PROGRESS REPORT

for

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VISSR Atmospheric Sounder (VAS) Development and Performance Evaluation

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Prepared by

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I. General

A draft of the Post-Launch Study Report of VAS-D performance was submitted in November 1980.

II. Data Processing System Development

VAS data is being routinely ingested and archived. The Sony archive is recording everything which the satellite sends. The quality of the Sony recording is somewhat degraded from the quality of the real-time ingests through the data base manager. Work is continuing on trying to improve the performance of the Sony full resolution archive. The real-time VAS ingests go onto disk files which can maintain the data from one day. This data is written onto 6250 bpi tapes daily. This tape archive has 100 tapes in a rotating archive which is sufficient for approximately one month. Those days which are of interest for case studies are pulled from this rotating archive.

Navigation is now being done routinely as is the scheduling of the satellite. The navigation is done using visible landmarks (at 2 mile resolution) on MSI images. The navigation still requires a input of an orbit from NASA. The navigation system generates a predicted orbit and attitude block for the SDB. There have been problems, however, with the SDB accepting the orbit and attitude block, which causes the Wallops crew to manually enter the betas. The earth was not centered with the manually entered data. As an experiment, the Wisconsin generated data were allowed to reside in the SDB, and the wide band turn on time was changed 2 milliseconds. This resulted in the earth being centered correctly, but it caused interference with another instrument on the satellite. This conflict between instruments still needs to be resolved.

III. VAS Instrument Support

To evaluate the inflight reliability of the VAS calibration procedure, the VAS radiance determinations were compared to nearly simultaneous HIRS (aboard TIROS-N) radiance determinations. From a statistical sample of radiosonde-rocketsonde data the 12 VAS spectral radiances were related to the 19 HIRS spectral radiances through regression matrices. In one case study of October 11, 1980, VAS radiances for 28 clear field of view were estimated from viewing angle corrected HIRS data; the comparison of the estimates with actual observations is summarized in Table I. The absolute error ranges for -1.9 to 2.2°C for the spectral bands and the relative error ranges from .5 to 1.5°C. This general agreement is suprisingly good.

Further evaluation of the calibration was accomplished by comparing the temperature profiles derived from VAS radiance data with time and space coincident radiosonde derived temperature profiles. The profiles are found to be typically within 1 or 2°C of one another; maximum deviations of 5°C are occasional. The agreement in temperature is good as should be expected between these two different types of sounding observations.

A post-launch spin budget was evaluated from the engineering checkout data of November 11, 1980. The auto covariance of the noise agreed very well with prelaunch estimates, however the single sample noise in the lower large detectors has increased somewhat. As a result the updated spin budget for the lower large detectors is thirty percent higher (91 instead of 69). The small detector values have been found to agree very well with prelaunch estimates. Tables II and III summarize the comparisons.

Continued monitoring of the signal to noise enhancement and calibration is planned.

Table I VAS Radiances (brightness temperatures) Comparison to VAS Radiance (brightness temperature) Estimates from HIRS Data

VAS Bands #	VAS Bands $\nu(cm^{-1})$	HIRS Bands[a] #	HIRS Bands[a] $\nu(cm^{-1})$	$B^{-1}(R_v) - B^{-1}(R_v^{est})$ abs(°C)	$B^{-1}(R_v) - B^{-1}(R_v^{est})$ rel(°C)
1	679	2	679	.72	1.54
2	691	3	691	1.59	1.42
3	702	4	704	2.17	.57
4	714	5	716	1.64	.55
5	750	7	748	1.86	.54
6	2210	14	2212	1.30	.52
7	790	10	1217[b]	-2.93	1.11
8	895	8	900	.43	1.28
9	1377	11	1363	-1.58	1.00
10	1487	12	1484	-.09	.99
11	2250	15	2240	1.92	.60
12	2535	18	2511	-1.90	1.43

[a] HIRS band closest to VAS band is listed; all HIRS bands enter through the regression relation.

[b] Transmittance is the same although frequency is different.

Table II Inflight Spin Budget of VAS-D Large Detectors

Band	σ(erg/etc)		Spin Budget*	
	inflight	prelaunch	inflight	prelaunch
1L	4.90	4.34	2	2
2L	3.13	2.87	24	19
3L	1.93	1.57	10	7
4L	1.72	1.55	8	7
5L	1.45	1.17	5	4
6L	.031	.025	11	7
7L	1.08	.88	3	3
8L	.21	.12	1	1
9L	1.37	1.22	14	9
10L	.34	.29	2	2
11L	.029	.024	10	7
12L	.008	.007	1	1
			91	69

*For sounding in 30 x 30 km area.

Table III Inflight Spin Budget of VAS-D Small Detectors

Band	σ(erg/etc)		Spin Budget*	
	inflight	prelaunch	inflight	prelaunch
35	3.97	3.94	73	72
45	3.69	3.62	63	62
55	2.82	2.84	37	37
75	2.42	2.40	26	26
85	.20	.32	1	1
95	2.83	3.03	103	116
105	.74	.73	16	16

*For sounding in a 15 by 15 km area.

IV. Technique Development

Development work during the last month was directed principally to the processing of VAS dwell sounding data. A quasi "standard" ingest mode was adopted to give 20 degrees of latitude of dwell sound at 1230, 1530, 1830, and 2130 GMT. In between MSI images were obtained for channels 7, 8, and 12 (for surface temperature determinations) and for channels 6, 8, and 10 (for atmospheric temperature and moisture variation). Because of R and D interruptions no complete 4-time period retrieval sets have been processed, but the data have been archived. In many cases 2 or 3-time period retrieval sets have been produced and it has been possible to document the VAS capability for detecting 3 hourly time changes in the atmosphere.

In order to improve signal to noise for temperature sounding the 16 km VAS observations are being avergaed over a 5 x 5 array (the size is optional but defaults to 5 x 5). In cases where extraneous noise causes problems a filter has been added to remove noise peaks.

Trials with numerous cloud covered areas have shown that the retrieval algorithm needs development to deal with cloud attenuation. Cirrus is especially troublesome through solid low low overcast also causes difficulty. The latest approach is to retrieve down to the cloud level and retain the first guess profile below. This appears to work well except that the determination of an accurate cloud level is critical. It is probable that the retrieval technique will have to be modified to allow better vertical resolution for integration of the radiative transfer equation at and near the cloud pressure.

A regression technique for determining sea surface temperature has been developed and applied to data from channels 7, 8, and 12 (the last used only in the absence of reflected sunlight). Experiments with VAS dwell sound data is very encouraging although absolute verification has not been attempted.