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Contract NAS5-21798
Report File
Day File

SPACE SCIENCE AND ENGINEERING CENTER

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TO: Contracting Officer, Code 245, NASA/GSFC
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FROM: Thomas O. Haig
Executive Director Thomas O. Haig/jb

REFERENCE: Contract NAS5-21798

SUBJECT: Monthly Progress Report for "Studies of Soundings and Imaging Measurements from Geostationary Satellites"

Task A Investigations of Meteorological Data Processing Techniques

Work on this task has not yet started since most of the work will be done by graduate students who will not be available until September. Drs. Sikdar and Martin have prepared preliminary plans and have designated data sets to be processed for use on the McIDAS equipment under this task.

Task B Sun Glitter

Work on this task will start in September with initial processing of two sun glitter cases to confirm quality of data.

Task D Cloud Growth Rate

Digital tapes for several ATS images are being processed for use on McIDAS. Considerable difficulty is being experienced in eliminating the effects of noise and line jitter. Since these problems are common to most ATS data, we are searching for a general solution.

Task E Comparative Studies in Satellite Stability

The highlight of our work in the past month is the determination of a system of time-optimal control for a dual-spin satellite. The control policy is to achieve a desired angular position, angular rates and angular position integrals in the shortest possible time, with limited control torque magnitudes.

The control systems used generally so far, are switching--relay systems. In other words, the maximum available torque is used for a calculated length of time. But this prolongs the

satellite transient motions. The advantage of the existing systems is that these are very easily produced. The torque form is given by

$$T = \begin{cases} T_{max}, & (0 \leq t \leq t_o) \\ 0, & \text{otherwise.} \end{cases}$$

where T is the control torque vector magnitude, and t_o is a variable.

In the control system we are proposing, there will be an optimum combination of the existing switching-relay systems and differential switching-relay systems. The differential system torques are of the form

$$\dot{A}\cdot T + B(t).\ T = \begin{cases} T_{max}, & (0 \leq t \leq t_o) \\ 0, & \text{otherwise.} \end{cases}$$

This combination will considerably reduce the transients and lead to increased stability. Further details are being worked out now.

We have decided that a hybrid computation and analysis is the most suitable approach for the problem. But qualitative theoretical analysis will be done to back up the results.

Task G Rainfall Measurements by RAKE Radar

Contacts with Bob Pool at Collins, who is making a feasibility study of RAKE rainfall measurements, have been made periodically throughout the month. Meteorological characteristics of tropical rainstorms have been extracted from literature references and personal contacts and pertinent data forwarded to Collins to support their studies. Estimates on the doppler spectra of rainfall have been calculated using available data in the literature on velocity and size distributions. The variance in such measurements appears to be quite high and an accurate determination of rainfall rate from the doppler will not be easy. Collins is doing some independent calculations on this and is pessimistic. The amplitude returns appear to be a better measure of rainfall if the extent of the rainfall area can be determined. Some calculations show that the back-scatter returns from the rain will be difficult to detect unless rainfall rates are high. This will be checked.

Task C, Particulates, and Task F, High Resolution from Geostationary Orbit, were deleted by instructions from William Bandeen.