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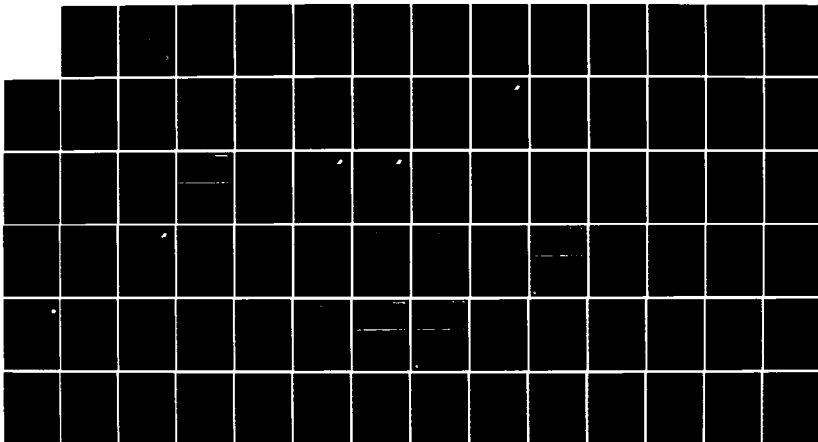
FABRICATION OF DIGICONS FOR THE SHAD EXPERIMENT(U)
SCIENCE APPLICATIONS INTERNATIONAL CORP SAN DIEGO CA
31 DEC 84 SAIC-84/1842 N00014-82-C-0363

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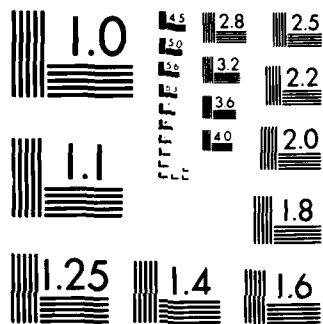
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NATIONAL BUREAU OF STANDARDS 1963-A

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AD-A152 694

FABRICATION OF DIGICONS
 FOR THE
 SHAD EXPERIMENT

FINAL REPORT

Contract N00014-82-C-0363

SCIENCE APPLICATIONS, INC.

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**FABRICATION OF DIGICONS
 FOR THE
 SHAD EXPERIMENT**

FINAL REPORT

 Contract N00014-82-C-0363

December 31, 1984

Prepared by:

Science Applications International Corporation
 Electronic Vision Systems Division
 11526 Sorrento Valley Road
 San Diego, California 92121

Prepared for:

Office of Naval Research
 Department of the Navy
 800 North Quincy Street
 Arlington, Virginia 22217

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 10401 Roselle Street, San Diego, California 92121

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1.0 PURPOSE

The purpose of this program is to provide the necessary personnel and facilities required to design, fabricate, test, and deliver the intensified quadrat photomultiplier tubes (Digicons) required to support the SHAD experiment. Deliverables included two (2) breadboard tubes, three (3) space-qualified tubes, reports, and data.

All work ~~required~~ by this contract has been accomplished. Two (2) breadboard tubes were fabricated, the design verified through testing and the tubes delivered. Three (3) space-qualified tubes have been fabricated, tested, and delivered. All reports and data requirements will have been satisfied with the ~~submittal~~ of this final report.

2.0 SHAD DIGICON DESIGN

2.1 BACKGROUND

The design of the quadrant photo tube for the SHAD Experiment was derived from the quadrant Digicon guider tube developed by SAIC under contract to the University of Maryland.

The Digicon tube is an imaging tube with a photocathode as an electron source on one end and a monolithic silicon photodiode array as a detector on the other end (Fig. 1). Electrons produced by incoming photons at the photocathode are accelerated by an electrostatic field and detected by the diode array. Each photodiode serves as the high-gain first stage of a detector channel, producing a charge pulse of approximately 5000 electron-hole pairs for each incident photoelectron. Each current pulse is amplified by a charge sensitive preamplifier and is "counted" if it exceeds a preset discriminator threshold level. The Digicon is characterized by a wide dynamic range, low noise, high photometric accuracy, and high reliability.

2.2 SHAD DESIGN

The design goals for the SHAD Flight-Qualified tube are listed in Table 1. In order to satisfy them, revisions were made to the internal tube structure making it more compatible with the vibration environment to be encountered. The quadrant diode array design was revised to specify the tighter inter-diode spacing recommended by Dr. Currie. See Fig. 2 SAIC Drawing No. 131-18-111-203.

The packaging and encapsulation design was completely revised for this application. The magnetic shield was redesigned to provide a closed shield. The encapsulant and HV cables were changed in order to be compatible with the requirement for use of space-qualified materials, and the method of attaching the High Voltage cable revised to accommodate the spacecraft's environmental requirements.

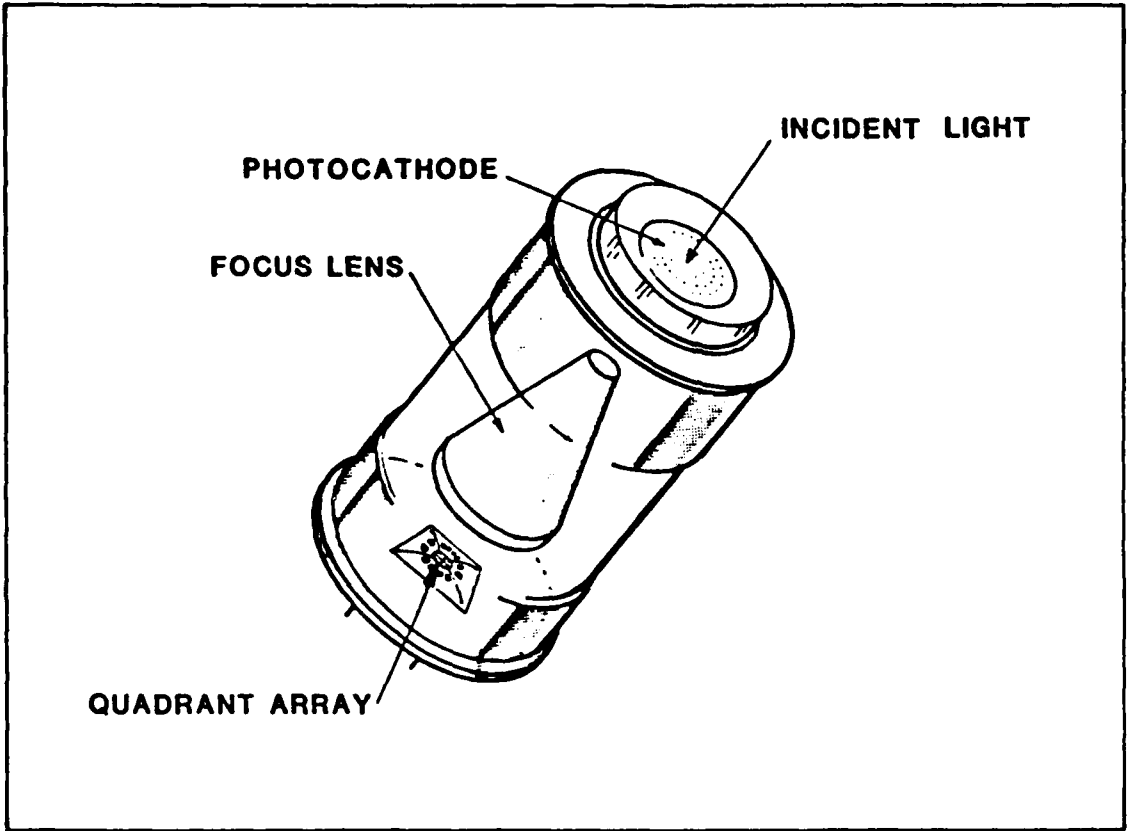


Figure 1. Quadrant Digicon—Unencapsulated View.

Table 1. SHAD Quadrant Digicon Performance Goals.

1. PHYSICAL (See Figure 4)	
• Length	3.50" ± 0.01"
• Diameter	2.00" ± 0.01"
• Weight	≤350 grams
• Array Configuration	See Fig. 2
2. ELECTRICAL	
• Diode Leakage Current (6V Reverse Bias)	≤1 nA (4 central diodes)
• Diode Capacitance (6V Reverse Bias)	≤15 pf (4 central diodes)
• ΔE/E at 15 kV	≤0.25 (4 central diodes)
3. PERFORMANCE AT 15 kV	
• Photocathode Quantum Efficiency	400 nm 25%
	500 nm 15%
	700 nm 2.5%
	800 nm 0.1%
• Dark Count	≤25 ct/sec/diode (avg of 4 central diodes)
• Magnification	0.6 < m < 1
• Error Function (10-90%)	50μ
• Uniformity (4 central diodes)	±5%
4. ENVIRONMENTAL	
• Vacuum Operation	Compatible
• Temperature	-40°C to +55°C
• Vibration	See SHAD Vibration Levels

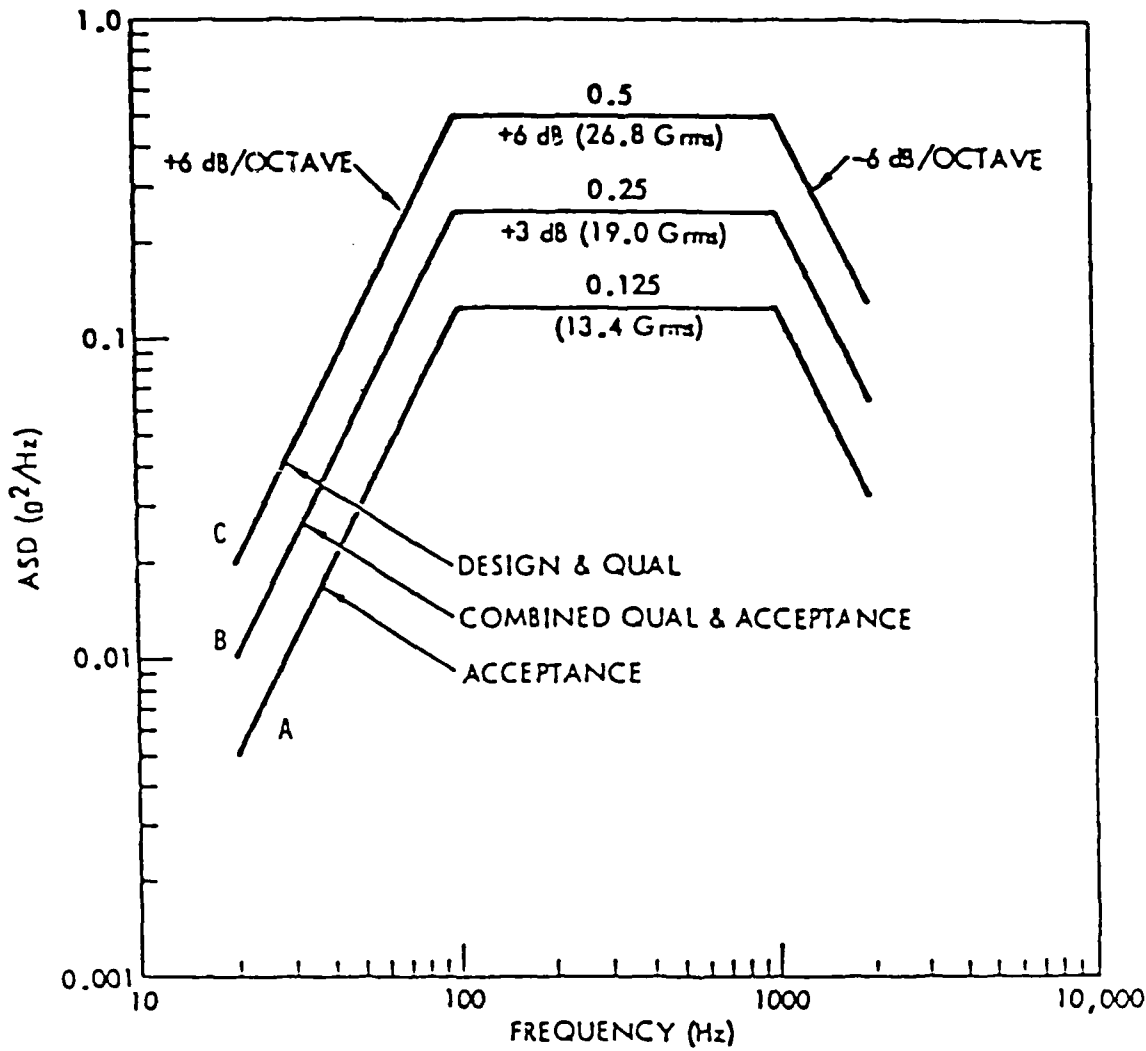


Figure 5. SHAD Vibration Levels

INTERFACE CONTROL DOCUMENT

DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND
 CHANGES HEREIN CONTAINED SHALL BE DEEMED TO ALTER
 TERMS OF ANY CONTRACT OR PURCHASE ORDER BE-
 TWEEN ALL PARTIES AFFECTED

SIZE

A

CODE IDENT NO.

03953

DRAWING NO.

MH09-00006-400

SCALE

REV

SHEET 10 OF

The encapsulation technique has been described in detail in a report to ONR, SAI-83/1421, dated December 1, 1983. The final encapsulated tube assembly is shown in Fig. 3, SAIC Drawing No. 131-18-110-000. The interface drawing, SAIC Drawing No. 131-18-110-001 is provided in Fig. 4.

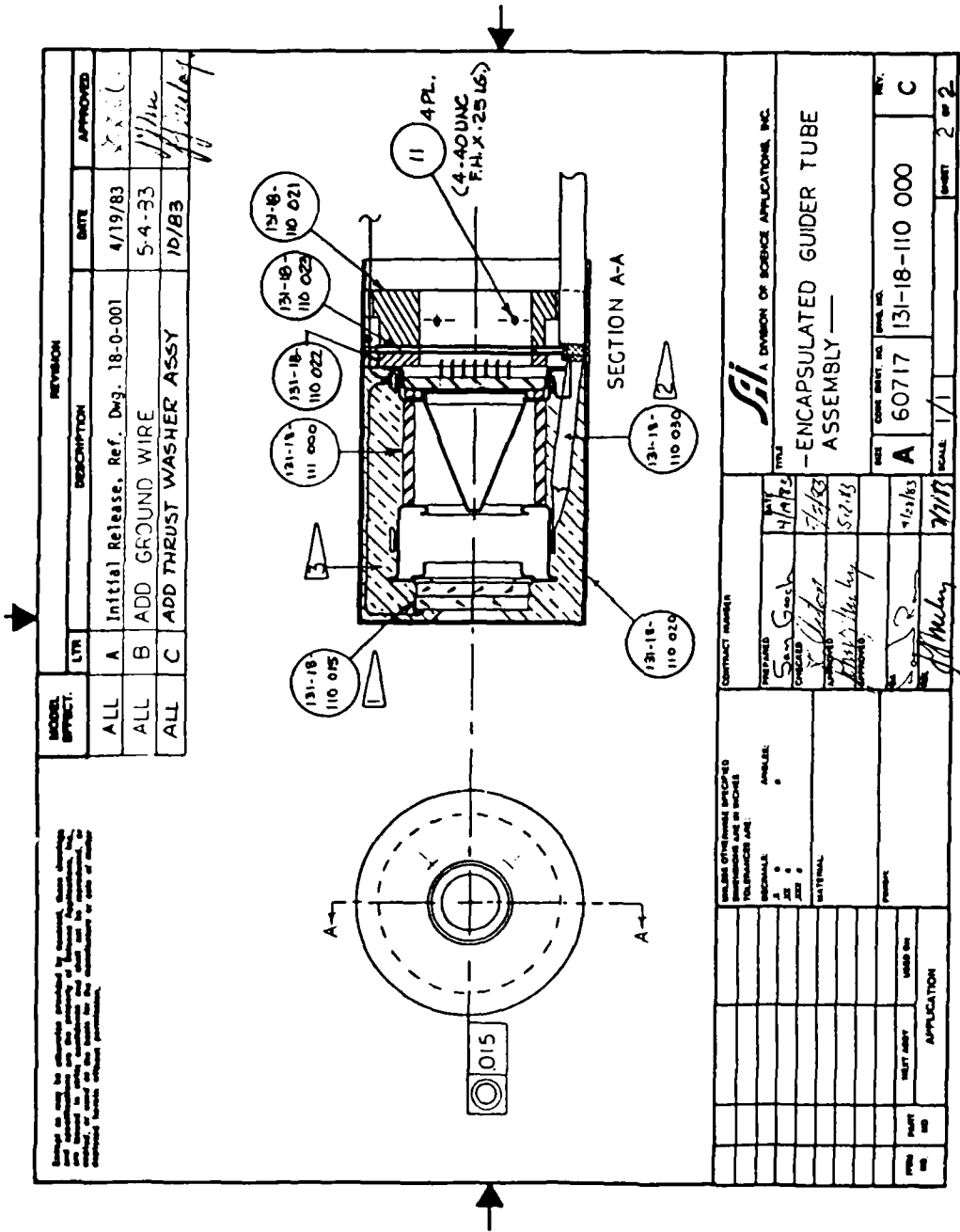


Figure 3. SAIC Drawing No. 131-18-110 000.

.3.a

DUV

TUBE NO. 673-5 12KV

DATE 5/17/84

DIGICON PERFORMANCE

a. MAGNIFICATION

DIODE (2)

	1/2	CENTER	1/2
μ Divisions	<u>5510μm</u>	<u>5070μm</u>	<u>4850μm</u>
Count Rate	<u>1926</u>	<u>3965</u>	<u>1925</u>
S (Total No. Divisions)	_____ = <u>650</u>		
W = S * (μ /Divisions)	_____ * _____ = _____		
M (Magnification) = D/W	= <u>400μm / 650μm = .606</u>		
(D = Diode Width)			

DIODE (1)

	1/2	CENTER	1/2
μ Divisions	<u>4890μm</u>	<u>4450μm</u>	<u>4240μm</u>
Count Rate	<u>1925</u>	<u>4290</u>	<u>2072</u>
S (Total No. Divisions)	_____ = <u>650μm</u>		
W = S * (μ /Divisions)	_____ * _____ = _____		
M (Magnification) = D/W	= <u>400μm / 650μm = .615</u>		
(D = Diode Width)			

(Average Magnification $\left(\frac{M_1 + M_2}{2}\right)$ = .610 Goal = $0.6 < M < 1$)

TEST ENGINEER J. Acton 5-17-84 QA

SAIT
QE4 5/17/84

CUSTOMER (if applicable) N/A

Focus Position 1.0250 cm

18-4.2
ge 7

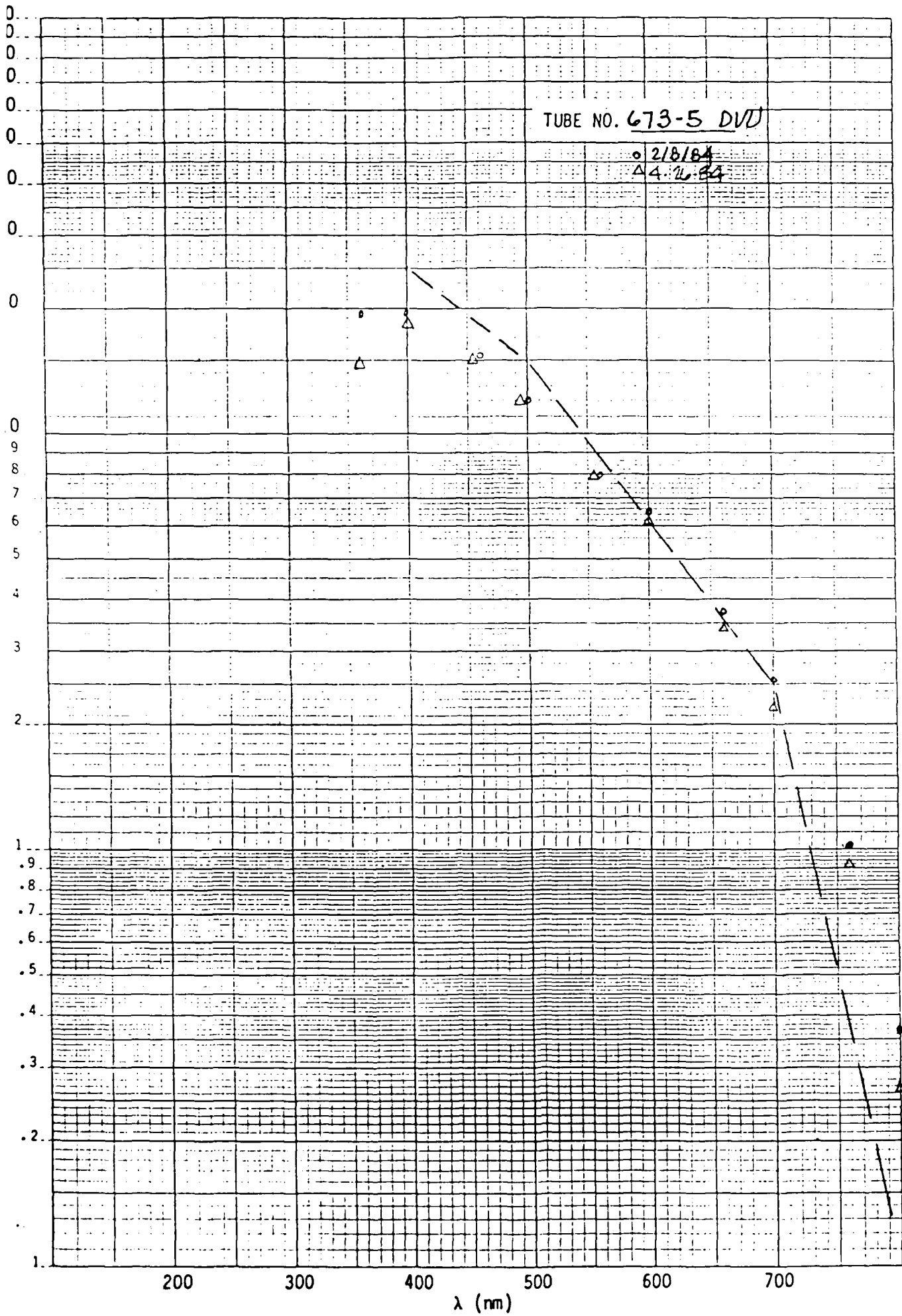
TUBE NO. 673-5

DATE 5/29/84

QUAD DIGICON ARRAY RESPONSE

DIODE	PIN	LEAKAGE CURRENT (nA) Goal ≤ 1 nA	CAPACITANCE (pf) Goal ≤ 15 pf	$\Delta E/E$ Goal ≤ 0.25
Q1	2	0.11	10.8	0.29
Q2	5	0.16	10.7	0.29
Q3	9	0.08	10.4	0.30
Q4	12	0.08	10.0	0.28
G1	1	0.04	8.6	0.29
G2	3	0.09	7.7	0.30
G3	4	0.15	6.9	0.30
G4	6	0.14	6.8	0.27
G5	8	0.06	8.4	0.28
G6	10	0.05	8.0	0.28
G7	11	0.04	8.8	0.27
G8	13	0.03	7.1	0.27

SAIT
DE4
5/29/84



TUBE NO. 673-5 DVU

DATE 4.26.84

**ENCAPSULATED
IN SHIELD**

PHOTOCATHODE RESPONSE

Visible Current Mode Quantum Efficiency Data Sheet

Wave- Length (nm)	Tube Signal (A)	Calibration Standard Signal (A)	Standard Calibration (QE%)	Comments	Calculated QE (%)	Goal QE (%)
360	.36 ± .07	.47 ± .09	19.3	BLUE FILTER	14.8	
400	.625 ± .08	.521 ± .08	15.4		18.5	25.0
460	1.68 ± .08	1.17 ± .08	10.5		15.1	
500	.765 ± .08	.496 ± .08	7.96	NO FILTER	12.3	15.0
560	.349 ± .08	.539 ± .08	5.09		5.02	
600	.755 ± .08	.468 ± .08	3.86	YELLOW FILTER	6.23	
660	.570 ± .08	.375 ± .08	2.52		3.83	
700	.380 ± .08	.268 ± .08	1.72		2.44	2.5
760	.522 ± .08	.411 ± .08	.726		.922	
800	.126 ± .08	.111 ± .08	.245		.278	0.1

Test Engineer E. Jozin QA SAIT QEA 4/26/84

Customer (if applicable) N/A

Calculated QE% = $\frac{\text{Tube Signal}}{\text{Calibration Standard Signal}} \times \text{Standard Calibration QA\%}$

ENCAPSULATED DIGICON ACCEPTANCE TESTS (SHAD)

DIGICON NO. 673-5 DVU

<u>TEST</u>	<u>DATE</u>
4.1 PHOTOCATHODE RESPONSE (QE)	<u>4/26/84</u>
4.2 DIODE ARRAY RESPONSE	
a. Leakage	<u>5/29/84</u>
b. Capacitance	<u>5/29/84</u>
c. $\Delta E/E$	<u>5/29/84</u>
4.3 DIGICON PERFORMANCE	
a. Magnification	<u>5/17/84</u>
b. Error Function	<u>5/17/84</u>
c. Dark Count	<u>5/17/84</u>
d. Uniformity	<u>5/17/84</u>
4.4 PHYSICAL	
a. Diameter	<u>5/25/84</u>
b. Length	<u>5/25/84</u>
c. Centering	<u>5/25/84</u>
d. Weight	<u>5/25/84</u>

Data Distribution:

- Test Build Log Book
- Test Lab
- Tube Engineer
- Quality Assurance
- Customer
- File

May 30, 1984



SHAD QUAD DIGICON [1-131-08-645]

SAI P/N: 131-18-110-000
S/N: 673-5 (DVU)

Contract No: N00014-82-C-0363
Office of Naval Research

CERTIFICATE OF PERFORMANCE

This is to certify that the item noted was tested in accordance with the SAI Acceptance Test Procedure AT-18-4.1- Photocathode Response (QE), AT-18-4.2A- Diode Array Response, AT-18-4.3A- Digicon Performance, and AT-18-4.4- Physical, Mechanical Dimensions. Test Data Summary Sheets are attached for each test. Physical test reports and data on file at this facility and are available for review by ONR.

Gary L. Russell
Quality Assurance

Distribution: SAI Test
SAI QA
SAI Contracts (4)
SAI File

SERIAL NUMBER 673-5
DESIGN VERIFICATION UNIT (DVU)

APPENDIX A

SHAD SPACE-QUALIFIED TUBES TEST DATA

673-5	Design Verification Unit (DVU)
676-5	First Flight Tube (F-1)
691-5	Second Flight Tube (F-2)
674-5	Third Flight Tube (F-3)
672-5	Unencapsulated Tube (Spare)

All tests were monitored by both SAIC Quality Engineering and the appointed Government representative.

Test data is included in Appendix A.

3.2.4 Space-Qualified Tube Delivery

The Design Verification Unit (DVU) was delivered to ONR at ITE, Beltsville, Maryland on June 1, 1984.

Following selection by ONR, Tube S/N 676-5 was selected to be encapsulated into the first Space-Qualified Tube (F-1). This tube was delivered on June 6, 1984.

Following the processing and testing of the redder photocathode tubes, Tube S/N 691-5 and S/N 674-5 were selected for use in the second and third Space-Qualified Tubes (F-2 and F-3). These tubes were delivered on October 8, 1984 and December 3, 1984, respectively.

Tube S/N 672-5, which is a good operating device but not selected for use as a deliverable flight tube, is still unencapsulated. It is being held in SHAD residual inventory at SAIC.

<u>Tube Run No.</u>	<u>Tube S/N</u>	<u>Results</u>	<u>Assignment/Use</u>
4	672-5	Good Tube	Hold in Residual
5	673-5	Good Tube	DVU Tube
6	674-5	Good Tube	F-3 Tube
7	676-5	Good Tube	F-1 Tube

At this point SAIC was directed to attempt a "redder" photocathode. Three cathode tests were performed on S/N 686, 688 and 690. Then the last two tube runs were made using the "redder" photocathode process.

8	691-5	Good Tube	F-2 Tube
9	695-5	Noisy Tube	Scrap

3.2.3 Space-Qualified Tube Testing

Testing of the Space-Qualified Tubes was performed in accordance with the SHAD Test Plan, TP 131-08-645-01, Rev. A, and the SHAD Acceptance Test Procedures, AT 18-4.0, AT 18.1, AT 18.2, AT 18.3, and AT 18.4. Testing included the following:

- Manufacturing Tests
 - Incoming Inspection
 - In-Process Inspection
- Unencapsulated Digicon Tests
 - Photocathode Response
 - Diode Response
 - Digicon Performance
 - Physical Inspection
- Encapsulated Digicon Tests
 - Photocathode Response
 - Diode Response
 - Digicon Performance
 - Physical Inspection

Unencapsulated tests were performed on all tubes produced. Encapsulated Tube Acceptance Tests were performed on the Design Verification Unit (DVU) and on the three flight tubes delivered (F-1, F-2, and F-3).

The encapsulated tube design was revised, modifying the anti-corona shield and the potting/installation techniques.

The first SHAD breadboard tube was re-encapsulated in the revised configuration which successfully passed thermal cycling between +55°C and -45°C. This tube was delivered to ONR at ITE, Beltsville, Maryland on October 5, 1983 for integration testing.

The second breadboard tube (S/N 651-5) was encapsulated in the new configuration. It received functional performance testing, thermal cycling, and vibration testing, passing all successfully. This tube was delivered to ONR at ITE on October 6, 1983.

3.2 SPACE-QUALIFIED TUBES

3.2.1 Space-Qualified Parts Procurement

The parts for fabrication of the Space-Qualified Tubes were procured under a separate contract, N00014-82-C-0708. All parts were received, inspected, and tested. We found, upon testing, that the diode arrays fabricated for these tubes failed during vacuum bake. After several reworks and weeks of delays, the problems being experienced (with metalization) were identified, and we received usable diode arrays.

3.2.2 Space-Qualified Tube Fabrication

Nine tube runs were completed for the fabrication of Space-Qualified tubes. The sequence and results are listed below:

<u>Tube Run No.</u>	<u>Tube S/N</u>	<u>Results</u>	<u>Assignment/Use</u>
1	661-5	Indium Seal Failure	Scrap
2	670-5	Diodes High Leakage	Scrap
3	671-5	Diodes High Leakage/Seal	Scrap

At this point the diode problem was identified and corrected.

3.0 HARDWARE FABRICATION AND TESTING

3.1 BREADBOARD TUBES

The first phase of this program was to design, fabricate, encapsulate, and test two (2) breadboard tubes of the design to be used in the space-qualified devices to follow.

3.1.1 Breadboard Tube Fabrication

The two breadboard quadrant tubes were fabricated successfully and tested for operation. These were, respectively, S/N 638-5 and 651-5.

Tube S/N 638-5 was selected for encapsulation processing and test while S/N 651-5 was designated the life and environmental test unit. The Life Test was performed on this tube with no unacceptable degradation of performance after the scheduled accumulation of 10^{12} electrons.

3.1.2 Breadboard Tube Encapsulation and Testing

The encapsulation process for the SHAD flight Digicons was developed using space-compatible materials based on experience with the University of Maryland quad guider tubes and with the ST FOS flight Digicons. This process was tested on a non-operating tube and the problems initially encountered with material compatibility, adhesion, and surface preparation worked out. Following successful processing of non-working tubes, the first SHAD breadboard tube, S/N 638-5, was encapsulated using this process. Post-encapsulation testing revealed that the tube was no longer operational. We dissected the tube and found that the indium seal had failed, most probably during the encapsulant's cure cycle. It appears that the force on the tube's anti-corona shield due to differential expansion during the potting cure was sufficient to mechanically force the faceplate from its indium seal. Additional problems were found during thermal testing of the encapsulated assembly.

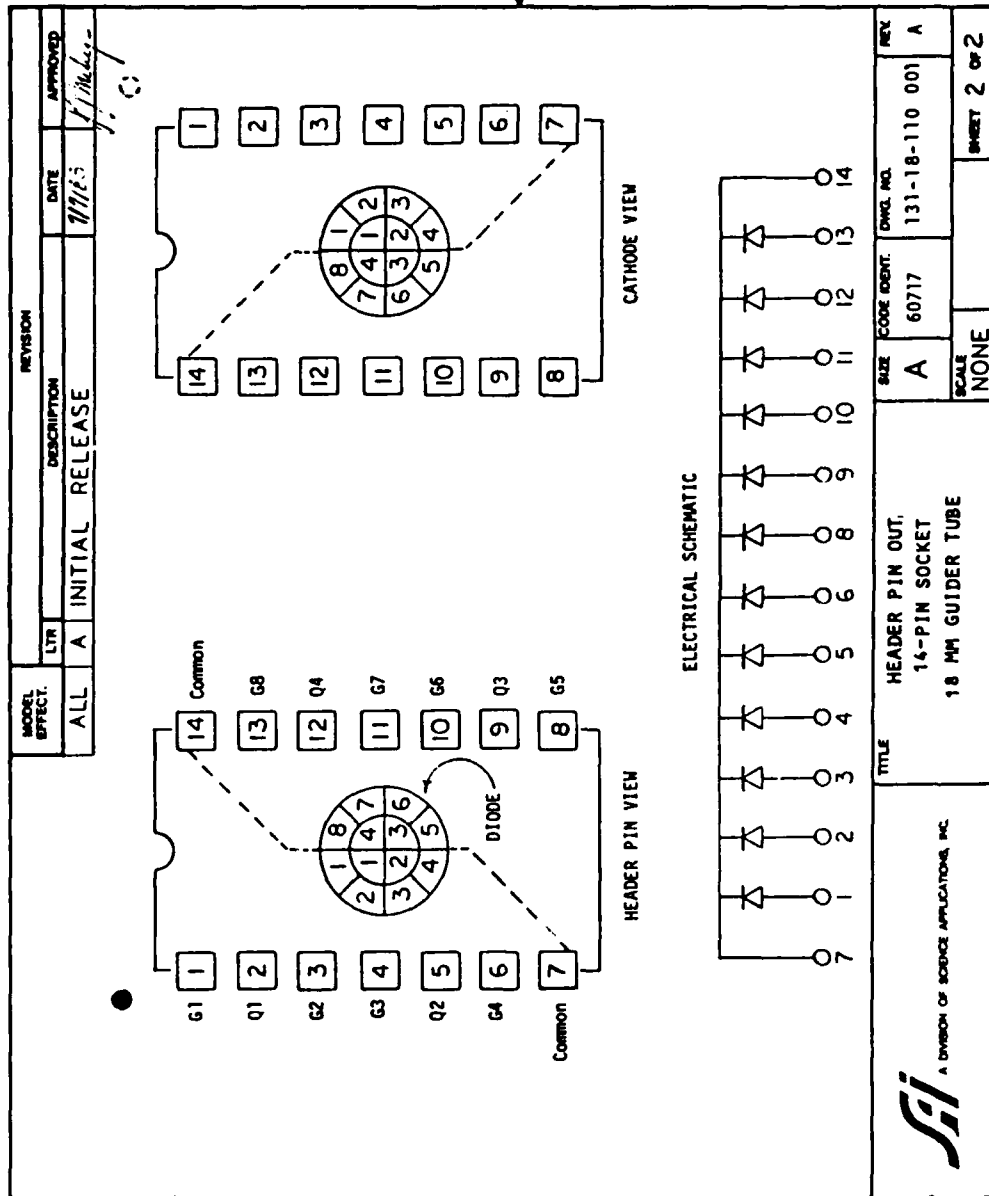
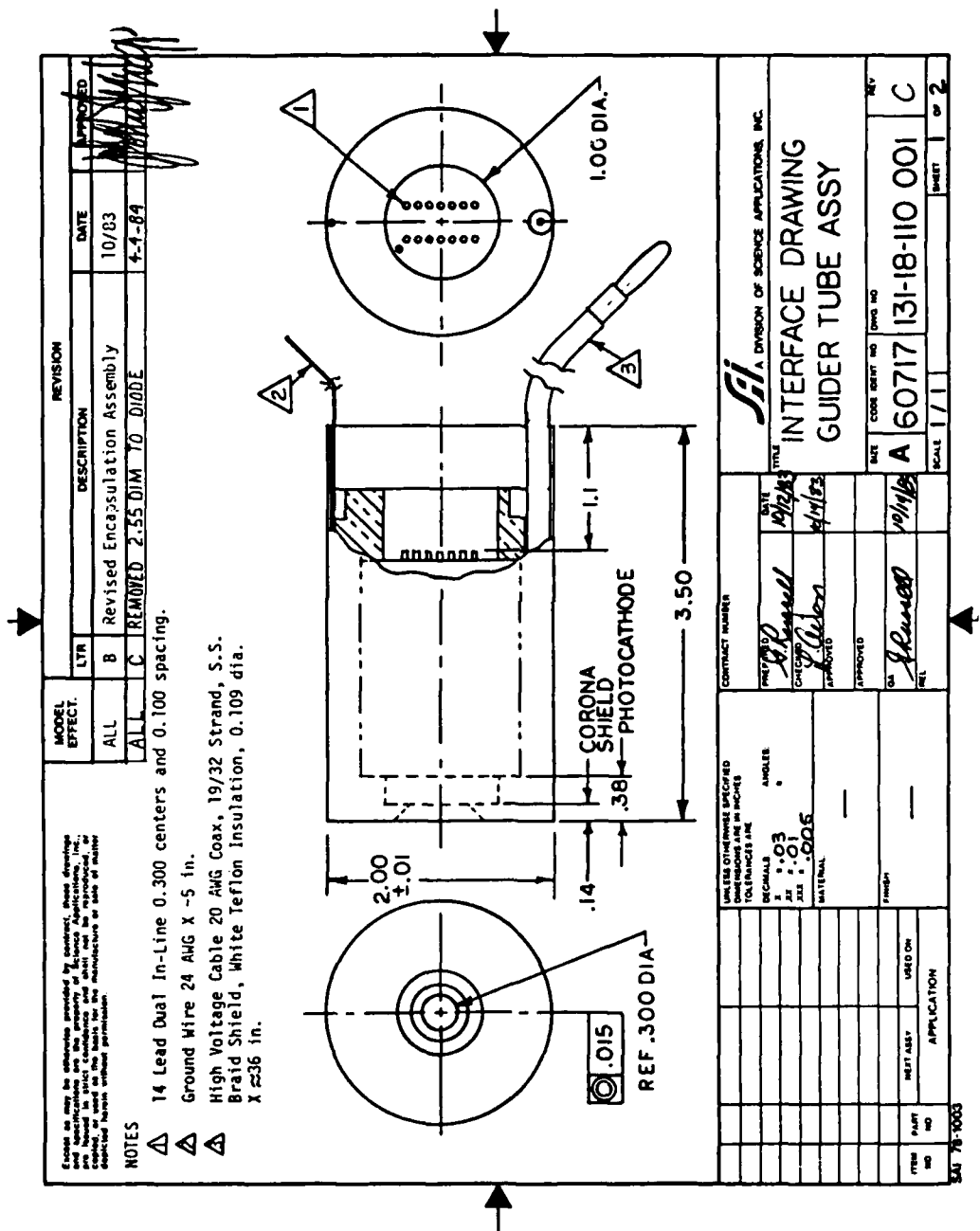


Figure 4 (Continued).



MODEL EFFECT		REVISION	
LTR	DESCRIPTION	DATE	APPROVED
ALL	B Revised Encapsulation Assembly	10/83	<i>[Signature]</i>
ALL	C REMOVED 2.55 DIM TO DIODE	4-1-84	<i>[Signature]</i>

EXCEPT AS MAY BE OTHERWISE SPECIFIED BY CONTRACT, THESE DIMENSIONS AND TOLERANCES ARE IN INCHES UNLESS OTHERWISE SPECIFIED. DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED. DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED. DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED. DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED. DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.	
DECIMALS	± .03
FRACTIONS	± .01
ANGLES	± .005
FINISH	
ITEM NO	
PART NO	
ASSEMBLY	
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	CONTRACT NUMBER	<i>SAL</i> A DIVISION OF SCIENCE APPLICATIONS, INC.
APPROVED BY: <i>[Signature]</i>	DATE: 10/19/83	TITLE: INTERFACE DRAWING
CHECKED BY: <i>[Signature]</i>	DATE: 10/19/83	GUIDER TUBE ASSY
APPROVED BY: <i>[Signature]</i>	DATE: 10/19/83	
DATE: 10/19/83	CODE: 60717	REV: C
DATE: 10/19/83	ORDER NO: 131-18-110 001	REV: C
DATE: 10/19/83	SCALE: 1/1	SHEET: 1 OF 2

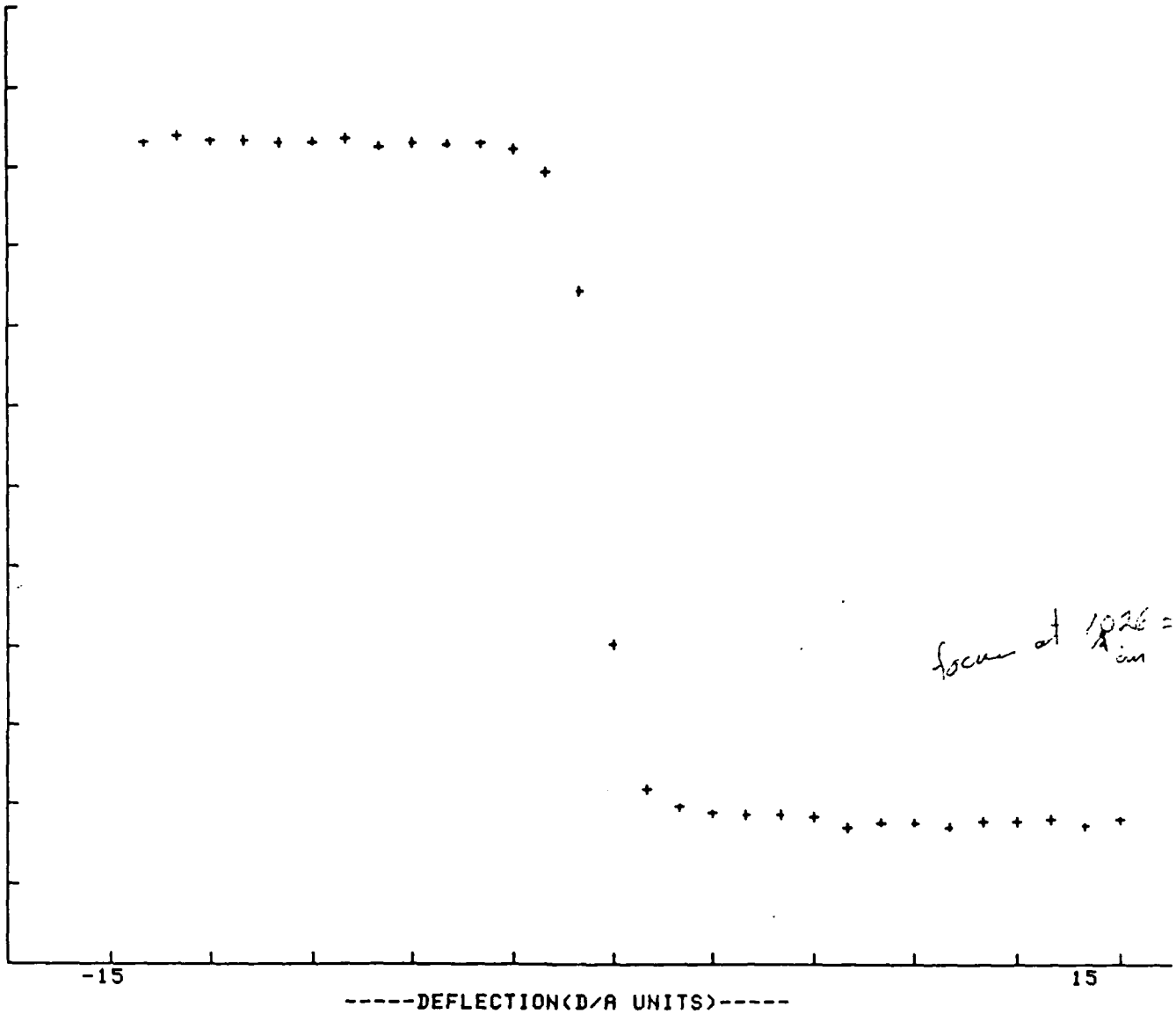
- NOTES
- △ 14 Lead Dual In-Line 0.300 centers and 0.100 spacing.
 - △ Ground Wire 24 AWG X -5 in.
 - △ High Voltage Cable 20 AWG Coax, 19/32 Strand, S-5. Braid Shield, White Teflon Insulation, 0.109 dia. X ≈ 36 in.

Figure 4. SAIC Drawing No. 131-18-110 001.

673-5 DUU

5/17/84

PREAMP No. 1 COUNTER No. 18 DIODE No. 1 THRESHOLD = 84
SCALE MAX, SCALE MIN = 20000 0



Hfm1, Hfm2, FWHM, Pos. = -14.41 - .46 13.95 -7.44
 10%-90%, 90%-10%, AVE = .67 2.46 1.57
 MAX COUNT, MIN COUNT = 20704.6 3523.06



5/17/84

STD. DEV OF EFUN = .836020563172
 SUMSUM = 4220.86666667
 MEAN EFUN = -4.15192341003E-02
 QUAD08(7/24/83)

Preamp. No.	1	2	3	4	5	6	7	8	9	10	11	
Counter No.	18	19	21	22	20	23	24	25	29	27	28	26
Diode No.	1	2	3	4	0	0	0	0	0	0	0	0
Threshold	84	100	80	70	254	254	254	254	254	254	254	254

DEFLECTION FACTORS: X= 6.25 Y= 6.25 (MICRONS PER D/A)

4.3.c,d

DVV
TUBE NO. 673-5 16KV
DATE 5/17/84

DIGICON PERFORMANCE

c. 100 SECOND INTEGRATION DARK COUNT

Q1 = 26731

Q2 = 26313

Q3 = 25113

Q4 = 25787

TOTAL = 104944

C = TOTAL/400 = 262
(Goal = 25)

d. QUADRANT RESPONSE UNIFORMITY

100 SECOND DARK COUNT TO 5100 % AVG

Q1 4217 +2.6

Q2 3950 -3.8

Q3 4000 -2.7

Q4 4274 +4.0

AVG = 4110
(Goal = ±5%)

TEST ENGINEER L. Carter 5/17/84 QA SAIT
QE4 5/17/84

CUSTOMER (if applicable) N/A

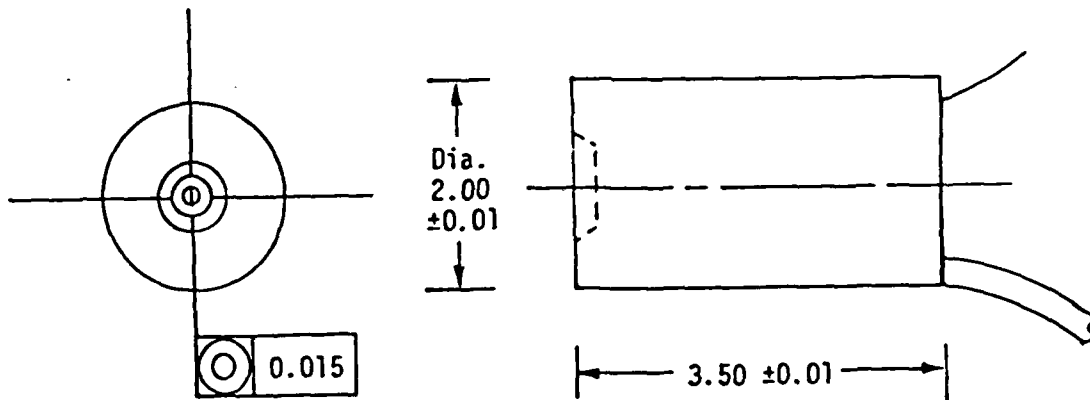
TUBE NO. 673-5 (DVU)

AT 18-4.4
Initial Release

DATE 5/25/84

PHYSICAL, MECHANICAL DIMENSIONS

- a. Maximum Diameter (2.00 ± 0.01 inch) 2.01 - 2.00
- b. Maximum Length (3.50 ± 0.01 inch) 3.49 - 3.51
- c. Concentricity:
Shield, Anticorona Metalization,
Cone I.D. Optical Inspection
(0.015 max. TIR).....Verified OK
- d. Weight (Max. 350 g.).....Verified OK



Inspector E. Russell QA 

Customer (if applicable) N/A



SCIENCE APPLICATIONS, INC.
TECHNOLOGY DEVELOPMENT GROUP (TDG)
 TELEPHONE - SHIPPING/RECEIVING DEPT: (619) 458-3787, 458-3700

SHIPPER CONTROL

NO. **1** 2170

FROM:
 ELECTRONIC VISION AND SYSTEMS DIVISION
 11526 SORRENTO VALLEY ROAD, SUITE A
 SAN DIEGO, CA 92121
 INSTRUMENTATION DEVELOPMENT LAB
 10373 ROSELLE STREET
 SAN DIEGO, CA 92121
 RAD&CO™
 A DIVISION OF SCIENCE APPLICATIONS, INC.
 10373 ROSELLE STREET
 SAN DIEGO, CA 92121

TO:
 Mr. E.C. Aaron
 Instrumentation Technology
 Engineering, Inc
 10511 Tucker St.
 Beltsville, MD 20705

CONTRACT/PURCHASE ORDER NO. N00014-82-C-0363		PROJECT NO. 1-131-08-645		DATE DUE	DATE SHIPPED 6-5-84	
SHIPPING AUTHORIZATION NO'S. G. Russell	SHIPMENT <input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL <input checked="" type="checkbox"/> COMPLETE			NET WEIGHT	GROSS WEIGHT	CUBE
SHIPPED VIA Air		CARRIER Emery 04948771		FOB <input checked="" type="checkbox"/> PREPAID <input type="checkbox"/> COLLECT		
REMARKS						

ITEM NO	PART NO.	DESCRIPTION	UNIT OF ISSUE	QUANTITY AUTHORIZED	QUANTITY SHIPPED
1	131-18-110-000	Digicon s/n 673-5 (DVU)	ea	1	1

WHITE - PACKING SLIP
 BLUE - REQUESTOR
 GREEN - ACCOUNTING

CANARY - PURCHASING
 PINK - CONTRACTS
 GOLD - SHIPPING

AUTHORIZED SIGNATURE

DATE

X Gary Mulvaney

6-5-84

SERIAL NUMBER 676-5

FIRST FLIGHT TUBE (F-1)

4 June 1984



#106

Office of Naval Research
Department of the Navy
459 Summer Street
Boston, MA 02210

Attention: Dr. Fred Quell

Subject: Certificate of Performance

Reference: Contract N00014-82-C-0363

Gentlemen:

Science Applications, Inc. (SAI) provides herewith two (2) copies of the "Certificate of Performance" for the FOS Digicon, SAI Part 131-18-110-000 and Serial Number 676-5 (F#1). This is to certify that the items were tested in accordance with the attached test reports, in accordance with the above referenced contract.

Should you require any additional technical information, please contact Mr. Gary Russell at (619) 458-3796.

Very truly yours,

SCIENCE APPLICATIONS, INC.

Barbara Bashforth
Administrative Assistant
Technology Development Group

/bb

Enclosures

cc: Mr. Pete Petiford - DCASMA, San Diego

bcc: J. McCoy
G. Russell
Chron
File
Deliverables

Science Applications, Inc. 10401 Roselle Street, San Diego, California 92121, (619) 458-3700

Other SAI Offices: Albuquerque, Atlanta, Chicago, Dayton, Denver, Huntsville, Los Angeles, Oak Ridge, San Diego, San Francisco, Tucson, and Washington, D.C.

May 30, 1984



SHAD QUAD DIGICON [1-131-08-645]

SAI P/N: 131-18-110-000
S/N: 676-5 (F#1)

Contract No: N00014-82-C-0363
Office of Naval Research

CERTIFICATE OF PERFORMANCE

This is to certify that the item noted was tested in accordance with the SAI Acceptance Test Procedures AT-18-4.1- Photocathode Response (QE), AT-18-4.2A- Diode Array Response, AT-18-4.3A- Digicon Performance, and AT-18-4.4- Physical, Mechanical Dimensions (Ref Request for Deviation/Waiver 5/29/84 #W8401). Test Data Summary Sheets are attached for each test. Physical test reports and data on file at this facility and are available for review by ONR.

Gary L. Russell
Quality Assurance

Distribution: SAI Test
SAI QA
SAI Contracts (4)
SAI File

ENCAPSULATED DIGICON ACCEPTANCE TESTS (SHAD)

DIGICON NO. 676-5 (F-1)

<u>TEST</u>	<u>DATE</u>
4.1 PHOTOCATHODE RESPONSE (QE)	<u>5/23/84</u>
4.2 DIODE ARRAY RESPONSE	
a. Leakage	<u>5/29/84</u>
b. Capacitance	<u>5/29/84</u>
c. $\Delta E/E$	<u>5/29/84</u>
4.3 DIGICON PERFORMANCE	
a. Magnification	<u>5/24/84</u>
b. Error Function	<u>5/24/84</u>
c. Dark Count	<u>5/24/84</u>
d. Uniformity	<u>5/24/84</u>
4.4 PHYSICAL	
a. Diameter	<u>5/29/84</u>
b. Length	<u>5/29/84</u>
c. Centering	<u>5/29/84</u> (SAI 25)
d. Weight	<u>5/29/84</u>

Data Distribution:

- Test Build Log Book
- Test Lab
- Tube Engineer
- Quality Assurance
- Customer
- File

TUBE NO. 676-5 (SHAD F-1)

DATE 5/23/85

PHOTOCATHODE RESPONSE

Visible Current Mode Quantum Efficiency Data Sheet

Wave- Length (nm)	Tube Signal (A)	Calibration Standard Signal (A)	Standard Calibration (QE%)	Comments	Calculated QE (%)	Goal QE (%)
360	.102 ⁻⁸	.767 ⁻⁹	19.3	BLUE FILTER IN	25.7	
400	.130 ⁻⁷	.804 ⁻⁸	15.4		24.9	25.0
460	.273 ⁻⁷	.162 ⁻⁷	10.5		17.7	
500	.456 ⁻⁷	.282 ⁻⁷	7.96	BLUE FILTER OUT	12.9	15.0
560	.462 ⁻⁷	.286 ⁻⁷	5.09		8.22	
600	.395 ⁻⁷	.260 ⁻⁷	3.86	YELLOW FILTER IN	5.86	
660	.255 ⁻⁷	.172 ⁻⁷	2.52		3.74	
700	.190 ⁻⁷	.119 ⁻⁷	1.72		2.75	2.5
760	.980 ⁻⁸	.425 ⁻⁸	.726		1.67	
800	.480 ⁻⁸	.119 ⁻⁸	.245		.988	0.1

Test Engineer L. Acton 5-23-84 QA SALT
SEALED 5/23/84

Customer (if applicable) Wibron SALT
SEALED 5/23/84

Calculated QE% = $\frac{\text{Tube Signal}}{\text{Calibration Standard Signal}} \times \text{Standard Calibration QA\%}$

TUBE NO. 676-5 (SHAD F-1)
DATE 5-24-84

4.3.a

DIGICON PERFORMANCE

a. MAGNIFICATION

DIODE A

	1/2	CENTER	1/2
μ Divisions	<u>4</u>	<u>2</u>	<u>18</u>
Count Rate	<u>2250</u>	<u>4562</u>	<u>2324</u>
S (Total No. Divisions)	<u>$50 \cdot 4 + 18 = 64$</u>		
W = S * (μ /Divisions)	<u>$64 * 10 = 640$</u>		
M (Magnification) = D/W (D = Diode Width)	<u>$400 \mu\text{m} / 640 = .63$</u>		

DIODE 3

	1/2	CENTER	1/2
μ Divisions	<u>19</u>	<u>36</u>	<u>28</u>
Count Rate	<u>2340</u>	<u>4669</u>	<u>2370</u>
S (Total No. Divisions)	<u>$19 + 50 + 28 = 59$</u>		
W = S * (μ /Divisions)	<u>$59 * 10 = 590$</u>		
M (Magnification) = D/W (D = Diode Width)	<u>$400 \mu\text{m} / 590 = .68$</u>		

(Average Magnification $\left(\frac{M_1 + M_2}{2}\right) = \underline{.66}$ Goal = $0.6 < M < 1$)

TEST ENGINEER E. Ngim SAIT 0E4 5/24/84

CUSTOMER (if applicable) [Signature] 5/25/84

[Signature]

Figure 4.3a

3.c,d

DIGICON PERFORMANCE

100 SECOND INTEGRATION DARK COUNT

Q1 = 249

Q2 = 236

Q3 = 262

Q4 = 256

TOTAL = 1003

C = TOTAL/400 = 2.5
(Goal = 10)

d. QUADRANT RESPONSE UNIFORMITY

% AVG

Q1 5866 +0.43%

Q2 5747 -1.64%

Q3 5858 +0.29%

Q4 5895 +0.92%

AVG = 5841
(Goal = ±5%)

TEST ENGINEER

E. Logan / J. Peterson QA



CUSTOMER (if applicable) _____

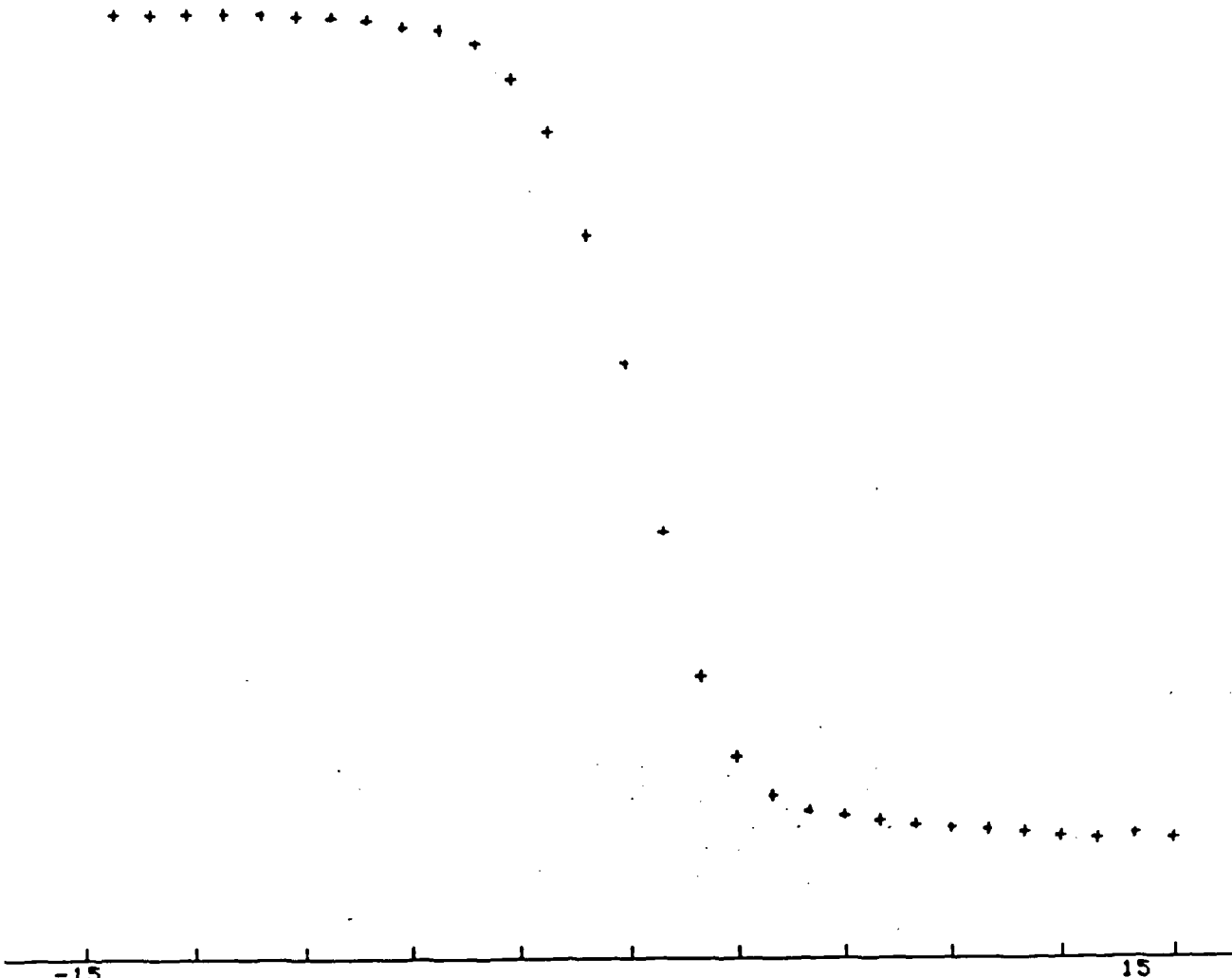
Figure 4.3b

5 / 24 / 83 13 : 48 (55 Sec.)
D TUBE SCAN

5 / 24 / 83 13 : 55 (17 Sec.)
D TUBE SCAN

US
SWEEP @ Y = 0
M -15 TO 15 IN 31 STEPS OF 1 EACH 1 Sec

AMP No. 1 COUNTER No. 18 DIODE No. 1 THRESHOLD = 84
LE MAX, SCALE MIN = 20000 0



-----DEFLECTION(D/A UNITS)-----

m1, Hfm2, FWHM, Pos. = -14.44 27 14.8 -7.03
%-90%, 90%-10%, AVE = .7 (5.69) 3.19
X COUNT, MIN COUNT = 21830.5 2774.54

SAIT
QE4

TO JIM BOYD

TD. DEV OF EFUN = .875349316025
5 / 24 / 83 13 : 57 (27 Sec.)

QUAD08(7/24/83)

18-4.2
e 7

TUBE NO. 676-5 (F-1)

DATE 5/29/84

QUAD DIGICON ARRAY RESPONSE

DIODE	PIN	LEAKAGE CURRENT (nA) Goal ≤ 1 nA	CAPACITANCE (pf) Goal ≤ 15 pf	$\Delta E/E$ Goal ≤ 0.25
Q1	2	0.9	12.2	0.25
Q2	5	1.3	11.7	0.34
Q3	9	1.1	11.4	0.33
Q4	12	1.3	12.0	0.33
G1	1	1.5	8.6	0.30
G2	3	1.1	9.1	0.35
G3	4	0.9	9.0	0.31
G4	6	1.2	9.0	0.31
G5	8	0.7	8.8	0.32
G6	10	0.5	8.6	0.38
G7	11	1.0	9.2	0.42
G8	13	0.7	9.4	

SAIT
QEA 5/29/84

William J. Peterson
By [Signature]
Sens QAR
5/29/84
5/29/84

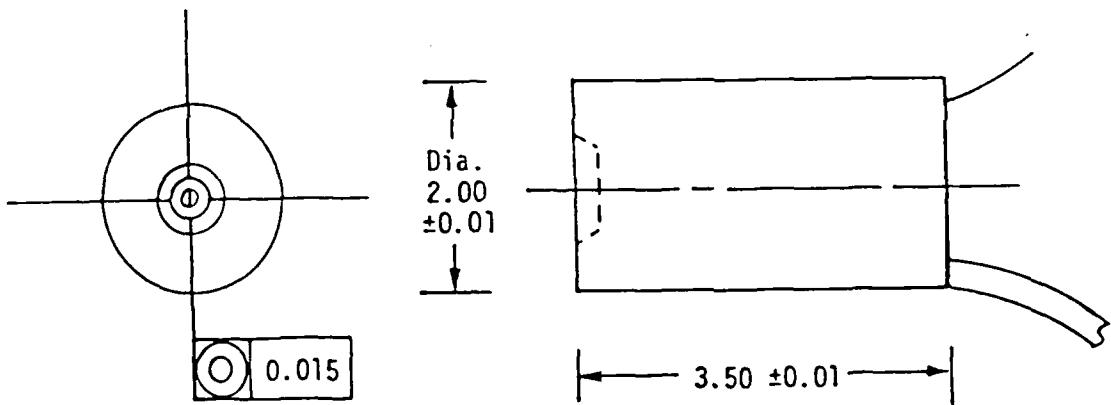


NO. 676-5 (F-1)
5/29/84

AT 18-4.4
Initial Release

PHYSICAL, MECHANICAL DIMENSIONS

- a. Maximum Diameter (2.00 ± 0.01 inch) verified
- b. Maximum Length (3.50 ± 0.01 inch) verified
- c. Concentricity:
Shield, Anticorona Metalization,
Cone I.D. Optical Inspection
(0.015 max. TIR).....Verified $\approx .020$ OUT OF SPEC. SAI
25
- d. Weight (Max. 350 g.).....Verified 340g approx



Inspector G. Russell QA SAI
0E4
Customer (if applicable) see request for Deviation/waiver 5/29/84
#WB401

TUBE NO. 691-5

DATE 10.4.84

DIGICON PERFORMANCE

MAGNIFICATION

DIODE 2

	1/2	CENTER	1/2
μ Divisions	<u>637</u>	<u>-</u>	<u>584</u>
Count Rate	<u>2734</u>	<u>5800</u>	<u>2683</u>
S (Total No. Divisions)	<u>637 - 584 = 53</u>		
W = S * (μ /Divisions)	<u>53 * 10 = 530</u>		
M (Magnification) = D/W (D = Diode Width)	<u>400 / 530 = .75</u>		

DIODE 4

	1/2	CENTER	1/2
μ Divisions	<u>584</u>	<u>-</u>	<u>527</u>
Count Rate	<u>2760</u>	<u>5480</u>	<u>2714</u>
S (Total No. Divisions)	<u>584 - 527 = 57</u>		
W = S * (μ /Divisions)	<u>57 * 10 = 570</u>		
M (Magnification) = D/W (D = Diode Width)	<u>400 / 570 = .70</u>		

(Average Magnification $\left(\frac{M_1 + M_2}{2}\right) = \left(\frac{.75 + .70}{2}\right) = .725$ Goal = $0.6 < M < 1$)

TEST ENGINEER E. Nigam QA  10/5/84

CUSTOMER (if applicable) _____

Figure 4.3a

10-4.3
e 4

TUBE NO. 691-5

DATE 10.4.84

.a

DIGICON PERFORMANCE

a. MAGNIFICATION


DIODE 1

	1/2	CENTER	1/2
μ Divisions	<u>536</u>	<u>—</u>	<u>584</u>
Count Rate	<u>2794</u>	<u>5356</u>	<u>2747</u>
S (Total No. Divisions)	<u>584 - 536 =</u>		<u>50</u>
W = S * (μ /Divisions) =	<u>50</u>	* <u>10</u>	= <u>500</u>
M (Magnification) = D/W =	<u>400</u>	/ <u>500</u>	= <u>.80</u>
(D = Diode Width)			

DIODE 3

	1/2	CENTER	1/2
μ Divisions	<u>598</u>	<u>—</u>	<u>648</u>
Count Rate	<u>1912</u>	<u>4222</u>	<u>2082</u>
S (Total No. Divisions)	<u>648 - 598 =</u>		<u>50</u>
W = S * (μ /Divisions) =	<u>50</u>	* <u>10</u>	= <u>500</u>
M (Magnification) = D/W =	<u>400</u>	/ <u>500</u>	= <u>.80</u>
(D = Diode Width)			

(Average Magnification $\left(\frac{M_1 + M_2}{2}\right) = \left(\frac{1.60}{2}\right) = .80$ Goal = $0.6 < M < 1$)

TEST ENGINEER E. J. [Signature] QA  10/5/84

CUSTOMER (if applicable) _____

Figure 4.3a

TUBE NO. 691-5 (SHAD 1-8)

DATE 10.5-84

QUAD DIGICON ARRAY RESPONSE

DIODE	PIN	LEAKAGE CURRENT (nA) Goal ≤ 1 nA	CAPACITANCE (pf) Goal ≤ 15 pf	$\Delta E/E$ Goal ≤ 0.25
Q1	2	.58	7.8 10.0	.29
Q2	5	.63	10.5	.28
Q3	9	.86	10.7	.28
Q4	12	.54	9.7	.28
G1	1	.83	7.8	.26
G2	3	.45	8.5	.25
G3	4	.48	7.4	.25
G4	6	.59	7.7	.25
G5	8	.91	7.2	.25
G6	10	.58	8.7	.25
G7	11	.55	7.4	.25
G8	13	.46	9.5	.25

EJozin 10.5.84


SAIT
QEB 10/5/84

AT 18-4.1

TUBE NO. 691-5 (SMD F-8)
 DATE 10-4-84

PHOTOCATHODE RESPONSE
 Visible Current Mode Quantum Efficiency Data Sheet

Wave-length (nm)	Tube Signal (A)	Calibration Standard Signal (A)	Standard Calibration (QE%)	Comments	Calculated QE (%)	Goal QE (%)
	[E]	[E]				
360	.142 ±9	.166 ±9	19.3		16.5	
400	.232 ±8	.192 ±8	15.4		18.6	25.0
460	.725 ±8	.461 ±8	10.5		16.5	
500	1.42 ±8	.842 ±8	7.96		13.4	15.0
560	1.75 ±8	.933 ±8	5.09		9.55	
600	1.55 ±8	.785 ±8	3.86		7.62	
660	1.33 ±8	.631 ±8	2.52		5.31	
700	1.06 ±8	.445 ±8	1.72		4.10	2.5
760	.593 ±8	.159 ±8	.726		2.71	
800	3.50 ±9	.436 ±9	.245		1.97	0.1

Test Engineer E. Jozin QA  10/5/84
 Customer (if applicable) _____

Calculated QE% = $\frac{\text{Tube Signal}}{\text{Calibration Standard Signal}} \times \text{Standard Calibration QA\%}$



SCIENCE APPLICATIONS, INC.
 APPLIED SCIENCE & TECHNOLOGY GROUP
 TELEPHONE - SHIPPING/RECEIVING DEPT.: (714) 452-9150

SHIPPER CONTROL

NO. 10455

TO: Systems Division
 ELECTRONIC VISION COMPANY
 1526 SORRENTO VALLEY ROAD, SUITE A
 SAN DIEGO, CA. 92121

TO: Instrumentation Technology Engineering, Inc.
 10511 Tucker Street
 Beltsville, MD 20705
 Attn: Mr. E. C. Aaron

INSTRUMENTATION DEVELOPMENT LAB
 11526 SORRENTO VALLEY ROAD, SUITE B
 SAN DIEGO, CA. 92121

EFFLUENT CONTROL LAB
 1030 SORRENTO VALLEY BLVD.
 SAN DIEGO, CA. 92121

SAI TECHNOLOGY COMPANY
 1060 SORRENTO VALLEY BLVD.
 SAN DIEGO, CA. 92121

FACT/PURCHASE ORDER NO. 0014-82-C-0363	PROJECT NO. 1-131-08-645-00	DATE DUE 10/8/84	DATE SHIPPED 10/4/84
---	--------------------------------	---------------------	-------------------------

SHIPPING AUTHORIZATION NO'S.	SHIPMENT <input checked="" type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL <input type="checkbox"/> COMPLETE	NET WEIGHT	GROSS WEIGHT	CUBE	NO. PACKAGES 1
------------------------------	--	------------	--------------	------	-------------------

SHIPMENT VIA	CARRIER Federal Express	FOB Destination	<input checked="" type="checkbox"/> PREPAID <input type="checkbox"/> COLLECT
--------------	----------------------------	--------------------	--

MARKS

PART NO.	DESCRIPTION	UNIT OF ISSUE	QUANTITY AUTHORIZED	QUANTITY SHIPPED
	SHAD Flight Digicon #2, S/N 691-5	each	1	1
	Line Item 0001AE			
	Copy of Test Data	each	1	1
<p>ok to ship: D.G. Wood</p> <p>W. W. Huffman DCAS 10/5/84</p> <p>SAIT QEB</p>				

AUTHORIZED SIGNATURE
 X *John J. ...*

DATE
 10/4/84

ENCAPSULATED DIGICON ACCEPTANCE TESTS (SHAD)

DIGICON NO. 691-5

<u>TEST</u>	<u>DATE</u>
4.1 PHOTOCATHODE RESPONSE (QE)	<u>10-4-84</u>
4.2 DIODE ARRAY RESPONSE	
a. Leakage	<u>10-5-84</u>
b. Capacitance	<u>10-5-84</u>
c. $\Delta E/E$	<u>10-5-84</u>
4.3 DIGICON PERFORMANCE	
a. Magnification	<u>10-4-84</u>
b. Error Function	<u>10-4-84</u>
c. Dark Count	<u>10-4-84</u>
d. Uniformity	<u>10-5-84</u>
4.4 PHYSICAL	
a. Diameter	<u>10-5-84</u>
b. Length	<u>10-5-84</u>
c. Centering	<u>10-5-84</u>
d. Weight	<u>10-5-84</u>

Data Distribution:

- Test Build Log Book
- Test Lab
- Tube Engineer
- Quality Assurance
- Customer
- File



Science Applications International Corporation

December 3, 1984

SHAD QUAD DIGICON (1-131-08-645)

SAIC P/N: 131-18-110-000

SAIC S/N: 691-5 (F#2)

Contract No.: N00014-82-C-0363
Office of Naval Research

CERTIFICATE OF PERFORMANCE

This is to certify that the item noted was tested in accordance with the SAIC Acceptance Test Procedures AT-18-4.1- Photocathode Response (QE), AT-18-4.2A- Diode Array Response, AT-18-4.3A- Digicon Performance, and AT-18-4.4- Physical, Mechanical Dimensions. Test Data Summary Sheets are attached for each test. Physical test reports and data are on file at this facility and are available for review by ONR.

Gary L. Russell
Quality Assurance

Distribution: SAIC Test
SAIC QA
SAIC Contracts (4)
SAIC File



Science Applications International Corporation

#216

3 December 1984

Office of Naval Research
Department of the Navy
459 Summer Street
Boston, MA 02210

Attention: Dr. Fred Quell

Subject: Certificate of Performance

Reference: Contract N00014-82-C-0363

Gentlemen:

Science Applications International Corporation (SAIC) provides herewith two (2) copies of the "Certificate of Performance" for the FOS Digicon, SAI Part Number 131-18-110-000 and Serial Number 691-5 (F#2). This is to certify that the items were tested in accordance with the attached test reports, in accordance with the above referenced contract.

Should you require any additional technical information, please contact Mr. Gary Russell at (619) 458-3796.

Very truly yours,

SCIENCE APPLICATIONS INTERNATIONAL CORP.

A handwritten signature in cursive script that reads "Barbara Bashforth". The signature is written in black ink and is positioned above the typed name and title.

Barbara Bashforth
Administrative Assistant

/bb

Enclosures

cc: Mr. Pete Petiford - DCASMA (San Diego)

SERIAL NUMBER 691-5
SECOND FLIGHT TUBE (F-2)

MATERIAL INSPECTION AND RECEIVING REPORT		1 PROC INSTRUMENT IDEN (CONTRACT) N00014-82-C-0363		ORDER NO	6 INVOICE NO.	7 PAGE OF 1	8 ACCEPTANCE POINT D
2 SHIPMENT NO SAI0001	3 DATE SHIPPED 84JUN07	4 B/L TCN		5 DISCOUNT TERMS			
9 PRIME CONTRACTOR CODE Science Applications, Inc. 10401 Roselle Street San Diego, CA 92121		52302	10 ADMINISTERED BY CODE DCASMA - La Jolla Bldg. 4, AF Plant 19 4297 Pacific Highway San Diego, CA 92110		S0514A		
11 SHIPPED FROM (if other than 9) CODE Same as Block 9		52302	FOB S	12 PAYMENT WILL BE MADE BY CODE DCASMA - Los Angeles 11099 So. La Cienega Blvd. P.O. Box 45011 Los Angeles, CA 90045		S0506A	
13 SHIPPED TO CODE Instrumentation Technology Engineering, Inc. 10511 Tucker Street Beltsville, MD 20705				14 MARKED FOR CODE Mr. E. C. Aaron			

15 ITEM NO	16 STOCK PART NO <small>Indicate number of shipping containers type of container container number</small>	DESCRIPTION	17 QUANTITY SHIP'D, REC'D	18 UNIT	19 UNIT PRICE	20 AMOUNT
0001 AD		The Contractor shall design, build, test and deliver one space-qualified flight model of their intensified quadrant photomultiplier tube. SAI Part No. 131-18-100-000 Serial No. 676-5 (F-1) (18 mm Quadrant Digicon Guider Tube Assembly)	1	EA	NSP	NSP

21 PROCUREMENT QUALITY ASSURANCE		22 RECEIVER'S USE	
<input checked="" type="checkbox"/> A ORIGIN ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract except as noted herein or on supporting documents.		<input type="checkbox"/> B DESTINATION ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract except as noted herein or on supporting documents.	
DATE 84 JUN 07 SIGNATURE OF AUTH GOVT REP <i>Pete Petiford</i>	DATE SIGNATURE OF AUTH GOVT REP	Quantities shown in column 17 were received in apparent good condition except as noted.	
TYPED NAME AND OFFICE Pete Petiford S0514A	TYPED NAME AND TITLE	DATE RECEIVED SIGNATURE OF AUTH GOVT REP TYPED NAME AND OFFICE *If quantity received by the Government is the same as quantity shipped, indicate by () mark, if different, enter actual quantity received below quantity shipped and encircle.	

23 CONTRACTOR USE ONLY

MATERIAL INSPECTION AND RECEIVING REPORT	1 PROC INSTRUMENT IDEN (CONTRACT) N00014-82-C-0363	ORDER NO	6 INVOICE NO	7 PAGE OF 1
			DATE	8. ACCEPTANCE POINT D

2 SHIPMENT NO SAI0001	3 DATE SHIPPED 84JUN07	4 B/L ICN	5 DISCOUNT TERMS 2
--------------------------	---------------------------	--------------	-----------------------

9 PRIME CONTRACTOR CODE 52302 Science Applications, Inc. 10401 Roselle Street San Diego, CA 92121	10 ADMINISTERED BY CODE S0514A DCASMA - La Jolla Bldg. 4, AF Plant 19 4297 Pacific Highway San Diego, CA 92110
---	---

11 SHIPPED FROM (if other than 9) CODE 52302 Same as Block 9	FOB S	12 PAYMENT WILL BE MADE BY CODE S0506A DCASMA - Los Angeles 11099 So. La Cienega Blvd. P.O. Box 45011 Los Angeles, CA 90045
--	----------	--

13 SHIPPED TO CODE Instrumentation Technology Engineering, Inc. 10511 Tucker Street Beltsville, MD 20705	14 MARKED FOR CODE Mr. E. C. Aaron
---	---------------------------------------

15 ITEM NO	16 STOCK PART NO (Indicate number of shipping containers-type of container container number.)	DESCRIPTION	17 QUANTITY SHIP'D, REC'D	18 UNIT	19. UNIT PRICE	20 AMOUNT
0001 AD		The Contractor shall design, build, test and deliver one space-qualified flight model of their intensified quadrant photomultiplier tube. SAI Part No. 131-18-100-000 Serial No. 676-5 (F-1) (18 mm Quadrant Digicon Guider Tube Assembly)	1	EA	NSP	NSP

21 PROCUREMENT QUALITY ASSURANCE		22 RECEIVER'S USE	
<input checked="" type="checkbox"/> POA <input type="checkbox"/> A ORIGIN ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract, except as noted herein or on supporting documents.		<input type="checkbox"/> POA <input checked="" type="checkbox"/> B DESTINATION ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract, except as noted herein or on supporting documents.	
DATE: 84 JUN 07 SIGNATURE OF AUTH GOVT REP: <i>Pete Petiford</i> TYPED NAME AND OFFICE: Pete Petiford S0514A		Quantities shown in column 17 were received in apparent good condition except as noted. DATE RECEIVED: _____ SIGNATURE OF AUTH GOVT REP: _____ TYPED NAME AND OFFICE: _____	
23 CONTRACTOR USE ONLY		*If quantity received by the Government is the same as quantity shipped, indicate by (s) mark, if different, enter actual quantity received below quantity shipped and encircle.	

7 June 1984



#107

Instrumentation Technology
Engineering, Inc.
10511 Tucker Street
Beltsville, MD 20705

Attention: Mr. E. C. Aaron

Subject: Material Inspection & Receiving Report -
Shipment of Photomultiplier Tube

Reference: Contract N00014-82-C-0363

Gentlemen:

In accordance with the requirements of the above referenced contract, Science Applications, Inc. (SAI) provides herewith four (4) copies of the DD Form 250, Material Inspection and Receiving Report completed to verify Shipment No. SAI0001, entitled "Quadrant Photomultiplier Tube" under Contract Line Item Number 0001AD. SAI has been directed by the ONR Technical Representative, Dr. Quell, to ship directly to your facility the enclosed tube.

If you have any questions of a technical nature, contact Mr. John McCoy at (619) 458-3794 or Mr. Gary Russell at (619) 458-3796.

Very truly yours,

SCIENCE APPLICATIONS, INC.

Barbara Bashforth
Administrative Assistant

/bb

Enclosures

cc: Dr. Fred Quell - ONR
Mr. Pete Petiford - DCASMA, QAR
Mr. John Christensen - ONR (CO)

bcc: J. McCoy
G. Russell
Chron
File
Deliverables

Science Applications, Inc. 10401 Roselle Street, San Diego, California 92121, (619) 458-3700

Other SAI Offices: Albuquerque, Atlanta, Chicago, Dayton, Denver, Huntsville, Los Angeles, Oak Ridge, San Diego, San Francisco, Tucson, and Washington, D.C.



DEPARTMENT OF THE NAVY
OFFICE OF NAVAL RESEARCH
DETACHMENT, BOSTON
495 SUMMER STREET
BOSTON, MA 02210

IN REPLY REFER TO

FWQ:ac1
31 May 1984

SAI
Attn: Gerry Russel
Quality Assurance
10401 Roselle Street
San Diego, CA 92121

Dear Mr. Russel:

By authority of this letter you are advised to ship the SHAD flight
F1 Quadrant Tube #676-5 with open waver #W8401.

Sincerely yours,

A handwritten signature in cursive script, reading "Fred W. Quelle", is written over the typed name.

FRED W. QUELLE

REQUEST FOR DEVIATION/WAIVER
(SEE MIL-STD-480 OH 481 FOR INSTRUCTIONS)

DATE PREPARED
5/29/84

PROCURING ACTIVITY NO.

1. ORIGINATOR NAME AND ADDRESS
Science Applications, Inc. Electronic Vision Systems
11526 Sorrento Valley Rd. San Diego, CA 92121 Division

2. DEVIATION WAIVER
3. MINOR MAJOR CRITICAL

4. DESIGNATION FOR DEVIATION/WAIVER
a. MODEL/TYPE *IBMm Digicon* b. MFR. CODE *60717* c. SYS. DESIG. d. DEV/WAIVER NO *WBAD1*

5. BASE LINE AFFECTED
 FUNCTIONAL ALLOCATED PRODUCT YES NO

6. OTHER SYSTEMS/CONFIGURATION ITEMS AFFECTED
 YES NO

7. SPECIFICATIONS AFFECTED-TEST PLAN				8. DRAWINGS AFFECTED			
a. SYSTEM	MFR. CODE	SPEC./DOC. NO.	SCN	MFR. CODE	NUMBER	REV.	NOR. NO.
				<i>60717</i>	<i>131-18-11000</i>	<i>C</i>	

9. TITLE OF DEVIATION/WAIVER
Mechanical Dimension - Concentricity

10. CONTRACT NO. & LINE ITEM
N00014-82-C-0363
Item 0001

11. CONFIGURATION ITEM NOMENCLATURE

12. CD NO. 13. DEFECT NO. 14. DEFECT CLASSIFICATION
 MINOR MAJOR CRITICAL

15. NAME OF PART OR LOWEST ASSEMBLY AFFECTED
Guider Tube Assy 16. PART NO. OR TYPE DESIG. *131-18-110-000*

17. LGT NO. *1* 18. QTY *1* 19. RECURRING DEVIATION/WAIVER
 YES NO

20. EFFECT ON COST/PRICE
None

21. EFFECT ON DELIVERY SCHEDULE
None

22. EFFECT ON INTEGRATED LOGISTIC SUPPORT, INTERFACE, ETC.
TBD

23. DESCRIPTION OF DEVIATION/WAIVER
Guider tube concentricity in potted configuration - drawing specifies .015 TIR tube assembly measures \approx .02 TIR, on Assembly # 676-5.
(Note: Corrective Action has been instituted to preclude recurrence of this nonconformance, The potting fixture was modified and additional inspection points incorporated.)

24. REASON FOR DEVIATION/WAIVER

25. PRODUCTION EFFECTIVITY BY SERIAL NUMBER
SIN 676-5 (SHAD F#1)

26. SUBMITTING ACTIVITY AUTHORIZING SIGNATURE
Sony J. Russell TITLE *QUALITY ASSURANCE*

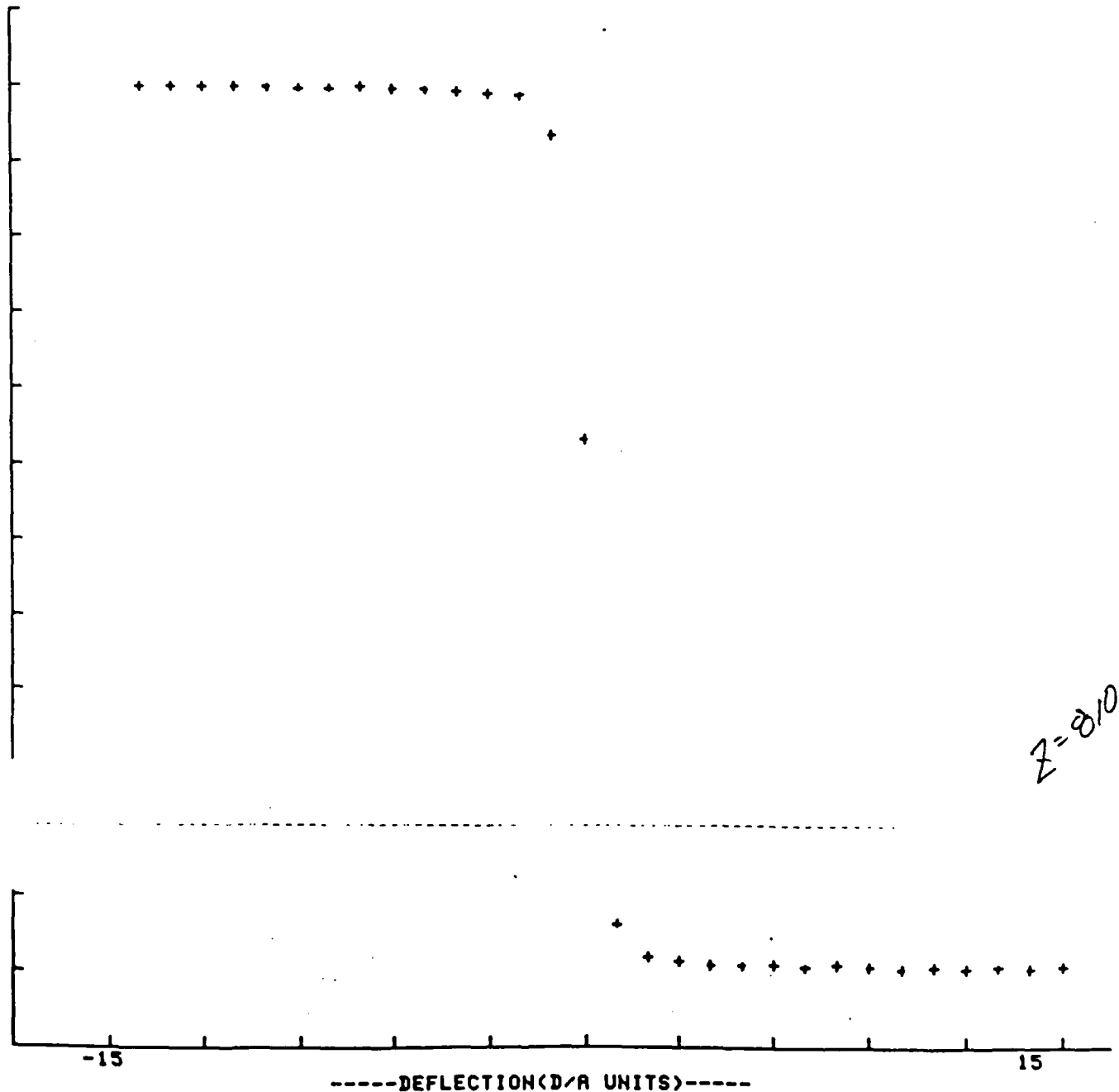
27. APPROVAL/DISAPPROVAL
a. APPROVAL RECOMMENDED b. APPROVED DISAPPROVED
c. GOVERNMENT ACTIVITY SIGNATURE DATE

10 / 4 / 83 14 : 15 (33 Sec.)
QUAD TUBE SHAD F-8 ATP 10-4-84

10 / 4 / 83 14 : 22 (31 Sec.)
QUAD TUBE SHAD F-8 ATP 10-4-84

X-SWEEP @ Y = 0
FROM -15 TO 15 IN 31 STEPS OF 1 EACH 1 Sec

PREAMP No. 1 COUNTER No. 18 DIODE No. 1 THRESHOLD = 60
SCALE MAX, SCALE MIN = 20000 0



Hf_{m1}, Hf_{m2}, FWHM, Pos. = -14.45 .07 14.52 -7.19
10%-90%, 90%-10%, AVE = .72 1.82 1.27
MAX COUNT, MIN COUNT = 21932.8 2073.94

RESOLUTION
(ERROR FUNCTION)

SAIT
QEB

10/5/84

E. J. J. 10-4-84

STD. DEV OF EFUN = .979056511223

4.3.c,d

DATE 10-5-84

DIGICON PERFORMANCE

c. 100 SECOND INTEGRATION DARK COUNT

Q1 = 567
Q2 = 573
Q3 = 426
Q4 = 564
TOTAL = 2130


C = TOTAL/400 = 5.325
(Goal = 10)

d. QUADRANT RESPONSE UNIFORMITY

	% AVG
Q1 <u>4263</u>	<u>-0.95</u>
Q2 <u>4784</u>	<u>+1.03</u>
Q3 <u>4628</u>	<u>+1.02</u>
Q4 <u>4354</u>	<u>-0.97</u>

4507 = \bar{x}

AVG = ~~4507~~ 0.99%
(Goal = $\pm 5\%$)

TEST ENGINEER E. Verjia QA  10/5/84

CUSTOMER (if applicable) _____

Figure 4.3b

TUBE NO. 691-5

AT 18-4.4
Initial Release

DATE 10-5-84

PHYSICAL, MECHANICAL DIMENSIONS

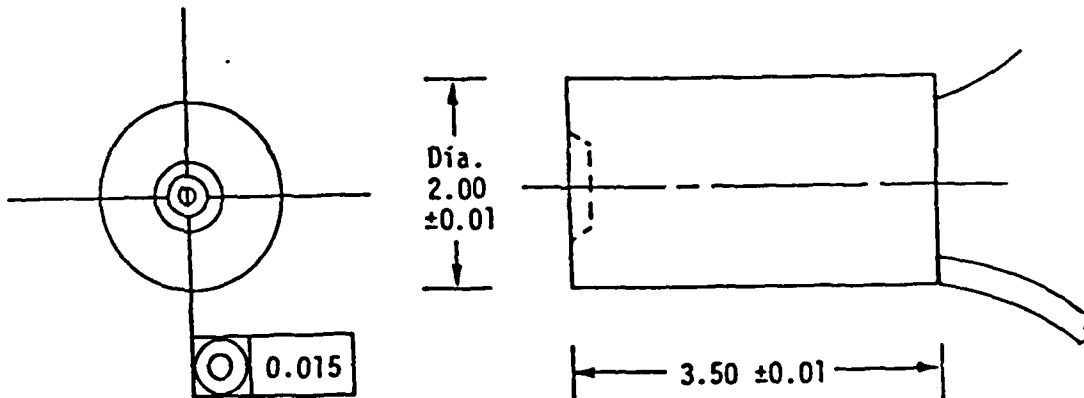
a. Maximum Diameter (2.00 ± 0.01 inch) 2.001

b. Maximum Length (3.50 ± 0.01 inch) 3.499

c. Concentricity:

Shield, Anticorona Metalization,
Cone I.D. Optical Inspection
(0.015 max. TIR).....Verified 0.012 in

d. Weight (Max. 350 g.).....Verified 317 grams



Inspector E. Wozniak 10-5-84 QA SAIT QEB 10/5/84

Customer (if applicable) _____

SERIAL NUMBER 674-5

THIRD FLIGHT TUBE (F-3)

Gary Russell



Science Applications International Corporation
#215

3 December 1984

Office of Naval Research
Department of the Navy
459 Summer Street
Boston, MA 02210

Attention: Dr. Fred Quell

Subject: Certificate of Performance

Reference: Contract N00014-82-C-0363

Gentlemen:

Science Applications International Corporation (SAIC) provides herewith two (2) copies of the "Certificate of Performance" for the FOS Digicon, SAI Part Number 131-18-110-000 and Serial Number 674-5 (F#3). This is to certify that the items were tested in accordance with the attached test reports, in accordance with the above referenced contract.

Should you require any additional technical information, please contact Mr. Gary Russell at (619) 458-3796.

Very truly yours,

SCIENCE APPLICATIONS INTERNATIONAL CORP.

Barbara Bashforth

Barbara Bashforth
Administrative Assistant

/bb

Enclosures

cc: Mr. Pete Petiford - DCASMA (San Diego)



Science Applications International Corporation

December 3, 1984

SHAD QUAD DIGICON (1-131-08-645)

SAIC P/N: 131-18-110-000

SAIC S/N: 674-5 (F#3)

Contract No.: N00014-82-C-0363
Office of Naval Research

CERTIFICATE OF PERFORMANCE

This is to certify that the item noted was tested in accordance with the SAIC Acceptance Test Procedures AT-18-4.1- Photocathode Response (QE), AT-18-4.2A- Diode Array Response, AT-18-4.3A- Digicon Performance, and AT-18-4.4- Physical, Mechanical Dimensions. Test Data Summary Sheets are attached for each test. Physical test reports and data are on file at this facility and are available for review by ONR.

Gary L. Russell
Quality Assurance

Distribution: SAIC Test
SAIC QA
SAIC Contracts (4)
SAIC File



SCIENCE APPLICATIONS, INC.
TECHNOLOGY DEVELOPMENT GROUP (TDG)
 TELEPHONE - SHIPPING/RECEIVING DEPT: (619) 458-3787, 458-3700

SHIPPER CONTROL

NO. 1 2174

FROM:
 ELECTRONIC VISION AND SYSTEMS DIVISION
 11526 SORRENTO VALLEY ROAD, SUITE A
 SAN DIEGO, CA 92121
 INSTRUMENTATION DEVELOPMENT LAB
 10373 ROSELLE STREET
 SAN DIEGO, CA 92121
 RADeCO™
 A DIVISION OF SCIENCE APPLICATIONS, INC.
 10373 ROSELLE STREET
 SAN DIEGO, CA 92121

TO:
 Instrumentation Technology Eng. Inc
 10511 Tucker St.
 Beltsville, MD 20705
 ATTN: Mr. E.C.Aaron

CONTRACT/PURCHASE ORDER NO. N00014-82-C-0263		PROJECT NO. 1-131-08-645		DATE DUE		DATE SHIPPED 6-7-84	
SHIPPING AUTHORIZATION NO'S. J. McCoy		SHIPMENT <input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL <input checked="" type="checkbox"/> COMPLETE		NET WEIGHT		GROSS WEIGHT	
SHIPPED VIA Air		CARRIER Emery 04948767		CUBE		NO. PACKAGES 1	
REMARKS		FOB		<input checked="" type="checkbox"/> PREPAID		<input type="checkbox"/> COLLECT	

ITEM NO	PART NO.	DESCRIPTION	UNIT OF ISSUE	QUANTITY AUTHORIZED	QUANTITY SHIPPED
1	131-18-100-000	18mm Quadrant Digicon Guider Tube Assy. s/n 676-5(F-1)	ea	1	1

WHITE - PACKING SLIP
 BLUE - REQUESTOR
 GREEN - ACCOUNTING

CANARY - PURCHASING
 PINK - CONTRACTS
 GOLD - SHIPPING

AUTHORIZED SIGNATURE

DATE

X Gary Mulvaney

6-7-84



SCIENCE APPLICATIONS, INC.
 APPLIED SCIENCE & TECHNOLOGY GROUP
 TELEPHONE - SHIPPING/RECEIVING DEPT.: (714) 452-9150

SHIPPER CONTROL

NO. 10469

FROM: Systems Division

TO:

- ELECTRONIC VISION COMPANY
526 SORRENTO VALLEY ROAD, SUITE A
SAN DIEGO, CA. 92121
- INSTRUMENTATION DEVELOPMENT LAB
11526 SORRENTO VALLEY ROAD, SUITE B
SAN DIEGO, CA. 92121
- EFFLUENT CONTROL LAB
4030 SORRENTO VALLEY BLVD.
SAN DIEGO, CA. 92121
- SAI TECHNOLOGY COMPANY
4060 SORRENTO VALLEY BLVD.
SAN DIEGO, CA. 92121

Instrumentation Technology Engineering, Inc.
 10511 Tucker Street
 Beltsville, MD 20705
 Attn: Mr. E.C. Aaron

CONTRACT/PURCHASE ORDER NO. N00014-82-C-0363	PROJECT NO. 1-131-08-645-00	DATE DUE 12/5/84	DATE SHIPPED 12/3/84
SHIPPING AUTHORIZATION NO'S.	SHIPMENT <input type="checkbox"/> PARTIAL <input checked="" type="checkbox"/> FINAL <input type="checkbox"/> COMPLETE	NET WEIGHT	GROSS WEIGHT
SHIPPED VIA Air	CARRIER Federal Express	CUBE	NO PACKAGES 1
REMARKS		FOB Dest	<input checked="" type="checkbox"/> PREPAID <input type="checkbox"/> COLLEC

ITEM NO.	PART NO.	DESCRIPTION	UNIT OF ISSUE	QUANTITY AUTHORIZED	QUANTITY SHIPPED
1	131-18-110 000	SHAD Flight Digicon #3 SAIC P/N 131-18-110 000 S/N 674-5 Line Item 0001AF	ea	1	1
2		Copy of Test Data	ea	1	1

OK to ship Russell 12/3/84

Pete Petzold 12/3/84
S05144

1 AUTHORIZED SIGNATURE: *[Signature]* DATE: 12/3/84

PACKING SLIP

MATERIAL INSPECTION AND RECEIVING REPORT	1 PROC INSTRUMENT IDEN (CONTRACT)	ORDER NO	6 INVOICE	7 PAGE OF
	N00014-82-C-0363		NO	1 1
			DATE	8 ACCEPTANCE POINT
				D

2 SHIPMENT NO	3 DATE SHIPPED	4 B/L	5 DISCOUNT TERMS
SAI0002	84DEC03	TCN	

9 PRIME CONTRACTOR	CODE	10 ADMINISTERED BY	CODE
Science Applications International Corp. 10401 Roselle Street San Diego, CA 92121	52302	DCASMA - La Jolla Bldg. 4, AF Plant 19 4297 Pacific Highway San Diego, CA 92110	S0514A

11 SHIPPED FROM (if other than 9)	CODE	FOB	12 PAYMENT WILL BE MADE BY	CODE
Same as Block 9.	52302	S	DCASMA - Los Angeles 11099 So. La Cienega Blvd. P.O. Box 45011 Los Angeles, CA 90045	S0506A

13 SHIPPED TO	CODE	14 MARKED FOR	CODE
Instrumentation Technology Engineering, Inc. 10511 Tucker Street Beltsville, MD 20705		Mr. E. C. Aaron	

15 ITEM NO	16 STOCK PART NO <small>(Indicate number of shipping containers type of container container number)</small>	DESCRIPTION	17 QUANTITY SHIP'D REC'D	18 UNIT	19 UNIT PRICE	20 AMOUNT
0001 AF		The Contractor shall design, build, test and deliver one space-qualified flight model of their intensified quadrant photomultiplier tube. SAIC Part No. 131-18-110-000 Serial No. 674-5 (F#3) (18 mm Quadrant Digicon Guider Tube Assembly)	1	EA	NSP	NSP

21 PROCUREMENT QUALITY ASSURANCE		22 RECEIVER'S USE	
<input checked="" type="checkbox"/> POA <input type="checkbox"/> A ORIGIN	<input type="checkbox"/> POA <input checked="" type="checkbox"/> B DESTINATION	Quantities shown in column 17 were received in apparent good condition except as noted	
<small>ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract except as noted herein or on supporting documents</small>	<small>ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract except as noted herein or on supporting documents</small>	DATE RECEIVED	SIGNATURE OF AUTH GOVT REP
34 Dec 06 DATE	<i>Pete Petiford</i> SIGNATURE OF AUTH GOVT REP		
TYPED NAME AND OFFICE Pete Petiford S0514A	DATE	TYPED NAME AND OFFICE	
	SIGNATURE OF AUTH GOVT REP	<small>*If quantity received by the Government is the same as quantity shipped, indicate by (x) mark; if different, enter actual quantity received below quantity shipped and encircle.</small>	

23 CONTRACTOR USE ONLY

MATERIAL INSPECTION AND RECEIVING REPORT	1 PROC INSTRUMENT IDEN (CONTRACT) N00014-82-C-0363	ORDER NO	6 INVOICE NO	7 PAGE 1 OF 1
			DATE	8 ACCEPTANCE POINT D

9 PAYMENT NO 0003	3 DATE SHIPPED 840CT04	4 B/L TCN	5 DISCOUNT TERMS
----------------------	---------------------------	--------------	------------------

10 ADMINISTERED BY DCASMA - La Jolla Bldg. 4, AF Plant 19 4297 Pacific Highway San Diego, CA 92110	11 CONTRACTOR ence Applications International Corp. 01 Roselle Street Diego, CA 92121	CODE 52302	CODE S0514A
--	--	---------------	----------------

12 PAYMENT WILL BE MADE BY DCASMA - Los Angeles 11099 So. La Cienega Blvd. P.O. Box 45011 Los Angeles, CA 90045	13 SHIPPED FROM (If other than 9) e as Block 9.	CODE 52302	FOB S	CODE S0506A
---	--	---------------	----------	----------------

14 MARKED FOR Mr. E. C. Aaron	15 SHIPPED TO strumentation Technology Engineering, Inc. 11 Tucker Street tsville, MD 20705	CODE	CODE
----------------------------------	--	------	------

ITEM NO	16 STOCK PART NO <small>(Indicate number of shipping containers type of container container number)</small>	DESCRIPTION	17 QUANTITY SHIP'D REC'D	18 UNIT	19 UNIT PRICE	20 AMOUNT
1	AE	The Contractor shall design, build, test and deliver one space-qualified flight model of their intensified quadrant photomultiplier tube. SAIC Part No. 131-18-110-000 Serial No. 691-5 (F#2)	1	EA	NSP	NSP

PROUREMENT QUALITY ASSURANCE A ORIGIN <input type="checkbox"/> ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract except as noted herein or on supporting documents. B DESTINATION <input checked="" type="checkbox"/> POA ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract except as noted herein or on supporting documents.		22 RECEIVER'S USE Quantities shown in column 17 were received in apparent good condition except as noted. DATE RECEIVED _____ SIGNATURE OF AUTH GOVT REP _____ TYPED NAME AND OFFICE _____ <small>*If quantity received by the Government is the same as quantity shipped, indicate by (✓) mark; if different enter actual quantity received below quantity shipped and encircle.</small>
DATE _____ SIGNATURE OF AUTH GOVT REP <i>Pete Petiford</i>	DATE _____ SIGNATURE OF AUTH GOVT REP _____	TYPED NAME AND TITLE Pete Petiford S0514A

CONTRACTOR USE ONLY

ENCAPSULATED DIGICON ACCEPTANCE TESTS (SHAD)

DIGICON NO. 274-5
F-3

<u>TEST</u>	<u>DATE</u>
4.1 PHOTOCATHODE RESPONSE (QE)	<u>12-3-84</u>
4.2 DIODE ARRAY RESPONSE	
a. Leakage	<u>11-30-84</u>
b. Capacitance	<u>11-30-84</u>
c. $\Delta E/E$	<u>11-30-84</u>
4.3 DIGICON PERFORMANCE	
a. Magnification	<u>11-29-84</u>
b. Error Function	<u>11-29-84</u>
c. Dark Count	<u>11-29-84</u>
d. Uniformity	<u>11-29-84</u>
4.4 PHYSICAL	
a. Diameter	<u>11-30-84</u>
b. Length	<u>11-30-84</u>
c. Centering	<u>11-30-84</u>
d. Weight	<u>11-30-84</u>

Data Distribution:

- Test Build Log Book
- Test Lab
- Tube Engineer
- Quality Assurance
- Customer
- File



12/3/84

TUBE NO. 674-5 F-3
 DATE 12-3-84
 (ATP)

PHOTOCATHODE RESPONSE
Visible Current Mode Quantum Efficiency Data Sheet

Wave-length (nm)	Tube Signal (A)	Calibration Standard Signal (A)	Standard Calibration (QE%)	Comments	Calculated QE (%)	Goal QE (%)
360	2.24 ±9	1.98 ±9	19.3		24.3	
400	2.05 ±9	1.43 ±9	15.4		22.1	25.0
460	1.994 ±8	2.48 ±9 592 ±8	10.5		17.6	
500	1.96 ±8	1.11 ±8	7.96		14.1	15.0
560	2.14 ±8	1.16 ±8	5.09		9.39	
600	1.79 ±8	.958 ±8	3.86		7.21	
660	1.38 ±8	.724 ±8	2.52		4.80	
700	1.03 ±8	.496 ±8	1.72		3.57	2.5
760	.496 ±8	.168 ±8	.726		2.14	
800	.940 ±9	186 ±9	.245		1.24	0.1

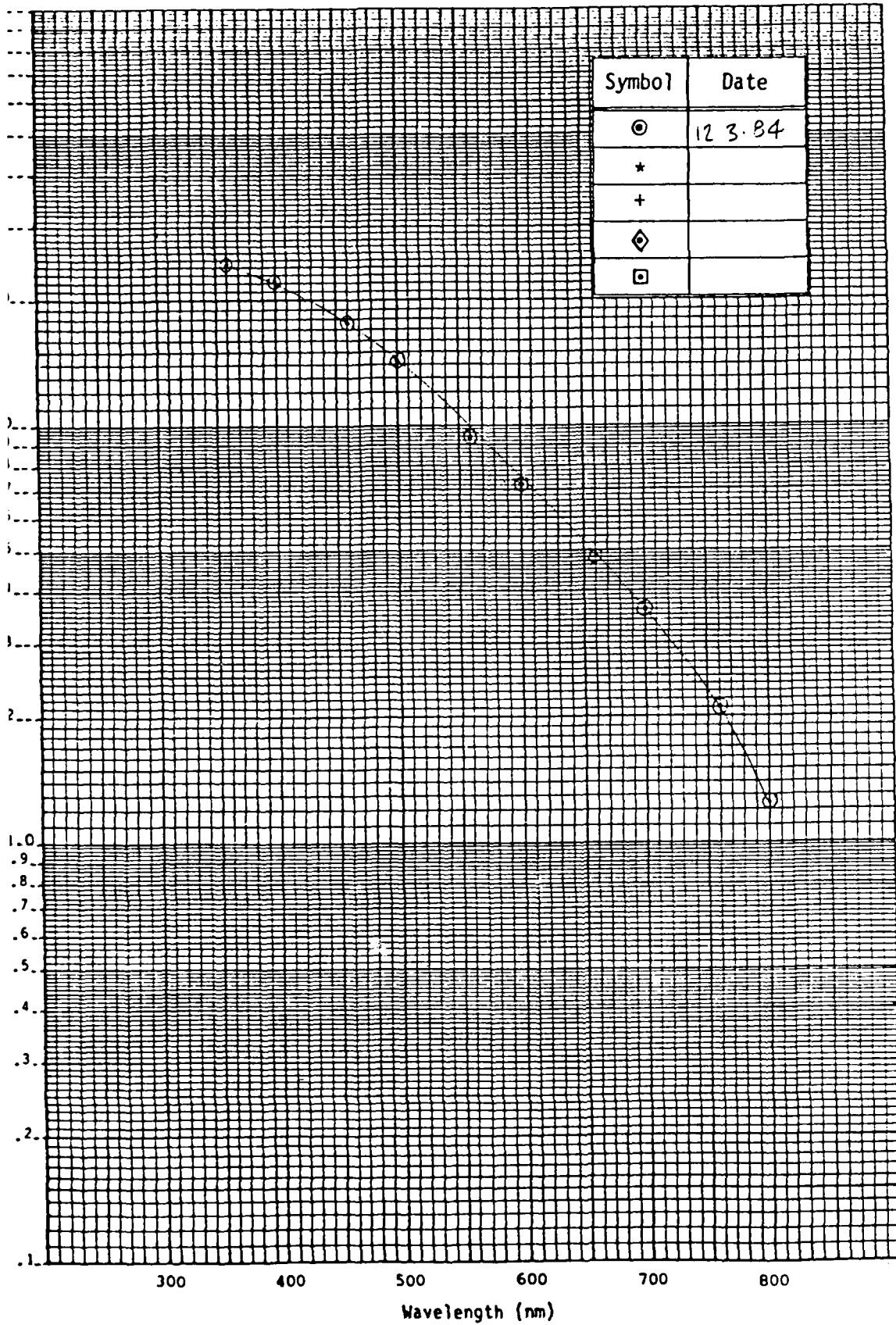
Test Engineer E. Wojcik QA 

Customer (if applicable) _____

Calculated QE% = $\frac{\text{Tube Signal}}{\text{Calibration Standard Signal}} \times \text{Standard Calibration Q\%}$

AT-3018

TUBE NO. 674-5
F-3



TUBE NO. 674-5 F-3

DATE 11-30-84

QUAD DIGICON ARRAY RESPONSE

DIODE	PIN	LEAKAGE CURRENT (nA) Goal ≤ 1 nA	CAPACITANCE (pf) Goal ≤ 15 pf	$\Delta E/E$ Goal ≤ 0.25
Q1	2	2.4	10.6	0.26
Q2	5	2.08	10.4	0.28
Q3	9	3.0	10.3	0.30
Q4	12	3.18	10.6	0.27
G1	1	.47	7.4	0.23
G2	3	.93	7.8	0.21
G3	4	.45	7.6	0.27
G4	6	.65	7.6	0.20
G5	8	.80	7.5	0.21
G6	10	.62	7.8	0.20
G7	11	.46	7.5	0.26
G8	13	.52	7.8	0.21



TEMPERATURE = 0 DEGREES CENTIGRADE

672-5

TUBE SCAN

2 / 2 / 83 9 : 55 (10 Sec.)
ROUND COUNT FOR 10 INTERVALS OF 1 SEC EACH
DEFLECTION OF X= 0 & Y= 0
DINC. ACCEPTED = 5
LIMIT = 100 COUNTS
TEMPERATURE = 0 DEGREES CENTIGRADE

DIODE NUMBER	-----COUNTS-----		
	ISOLATED	FILTERED	TOTAL
1	0	118	118
2	0	96	96
3	0	95	95
4	0	93	93

ALS 402 402

INTERVALS REJECTED; 0 INTERVALS WITHOUT COUNTS

TEMPERATURE = 0 DEGREES CENTIGRADE

TUBE SCAN

2 / 2 / 83 9 : 57 (10 Sec.)
ROUND COUNT FOR 100 INTERVALS OF 1 SEC EACH
DEFLECTION OF X= 0 & Y= 0
DINC. ACCEPTED = 5
LIMIT = 100 COUNTS
TEMPERATURE = 0 DEGREES CENTIGRADE

DIODE NUMBER	-----COUNTS-----		
	ISOLATED	FILTERED	TOTAL
1	0	1118	1118
2	0	975	975
3	0	874	874
4	0	946	946

ALS 3913 3913

INTERVALS REJECTED; 0 INTERVALS WITHOUT COUNTS

TEMPERATURE = 0 DEGREES CENTIGRADE

TUBE NO. 672-5

DATE 2/2/84

SHAD DIGICON DARK COUNT

DO SECOND INTEGRATION

Q1 = 1118
Q2 = 975
Q3 = 874
Q4 = 946
TOTAL = 3913

C = TOTAL/400 = 9.78

QUADRANT UNIFORMITY

	% AVG
Q1 <u>3750</u>	<u>99.87</u>
Q2 <u>3760</u>	<u>100.13</u>
Q3 <u>3750</u>	<u>99.87</u>
Q4 <u>3760</u>	<u>100.13</u>

AVG = 3755

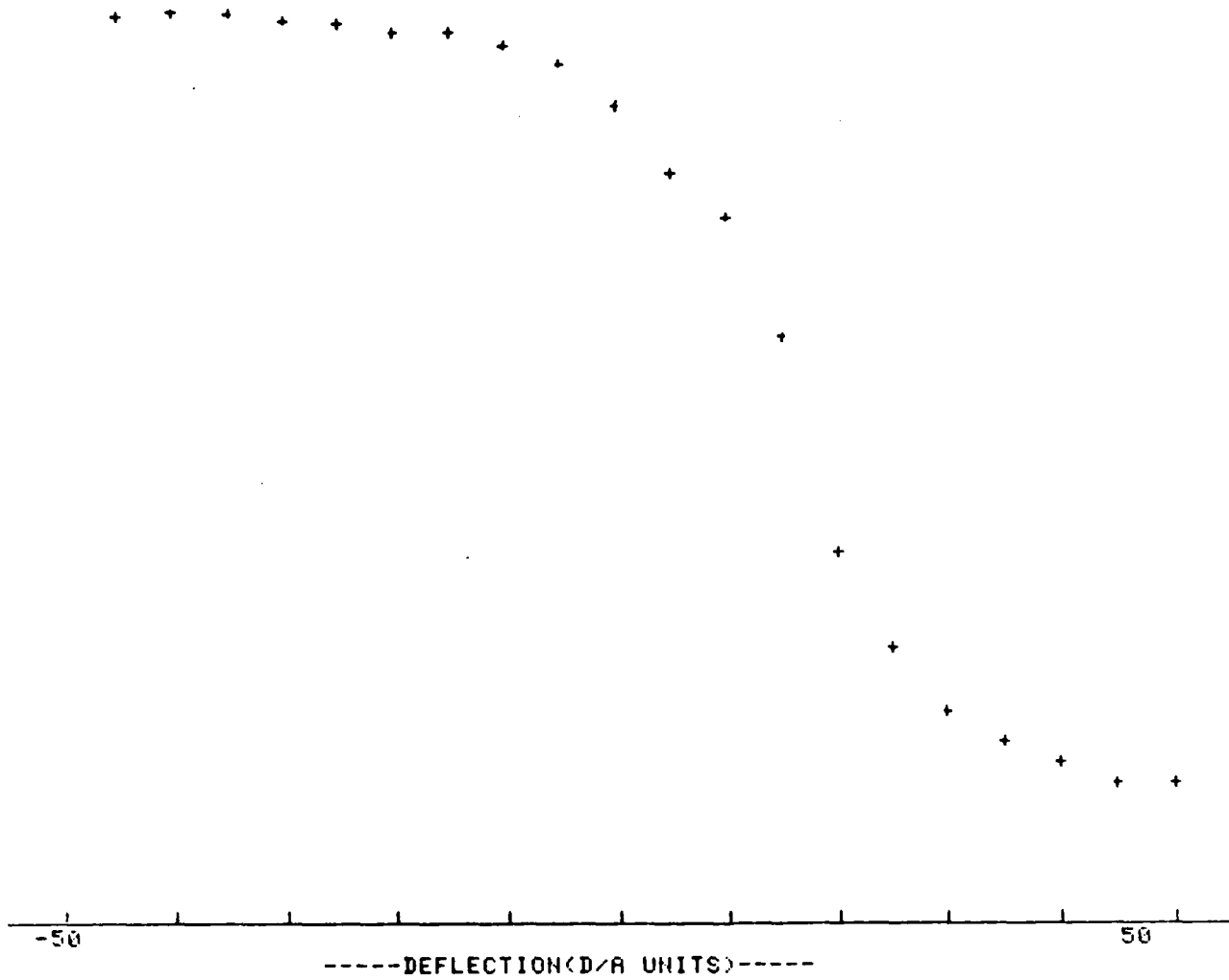
EST ENGINEER _____ QA _____

2 / 2 / 83 16 : 12 (21 Sec.)
TUBE SCAN

SN/REP

672 RESOLUTION
EEP @ Y = 0
-50 TO 50 IN 21 STEPS OF 5 EACH 1 Sec

1P No. 1 COUNTER No. 18 DIODE No. 1 THRESHOLD = 54
E MAX, SCALE MIN = 20000 0



l, Hfm2, FWHM, Pos. = -47.09 16.35 63.44 -15.37
-90%, 90%-10%, AVE = 3.36 31.05 17.2 = 21.05 μ
COUNT, MIN COUNT = 20884.4 3374.68

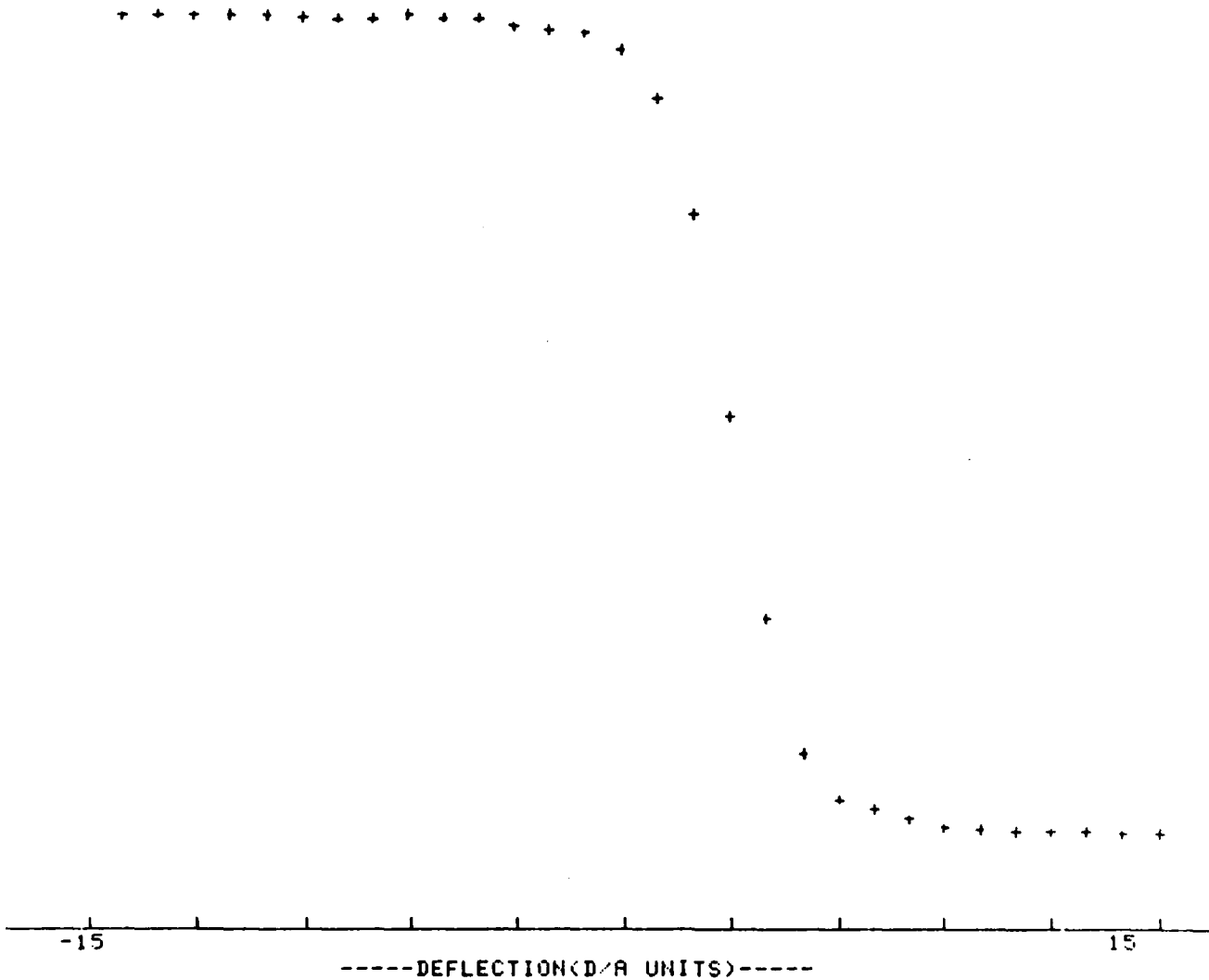
2 / 2 / 83 9 : 34 (3 Sec.)
ID TUBE SCAN

FOR FUNCTION (FINE) 2/2/84

-SWEEP @ Y = -2

DM -15 TO 15 IN 31 STEPS OF 1 EACH 1 Sec

AMP No. 1 COUNTER No. 18 DIODE No. 1 THRESHOLD = 84
SCALE MAX, SCALE MIN = 20000 0



m1, Hf m2, FWHM, Pos. = -14.45 3.04 17.49 -5.7
90%-90%, 90%-10%, AVE = .72 4.04 2.38 RES = 40.4 μ
PIX COUNT, MIN COUNT = 21779.7 2278.21

1 DIA = 10 μ

STD. DEV OF EFUN = .906151062727
SUMSUM = 2718.4
MEAN EFUN = .224906928429

TUBE NO. 672-5

DATE 2/3/84

SHAD DIGICON MAGNIFICATION TEST

DIODE 2

	1/2	CENTER	1/2
μ Divisions	<u>5.4</u>	<u> </u>	<u>2.2</u>
Count Rate	<u>2925</u>	<u>6000</u>	<u>3065</u>
S (Total No. Divisions)	<u>25 - 5.4 + 2.2 = 21.8</u>		
W = S * (μ /Divisions)	<u>21.8 * 25.4 = 553.72</u>		
M (Magnification) = D/W (D = Diode Width)	<u>400 / 553.72 = 0.722</u>		

DIODE _____

	1/2	CENTER	1/2
μ Divisions	<u> </u>	<u> </u>	<u> </u>
Count Rate	<u> </u>	<u> </u>	<u> </u>
S (Total No. Divisions)	<u> </u> = <u> </u>		
W = S * (μ /Divisions)	<u> </u> * <u> </u> = <u> </u>		
M (Magnification) = D/W (D = Diode Width)	<u> </u> / <u> </u> = <u> </u>		

TEST ENGINEER Acton/Mc Coy QA

VISIBLE CURRENT MODE QUANTUM EFFICIENCY DATA SHEET

Wave-length (nm)	Standard Calibration (mA/w)/Q.E.	Standard Signal Current (nA)	Calculated Monochromator Out-Put (μ W)	Tube Signal Current (μ A)	Calculated Q.E. (%)	Spec Q.E. (%)
400 nm	15.9	.644E-9		1.09E-9	24.87	25.0
420 nm		(.616E-9)		(1.02E-9)	(25.5)	
440 nm						
460 nm	10.5	1.46E-9		2.59E-9	18.27	
480 nm						
500 nm	7.96	2.82E-9		.508E-8	14.34	15.0
520 nm						
540 nm						
560 nm	5.09	.306E-8		.578E-8	9.6	
580 nm						
600 nm	3.86	.252E-8		.467E-8	7.15	
620 nm						
640 nm						
660 nm	2.52	.200E-8		.346E-8	4.36	
680 nm						
700 nm	1.72	.142E-8		.238E-8	2.88	2.5
720 nm						
740 nm						
760 nm	.726	.498E-9		.836E-9	1.22	
780 nm						
800 nm	.245	.132E-9		.222E-9	0.3	0.1
820 nm						
840 nm						
860 nm	.017					
880 nm						
900 nm	.002					<0.1

Date Jan 11 1984 Tube S/N: 672-5 Test Eng. Acton

Q.A. _____ Q.A. Verification of Equipment Calibration _____

PHOTOCATHODE RESPONSE
Visible Current Mode Quantum Efficiency
Data Sheet

Tube No. 672-5
Date 2-8-84

Wavelength (nm)	UUT Tube Signal		Calibration Standard Signal		Standard Calibration (QE%)	Comments	UUT Calculated QE (%)	Goal QE (%)
	(A)	E	(A)	E				
360	.487	-10	.36	-10	19.3	Blue Filter	26.1	
400	.605	-9	.377	-9	15.4	"	24.7	25.0
460	.150	-8	.890	-9	10.5	"	17.7	
500	.305	-8	.173	-8	7.96	no filter	14.0	15.0
560	.352	-8	.201	-8	5.09	"	8.91	
600	.286	-8	.159	-8	3.86	Orange Filter	6.94	
660	.213	-8	.126	-8	2.52	"	4.26	
700	.148	-8	.885	-9	1.72	"	2.88	2.5
760	.514	-9	.308	-9	.726	"	1.21	
800	.148	-9	.85	-10	.245	"	0.43	0.1
850								

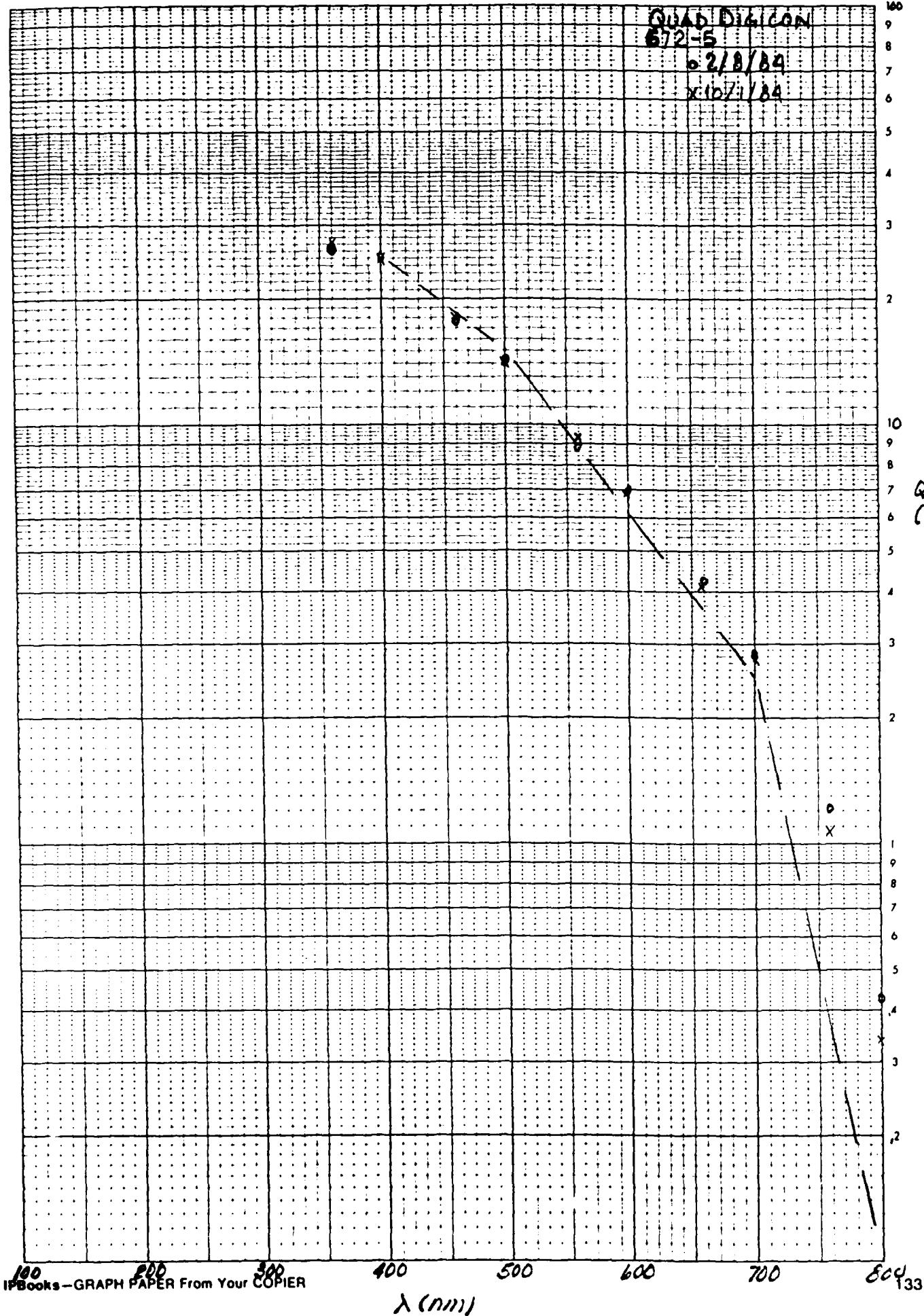
Test Engineer J. Acton QA _____
Customer (if applicable) _____

$$\text{Calculated QE\%} = \frac{\text{Tube Signal}}{\text{Cal. Std. Signal}} \times \text{Std. Cal. QE\%}$$

70 Divisions 5th, 10th Accent by 3 Cycle Semi-Log

QUAD DIGICON
672-5
o 2/8/84
x 10/7/84

QE (%)



λ (nm)

UNENCAPSULATED DIGICON TESTS (SHAD)

DIGICON NO. 672-5

<u>TEST</u>	<u>DATE</u>
PHOTOCATHODE RESPONSE	<u>1/11/84 2/8/84</u>
DIODE ARRAY RESPONSE	
Leakage (12)	<u>2/10/84</u>
Capacitance (12)	<u>2/10/84</u>
$\Delta E/E$ (12)	<u>2/10/84</u>
DIGICON PERFORMANCE	
Magnification	<u>2/3/84</u>
Error Function	<u>2/2/84</u>
Dark Count	<u>2/2/84</u>
Uniformity	<u>2/2/84</u>

.72

40.4

9.78

5.9

$\pm .1\%$

SERIAL NUMBER 672-5
UNENCAPSULATED TUBE (SPARE)

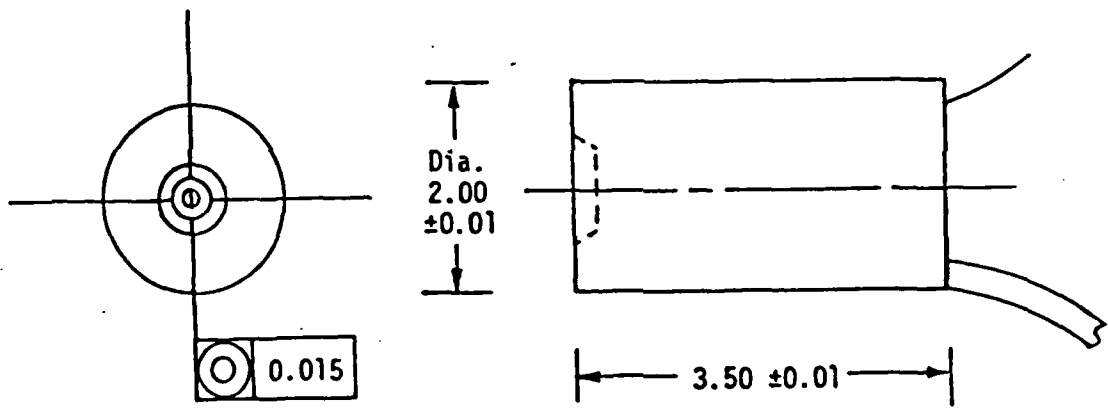
TUBE NO. 674-5 F-3



AT 18-4.4
Initial Release

DATE 11-30-84

PHYSICAL, MECHANICAL DIMENSIONS

- a. Maximum Diameter (2.00 ± 0.01 inch) 2.004
- b. Maximum Length (3.50 ± 0.01 inch) 3.503
- c. Concentricity:
Shield, Anticorona Metalization,
Cone I.D. Optical Inspection
(0.015 max. TIR).....Verified E. Vojin
- d. Weight (Max. 350 g.).....Verified E. Vojin (290g)



Inspector E. Vojin QA 
Customer (if applicable) DATA REVIEW 

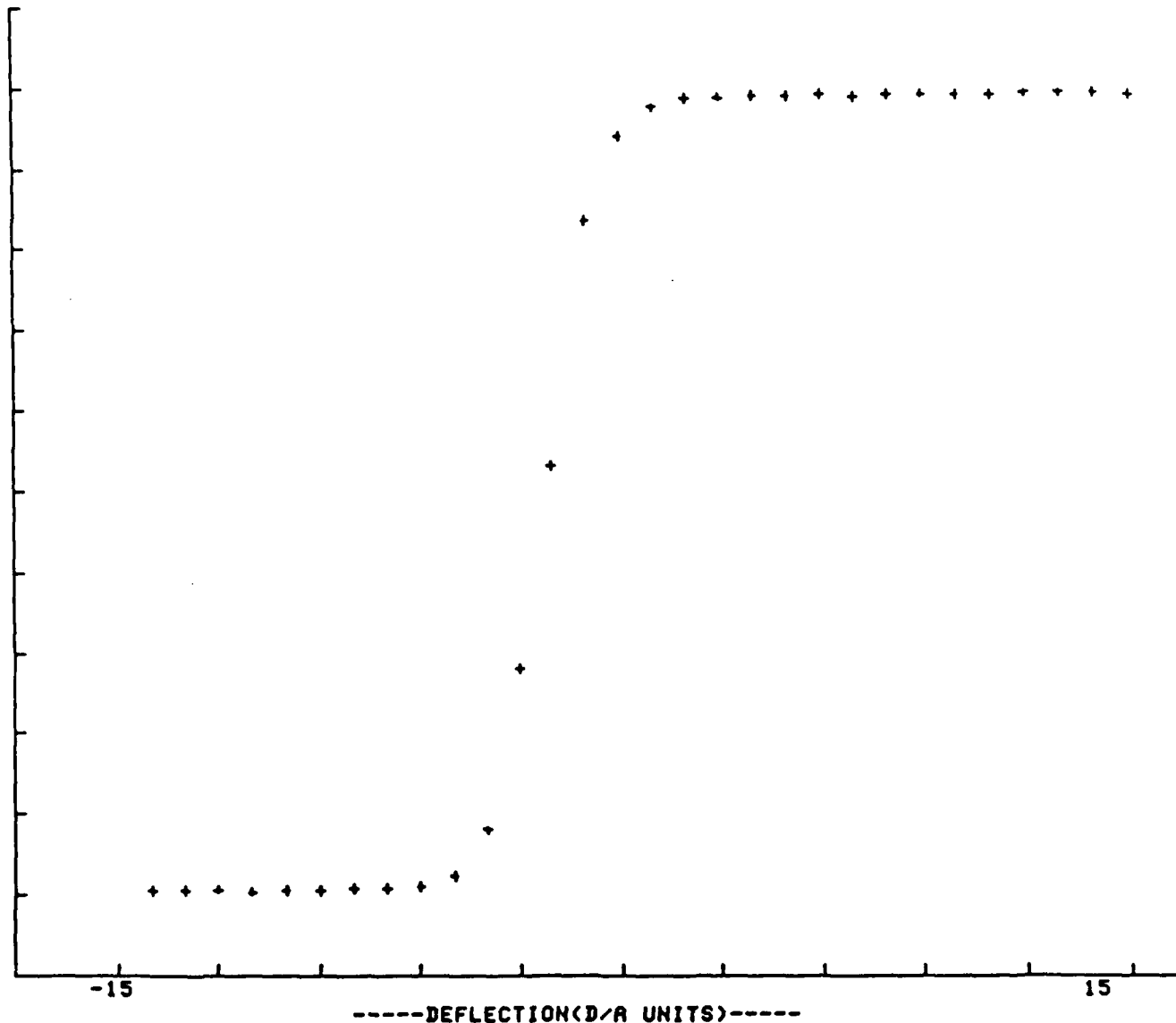
11 / 29 / 85⁶⁴ 12 : 29 (38 Sec.)
QUAD TUBE SCAN SHAD F-3 11.29.84

11 / 29 / 85⁶⁴ 13 : 49 (44 Sec.)
QUAD TUBE SCAN SHAD F-3 11.29.84

Error Function
Digicon # 674-5
F-3

X-SWEEP @ Y = -13
FROM -15 TO 15 IN 31 STEPS OF 1 EACH 1 Sec

PREAMP No. 1 COUNTER No. 18 DIODE No. 1 THRESHOLD = 54
SCALE MAX, SCALE MIN = 20000 0



Hfm1, Hfm2, FWHM, Pos. = -2.19 15 17.19 6.4
10%-90%, 90%-10%, AVE = 3.69 0 1.84
MAX COUNT, MIN COUNT = 21927.7 1416.72

36.9 μ m



STD. DEV OF EFUN = .935928721891
SUMSUM = 5793.46666667
MEAN EFUN = .176272619362

J. Anton

TUBE NO. 674-5 F-3

DATE 11-29-84


SHAD DIGICON MAGNIFICATION TEST

DIODE Q3

	1/2	CENTER	1/2
μ Divisions	<u>532</u>	<u>498</u>	<u>464</u>
Count Rate	<u>2953</u>	<u>5720</u>	<u>3320</u>
S (Total No. Divisions)	<u>532 464</u>		= <u>68</u>
W = S * (μ /Divisions)	= <u>68</u> * <u>10μ</u>		= <u>680</u>
M (Magnification) = D/W (D = Diode Width)	= <u>400</u> / <u>680</u>		= <u>.588</u>

DIODE Q4

	1/2	CENTER	1/2
μ Divisions	<u>409 462</u>	<u>492</u>	<u>523</u>
Count Rate		<u>5843</u>	
S (Total No. Divisions)	<u>523 - 462</u>		= <u>61</u>
W = S * (μ /Divisions)	= <u>61</u> * <u>10μ</u>		= <u>610</u>
M (Magnification) = D/W (D = Diode Width)	= <u>400</u> / <u>610</u>		= <u>.656</u>

TEST ENGINEER E. Joyin / S. Peters QA 

TUBE NO. 674-5 F-3DATE 11.29.84SHAD DIGICON MAGNIFICATION TESTDIODE Q1

	1/2	CENTER	1/2
μ Divisions	<u>528</u>	<u>494</u>	<u>465</u>
Count Rate	<u>2862</u>	<u>5782</u>	<u>3078</u>
S (Total No. Divisions)	<u>528 - 465 = 63</u>		
W = S * (μ /Divisions)	<u>63 * 10μ = 630</u>		
M (Magnification) = D/W (D = Diode Width)	<u>400μ / 630 = .635</u>		

DIODE Q2

	1/2	CENTER	1/2
μ Divisions	<u>465</u>	<u>434</u>	<u>403</u>
Count Rate	<u>3124</u>	<u>5802</u>	<u>2984</u>
S (Total No. Divisions)	<u>465 - 403 = 62 = 62</u>		
W = S * (μ /Divisions)	<u>62 * 10μ = 620</u>		
M (Magnification) = D/W (D = Diode Width)	<u>400μ / 620 = .645</u>		

TEST ENGINEER

E. Uzju

QA



END

FILMED

5-85

DTIC