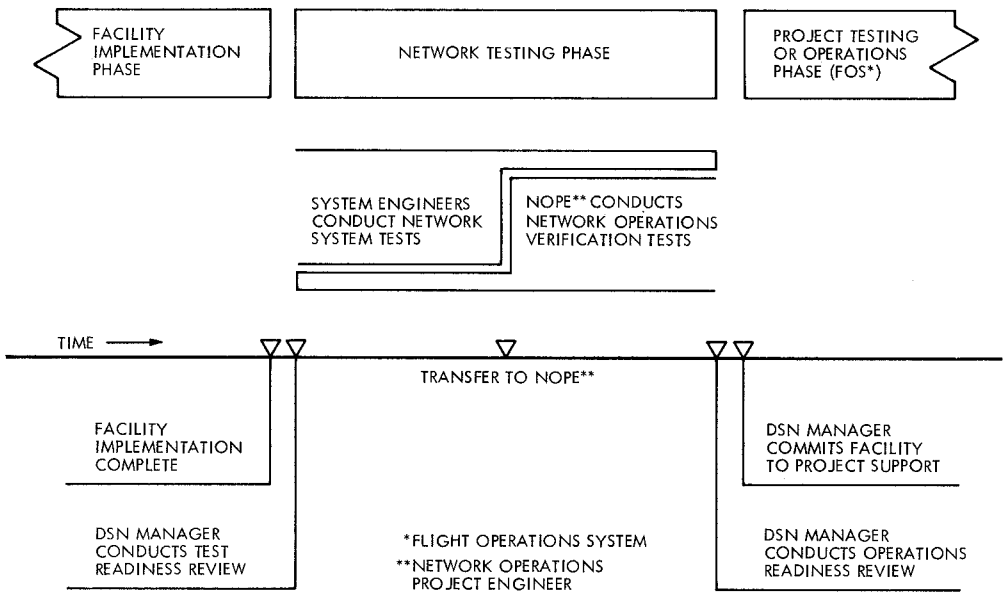
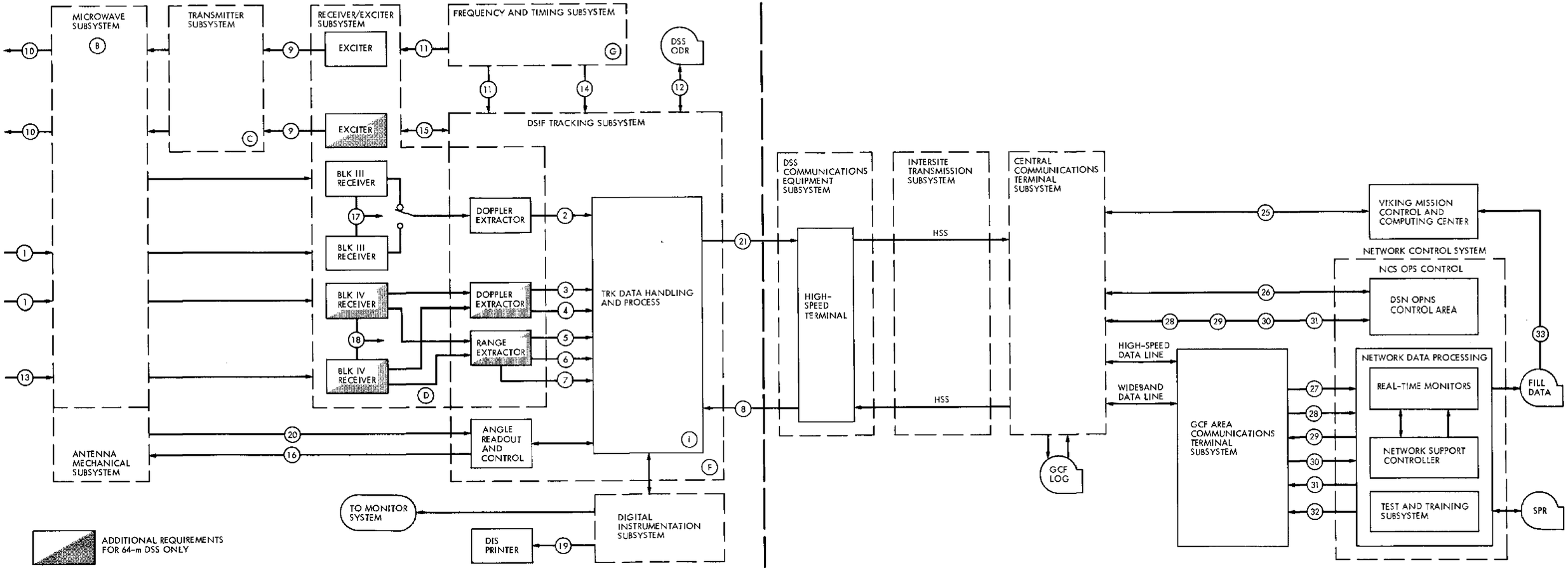


Fig. 1. Three phases of DSN activity



DATA FLOW PATHS

1. TWO-WAY S-BAND DOWNLINKS FROM UP TO TWO ORBITERS OR ONE ORBITER AND ONE LANDER. TWO CARRIERS PER 64-m DSS; ONE CARRIER PER 26-m DSS
2. S-BAND DOPPLER DATA FROM EITHER ONE OF TWO BLOCK III RECEIVERS
3. S-BAND DOPPLER DATA FROM ONE BLOCK IV RECEIVER
4. X-BAND DOPPLER DATA FROM THE OTHER BLOCK IV RECEIVER
5. S-BAND RANGING DATA FROM ONE BLOCK IV RECEIVER
6. X-BAND RANGING DATA FROM ONE BLOCK IV RECEIVER
7. S-BAND AND X-BAND DRVID DATA FROM ONE ORBITER OR ONE LANDER
8. HIGH-SPEED PREDICTS, ACQUISITION MESSAGES, STANDARDS AND LIMITS, AND ODR RECALL REQUESTS
9. TRANSMITTER DRIVE, MODULATED WITH RANGING SIGNALS WHEN REQUIRED. RANGE MODULATION OF ONLY ONE CARRIER AT A TIME
10. S-BAND UPLINKS TO TWO ORBITERS OR ONE ORBITER AND ONE LANDER. TWO CARRIERS PER 64-m DSS; ONE CARRIER PER 26-m DSS
11. REFERENCE FREQUENCY
12. DIGITAL ODR OF ALL SUBSYSTEM DATA OUTPUTS (DOPPLER, RANGE, ANGLES, FREQUENCY REFERENCES, STATION PARAMETERS, AND CALIBRATION DATA)
13. ONE-WAY COHERENT X-BAND DOWNLINK FROM EITHER ONE OF TWO ORBITERS
14. TIME
15. FREQUENCY REFERENCES AND SEQUENTIAL RANGING MODULATION
16. ANTENNA DRIVE SIGNALS
17. S-BAND AGC FROM EITHER OR BOTH BLOCK III RECEIVERS
18. S-BAND OR X-BAND AGC FROM EITHER OR BOTH BLOCK IV RECEIVERS
19. PAGE PRINT OF DSS PREDICTS FROM NCS OPERATIONS CONTROL
20. ANTENNA POINTING ANGLES
21. TRACKING DATA FROM DSIF TRACKING AND MONITOR AND CONTROL SUBSYSTEM (DTS) TO VMCCC VIA HSS
22. DSS PARTIAL STATUS AND DETECTED ALARMS TO DSN MONITOR SYSTEM
23. DSN TRACKING SYSTEM ALARMS TO DSN MONITOR SYSTEM
24. NOT USED
25. REAL-TIME TRACKING DATA AND GFC RECALL TO VMCCC VIA HSS FOR DATA PROCESSING
26. TRACKING REQUESTS TO AND DISPLAYS FROM NCS DATA PROCESSING FUNCTION
27. REAL-TIME DIGITAL TRACKING DATA FROM DSS TO RTM'S; REQUESTS FROM AND DISPLAYS TO DSN OPERATIONS AREA
28. REQUESTS FROM DSN OPERATIONS FOR TRACKING STANDARDS AND LIMITS
29. DISPLAYS OF TRACKING STANDARDS AND LIMITS DATA TO DSS/DSN OPERATIONS
30. REQUESTS FROM DSN OPERATIONS FOR RECALL OF TRACKING DATA
31. DISPLAYS TO DSN OPERATIONS/DSS OF RECALL TRACKING DATA/ NETWORK DATA PROCESSING
32. DSN SIMULATION DATA FOR TRACKING
33. FILE TRACKING DATA TO PROJECT ON TAPE

Fig. 2. DSN/VK75 Tracking System baseline functional requirements