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MONTHLY REPORT

for

NOVEMBER 1979

VISSR Atmospheric Sounder (VAS)
Development and Performance Evaluation

Contract No.: NAS5-21965

Prepared by

Space Science and Engineering Center
The University of Wisconsin
Madison, WI

for

National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, MD

I. General

On November 13, 1979 P. Menzel of SSEC travelled to Greenbelt, MD to attend the VAS Working Group Meeting. A status report on the instrument calibration and spin budget was given. On November 15, 1979 P. Menzel travelled to Santa Barbara, CA to review vacuum test results with F. Malinowski of SBRC. Possible loss of the upper large HgCdTe detector was discussed.

II. Data Processing System Development

Hardware construction of all wideband communications link boxes is nearly complete. All boxes have been wired, but some boxes are still missing some chips. Hardware shakedowns of the boxes are proceeding well. The software for all communications services has been successfully tested in the DBM-2AP configuration. Everything is on schedule for mid-January installation.

The signal system electronics board for the VAS user terminal modifications finally arrived. Most of the electronics integration has been accomplished. The system tuning is proceeding. When completed, VAS will have two user terminals, each with 260 frames, 12 bit enhancement, and 4 graphics levels.

The TIROS-N (and NOAA-6) receiving system is being expanded so that real time ingest of the APT signal is possible. Coming down on a separate VHF signal from the spacecraft, APT offers daytime 4 km resolution visible and 11 micron images and nighttime 4 km resolution 3.7 and 11 micron images. An appropriate receiver has been integrated into the receiving system and an extra board has been added to the main microprocessor to perform analog to digital conversion, frame synchronization, and direct memory access. APT reception should be accomlished early next year.

III. VAS Instrument Support

UW Analysis of vacuum test data affecting calibration and noise reduction has produced the following conclusions. Further analyses are planned.

Adequate information was produced during the September thermal vacuum test to determine the calibration coefficients with sufficient accuracy to meet the specifications. The measure for successful inflight calibration is the accuracy of the determination of an effective external blackbody temperature from thermistor readings in the internal blackbody and the telescope foreoptics. For the 28 test produced temperature gradients (which are actually more severe than those expected inflight) the largest absolute error for the twelve spectral bands was less than .8°C (spec is 1.5°C) and the largest rms error for the twelve spectral bands less than .5°C (spec is .5°C). Table 1 summarizes these results.

Analysis of the high speed raw data (taped during the 15°C scanner temperature final calibration test) has produced a spin budget well below the normal 157 spins cited prior to the vacuum test. Achievement of an adequate signal to noise ratio on the VAS involves multiple scanning of the same earth swath and integrating the detector response over a sufficiently large area. This integration requires averaging data with correlated noise. Actual evaluation of the autocovariance of the detector response of one sample with following samples showed that the noise was less correlated than expected. The spin budget for dwell sounding by integrating the large detector responses over 30 x 30 km^2 areas for all spectral bands (except spectral band one where 150 x 150 km^2 area is used) was found to be 100 for channel 1 and 79 and for channel 2. Table 2 gives a band by band breakdown.

Loss of one of the large HgCdTe detector would hamper the VAS instrument capabilities. Multispectral Imaging could now deliver the following images; 1 km visible, 7 km 11 micron infrared, and only one additional 14 km infrared (instead of the two previously possible). Dwell Sounding would take 140 spins to achieve useful signal to noise ratios for sounding derivations (instead of the 100 spins indicated in Table 2). While the VAS Demonstration with GOES-D

would still be possible, the capability demonstrated would have been diminished.

IV. VAS Data Processing Technique Development

The 10-level version of the Numerical Weather Prediction model, using a 101 x 71 grid in the horizontal, has been run with a recently incorporated nesting code. The nesting was first tried out on the 14-15 March 1979 case over the U.S. mainland with 67.6-km resolution, using interpolated six-hourly LFM datasets (initial analysis and forecast fields from 6 through 24 hours) with nesting applied over 5 grid rows or columns from the lateral boundaries inward. As had been hoped, the nesting greatly improved NWP forecast results near boundaries, especially near the northeast corner. There, earlier non-nested forecasts with time-independent boundary conditions had degenerated into extreme short-wave noise; with nesting, the noise decreased dramatically and a mid-Atlantic High was enabled to propagate realistically.

Work is now proceeding to incorporate a three-dimensional convective storm model into the NWP model by next spring, particularly for application to active SESAME '79 days. The environment in the smaller-scale simulation would be initialized with mesoscale variability obtained by interpolating NWP model output over the area of one NWP model grid column (roughly 50 km on a side) near the time and place of observed severe storms.

Table 1

Spectral Band	C_{BF}	C_{SMS}	abs err (in degrees centigrade)	rms error
1	.134	.143	-.25	.44
2	.103	.123	-.69	.35
3	.122	.133	-.61	.21
4	.107	.131	-.73	.30
5	.120	.148	-.74	.24
6	.118	.144	-.53	.18
7	.135	.168	-.72	.17
8	.120	.186	-.82	.16
9	.113	.218	-.42	.26
10	.165	.189	-.28	.19
11	.113	.167	-.50	.10
12	.137	.202	-.49	.24

Table 2

Spectral Band	Spin Budget	
	IR1	IR2
1	3	3
2	28	22
3	13	8
4	11	8
5	5	4
6	8	9
7	4	3
8	1	1
9	17	10
10	2	2
11	7	8
12	1	1
	100	79

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THE UNIVERSITY OF WISCONSIN

10 December, 1979

Ms. Vanessa Scott
Code 269, Bldg. 16
Goddard Space Flight Center
Greenbelt, MD 20771

Dear Ms. Scott:

In accordance with Article III of Contract NAS5-21965, I am submitting the required Progress Report for the month of November, 1979.

If you have any questions or desire further information, please contact me at (608)262-6361.

Sincerely,

Paul Menzel

Paul Menzel
Program Manager

APM/klv

Enclosure

cc: H. Montogomery, Code 942 (10 copies)