28 September 1976

MEMORANDUM TO: I. Cindrich

FROM: R. J. Dallaire RJP

SUBJECT: Preliminary Test Comparisons Between the Reticon and Fairchild Sensor Arrays.

Two linear image sensors were tested using a He-Ne laser and a Argon laser. The results showed that the Reticon device, although less sensitive than the Fairchild, is the device to be used for image detection of laser illuminated images in cases where saturation can occur in some of the pixels. In the case of VLA and radar data, many pixels in the image do saturate. When saturation does occur, the Reticon device spills the energy into adjacent cells in a linear fashion. The Fairchild device will spill the energy into cells to samples away and do it in a very nonlinear manner. In the case of severe saturation (10 times full scale), the entire line would be lost.

The devices tested were the Reticon (RL1024EC) and the Fairchild (CCD121). Both are 1024 element one-dimensional arrays, and both were tested using the standard manufacturer supplied electronics boards. It is recognized that the performance of both devices could be improved by optimizing the electronics to fit the application, but the performance of the Reticon with its associated electronics board is adequate for the VLA study program.

The performance of the Fairchild device lagged behind the Reticon in four areas: 1) dynamic range (569.1: to 773.4:1), 2) crosstalk (25% to 5.3%), 3) MTF (37% to 48%) and 4) nonlinear saturation characteristics which can obliterate an entire line.

The only areas where the Fairchild device is superior is with a better gain uniformity (7.5% vs. 20.6% peak), and greater sensitivity (33 times more). Reference the attached table of results.

The results of tests are preliminary prior to a full characterization using a computer. But the results thus far indicate that the Reticon device is to be the one chosen for the final tests. The problem with the larger gain nonuniformity is not significant since only a small number of cells differ significantly from the mean (σ = 6.9%) and the problem of lower sensitivity can be solved by a more powerful laser or cooling and a longer integration period.

RJD:sd

cc: C. Aleksoff
D. Ausherman
J. Fienup
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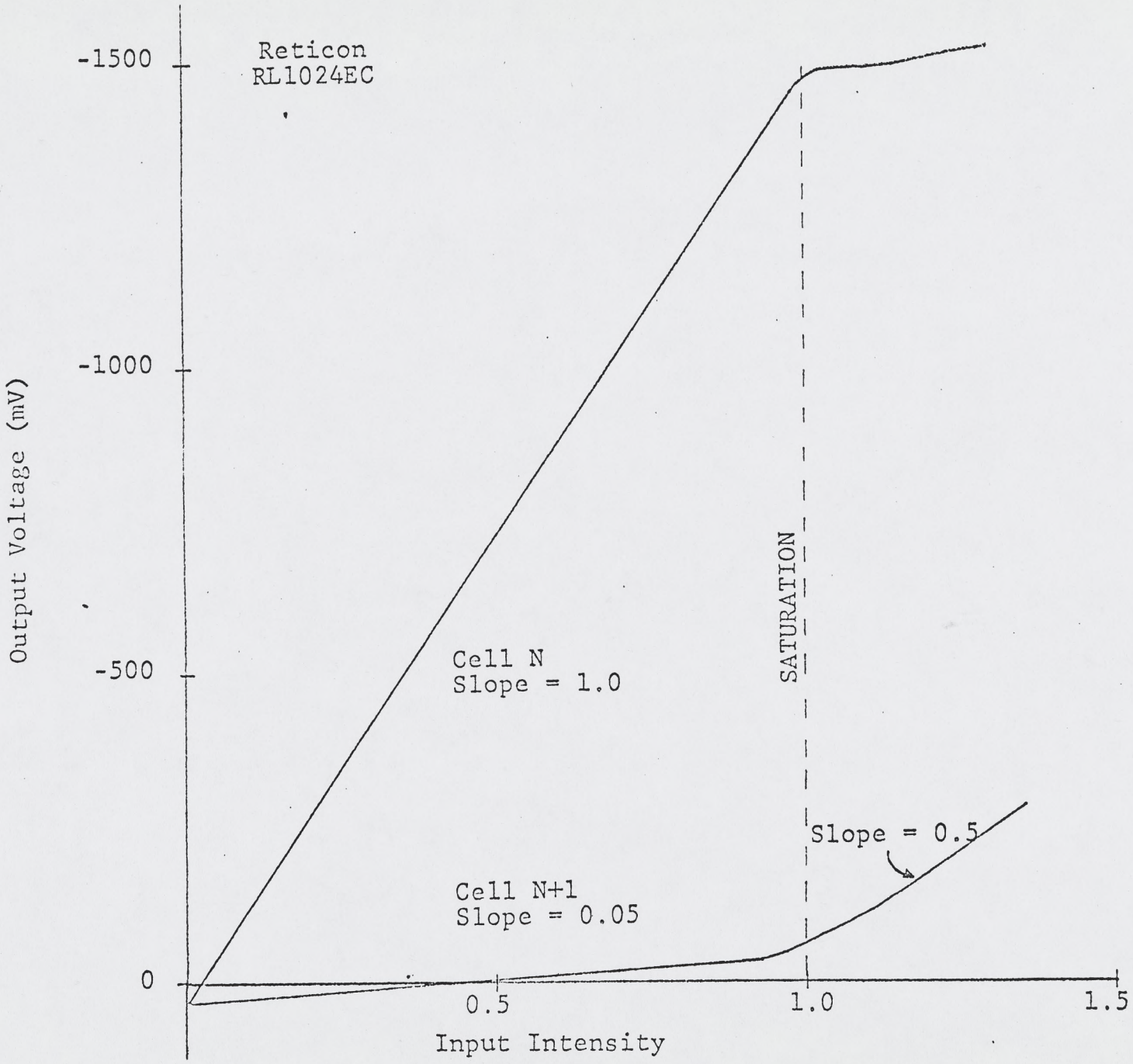
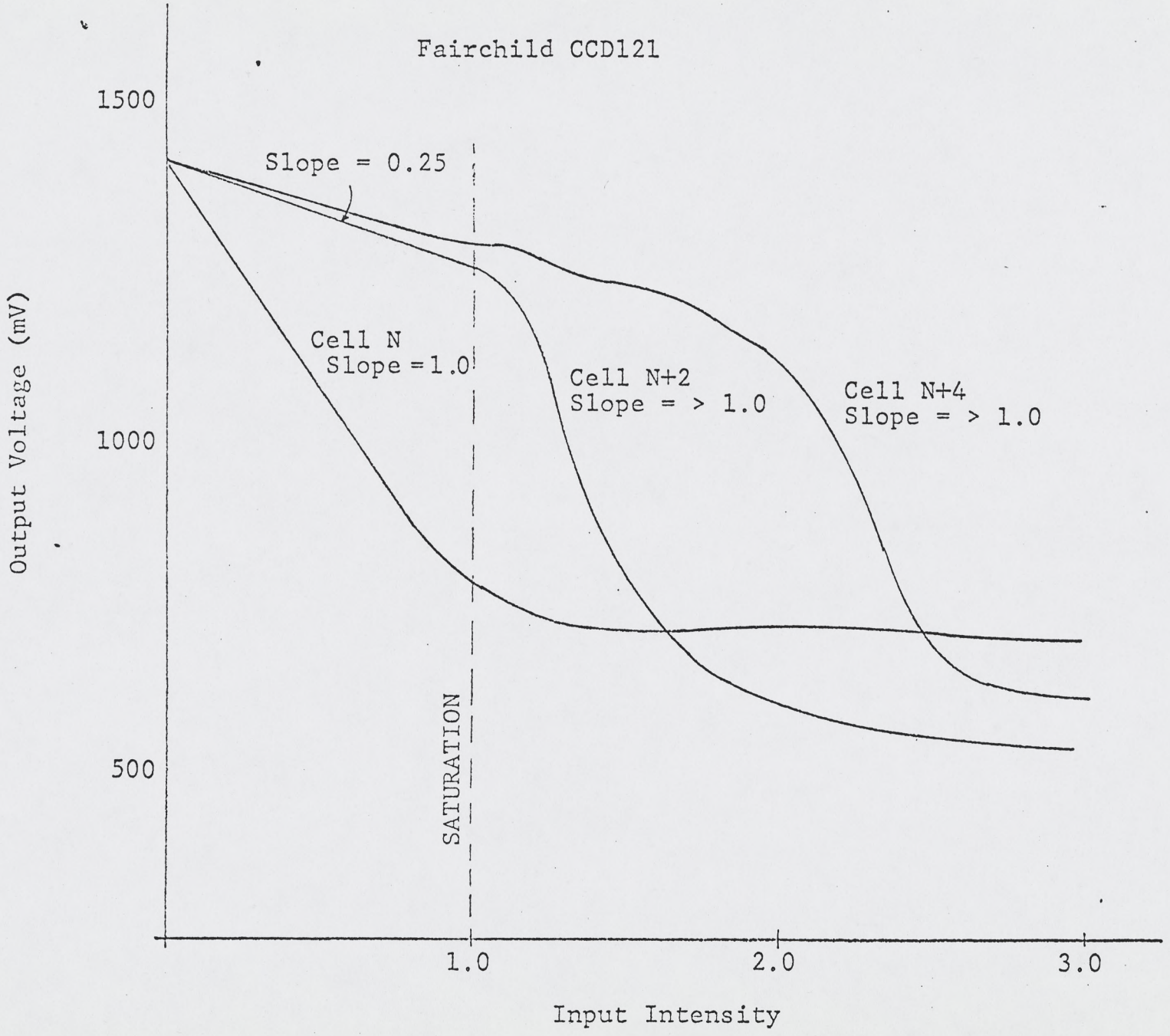
J. Marks

RESULTS

	Reticon		Fairchild	
Noise peak/peak	6.7mV		4mV	
(Dark) RMS	1.92mV		1.15mV	
Peak Signal	1485mV		650mV	
Dynamic Range Peak/RMS	773.4:1		562.9:1	
Saturation (see attached curves)	He-Ne	Ar	He-Ne	Ar
% to next w/c cell	.50	.42	100%	—
	He-Ne	Ar	He-Ne	Ar
Crosstalk	5.3%	2.5%	25%*	—
Sensitivity	3.5 $\mu J/cm^2$		.41 $\mu J/cm^2$	
Normalized to cell size (1 mil^2)**	3.5		.107	
Gain Nonuniformity	-20.6%	+13.2	-7.5%	
MTF (@ maximum frequency)	48%		37%	

* Not same lens setup
** Fairchild is 33 × more sensitive/cell


Reticon
RL1024EC
-1500
-1000
-500
0
Output Voltage (mV)
Cell N
Slope = 1.0
SATURATION
Slope = 0.5
Cell N+1
Slope = 0.05
0.5
1.0
1.5
Input Intensity


Fairchild CCD121
1500
1000
500
Output Voltage (mV)
Slope = 0.25
Cell N
Slope = 1.0
Cell N+2
Slope = > 1.0
Cell N+4
Slope = > 1.0
SATURATION
1.0
2.0
3.0
Input Intensity