

August 1968

Brief 68-10296

# NASA TECH BRIEF



NASA Tech Briefs are issued to summarize specific innovations derived from the U.S. space program, to encourage their commercial application. Copies are available to the public at 15 cents each from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

## Computer Graphics Data Conditioning

A graphics data conditioning program has been developed as a computerized technique for rapid display, adjustment, and smoothing of flight data (obtained from tracking and telemetry instruments) to expedite engineering analysis and thus ensure timely correction of measurement errors. Conventional data conditioning programs operate in the batch-processing mode, with the attendant large quantity of keypunch cards, long turn-around time, and susceptibility to error. With these programs, results are often not visible for several days because of the number of operations and flow time required to obtain plots and listings of the conditioned data. The new technique, through the addition of interactive computer graphic displays to existing data conditioning programs, provides the engineer with immediate visibility of computational results and permits on-line intervention and control of the computer processing.

For the purpose of data conditioning, the errors of measurement are defined to consist of three components: accidental error, systematic error, and noise error. Each of these components exhibits individual characteristics in the frequency domain and requires different methods of correction.

The accidental error component is a sporadic, large-amplitude error such as would be caused by malfunctions of the measuring system or large disturbances external to the system. When the data are presented graphically, this error component is viewed as a "wild point" which is a significant distance away from the nominal trend of neighboring data points. The technique for correcting this error is detailed in the procedure.

The noise error component consists of the higher frequencies (relative to the data frequencies) and is considered to have a zero mean. This error results in

the scattering of data points when they are viewed graphically. Two methods for the correction of this error are provided.

The systematic error component has a form which is very similar to the data. Thus, specialized techniques such as mathematical error models, calibration schemes, and least-squares adjustment of redundant measurements are required for correcting this type of error. A method of correcting a linearly time-varying bias is provided in a data-editing program.

In addition to the correction of errors of measurement, certain operations such as differentiation, integration, curve fitting, and selective frequency filtering may be accomplished to condition the data for engineering analysis. Methods for performing these functions are included.

### Notes:

1. The technique for on-line graphical display and manipulation of data may be applicable in the fields of oceanography, meteorology, and transportation. It may be extended to application in management information systems involving cost, schedule, and resources data.
2. Complete details may be obtained from:

Technology Utilization Officer  
Marshall Space Flight Center  
Huntsville, Alabama 35812  
Reference: B68-10296

### Patent status:

No patent action is contemplated by NASA.

Source: G. C. McMillen and K. H. Hagenau  
of The Boeing Company  
under contract to  
Marshall Space Flight Center  
(MFS-14695)

Category 06