High-Speed Data Outage Distribution

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The outages experienced on the present Ground Communications Facility (GCF) 4800-bits/s high-speed data subsystem have been examined. An outage is defined as any interval when 10 or more consecutive high-speed data (HSD) blocks were received in error or were not received at all. For a 3-month period in 1973, outages ranged from 2.5 s to 4.8 h in length. The median outage was 15 s. Approximately 16% of the outages exceeded 1 min, and only 1.5% exceeded 15 min duration.

I. Introduction

The GCF provides high-speed data transmission at a rate of 4800 bits/s, using NASCOM circuits and Western Electric 203A data sets. Data are divided into 1200-bit blocks, transmitted at four blocks per second. If no data are available for transmission, the GCF generates and sends filler blocks in order to keep the circuit active and provide block synchronous operation. Before transmission, an error detection code is calculated and included in the block. At the receiving end, a GCF decoder checks the received code and sets status bits if transmission errors are present. If blocks are not received at all, the decoder goes out of lock (into search) for an integral number of block times until flow is re-established. The receive data set carrier failure signal also comes on during local circuit failures.

The information available from the GCF decoder has been studied to determine the distribution of the outages experienced in the data forwarded from the DSSs to JPL.

II. Outages

For this study, an outage was defined as any interval when 10 or more consecutive HSD blocks were received in error or not received at all. Intervals of less than ten blocks were considered to be error bursts. This definition is a bit arbitrary; however, 10 block times (2½ s) is an improbably long error burst, hence there is some justification for this choice.

For outage study purposes, slightly less than three months of 1973 data were analyzed. These data were collected from the normal HSD operational circuits during regular tracking passes. No attempt was made to sort the data, though some data reflecting equipment malfunctions were discarded.

Outages ranged from 10 blocks (2½ s) to 17,513 blocks (4.8 h) in length, with long outages being in the minority. Table 1 lists outage parameters for each of the DSS geo-

graphical areas, plus a total of all four DSS areas. Information on the performance of the Ames–JPL circuits is also shown.

As indicated in the tabulation, the median outages ranged from 58 to 63 blocks (14.5 to 15.75 s), a very close span considering the widely different transmission distances involved.

III. Distribution

The outage distribution for the combined DSSs is shown in Fig. 1. On this plot, the abscissa indicates the percentage of the outages which had lengths equal to or less than the X-coordinate value. For instance, 71% of the outages were 100 blocks or less in length.

The abrupt breaks in the curves in the 30- and 50-block areas are caused by data set retrain characteristics. When a high data error rate condition occurs, the transmit and receive data sets interrupt the data flow and perform an internal readjustment sequence to compensate for changed circuit conditions. These interruptions cause data outages.

The GCF has a current commitment to restore service in 15 min or less. As measured, only 1.5% of the outages exceed 3600 blocks (15 min). In fact, only 16% of the outages exceed 1 min (240 blocks). A different definition of an outage would vary these findings; however, the GCF is definitely meeting its restoral commitment.

A future report will discuss the burst characteristics of faulty blocks.

Table 1. HSD outage data and distributions

	Canberra	Madrid	Goldstone	Johannesburg	Ames	DSS Total
Blocks transmitted ($\times 10^6$)	18.588	11.242	19.571	10.810	45.771	60.211
Circuit, days	53.8	32.5	56.6	31.3	132.4	174.2
Outages ($\geqq$10 blocks)	375	163	94	246	142	878
Average interval between outages, h	3.44	4.79	14.4	3.05	22.4	4.76
% outages exceeding 1 min	13.3	18.4	18.1	15.9	16.2	16.3
% outages exceeding 5 min	2.1	3.1	5.4	4.1	3.6	3.7
% outages exceeding 10 min	1.1	0.6	3.2	1.3	2.1	1.7
% outages exceeding 15 min	0.6	0.0	3.2	1.3	2.1	1.5
% outages exceeding 30 min	0.3	0.0	1.1	0.8	0.0	0.65
Outages exceeding 1 min	50	29	17	40	23	136
Outages exceeding 5 min	8	5	5	10	5	28
Outages exceeding 10 min	4	1	3	2	3	10
Outages exceeding 15 min	2	0	3	2	3	10
Outages exceeding 30 min	1	0	1	1	0	3
Outage blocks	69829	31996	46475	57434	31485	237219
Outage duration						
Average, blocks	186.2	196.3	494	233	221	270
Average, s	46.6	49.1	123.6	58.4	55.4	67.5
Median, blocks	58	63	62	59	34	60
Median, s	14.5	15.7	15.5	14.7	8.5	15

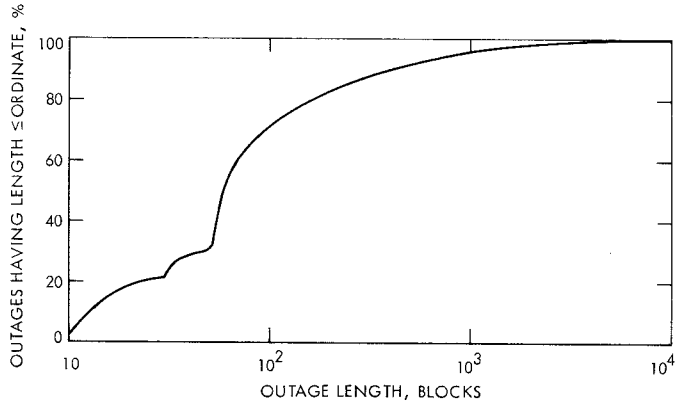

Fig. 1. HSD outage distribution, DSS to JPL