Viking Mission Support

D. J. Mudgway
Mission Support Office

The DSN support for Viking continues to move from the completion of the planning and negotiating phase into the implementation phase in accordance with established schedules. Most documents reflecting this activity have been completed, and a major Project review of the ground data system design for Viking has been supported. A problem associated with the Viking requirement for simultaneous dual carrier operation is being investigated.

I. Introduction

The basic structure of DSN support for Viking was described in a previous article (Ref. 1). Over the past two months, activity has continued in all areas with the emphasis beginning to change from planning and negotiating towards design and implementation. At this stage, progress is best indicated by the completion and signoff of various documents reflecting agreements and decisions, and these are described below.

In one area, a significant technical problem has emerged and is being investigated at this time. Project-sponsored reviews of activity have been supported, with major effect being given to the Launch and Flight Operations Preliminary Design Review.

II. Configuration

The DSN configuration for Viking has now been defined in functional terms in Ref. 2 for each of the DSN Systems. The configuration of the DSN Telemetry System for Viking is given in Fig. 1. Subsequent issues of this report will describe the remaining systems — Command, Tracking, and Test and Training.

III. Interfaces

The RF interfaces between the Orbiter and DSN and between the Lander and DSN have now been defined and passed through final review in preparation for approval and release. In addition to the customary RF interface parameters and telecommunications link performance curves, these interface documents contain all the telemetry and command data formats and associated material. This is to ensure that the DSN software residing in the telemetry and command processors is properly accounted for in defining the overall flight/ground compatibility criteria.

The remaining DSN interface — with the Viking Mission Control and Computing Center — is being developed to cover all data flow between the DSN and Viking Mission Control and Computing Center (VMCCC) and is in draft form at the present time.

IV. Schedules

Major milestones on the Tracking Data System (TDS)/ Project schedules have been met with the release of the DSN Support Plan for Viking and the DSN support of the Flight Operations System Preliminary Design Review. As DSN support moves towards the implementation phase, the Level 5 and Level 6 schedules contained in the DSN Support Plan and the Facilities Preparation Plan will be used to report progress in these areas.

V. Problem Areas

The Viking requirement for simultaneous dual carrier operation led to a configuration at the 64-m DSSs involving excitation of a single klystron power amplifier by two carriers. To keep the intermodulation products at an acceptable level, it was proposed to run each dual carrier at a level about 10 dB below the maximum single carrier rating for each klystron.

In the course of testing this configuration over recent months, other effects related to carrier mixing on the antenna surface with consequent interference in the downlink have been noted. A substantial effort to investigate these effects has been mounted using DSS 13 as a "test bed." The objective of these tests is to obtain an understanding of the processes by which these undesired signals are generated and to investigate means by which they may be eliminated. The background to this work and present status are described in another article in this issue (D. A. Bathker and D. W. Brown, *Dual Carrier Preparations for Viking*).

References

1. Mudgway, D. J., "Viking Mission Support," in *The Deep Space Network Progress Report*, Technical Report 32-1526, Vol. X, pp. 22–26. Jet Propulsion Laboratory, Pasadena, Calif., Aug. 15, 1972.

2. *DSN Support Plan for Viking*, Document 616-3. Jet Propulsion Laboratory, Pasadena, Calif. (a JPL internal document).

A. DATA FLOW PATHS

(1) SIMULTANEOUS S-BAND CARRIERS FROM UP TO TWO ORBITERS AND ONE LANDER, EACH CARRYING TWO SUBCARRIERS. THREE CARRIERS PER 64-m DSS; TWO CARRIERS PER 26-m DSS

(2) ORBITER LOW-RATE TELEMETRY DATA, UNCODED, 8-1/3 OR 7-3/4 OR 33-1/3 bps

(3) LANDER MEDIUM-RATE TELEMETRY DATA, UNCODED 8-1/3 bps OR BLOCK CODED UP TO 1000 bps

(4) ORBITER HIGH-RATE BLOCK-CODED DATA, UP TO 16.2 kb/s OR 4 kb/s UNCODED DATA

(5) ILLUSTRATES GROUND AGC AVAILABLE FROM ANY RECEIVER TO 920 COMPUTER FOR TRANSMISSION TO VMCCC WITH TELEMETRY DATA STREAMS

NOTE: THIS INCLUDES X-BAND AGC WHEN EITHER OF BLOCK IV RECEIVERS IS IN X-BAND MODE

(6) OUTPUT OF ALL SUBCARRIER DEMODULATOR ASSEMBLIES (SDA) IS RECORDED

(7) PLAYBACK OF ANY OR ALL RECORDED SDA OUTPUT

(8) PERIODIC STATUS, SIGNAL-TO-NOISE RATIO (SNR) CALCULATIONS, DATA/TAPE LOSS ALARMS

(9) DIGITAL RECORDINGS OF 920 AND DATA DECODER ASSEMBLY (DDA) COMPUTER OUTPUT, PRIME ODR FOR TELEMETRY DATA, REPLAY OF TAPED DATA

(10) UNIVERSAL TIME REFERENCE

(11) REAL-TIME TELEMETRY DATA TRANSMISSION TO VMCCC AND NCS VIA HSS, ALL LOW-RATE AND MEDIUM-RATE DATA STREAMS, INCLUDING DSN TELEMETRY SYSTEM PARTIAL STATUS AND POSTPASS TAPE REPLAYS TO GCF LOG

(12) REAL-TIME TELEMETRY DATA TRANSMISSION TO VMCCC AND NCS VIA WBS, ONE 8-kb/s PLUS ONE 16-kb/s DATA STREAM FOR DSS 43 AND 63; TWO 16-kb/s DATA STREAMS FROM DSS 14, INCLUDING POSTPASS TAPE REPLAYS TO GCF LOG

(13) TDB

(14) DSS INITIALIZATION CONDITIONS AND TELEMETRY STANDARDS AND LIMITS FROM NCS TO DSS VIA HIGH-SPEED DATA LINE (HSDL)

(15) SPACECRAFT AGC, STATIC PHASE ERROR (SPE), AND COMMAND DETECTOR LOCK FROM TELEMETRY DATA TO STATION MONITOR CONSOLE FOR DSN COMMAND SYSTEM OPERATIONS

(16) PREDETECTION RECORDINGS, OUTPUT OF ALL RECEIVERS, NO PLAYBACK CAPABILITY

(17) PROVIDES FOR PROGRAM LOADING AND TRANSFER OF CONTROL INFORMATION FROM TCP COMPUTER TO DDA AND MONITOR INFORMATION FROM DDA TO TCP COMPUTER

(18) TELEMETRY DATA, INCLUDING PARTIAL STATUS, FORMATTED FOR HSDL TRANSMISSION TO VMCCC AND NCS

(19) TELEMETRY DATA, INCLUDING PARTIAL STATUS, FORMATTED FOR WBS TRANSMISSION TO VMCCC AND NCS IN 64-m SUBNET ONLY

(20) TELEMETRY DATA FORMATTED FOR HSS TRANSMISSION

(21) TO (24) NOT USED

(25) ROUTING OF ALL REAL-TIME TELEMETRY DATA TO VMCCC VIA HSS FOR DECOMMUTATION, FORMATTING, AND PROCESSING FOR DISPLAY

(26) TELEMETRY REQUESTS TO AND TELEMETRY DISPLAYS FROM NCS DATA PROCESSING FUNCTION

(27) REAL-TIME TELEMETRY DIGITAL DATA FROM DSS TO REAL-TIME MONITORS (RTM), REQUESTS FROM AND TELEMETRY DISPLAYS TO DSN OPERATIONS AREA

(28) REQUESTS FROM DSN OPERATIONS FOR TELEMETRY STANDARDS AND LIMITS TRANSMISSION TO DSS

(29) DISPLAYS OF TELEMETRY STANDARDS AND LIMITS DATA TO DSS/DSN OPERATIONS

(30) DISPLAYS FROM DSN OPERATIONS FOR RECALL, TELEMETRY DATA/NETWORK DATA PROCESSING

(31) DISPLAYS TO DSN OPERATIONS/DSS OF RECALL TELEMETRY DATA/NETWORK DATA PROCESSING

(32) TELEMETRY SIMULATION DATA

(33) TELEMETRY FILL DATA TO PROJECT ON TAPE

B. EQUIPMENT/SYSTEM CAPABILITIES

(A) TBD

C. SOFTWARE CAPABILITIES

(a) TBD

KEY:

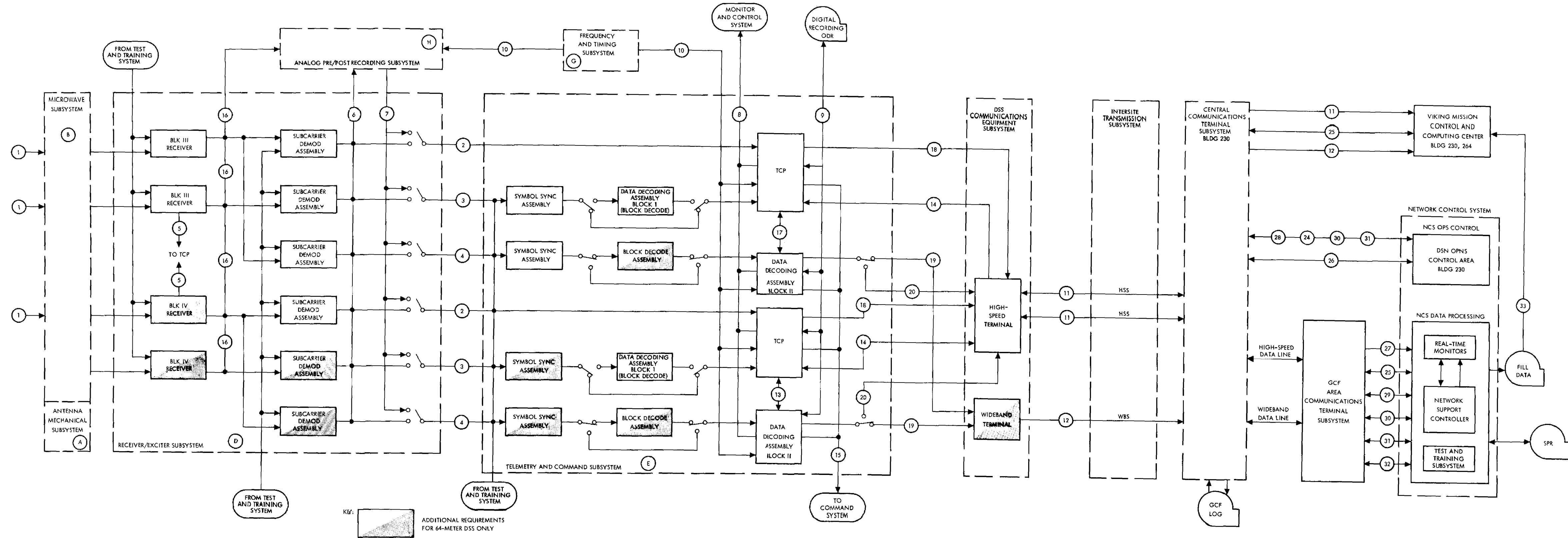ADDITIONAL REQUIREMENTS FOR 64-METER DSS ONLY

Fig 1. DSN/Viking telemetry system baseline functional requirements block diagram