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MEMO TO: W. Fromm

FROM: Systems Engineering

DATE: 14 October 1959

SUBJECT: F-1, F-2, and F-3 Vehicle Output Data Characteristics

This memo documents the characteristics of the output digital word from the F-1, F-2, and F-3 vehicles.

F-1 Vehicle Digital Word Data

Bit Rate: 8Kc $\pm 5\%$ (from recorder)
4Kc nominal (real time readout)

Word Length: 48 bits

Spacing between Words: 24 bit minimum

Bit Width: 62 ± 12 microseconds

Amplitude: "one" bit level $+6V$ to $+12V$. (8V nominal)
"zero" bit level $-6V$ to $-12V$ ($-8V$ nominal)

Signal form: Three level return to zero.

F-2A and F-2B Vehicle Digital Word Data

Bit Rate: 10Kc $\pm 20\%$

Word Length: 50 bits and 5 milliseconds $\pm 20\%$

Spacing between Words: 3.8 to 10 milliseconds

Bit Length: 100 microsecond $\pm 20\%$ from the leading edge of one bit to the leading edge of the following bit.

Duty Cycle per Bit: 40 to 65%

Amplitude: "one" bit level, $+6V$ $\pm 10\%$
"zero" bit level, $-6V$ $\pm 10\%$

F-3A and F-3B Vehicle Digital Data Output of Digital Recorder

Bit Rate: 10Kc $\pm 20\%$

Word Length: 68 bits and 6.8 milliseconds $\pm 20\%$

Spacing between Words: 3.8 to 10 milliseconds

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Bit Length: 100 microseconds $\pm 20\%$ from the leading edge of one bit to the leading edge of the following bit.

Duty Cycle per Bit: 40 to 65%

Amplitude: "one" bit level, +6V $\pm 10\%$
"zero" bit level, -6V $\pm 10\%$

Signal Form: Three level return to zero.

F-3A Vehicle Digital Track Output of Analogue Recorder (double speed readout only)

Bit Rate: 20Kc $\pm 1\%$

Word Length: 68 bit and 3.4 milliseconds nominal

Spacing between Words: 4 milliseconds minimum

Bit Width: 20 to 30 microseconds

Amplitude: "one" bit level, +6V $\pm 10\%$
"zero" bit level, -6V $\pm 10\%$

Signal Form: Three level return to zero

F-3B Vehicle Digital Track Output of Analogue Recorder (single speed readout)

Bit Rate: 10Kc $\pm 1\%$

Word Length: 68 bit and 6.8 milliseconds nominal

Spacing between Words: 8 milliseconds minimum

Bit Width: 40 to 60 microseconds

Amplitude: "one" bit level +6V $\pm 10\%$
"zero" bit level -6V $\pm 10\%$

Signal Form: Three level return to zero

F-3A Vehicle Analogue Output of Analogue Recorder (double speed readout)

Performance figures are not available for the vehicle recorder only. Data below is for a vehicle-ground recording system. Since the vehicle recorder is read out at double speed, the frequency characteristics are at least double those stated below:

System Frequency Response: The overall frequency response of the system is such that for an input signal flat from 30 cps to 100Kc, the reproduced output signal is flat within ± 0.5 db to -1.5 db with respect to the response obtained at 30 Kc.

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Signal to Noise Ratio: The signal to noise ratio of the airborne unit is less than 40 db peak to peak signal to RMS noise measured over the full reproduced band width.

Output Signal Amplitude: 1.2V peak to peak maximum

Outputs: Two analogue tracks are read out simultaneously.

F-3B Analogue Output of Analogue Recorder (single speed readout)

Frequency Response: 12 Mc wide from 1 to 13 Mc

Signal to Noise Ratio: The signal to noise ratio of recording system consisting of the vehicle recorder and its complementary ground recorder is no less than 35 db peak to peak signal to RMS noise measured over the full specified bandwidth.

Output signal Amplitude: 2V peak-to-peak, nominal

F-3B Signal Characteristics

The signal played back by the airborne unit is a composite and compounded signal requiring two channels each 12 Mc wide for transmission to the ground unit. The output from two alternate heads on the scanning wheel of the recorder are switched to one transmission channel; that from the other two alternate heads on the scanning wheel are switched to the other channel. In other words, the output from heads 1 and 3 is carried by channel A and that from 2 and 4 is on channel B. This gives a time sequence of 1-A, 2-B, 3-A, 4B, 1-A, 2-B, etc. There are overlap periods between the channels corresponding to the overlap periods on the tape. These overlap periods accommodate the time reference bursts. The time reference consists of 25 usec bursts of a 4 Mc time at the start and end of each segment of data. The data is frequency modulated with a center frequency of 8 Mc and sidebands extending from 1 Mc to 13 Mc. Each segment of data plus time reference lasts approximately 725 usec. The black period between segment is approximately 525 usec.

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cc: F. Tenenbaum (6 copies)
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