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POST-ANALYSIS REPORT ON CHESAPEAKE BAY DATA PROCESSING

Informal Final Report

by

F. Thomson

INFRARED AND OPTICS LABORATORY
WILLOW RUN LABORATORIES
INSTITUTE OF SCIENCE AND TECHNOLOGY
THE UNIVERSITY OF MICHIGAN

prepared for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA Wallops Station
Contract NAS 6-2058

NOTICES

Sponsorship. The work reported herein was conducted by the Willow Run Laboratories of the Institute of Science and Technology for the National Aeronautics and Space Administration, NASA Wallops Station, under Contract No. NAS 6-2058, and under the guidance of Mr. Edgar Everton, Technical Monitor. Contracts and grants to The University of Michigan for the support of sponsored research are administered through the Office of the Vice-President for Research.

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Wallops Island, Virginia

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of the unusual weather conditions, it was not possible to discriminate all the categories we had hoped to, and one compromise map of each line's data was prepared. Aspect ratios of each line's data were matched to photography by varying the imagery camera film speed, and precise match was obtained using different film speeds for each run.

Before histogram preparation, digitized data were corrected for scan angle dependent variations in observed radiance by subtracting quadratic functions of scan angle from each channel's data. Two sets of quadratic functions were determined--one for correcting water data and the other for correcting land data. Two types of histograms were prepared. The first type was a normal histogram--a plot of percentage of points in each training set in each voltage interval. The second histogram type produced a similar display, but with a comparison of the actual data marginal distribution functions to Gaussian distribution functions. From the χ^2 test, we determined that nearly all the training set marginal distribution functions could be considered Gaussian. This is a necessary, but not sufficient condition for the entire spectral signature statistics to be considered Gaussian.

SPARC results from two Rhode River Test Area lines flown on 11/6/70 at 1425-1436 hrs show that signatures can be extended between the two runs. Some dropout of recognition along the north edge of Line 12 is attributed to failure of the preprocessing correction. The effect is not serious. The recognition of various training sets on Line 11 from the new setup differ (in some cases materially) from the recognition obtained in April 1971. This is attributed to the fact that signature mean values had to be adjusted to account for some recalibration of SPARC which was completed last summer.

2.0 SPARC Work

The purpose of the SPARC work, performed on data from two flight lines over the Rhode River test site, was to attempt to extend spectral signatures from Run 11 to Run 12. The data for the processing were collected on 11/6/70 at 1425-1436 hrs. EST at 5000 ft. above terrain. Since processing had already been done on Line 11, spectral signature, SPARC training information, and preprocessor settings were already available for this run.

The same six optimum channels were used for this processing effort as were used for the previous effort (April 1971). These six channels were: 0.68-0.58, 0.75-0.85, 0.68-0.74, 0.55-0.58, 0.43-0.45 and 0.41-0.43 μm. Preprocessing applied in April (subtracting a function of scan angle from each channel) was again applied. Signals were examined and there were no discernable residual angle dependent variations.

Signature means, standard deviations, and covariances were entered from the SPARC record of the April work. Because of SPARC recalibration during the summer of 1971, the old signature settings did not produce proper recognition on Run 11 data. Because the prime part of the summer recalibration was an adjustment of operational amplifier zeroing, we felt that the signature mean values were probably in error, but that the standard deviation and covariance settings were probably correct. Accordingly, the mean values in each channel were readjusted for each training set, using data from the original tape loops and training sets to determine when the means had been properly adjusted. A comparison of recognition patterns on the tape loop data from the April work and from the present study was also made.

Filmstrips were printed of video channels and of recognition on both Lines 11 and 12. The same camera film speeds were used for the two runs. Individual recognition maps were enlarged about 2.5 times, the enlargements converted to ozalids, and the resulting ozalids registered and photographed. Two separate color coded ozalid maps were provided to match previous work. The color codes of the Line 12 data were identical to those of the previously delivered Line 11 results. Because many of the recognition patterns were quite sparse, a 2.5 X blowup of a red channel of imagery (0.63-0.68 μm) was provided for reference. This blowup is at the same scale as the enlarged recognition maps and the original ozalids.

2.1 Analysis of New SPARC Results from Line 11

As a first analysis step, the new recognition results from Line 11 were compared with the results previously generated. This analysis uncovered some discrepancies in recognition patterns between the two sets of SPARC results. These discrepancies are attributable to the fact that signature mean values had to be adjusted because of the SPARC calibration procedure.

Water recognition (w-blue) between the two setups is quite consistent. All water areas except very shallow water (maybe mud flat?) at the head of the bay are detected. Tree shadows are prominent false alarms and are detected as water probably because they appear dark in most channels (blue channels an exception) as does water. Shallow water areas are probably not detected because the blue channels used penetrate the water, probably to the bottom. Because of bottom reflectance, shallow water has a different spectral signature than the deeper water.

Recognition of bare soil 2 (BS2-black) seems slightly greater in the recent map than in the April 1971 map, but nearly all classifications appear to be correct. Some arcs of detection surrounding land areas in the right center of the scene may be false alarms in turbid shallow water.

Bare soil (BS4-brown) recognition seems to compare quite closely between the two sets of Line 11 maps. There seems to be slightly more BS-4 recognition, at the expense of BS-2 recognition, in two fields in the south center of the scene in the new SPARC results. No prominent false alarms can be identified. The spotty detection of the roadway is not considered a false alarm, because what may be detected is the gravel shoulders.

The hardwood signature H1 (orange) seems to have recognized a considerable amount of bare soil in the new SPARC results compared to the old results. This effect is particularly apparent in the marsh area in the center of the scene and in the bare soil areas in the eastern portion of the scene. Some hardwood areas are more solidly detected in the new map as compared to the old map. This is especially apparent in the north central part of the scene. The cause of the bare soil false alarms is probably a slightly misadjusted set of mean values for the H1 signature. The signature means were readjusted to compensate for SPARC amplifier calibrations. The readjustments brought signals from the H1 training set to zero mean, but apparently darker bare soil signals were also brought within the detection range of the H1 signature. The readjustment has produced greater recognition of hardwood areas, at the expense of a higher false alarm rate in dark bare soil areas. This confusion does not materially affect the utility of these results for assessing the success of signature extension, because only comparison of recognition patterns on Line 11 and 12 are involved there.

Hardwood (H4-blue green) detection appears slightly greater in the new version of the recognition map than in the old version. Noticeable differences occur at the northern edge of the scene, where the new map reveals considerably greater detection than the old map. There also seems to be more recognition in the new map on the two peninsulas at the right center (eastern side) of the scene.

Loblolly pine (C3-violet) detection seems more prevalent in the new SPARC results compared with the old results. The training set at the tip of the easternmost peninsula appears well detected in both maps. Slightly more pine detection occurs in the north central and central portions of the new results. It is not possible for us to determine whether there are pine trees in these areas of the scene, but the predominance of hardwood recognition would seem to argue against that. It is possible that some scene points which would have been classified as H1 are now classified as C3 because of the slight misadjustment of the H1 signature means.

The recognition of abandoned field (F1-yellow) compares quite favorably between the two Line 11 maps. The training set seems slightly better detected in the new results than in the April 1971 results. All other major occurrences of F1 detection agree quite well.

The pasture detection (P-dark green) appears more solid in the new SPARC map, although no new major areas of pasture are identified in the new map. The training set seems more solidly detected and pastures in the eastern half of the run appear at least, if not more, solidly detected in the new map than in the old map. However, pasture areas in the western half of the run appear less solidly detected in the new map than in the old, although the effect is not major.

Spartina (S-olive green) detection seems quite sparse in both results. The new results seem to have more false alarms in pastures and bare soil areas in the south central and western portions of the scene. Detection of spartina in what we assume is the major area (the marsh in the north central part of the scene) is spotty in both sets of results with more recognition apparent in the new results. The sparse recognition of spartina is felt to be caused by the training on only brightest areas of spartina in the initial SPARC work.

On the whole, with the exception of the H1 signature, there seems to be reasonable agreement between the Line 11 results of April 1971 and those of March 1972. The agreement is quantified in Table 1, where the percentage of scene area classified as each of the categories is tabulated. Interpretation of these results, derived from area counts accumulated during SPARC processing, must proceed with caution however. Even if the number of counts (and hence the percentage of the scene detected) agree for the two processing runs, the recognition patterns may not necessarily agree. For this reason, area count information should be interpreted jointly with the recognition maps. Further, there may be general disagreement between the total percentage of the scene detected as computed from the counter data and that estimated from looking at the map. This effect occurs because of the overlap of scan lines in printing which is necessary to achieve a map with proper aspect ratio.

The counter totals the number of tens of microseconds of recognition signal in the run. The film records the same signal with about 5:1 overlap for 5000 ft data. It is possible to have an area appear solidly recognized on the film but for the counter to show only 40-50% recognition, because only 1 line in 5 need be recognized to obtain a solid black area on the film.

2.2 SPARC Signature Extension Results

The signature extension from Line 11 to Line 12 was successful. In general, recognition patterns in the common area between the two runs agreed quite well. There was an area of no recognition on the northern edge of Line 12, probably caused by a failure of the preprocessing to properly correct signals at this edge of the scene.

The quantitative comparison of Line 11 and Line 12 is shown in Table 2. The numbers in this table must be interpreted with a certain amount of caution as previously discussed. Also the relative proportions of various objects in the scene may be different because of different scene coverage.

Water (blue) is well recognized in both maps, with the exception of shallow water (possibly mud flat) which is not detected. This is probably because of water turbidity and/or bottom reflectance modifications of water spectral signature in the blue channels. Shadows of trees are detected on both Line 11 and Line 12 maps.

Bare soil (BS2-black) is well recognized on both Lines 11 and 12, and patterns in the common area are similar. Also, a comparable percentage of each scene was recognized as bare soil 2.

Bare soil (BS4-brown) detection in Line 12 results seem more spotty than in Line 11. Also, the training set for this category is not on the Line 12 data. This probably explains the lower percentage of the scene detected as bare soil 4 in Line 12.

Hardwood (H1-orange) recognition is comparable in the two runs of data, although there are prominent false alarms in such dark bare soil areas as the mud flat and certain fields and water courses. The percentage of the scene recognized as H1 is comparable in Line 11 and Line 12 results.

Hardwood (H4-blue-green) recognition seems to be slightly greater in Line 11 than in Line 12, and this is borne out by the percentage figures. Recognition is concentrated in the upper half of Line 12 and the middle of Line 11. Since this is the same geographic area, this effect is probably not caused by preprocessing. A subset of all the hardwoods in the scene seems to be detected by this signature.

Loblolly pine (C3-violet) recognition on Line 11 is distinctly better than on Line 12. The signature area on Line 12 is in the region of the data where preprocessing failed to adequately account for signal variations. Consequently the training set is not detected on Line 12. Also some areas north of the spartina marsh are detected in Line 12 and not in Line 11. On the whole, this signature probably extends less favorably than any of the other signatures. A great deal of the problem is related to the failure of the preprocessing at the north edge of Line 12 data.

Abandoned field (F1-yellow) detection in Line 12 is not precisely comparable to Line 11, even though the percentages of the scene detected are similar. On Line 12, there seems to be a lot more detection of this category in bare soil fields and the patterns in these fields do not precisely compare in the two runs. Also this category seems to recognize a large area in the marsh on Line 11 which is not apparent on Line 12 results.

Pasture (P-dark green) detection in Line 12 and Line 11 is quite similar, with a few exceptions. The training set in Line 12 is more poorly detected than in Line 11. In Line 12 data, pasture seems to recognize more of the abandoned field training set than in Line 11. Aside from this, the patterns of detection are quite comparable. The slightly lower percentage of scene detected in Line 12 is probably primarily caused by poorer performance in the training set area.

Spartina (S-olive green) in Line 12 is restricted to apparent false alarm areas in bare soil fields. Very little detection occurs in the marsh area on Line 12. The difference in percentages of the scene detected is fairly large and representative of the difference in classifier performance. Along with loblolly pine, the extension of this signature was probably the least successful of any of the signatures.

Table 1

Comparison of Percentage Scene Composition in Two Rhode River (Line 11) SPARC Processing Operations

Category	Color	April 1971 Results	March 1972 Results
Water	Blue	23.42	27.25
Bare Soil (2)	Black	1.056	1.099
Bare Soil (4)	Brown	3.80	0.511
Hardwoods (1)	Orange	4.700	4.800
Hardwoods (4)	Blue-Green	4.401	3.504
Loblolly Pine	Violet	0.258	0.973
Abandoned Field	Yellow	1.738	0.825
Pasture	Dark Green	1.562	0.628
Spartina	Olive Green	0.142	0.059
TOTAL		41.077	39.649

Table 2

Comparison of Percentage Scene Compositions for Two Rhode River Runs (Lines 12 and 11) April 1972 Results

Category	Color	Line 17	Line 18
Water	Blue	27.25	21.01
Bare Soil(2)	Black	1.099	1.370
Bare Soil(4)	Brown	0.511	.203
Hardwood(1)	Orange	4.800	4.577
Hardwood(4)	Blue-Green	3.504	3.643
Loblolly Pine	Violet	0.973	.912
Abandoned Field	Yellow	0.825	.539
Spartina	Olive Green	0.059	.050
TOTAL		39.649	33.106

3.0 Conclusions of the Signature Extension Study

In general, spectral signatures trained on Line 11 of the Rhode River Test Site data classified data from Line 12 reasonably well. Some signatures performed better than others on the Line 12 data. A similar effect has been noticed in other signature extension work (on other data sets) conducted by Mr. Richard Nalepka of The University of Michigan.

A more realistic quantitative test of signature extension could have been done had better quality original data been available and had more training sets been used to classify a greater fraction of the total scene. The present results are encouraging however. It should be pointed out that because the two data sets were collected over the space of a few minutes, changes in solar illumination were negligible and no compensation for these changes was necessary. Also, the preprocessing used for one run was applied to the second run without modification. In the more general signature extension case, both compensation for changes in solar illumination and changing the parameters of the preprocessing corrections will be necessary.

4.0 Recommendations for Future Data Collection for Rhode River and Pine Bark Beetle Attacked Trees

Data quality was a significant factor in the quality of processed results delivered under this contract. We realize that the November 1970 data collection mission was a compromise of many factors. In this section we will attempt to present some thoughts on more nearly optimum flight profiles and sensor configurations for delineating pine bark beetle attacked trees and for classification of the Rhode River Test Area.

Dr. F. P. Weber of the U.S. Forest Service Pacific Southwest Experiment Station, Berkeley, California, has shown that Black Hills ponderosa pine trees attacked by pine bark beetles exhibit temperature differences from normal trees at certain times of day. In previous work with Dr. Weber, we have had some success mapping attacked trees before visual symptoms appear using data from 1.0-1.4, 2.0-2.6, and 4.5-5.5 μm regions collected by a three element InSb detector. The data were collected at low altitude (1000-2000 ft) and were collected on a diurnal cycle of four flights from predawn through post-sunset on a clear day in May. Comparison with ground measurements showed greatest temperature difference between attacked and healthy trees in late morning.

From this experience, the following flight profile is suggested. Flights made during a diurnal cycle from predawn through post sunset should be made at a time when beetles have started to attack the trees. Flights should be made at low altitude (1000 ft is suggested) and should emphasize data from thermal (4.5-5.5 or 8-13.5 μm) and reflective near infrared (1.0-1.4, 1.5-1.8, and 2-2.6 μm) regions. Ground measurements of canopy temperatures of diseased and healthy trees should be made for correlation with aircraft data.

For classification of Rhode River Test Site Data, a flight in mid-summer is recommended. At this time, hardwood trees have green leaf canopies and can easily be distinguished from conifers. Pastures and abandoned fields would be relatively green, and marsh vegetation should be green and well developed. Flights at various altitudes should be made. The 5000 ft data is useful for general classification, but if more detailed mapping is desired, higher spatial resolution data collected at lower flight altitudes would be desirable. Flights should be made in midday, and flight direction should be such that the aircraft is flying directly into or away from the sun. This will minimize scan angle dependent variations in observed radiance. Visible and reflective near infrared data should be emphasized.

APPENDIX I

Delivered SPARC Materials

The following materials have been delivered to Mr. Edgar Everton as part of the SPARC processing job.

1) Original ozalid materials (2 sets) for color coded recognition maps of Line 18 data.

2) Two color negatives, two color positive transparencies, and three color prints (scale ∿ 1:24000) of Line 18 results.

3) Enlarged recognition maps and video data from Line 18.

Enclosed with this report are the original 70 mm SPARC maps and imagery. Table 3 relates the serial number of the SPARC map to the category recognized and the threshold used.

Table 3

Coding of Original SPARC Maps

Category	Threshold	Line 17 Serial No.	Line 18 Serial No.
Spartina		051-032	051-032A
Pasture		051-033	051-033A
Abandoned Field		051-034	051-034A
Loblolly Pine		051-035	051-035A
Hardwood (H1)		051-037A	051-037AA
Hardwood (H4)		051-038	051-038A
Bare Soil (BS2)		051-039	051-039A
Bare Soil (BS4)		051-036	051-036A
Water		051-049	051-049A
0.63-0.68 μm Video		051-040	051-040A

APPENDIX II

SPARC Data Records

This appendix contains the SPARC data records for job 051 - the signature extension job for the Rhode River area. The form is virtually unchanged from the form on which job 022 (the first work on this data) results were reported. The standard deviation values and covariance values on job 051 were identical to those used on job 022A, and therefore are not recorded. Copies of SPARC data records from job 022A are also enclosed in this appendix.

SPARC Processing Record

PRINTS 1-30

Tape Channel	Patch Channel	Op Amp Gain	μm	Skew	Delay
1				-10	
2	2	2		-5	
3				-5	
4	3	2		-5	
5	6	2		-5	
6	1	3		-2	+4
8				0	
9				-4	
10	4	3		+2	+4
11	5	2		-5	
12				+5	
13				+9	
7			SYNC	INVERTED	

θ	φ	
262	259	A Delay
		B Delay

L	R	
638	676	Zero Clamp
		Sun Gate

2	φ Delay
1	φ Ramp
1	θ Delay
2	θ Ramp

	L	R
D Gate	200	700

Period A	15680
T.I. A to B	3488
FOV	80°

	Target	Loop	Gate 1		P/M	Gate 2		
1	S	5				253	225	H
						[illegible]	330	V
2	P	8	172	130				H
			120	261				V
3	F1	2	504	518				H
			440	580				V
4	C3	4				268	265	H
						370	500	V
5 [7]	BS4	6	221	194				H
			540	690				V
6 [8]	H1	2				082	057	H
						330	450	V
7 [9]	H4	6				366	361	H
						200	270	V
8 [10]	BS-2	4	199	167				H
			030	310				V
9								H
								V
10	NOTE:	LOOPS AND GATES						H
		DATA FROM 0224						V
11								H
								V
12								H
								V
13								H
								V
14								H
								V
15								H
								V
16								H
								V

Project	Job No.	Processor	Date
CHES BAY 11-6-70, 0830 RUN 18 LINE 12	051	CRJ RK	3-2-72

010653

2 12

Preprocessor Setup*

*Applies to ~~sheets~~ 1-48 ~~27 112~~

Sheet ~~6~~ of 12

Purpose: $S_i' = S_i' - (\pm K_1\phi \pm K_2\phi^2 \pm K_3\phi^3)$

Inputs / AGC Inputs

	Inputs	AGC Inputs
1	1	
2	2	
3	3	
4	4	
5	5	
6	6	
7		
8		
9		
10		
11		
12		

Buffers

	Inputs	Gain
1	BNC 1	1
2	BNC 2	1
3	~~M3 X~~ BNC3	1

Outputs to SPARC / Monitor Jacks

	Outputs to SPARC	Monitor Jacks
1	POT 31	POT 31
2	POT 32	POT 32
3	POT 33	POT 33
4	POT 34	POT 34
5	POT 35	POT 35
6	POT 36	POT 36
7		
8		
9		
10		
11		
12		

Pots

	Input	Setting
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13	BUF1	054
14	BUF1	074
15	BUF1	067
16	BUF1	021
17	BUF1	010
18	BUF1	008
19	BUF2	088
20	BUF2	0
21	BUF2	034
22	BUF2	085
23	BUF2	102
24	BUF3	073
25	BUF3	041
26	BUF3	044
27	BUF3	034
28	BUF3	038
29	BUF3	060
30	BUF3	032
31	M1 Y	1000
32	M2 Y	750
33	M3 Y	750
34	M4 Y	750
35	M5 Y	750
36	M6 Y	1000

Multipliers

	X In	M/D	Y In
1			POT 13
		M	POT 19
	IN 1		POT 25
2			POT 14
		M	POT 20
	IN 2		POT 26
3			POT 15
		M	POT 21
	IN 3		POT 27
4			POT 16
		M	POT 22
	IN 4		POT 28
5			POT 17
		M	POT 23
	IN 5		POT 29
6			POT 18
		M	POT 24
	IN 6		POT 30
7			
8	~~BNC 3~~	~~M~~	
9			
10			
11			
12			

Sum Circuit Inputs

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Gate Signal Conditioner

In:

Averager

In:

+:

−:

BNC's on Front Panel

1	-10ϕ
2	$-10\phi^2$
3	$+10\phi^3$

Job No. ~~622A~~ 051

Date ~~4-20-71~~ 3-2-72

PRINTS 1-30

SPARC Setup

(Target 1) — Inputs

	V1	V2	V3	V4	V5	V6
S						
M	903	137	540	704	650	662

(Target 2) — Inputs

	V1	V2	V3	V4	V5	V6
S						
M	446	391	482	717	682	600

(Target 3) — Inputs

	H1	H2	H3	H4	H5	H6
S						
M	681	431	732	738	624	286

(Target 4) — Inputs

	H1	H2	H3	H4	H5	H6
S						
M	428	358	492	561	349	581

(Target ~~5~~ 7) — Inputs

	V1	V2	V3	V4	V5	V6
S						
M	868	303	714	822	696	683

(Target ~~6~~ 8) — Inputs

	V1	V2	V3	V4	V5	V6
S						
M	259	432	276	228	538	597

(Target ~~7~~ 9) — Inputs

	H1	H2	H3	H4	H5	H6
S						
M	726	466	520	570	547	579

(Target ~~8~~ 10) — Inputs

	H1	H2	H3	H4	H5	H6
S						
M	924	297	596	822	717	712

SEE PAGE 4 FOR S AND COVARIANCE VALUES

Job No.	Date
051	3-9-72

1-30

~~PRINTS 27 116~~

SPARC Setup

Sheet ~~2~~ 4 of ~~N~~ 12

(Target 1) S — Inputs

	V1	V2	V3	V4	V5	V6	
S	678	185	618	901	1000	1000	S
M	~~855~~	~~126~~	~~520~~	~~726~~	~~654~~	~~630~~	M
	1000	012	050	032	002	000	H1
		1000	042	044	065	098	H2
			1003	078	007	082	H3
				958	003	095	H4
					004	018	H5
						853	H6

(Target 3) F1 — Inputs

Inputs	H1	H2	H3	H4	H5	H6	
V1	1000						
V2	006	1000					
V3	212	086	1000				
V4	206	064	078	888			
V5	067	000	064	006	510		
✓V6	029	005	006	046	025	1000	
S	632	634	940	1000	1000	466	S
M	~~681~~	~~431~~	~~732~~	~~738~~	~~635~~	~~272~~	M

(Target 2) P — Inputs

	V1	V2	V3	V4	V5	V6	
S	389	461	574	904	1000	869	S
M	~~434~~	~~374~~	~~488~~	~~[illegible]~~	~~680~~	~~542~~	M
	1000	005	538	269	000	213	H1
		1000	450	121	198	000	H2
			1000	030	008	058	H3
				1000	242	035	H4
					524	046	H5
						416	H6

(Target 4) C3 — Inputs

Inputs	H1	H2	H3	H4	H5	H6	
V1	1000						
V2	043	1000					
V3	014	091	655				
V4	114	006	000	538			
V5	001	000	012	032	182		
V6	060	035	015	026	008	614	
S	969	525	1000	1000	1000	1000	S
M	~~623~~	~~385~~	~~406~~	~~593~~	~~564~~	~~381~~	M

(Target ~~5~~ 7) B34 — Inputs

	V1	V2	V3	V4	V5	V6	
S	620	446	769	951	987	953	S
M	~~849~~	~~308~~	~~726~~	~~859~~	~~724~~	~~674~~	M
	1000	008	094	058	081	006	H1
		946	053	128	142	131	H2
			1000	011	199	132	H3
				1000	012	077	H4
					1000	000	H5
						1000	H6

(Target ~~7~~ 9) H4 — Inputs

Inputs	H1	H2	H3	H4	H5	H6	
V1	1000						
V2	026	1000					
V3	032	234	1000				
V4	149	000	005	816			
✓V5	055	000	000	018	344		
V6	083	000	000	052	020	531	
S	918	750	960	1000	1000	1000	S
M	~~726~~	~~592~~	~~520~~	~~559~~	~~[illegible]~~	~~[illegible]~~	M

(Target ~~6~~ 8) H1 — Inputs

	V1	V2	V3	V4	V5	V6	
S	294	488	[illegible]	[illegible]	1000	1000	S
M	~~257~~	~~430~~	~~276~~	~~[illegible]~~	~~535~~	~~597~~	M
	996	000	005	207	017	013	H1
		1000	058	000	012	124	H2
			1000	006	004	232	H3
				1000	006	031	H4
					850	000	H5
						1000	H6

(Target ~~8~~ 10) ES-2 — Inputs

Inputs	H1	H2	H3	H4	H5	H6	
V1	1000						
V2	000	1000					
V3	107	024	1000				
V4	104	003	031	1003			
V5	000	000	001	058	856		
V6	000	005	056	008	002	923	
S	720	556	737	1000	1000	100	S
M	~~924~~	~~297~~	~~596~~	~~853~~	~~721~~	~~719~~	M

Job No.	Date
~~032~~ 051	~~[illegible]~~ 3-9-72

SPARC Processing Record

PRINTS 31-48

Tape Channel	Patch Channel	Op Amp Gain	µm	Skew	Delay
1					
2	2	2			
3					
4	3	2			
5	6	2			
6	1	3			+4
8					
9					
10	4	3			+4
11	5	2			
12					
13					
7			SYNC	INVERTED	

	θ	φ
A Delay		
B Delay		

	L	R
Zero Clamp		
Sun Gate		

φ Delay
φ Ramp
θ Delay
θ Ramp

	L	R
D Gate		

Period A
T.I. A to B
FOV

	Target	Loop	Gate 1		P/M	Gate 2		
1	S	5				255	227	H
						230	320	V
2	P	6/8	172	130				H
			710	870				V
3	F1	2 1/2	509	518				H
			160	300				V
4	C3	4				268	265	H
						140	300	V
5								H
								V
6								H
								V
7	BS9	6/8	220	192				H
			450	590				V
8	H1	2				082	058	H
						240	300	V
9	H9	6/8				366	361	H
						140	210	V
10	BS2	4	194	167				H
			010	160				V
11								H
								V
12	LOOPS FROM 051 TAPE DUPE							H
								V
13								H
								V
14								H
								V
15								H
								V
16								H
								V

Project	Job No.	Processor	Date
	051	CRJ RK	3-10-72

PRINTS 31-48

SPARC Setup

(Target 1) — Inputs

	V1	V2	V3	V4	V5	V6
S						
M	830	126	522	704	651	662

(Target 2) — Inputs

	V1	V2	V3	V4	V5	V6
S						
M	429	392	482	732	682	582

(Target 3) — Inputs

	H1	H2	H3	H4	H5	H6
S						
M	669	431	759	738	653	270

(Target 4) — Inputs

	H1	H2	H3	H4	H5	H6
S						
M	428	358	491	561	459	556

(Target ~~5~~ 7) — Inputs

	V1	V2	V3	V4	V5	V6
S						
M	830	303	704	837	720	649

(Target ~~6~~ 8) — Inputs

	V1	V2	V3	V4	V5	V6
S						
M	238	366	258	239	620	674

(Target 7) — Inputs

	H1	H2	H3	H4	H5	H6
S						
M	726	466	559	599	573	579

(Target 8) — Inputs

	H1	H2	H3	H4	H5	H6
S						
M	838	285	545	898	721	682

SEE PAGE 4 FOR S AND COVARIANCE VALUES

Job No.	Date
051	3-13-72

PRINT 49

SPARC Processing Record

Tape Channel	Patch Channel	Op Amp Gain	μm	Skew	Delay
1					
2					
3					
4					
5					
6					
8					
9					
10					
11					
12					
13					

θ	φ	
		A Delay
		B Delay

L	R	
		Zero Clamp
		Sun Gate

	φ Delay
	φ Ramp
	θ Delay
	θ Ramp

	L	R
D Gate		

Period A	
T.I. A to B	
FOV	

	Target	Loop	Gate 1		P/M	Gate 2		
1								H
								V
2								H
								V
3								H
								V
4	WATER							H
								V
5								H
								V
6								H
								V
7								H
								V
8								H
								V
9								H
								V
10								H
								V
11								H
								V
12								H
								V
13								H
								V
14								H
								V
15								H
								V
16								H
								V

Project	Job No.	Processor	Date
	051		3-13-72

Preprocessor Setup* 49 ~~112-114~~

*Applies to PRINTS ~~sheets~~

Purpose: $S_i' = S_i - (\pm K_1\phi \pm K_2\phi^2 \pm K_3\phi^3)$

Sheet 8 of 12 (~~15 of 17~~)

	Inputs	AGC Inputs
1	1	
2	2	
3	3	
4	4	
5	5	
6	6	
7		
8		
9		
10		
11		
12		

Buffers

	Inputs	Gain
1	M7X	
2	BNC2	
3	~~BNC?~~	
	BNC3	

	Outputs to SPARC	Monitor Jacks
1	POT31	POT31
2	POT32	POT32
3	POT33	POT33
4	POT34	POT34
5	POT35	POT35
6	POT36	POT36
7		
8		
9		
10		
11		
12		

Pots

	Input	Setting
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13	BUF1	010
14	↓	0
15	↓	019
16	↓	058
17	↓	020
18	↓	0
19	BUF2	085
20	↓	026
21	↓	042
22	↓	131
23	↓	178
24	↓	106
25	BUF3	078
26	↓	0
27	↓	0
28	↓	024
29	↓	097
30	↓	028
31	M1Y	1000
32	M2Y	750
33	M3Y	250
34	M4Y	250
35	M5Y	250
36	M6Y	1000

Multipliers

	X In	M/D	Y In
1			POT13
			POT19
	IN1		POT25
2			POT14
			POT20
	IN2		POT26
3			POT15
			POT21
	IN3		POT27
4			POT16
			POT22
	IN4		POT28
5			POT17
			POT23
	IN5		POT29
6			POT18
			POT24
	IN6		POT30
7	BNC1		
8	~~BNC3~~		
9			
10			
11			
12			

Sum Circuit Inputs

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Gate Signal Conditioner

In:

Averager

In:
+:
−:

BNC's on Front Panel

1	-10ϕ
2	$10\phi^2$
3	$10\phi^3$

Job No.: ~~[illegible]~~ 051

Date: ~~[illegible]~~ 3-13-72

PRINT 49

SPARC Setup

(Target 1) Inputs (Target 2)

V1 V2 V3 V4 V5 V6

S M H1 H2 H3 H4 H5 H6

Inputs V1 V2 V3 V4 V5 V6

Inputs

(Target 3) Inputs (Target 4)

	H1	H2	H3	H4	H5	H6
S	272	428	570	125	369	438
M	129	092	148	056	210	248

(Target 5) Inputs (Target 6)

V1 V2 V3 V4 V5 V6

S M H1 H2 H3 H4 H5 H6

Inputs V1 V2 V3 V4 V5 V6

Inputs

H1 H2 H3 H4 H5 H6

(Target 7) Inputs (Target 8)

Job No.	Date
051	3-13-72

Area Covered

Geometry Corrections:

Tan ϕ X

Yaw

Field Of View 80°

Camera Settings:

Motor Settings 300

Drive Frequency 25.2 Hz

Exposure f 5.6

5000 FT

Print No.	Type of Print	Spectral Channel or Threshold	Targets	Backgrounds	Other Comments
1	VID	TAPE CH 1	TAPE	051	3X 094 -500
2		2		"	2X 108
3		3		"	162
4		4		"	178
5		5		"	174
6		6		"	154
8		8		"	146
9		9		"	108
10		10		"	117
11		11		"	168
12		12		"	112
13		13		"	146
14		4	TAPE	022-1	2X 150
15		5		"	113
16		6		"	099
18		8		"	084
19		9		"	080
20	↓	10		"	090

Job No.	Date
051	3-7-72

Area Covered ______

Geometry Corrections:

Tan ϕ —

Yaw ______

Field Of View 80°

Camera Settings:

Motor Settings 300

Drive Frequency 25.2 Hz

Exposure f 5.6

5000 FT

Print No.	Type of Print	Spectral Channel or Threshold	Targets	Backgrounds	Other Comments RUN 17 [illegible]	
21	LR	1.0	T1	OTHERS	1090 / 569	LO
22		0.5	T2		15330 / 9440	TOO MUCH
23		1.0	T3		41740 / 39000	TOO MUCH
24		0.5	T4		20320 / 13550	NOT SPECIFIC
25		0.5	T7		3300 / 960	LO
26		0.5	T8		72200 / 66130	—
27		0.75	T9		62800 / 58000	—
28	↓	0.5	T10	↓	16060 / 10260	—
29	VID	SPARC CH 1			2,061,000 / 1,800000	
30	VID	OZZA LOOP 5	GATE	T1		
31	"	LOOP 8	GATE	T2		
32	"		2	T3		
33	"		2	T6		
34	"		4	T4		
35	"		4	T8		
36	"		6	T5		
37	"		6	T7		

Job No.	Date
051	3-9-72

Sheet 12 of 12

Area Covered ______________________

Geometry Corrections:

Tan ϕ ——

Yaw ______________

Field Of View 80°

Camera Settings:

Motor Settings 300

Drive Frequency 25.2 Hz   5000 FT

Exposure f 5.6

Print No.	Type of Print	Spectral Channel or Threshold	Targets	Backgrounds	Other Comments RUN 17	RUN 18
32	LR	+1.0	T1	OTHERS	1180	913
33	↓	0.5	T2		12400	9800
34	↓	1.0	T3		16300	14600
35	↓	0.5	T4		19200	16600
36	↓	0.75	T7		10100	3700
37 37A	↓	0.5 1.0	T8		149400 94800	126100 83300
38	↓	0.75	T9		69200	66300
39	↓	0.5	T10		22700	20700
40	VID	CH. 1			1,975,000	1,820,000
41	↓		T3 GATE	LOOP 2½		
42	↓		T1 "	LOOP 5		
43	↓		T2 "	LOOP 6/8		
44	↓		T7 "	"		
45	↓		T9 "	"		
46	↓		T4 "	LOOP 4		
47	↓		T10 "	"		
48	↓		T8 "	LOOP 2		
49	ED	-1.0	T4		538200	382400

Job No.	Date
051	3-13-72

PRINTS 1-26

SPARC Processing Record

Patch Channel	Tape Channel	Op Amp Gain	FM Unit	µm	
1	8	3		.63-.68	0+4
2	10	1		.75-.85	+5
3	9	1		.68-.74	+2
4	6	2		.54-.58	0+4
5	5	1		.43-.45	+4
6	4	2		.41-.43	+4
7	2	2		—	—
8					
9					
10					
11					
12					
Sync	7				
Frame	13				

θ	φ	
262	259	A Delay
—	—	B Delay

L	R	
638	676	Zero Clamp
—	—	Sun Gate

2	φ Delay
1	φ Ramp
1	θ Delay
2	θ Ramp

	L	R
D Gate	200	700

Period A	15680
T.I. A to B	3488

	Target	Loop	Gate 1		P/M	Gate 2		
1	C3	4	271	262				H
			340	500				V
2	LH	2	152	110	P	118	076	H
			080	170		370	450	V
3	S	5				249	230	H
						230	330	V
4	PS	3	186	147				H
			015	110				V
5	BS-3	5				300	275	H
						570	650	V
6	H1	2				082	057	H
						330	450	V
7	C1	1				132	073	H
						050	120	V
8	B	5	237	207				H
			200	300				V
9								H
								V
10								H
								V
11								H
								V
12								H
								V
13								H
								V
14								H
								V
15								H
								V
16								H
								V

Project	Job No.	Processor	Date
CHES BAY	022	WJ CJ EL	4-19-71

00381 P

11-6-70 0830

RUN 17 LINE 11

PRINTS 1-26

SPARC Setup

C3 (Target 1)

Inputs	V1	V2	V3	V4	V5	V6
S	653	141	627	988	1000	1000
M	345	070	224	330	360	573
H1	1000	054	186	213	090	120
H2		103	191	124	064	050
H3			1000	204	076	048
H4				1000	132	125
H5					463	077
H6						1000

LH (Target 2)

Inputs	V1	V2	V3	V4	V5	V6
S	711	846	980	1000	1000	1000
M	672	493	496	378	450	693
H1	1000	170	132	166	057	051
H2		1000	230	018	000	018
H3			1000	022	000	038
H4				481	032	0
H5					150	014
H6						622

(Target 3) S

Inputs	H1	H2	H3	H4	H5	H6
V1	1000					
V2	093	905				
V3	176	077	899			
V4	119	0	060	274		
V5	032	0	031	017	208	
V6	025	0	023	031	014	579
S	443	834	850	1000	1000	1000
M	529	434	485	437	442	647

(Target 4) P.S.

Inputs	H1	H2	H3	H4	H5	H6
V1	1000					
V2	000	1000				
V3	063	000	1000			
V4	098	032	000	198		
V5	035	000	056	000	040	
V6	034	001	038	000	000	1000
S	755	642	874	966	994	1000
M	934	390	508	494	504	727

BS3 (Target 5)

Inputs	V1	V2	V3	V4	V5	V6
S	1000	998	1000	1000	1000	998
M	824	270	414	340	394	378
H1	607	160	008	0	002	102
H2		139	040	032	0	096
H3			014	011	002	052
H4				007	008	041
H5					000	176
H6						148

H1 (Target 6)

Inputs	V1	V2	V3	V4	V5	V6
S	387	506	665	941	1000	1000
M	422	345	498	459	454	690
H1	1000	178	213	282	084	071
H2		1000	250	0	0	029
H3			896	010	0	0
H4				687	0	044
H5					0	053
H6						671

(Target 7) C1 (4/16/71)

Inputs	H1	H2	H3	H4	H5	H6
V1	1000					
V2	170	1000				
V3	148	207	763			
V4	043	0	030	0		
V5	0	0	033	0	0	
V6	028	012	016	406	022	144
S	760	983	1000	1000	1000	1000
M	658	500	484	354	433	671

(Target 8) B

Inputs	H1	H2	H3	H4	H5	H6
V1	1000					
V2	134	1000				
V3	049	043	857			
V4	107	0	013	042		
V5	038	0	0	006	0	
V6	039	0	050	0	0	175
S	559	917	1000	1000	1000	1000
M	528	358	468	388	416	618

Job No.	Date
022-A	4-15-71

SPARC Film Output

Area covered CHESAPEAKE BAY (HOG ISLAND)

Geometry corrections:

Tan φ ✓

Yaw

Field of view 80°

Camera settings:

Motor setting 30

Drive frequency 25.2 Hz

Exposure f 5.6

Print No.	Type of Print	Spectral Channel or Threshold	Targets	Backgrounds	Other Comments
1	VIP	SPARC-1	C 3	GATE	Loop 4
2	"	"	LH	"	" 2
3	"	"	H1	"	" 2
4	"	"	S	"	" 5
5	"	"	B	"	" 5
6	"	"	BS-3	"	" 5
7	"	"	PS	"	" 3
8	"	"	C-1	"	" 1
9	LR	.7	C 3	LH, S, PS, BS-3 H-1, C-1, B	6078
10	"	1.5	LH	C 3, S, PS, BS-3 H1, C-1, B	12733
11	"	1.5	S	C 3, LH, PS, BS-3 H-1, C-1, B	2447
12	"	1.5	PS	C 3, LH, S, BS-3 H-1, C-1, B	1219
13	"	"	BS-3	C 3, LH, PS, H-1 C-1, B, S	83
14		1.0	H-1	C 3, LH, PS, BS-3 C-1, B, S	25731
15		"	C-1	C 3, LH, PS, BS-3 H-1, S, B	2949
16		"	B	C 3, LH, S, PS, BS-3, H1, C-1	36164
16		1.5	B	C-3, LH, S, BS-3 H-1, S, C-1	5913

2013680

Job No.	Date
022-A	4/6/71

SPARC Film Output

Area covered: CHESA. BAY

Geometry corrections:

Tan φ: X

Yaw: —

Field of view: 80°

Camera settings:

Motor setting: 300

Drive frequency: 25.2 Hz

Exposure: f 5.6

Print No.	Type of Print	Spectral Channel or Threshold	Targets	Backgrounds	Other Comments
17	VID	SPARC-1			LOW CONTRAST
18	LR	1.0	1	2-8	5078
19	"	1.5	2	1, 3-8	[illegible]
20	"	1.5	3	1, 2, 4-8	788
21	"	0.5	4	1-3, 5-8	5089
22	"	0.5	5	1-4, 6-8	222
23	"	1.0	6	1-5, 7, 8	26101
24	"	1.5	7	1-6, 8	[illegible]34
25	"	1.75	8	1-7	4274
26	VID	SPARC 1	63-68		LOW CONTRAST (684,)
27	"	" 1	63-68		NORMAL CONT.
28	"	2	75-85		"
29	"	3	68-74		"
30	"	4	54-58		"
31	"	5	43-45		"
32	"	6	41-43		"

4-23-71

Job No. 021-A

Date 4/16/71

PRINTS 27–112 Sheet 5 of 17

SPARC Processing Record

Patch Channel	Tape Channel	Op Amp Gain	FM Unit	μm	
1	8	-3		63-68	0+4
2	10	-2		75-85	+5
3	9	-2		68-74	+2
4	6	-3		54-58	0+4
5	5	-2		43-45	+4
6	4	-2		41-43	+4
7					
8					
9					
10					
11					
12					
Sync					
Frame					

	θ	φ
A Delay	262	259
B Delay	/	/

	L	R
Zero Clamp	638	676
Sun Gate		

φ Delay	2
φ Ramp	1
θ Delay	1
θ Ramp	2

D Gate: L 200, R 200

Period A: 15680

T.I. A to B: 3488

	Target	Loop	Gate 1		P/M	Gate 2		
1	S	5				253	225	H
						230	330	V
2	P	8	172	130				H
			120	260				V
3	F1	2	504	518				H
			440	580				V
4	C3	4				268	265	H
						370	500	V
5	BS4	6	221	194				H
			540	690				V
6	H1	2				082	057	H
						330	450	V
7	H4	6				316	361	H
						200	510	V
8	BS-2	4	194	167				H
			030	310				V
9								H
								V
10								H
								V
11								H
								V
12								H
								V
13								H
								V
14								H
								V
15								H
								V
16								H
								V

Project	Job No.	Processor	Date
CHESA BAY	022 A	WJ. CRJ	4-20-71

11-6-70 0830

RUN 17 : LINE 11

Preprocessor Setup*

Sheet 6 of 17

*Applies to ~~sheets~~ PRINTS 27-112

Purpose: $S_i' = S_i' - (\pm K_1 \phi \pm K_2 \phi^2 \pm K_3 \phi^3)$

	Inputs	AGC Inputs
1	1	
2	2	
3	3	
4	4	
5	5	
6	6	
7		
8		
9		
10		
11		
12		

Buffers

	Inputs	Gain
1	BNC 1	1
2	BNC 2	1
3	M8 X	1

	Outputs to SPARC	Monitor Jacks
1	POT 31	POT 31
2	POT 32	POT 32
3	POT 33	POT 33
4	POT 34	POT 34
5	POT 35	POT 35
6	POT 36	POT 36
7		
8		
9		
10		
11		
12		

Pots

	Input	Setting
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13	BUF 1	054
14	BUF 1	074
15	BUF 1	067
16	BUF 1	021
17	BUF 1	010
18	BUF 1	008
19	BUF 2	088
20	BUF 2	0
21	BUF 2	034
22	BUF 2	085
23	BUF 2	102
24	BUF 2	073
25	BUF 3	041
26	BUF 3	044
27	BUF 3	034
28	BUF 3	038
29	BUF 3	060
30	BUF 3	032
31	M1 Y	1000
32	M2 Y	750
33	M3 Y	750
34	M4 Y	750
35	M5 Y	750
36	M6 Y	1000

Multipliers

	X In	M/D	Y In
1			POT 13
		M	POT 19
	IN 1		POT 25
2			POT 14
		M	POT 20
	IN 2		POT 26
3			POT 15
		M	POT 21
	IN 3		POT 27
4			POT 16
		M	POT 22
	IN 4		POT 28
5			POT 17
		M	POT 23
	IN 5		POT 29
6			POT 18
		M	POT 24
	IN 6		POT 30
7			
8	BNC 3		
		M	
9			
10			
11			
12			

Sum Circuit Inputs

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Gate Signal Conditioner

In	

Averager

In	
+	
-	

BNC's on Front Panel

1	-10ϕ
2	$10\phi^2$
3	$-10\phi^3$

Job No. 022 A

Date 4-20-71

PRINTS 27-112

SPARC Setup

(Target 1) S — Inputs

	V1	V2	V3	V4	V5	V6
S	678	186	618	901	1000	1000
✓ M	855	126	520	726	604	650
H1	1000	[illegible]	050	032	002	000
H2		1000	042	044	065	098
H3			1000	078	007	082
H4				958	003	095
H5					004	018
H6						858

(Target 3) F1 — Inputs

	H1	H2	H3	H4	H5	H6
V1	1000					
V2	006	1000				
V3	212	086	1000			
V4	204	064	078	888		
V5	067	000	060	[illegible]	510	
✓ V6	029	005	006	046	025	1000
S	632	634	940	1000	1000	466
M	681	431	732	738	635	272

(Target 2) P — Inputs

	V1	V2	V3	V4	V5	V6
S	389	461	574	904	1000	869
M	424	374	488	742	680	592
H1	1000	005	538	269	000	213
H2		1000	450	121	198	000
H3			1000	030	008	058
H4				1000	242	095
H5					524	046
H6						416

(Target 4) C3 — Inputs

	H1	H2	H3	H4	H5	H6
V1	[illegible]					
V2	045	1000				
V3	014	091	655			
V4	114	006	000	838		
V5	001	000	012	032	182	
V6	060	035	015	026	008	614
S	969	525	1000	1000	1000	1000
M	623	385	496	593	554	581

(Target 5) B34 — Inputs

	V1	V2	V3	V4	V5	V6
S	620	446	769	951	987	953
M	844	308	726	859	724	674
H1	1000	008	094	058	081	006
H2		946	033	128	142	131
H3			1000	011	199	132
H4				1000	012	077
H5					1000	003
H6						1000

(Target 7) H4 — Inputs

	H1	H2	H3	H4	H5	H6
V1	[illegible]					
V2	026	1000				
V3	032	234	1000			
V4	149	000	005	[illegible]		
V5	055	000	000	018	[illegible]	
V6	083	000	000	052	020	[illegible]
S	918	750	760	[illegible]	[illegible]	[illegible]
M	[illegible]	[illegible]	520	559	[illegible]	[illegible]

(Target 6) H1 — Inputs

	V1	V2	V3	V4	V5	V6
S	224?	485?	[illegible]	[illegible]	1000	[illegible]
M	257	433?	276	258	[illegible]	577
H1	996	000	000	207	017	013
H2		[illegible]	058	000	012	124
H3			[illegible]	000	004	232?
H4				[illegible]	000	000
H5					234	000
H6						[illegible]

(Target 8) BS-2 — Inputs

	H1	H2	H3	H4	H5	H6
V1	1000					
V2	000	1000				
V3	107	024	1000			
V4	104	003	031	1000		
V5	000	000	001	058	856	
V6	000	005	056	008	002	923
S	720	556	737	1000	[illegible]	[illegible]
M	924	297	596	858	721	712?

Job No.	Date
022 A	[illegible]

SPARC Film Output

Area covered CHESA BAY

Geometry corrections:

Tan ϕ X

Yaw

Field of view 80°

Camera settings:

Motor setting 300

Drive frequency 25.2 Hz

Exposure f 5.6

100% A.C.= 2,007,600

Print No.	Type of Print	Spectral Channel or Threshold	Targets	Backgrounds	Other Comments
33	UID	SPARC 2 .75-.85	T1 - S	LOOP 5	GATE
34	"	"	T2 - P	8	"
35	"	"	T3 - F1	2	"
36	"	"	T4 - C3	4	"
37	"	"	T5 - BS4	6	"
38	"	"	T6 - H1	2	"
39	"	"	T7 - H4	6	"
40	"	"	T8 - BS2	4	"
41	ED	-1.0	T1		AREA COUNT 3,190
42	↓	-.75	T1		2,121
43		-.50	T1		1,210
44		-.75	T2		11,530
45		-.60	T2		8,090
46		-.50	T2		5,950
47		-.75	T3		8,460
48		-.6	T3		4,720
49		-.50	T3		2,870

Job No.	Date
022 A	4-23-71

SPARC Film Output

Area covered CHES BAY

Geometry corrections:

Tan ϕ X

Yaw

Field of view 80°

Camera settings:

Motor setting 300

Drive frequency 25.2 Hz

Exposure f 5.6

Print No.	Type of Print	Spectral Channel or Threshold	Targets	Backgrounds	Other Comments
50	ED	-1.25	T4		2,840
51		-1.0	T4		1740
52		-.75	T4		990
53		-1.0	T5		8,860
54		-.75	T5		6,010
55		-.50	T5		3,530
56		-1.0	T6		51,350
57		-.75	T6		32,490
58		-.50	T6		19,010
59		-1.0	T7		59,720
60		-.75	T7		40,300
61		-.50	T7		23,680
62		-1.0	T8		12,250
63		-.75	T8		7,650
64		-.50	T8		3,620

Job No.	Date
0224	4-23-71

SPARC Film Output

Sheet 10 of 17

Area covered: CHES BAY

Geometry corrections:

Tan ϕ: X

Yaw:

Field of view: 80°

Camera settings:

Motor setting: 300

Drive frequency: 25.2 Hz

Exposure f: 5.6

Print No.	Type of Print	Spectral Channel or Threshold	Targets	Backgrounds	Other Comments
65	L.R.	1.0	1	ALL OTHERS	AREA COUNT 2860 ✓
66		1.25	1		2130 ✓
67		1.5	1		1150 ✓
68		0.5	2		31360 ✓
69		0.75	2		27020 ✓
70		1.0	2		22730 ✓
71		1.0	3		34900 ✓
72		1.25	3		22160 ✓
73		1.5	3		11180 ✓
74		0.5	4		5170 ✓
75		0.25	4		4490 ✓
76		1.0	4		3720 ✓
77		0.75	5		11080 ✓
78		1.0	5		9780 ✓
79		1.25	5		7880 ✓
80		0.5	6		94350 ✓
81		0.75	6		86590 ✓
82		1.0	6		76190 ✓

Job No.	Date
022 A	4-26-71

SPARC Film Output

Area covered CHES BAY

Geometry corrections:

Tan ϕ X

Yaw

Field of view 80°

Camera settings:

Motor setting 300

Drive frequency 25.2 Hz

Exposure f 5.6

Print No.	Type of Print	Spectral Channel or Threshold	Targets	Backgrounds	Other Comments
83	LR	0.75	7	ALL OTHERS	88350 ✓
84	↓	1.0	7	↓	78880 ✓
85	↓	1.25	7	↓	63330 ✓
86	↓	0.5	8	↓	21200 ✓
87	↓	0.75	8	↓	19400 ✓
88	↓	1.0	8	↓	18250 ✓

Job No.	Date
022 A	4-27-71

SPARC Film Output

Area covered CHES BAY

Geometry corrections:

Tan ϕ X

Yaw ______

Field of view 80°

Camera settings:

Motor setting 300

Drive frequency 25.2 Hz

Exposure f 5.6

Print No.	Type of Print	Spectral Channel or Threshold	Targets	Backgrounds	Other Comments
89	LR+VID	VID 1 1.0	1	ALL OTHERS	(50% VIDEO) 2950
90	↓	↓ 1.25	1	↓	2150
91		1.5	1		1180
92		.5	2		30180
93		.75	2		26690
94		1.0	2		22220
95		1.0	3		30690
96		1.25	3		21,250
97		1.5	3		10,500
98		.5	4		5200
99		.75	4		4,400
100		1.0	4		3,590
101		.75	5		10,765
102		1.0	5		9,445
103		1.25	5		7,670
104		.5	6		94,560
105		.75	6		86,920
106	↓	↓ 1.0	6	↓	77,170

Job No.	Date
022 A	4-22-71

SPARC Film Output

Area covered CHES BAY

Geometry corrections:

Tan ϕ X

Yaw

Field of view 80°

Camera settings:

Motor setting 300

Drive frequency 252 Hz

Exposure f 5.6

Print No.	Type of Print	Spectral Channel or Threshold	Targets	Backgrounds	Other Comments
107	LR+VID	VID 1 .75	7	ALL OTHERS	84 6[illegible]
108		1.0	7		74610
109		1.25	7		60090
110		.5	8		21,130
111		.75	8		[illegible]
112		1.0	8		18,130
113	VID	.75-.85	T9	LOOP 4	TRAIN GATE
114	ED	-1.0	T9	(12 COPIES)	477260

Job No.	Date
022A	4-27-71

PRINTS 113-114

SPARC Processing Record

	Patch Channel	Tape Channel	Op Amp Gain	FM Unit	μm
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
Sync					
Frame					

SEE SHEET 6

	θ	φ
A Delay		
B Delay		

	L	R
Zero Clamp		
Sun Gate		

φ Delay	
φ Ramp	
θ Delay	
θ Ramp	

	L	R
D Gate		

Period A	
T.I. A to B	

	Target	Loop	Gate 1		P/M	Gate 2		
1								H
								V
2								H
								V
3								H
								V
4	WATER		098	095	P	318	546	H
			001	750		220	410	V
5								H
								V
6								H
								V
7								H
								V
8								H
								V
9								H
								V
10								H
								V
11								H
								V
12								H
								V
13								H
								V
14								H
								V
15								H
								V
16								H
								V

Project	Job No.	Processor	Date
	022 B	W.J. C.R.J.	4-27-71

Preprocessor Setup*

*Applies to ~~sheets~~ PRINTS 113 - 114

Purpose: $S_i' = S_i - (\pm K_1\phi \pm K_2\phi^2 \pm K_3\phi^3)$

	Inputs	AGC Inputs
1	1	
2	2	
3	3	
4	4	
5	5	
6	6	
7		
8		
9		
10		
11		
12		

Buffers

	Inputs	Gain
1	M7X	
2	BNC2	
3	M8X	

	Outputs to SPARC	Monitor Jacks
1	POT31	POT31
2	POT32	POT32
3	POT33	POT33
4	POT34	POT34
5	POT35	POT35
6	POT36	POT36
7		
8		
9		
10		
11		
12		

Pots

	Input	Setting
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13	BUF1	010
14	↓	0
15	↓	019
16	↓	058
17	↓	020
18	↓	0
19	BUF2	085
20	↓	026
21	↓	042
22	↓	131
23	↓	178
24	↓	106
25	BUF3	078
26	↓	0
27	↓	0
28	↓	024
29	↓	097
30	↓	028
31	M1Y	1000
32	M2Y	250
33	M3Y	250
34	M4Y	250
35	M5Y	250
36	M6Y	1000

Multipliers

	X In	M/D	Y In
1			POT 13
			POT 19
	IN1		POT 25
2			POT 14
			POT 20
	IN2		POT 26
3			POT 15
			POT 21
	IN3		POT 27
4			POT 16
			POT 22
	IN4		POT 28
5			POT 17
			POT 23
	IN5		POT 29
6			POT 18
			POT 24
	IN6		POT 30
7	BNC1		
8	BNC3		
9			
10			
11			
12			

	Sum Circuit Inputs
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Gate Signal Conditioner

In:

Averager

In:

+:

−:

BNC's on Front Panel

1	-10ϕ
2	$10\phi^2$
3	$-10\phi^3$

Job No. 0228

Date 4-22-71

PRINTS 113-114

SPARC Setup

Sheet 16 of 17

(Target 1)

Inputs	V1	V2	V3	V4	V5	V6
S						
M						
H1						
H2						
H3						
H4						
H5						
H6						

(Target 2)

Inputs	V1	V2	V3	V4	V5	V6
S						
M						
H1						
H2						
H3						
H4						
H5						
H6						

(Target 3)

Inputs	H1	H2	H3	H4	H5	H6
V1						
V2						
V3						
V4						
V5						
V6						
S						
M						

(Target 4)
WATER

Inputs	H1	H2	H3	H4	H5	H6
V1	1000					
V2		1000				
V3			1000			
V4				1000		
V5					1000	
V6						1000
S	272	428	570	427	370	438
M	160	050	153	272	210	235

(Target 5)

Inputs	V1	V2	V3	V4	V5	V6
S						
M						
H1						
H2						
H3						
H4						
H5						
H6						

(Target 6)

Inputs	V1	V2	V3	V4	V5	V6
S						
M						
H1						
H2						
H3						
H4						
H5						
H6						

(Target 7)

Inputs	H1	H2	H3	H4	H5	H6
V1						
V2						
V3						
V4						
V5						
V6						
S						
M						

(Target 8)

Inputs	H1	H2	H3	H4	H5	H6
V1						
V2						
V3						
V4						
V5						
V6						
S						
M						

Job No.	Date
022B	4-27-71

Remarks

Sync signal: GOOD

60 Hz GOOD

Tape quality:

Signal variations: PREPROCESSING REQUIRED TO REMOVE CROSS-FLIGHT SIGNAL VARIATIONS. ALONG-FLIGHT SIGNAL VARIATIONS PREVENTED GOOD WATER RECOGNITION.

Preprocessing problems:

CROSS-FLIGHT CORRECTION DIFFERENT FOR LAND AND WATER AREAS.

Processing problems:

SOME EVIDENCE OF NON-OPTIMUM PRE-PROCESSING SHOW AS POOR EDGE RECOGNITION.

Date 4-28-71

Job No. 022,A,B