64-9

C-BAND TRIODE-CAVITY OSCILLATORS

PRODUCTION ENGINEERING MEASURE

SECOND QUARTERLY PROGRESS REPORT

31 AUGUST 1963 THROUGH 30 NOVEMBER 1963

CONTRACT NO. DA 36-039-AMC-01474(E)

ORDER NO. 21049-PP-63-81-81

U. S. ARMY ELECTRONICS MATERIEL AGENCY

PHILADELPHIA, PENNSYLVANIA

CLASSIFICATION - NONE

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

OWENSBORO, KENTUCKY

C-BAND TRIODE-CAVITY OSCILLATORS, PRODUCTION ENGINEERING MEASURE

SECOND QUARTERLY PROGRESS REPORT

31 AUGUST 1962 THROUGH 30 NOVEMBER 1963

Objective: (1) To optimize performance of the triode-cavity combination.

(2) To improve manufacturing methods.

(3) To assure more uniformity of product.

(4) To minimize the physical size of the cavity.

(5) To demonstrate 5 units per day production capability.

(6) To prepare and distribute progress reports.

(7) To prepare the Step II Report covering a rate of 1,000 units per month.

CONTRACT NO. DA 36-039-AMC-01474(E)

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SIGNAL CORPS INDUSTRIAL PREPAREDNESS
PROCUREMENT REQUIREMENTS NO. 15

CLASSIFICATION - NONE

REPORT BY - J. D. MARSHALL

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1.0 ABSTRACT

Pulse and CW cavity oscillators were assembled for the first engineering sample. Representative life tests have been completed. Operating characteristics of cavities are summarized. Modifications in triode design are being studied.

2.0 PURPOSE

The objectives of this contract are to optimize performance as defined in specifications SCL-7001/82 and SCL-7001/83, to improve manufacturing methods, to assure more uniformity of product, to minimize the physical size of the cavity, to establish a capability to produce at the rate of 5 units per day each of oscillator types EL-PO(X-1) and EL-LO(X-1), and to prepare a Step II Report covering a production rate of 1,000 units per month.

The triode electron tube is the heart of the end device. It has also been established that, to a great extent, tube design intimately affects optimum design of the cavity. Therefore tube design refinements are expected to improve product uniformity while maintaining optimum performance in a cavity of the smallest practical size. Data on tube performance and cavity performance must be taken and evaluated. A tube test specification must be established which will more accurately predict operation in a cavity oscillator.

By evaluation under various conditions, it is intended to reflect the benefits of this work in optimized cavity performance, and that such performance is assured during the expected life of the device. This evaluation includes tests for effects of shock, fatigue, vibration, load variation, supply voltage variation, ambient temperature cycling, and life tests.

Test requirements for triode and cavity oscillators, types EL-PO(X-1) and EL-LO(X-1), are defined by SCL-7001/82 and SCL-7001/83, dated 16 October 1962 and 23 October 1962 respectively, as amended.

3.0 NARRATIVE AND DATA

The program during this period has consisted of:

1. Preparation of test equipment.
2. Fabrication of triodes and of cavity parts for the first engineering sample.
3. Assembly and testing CW and pulse cavity oscillators.
4. Investigation of design refinements in both triodes.

3.1 TEST EQUIPMENT

The life test equipment for both the CW and pulse cavities has been completed. The units consist of 10 positions for each type.

Work on the pulse driver adaptor to be used with the universal pulse test set has been stopped as a universal driver unit is being constructed for this set which will be satisfactory for testing the EL-FO(X-1) cavities as well as the Y-1252 tubes prior to assembling in the cavities. This equipment will be completed in time for the preproduction run.

A tube test cavity for the Y-1252 pulse tube has been evaluated and found satisfactory for tube testing.

Design work has started on a tube test cavity for the Y-1251 CW tube. This cavity will be used in a universal CW RF power output test set which is part of the general laboratory test equipment.

The temperature cycling test chamber is being checked out with a five position adaptor panel which was designed and constructed for both the CW and pulse cavities. It was found feasible to use the existing laboratory chamber. A modulator unit similar to the one used for the pulse life test will be modified to permit temperature tests to be run on five cavities simultaneously. DC power supplies are available for the CW cavity tests.

A test and assembly area has been assigned exclusively to this contract. This will allow a closely supervised operation and will help to make most efficient use of the precision measuring equipment available. More accurate measurement of performance on life can thus be made than if the frequency measuring equipment were remotely located and transfer instruments had to be used.

3.2 CW OSCILLATOR, EL-LO(X-1)

Eighteen cavities were assembled using a 5/8" diameter body similar to that used for the pulse cavity. This design permits standardization of several of the cavity parts for both the CW and pulse cavities.

Tables I, II, III, IV and V summarize the performance of these cavities. The following design objectives are included in the program for the next sample:

1. Improve the performance at the high frequency end of the band.
2. Achieve more uniform output across the band.
3. Reduce the plate current to less than 20 mA maximum.
4. Reduce frequency pulling with load changes.

It is probable that these design goals can be met by further adjustment of cavity impedances, selection of grid cylinders to

TABLE I

TYPE EL-LO(X-1) C-BAND CW TRIODE
and CAVITY OSCILLATOR

Operating Characteristics - First Engineering Sample

SN	5250 Mc Po	5250 Mc Ib	5600 Mc Po	5600 Mc Ib	6050 Mc Po	6050 Mc Ib
236	175	18.1	98	16.8	11	24.5
237	75	17.0	69	16.1	5	25.0
238	12	23.6	18	22.6	F - Max = 5800 Mc	
239	29	15.3	32	14.9	F - Max = 5875 Mc	
240	155	25.2	202	22.2	14	22.3
241	88	18.5	112	18.0	15	20.2
242	75	15.6	92	15.0	8	19.0
243	175	22.0	134	19.5	10	24.3
244	65	16.1	56	16.0	7	25.0
245	139	23.6	130	20.0	34	24.5
246	66	22.3	198	19.8	58	21.8
247	61	14.7	65	14.2	5	21.0
248	68	15.0	60	14.5	4	23.7
249	119	16.8	108	16.2	19	19.8
250	116	17.8	86	17.0	14	24.3
251	36	24.0	79	21.6	15	25.4
252	53	17.8	100	17.0	7	20.2
253	125	19.3	71	19.0	3	29.5

Objective Specifications

Power output = 5 Mw min
Frequency Range = 5250 - 6050 Mc
Ib = 20 mAdc max

Ef = 6.3 Vac
Ebb- 150 Vdc

TABLE II

TYPE EL-LO(X01) C-BAND CW TRIODE
and CAVITY OSCILLATOR

Operating Characteristics - First Engineering Sample

Load Variation

SN	F = 5400 Mc: ΔF - Mc/S		ΔPo	-db	F = 5900 Mc: ΔF - Mc/S		ΔPo	-db
240	-1.0	+1.0	+0.5	-0.75	-1.6	+3.4	+1.2	[illegible]
241	-2.0	+0.8	+0.4	-0.6	-4.2	+5.9	+1.5	[illegible]
242	-3.2	+1.5	+0.4	-0.5	-4.6	+6.6	+1.8	-0.75
249	-4.0	+1.4	+0.3	-1.25	-6.6	+8.2	+1.4	-1.1
251	-4.8	+1.4	+0.4	-1.6	-6.6	+8.0	+1.6	-1.3

Objective Specifications

ΔF = ± 3 Mc/S
ΔPo = ± 2 db

Ef = 6.3 Volts
Ebb = 150 Vdc
VSWR = 1.5 ± 0.1

TABLE III

TYPE EL-LO(X-1) C-BAND CW TRIODE
and CAVITY OSCILLATOR

Operating Characteristics - First Engineering Sample

Supply Voltage Variation

SN	F = 5250 Mc ΔF - Mc/S		ΔPo	-db	F = 5950 Mc ΔF - Mc/S		ΔPo	-db
240	+0.13	-1.26	-0.75	+1.25	+0.75	-2.01	-1.75	+1.5
241	-0.16	+0.45	-1.2	+1.1	-2.32	+2.35	-1.9	+3.6
242	-1.52	+1.67	-1.6	+1.55	-3.06	+3.34	-2.4	+2.2
243	+0.68	-1.55	-1.55	+1.25	-0.72	+0.56	-2.[illegible]5	+[illegible]
249	-1.38	+1.32	-1.65	+1.45	-3.12	+3.24	-2.25	+1.5

Objective Specifications

ΔF = ± 4 Mc/S
ΔPo = ∓ 3 db

Ef = 6.0 - 6.6 Vac
Ebb = 142 - 158 Vdc

TABLE IV

TYPE EL-LO (X-1) C-BAND CW TRIODE
and CAVITY OSCILLATOR

Operating Characteristics - First Engineering Sample

Vibration

SN	#Freq - Mc/S	Po - mW	Pos. X1 ΔF - Mc/S	Pos X2 ΔF - Mc/S	Pos. Y1 ΔF - Mc/S
237	5950.0	9.5	0.1	0.2	0.4
240	5950.0	13.0	0.2	0.5	0.4
243	5950.0	8.1	0.1	0.2	1.0
244	5950.0	7.7	0.1	0.2	0.3

\# Test run at 5950 Mc instead of 5900 Mc to make it compatable with fatigue.

Objective Specification: ΔF = ± 2 Mc/S max.

Fatigue

SN	Freq - Mc/S	Po - mW	ΔF - Mc/S	ΔPo - %
237	5950.0	9.5	-0.5	-1
240	5950.0	13.0	-0.5	+23
243	5950.0	8.1	-1.0	+ 2
244	5950.0	7.7	0	- 3

Objective Specification: ΔF = 4 Mc/S; ΔPo = ± 30%.

Shock

SN	Freq - Mc/S	Po - mW	ΔF - Mc/S	ΔPo - %
245	5950.00	46.0	+3.25	0
247	5950.00	10.6	-2.00	0
248	5950.00	8.0	0	0
251	5950.00	22.0	+1.62	+9.1

Objective Specifications: ΔF = ± 4 Mc/S; ΔPo = ± 30%

TABLE V

TYPE EL-LO(X-1) C-BAND CW TRIODE
and CAVITY OSCILLATOR

<u>Operating Characteristics - First Engineering Sample</u>

<u>Life Test</u>

SN	Hours Life	F - Mc/S	Po - mW	Ib - mA	ΔF - Mc/S	ΔPo - %
236	0	5249	262	19.4	---	---
	94	5251	269	19.9	+2	+2.7
	208	5251	269	19.9	+2	+2.7
	334	5251	264	19.6	+2	+0.8
	429	5251	258	19.5	+2	-1.5
	501	5250	252	19.2	+1	-3.8
250	0	5240	148	19.4	--	---
	94	5241	154	19.7	+1	+4.1
	208	5241	154	19.7	+1	+4.1
	334	5239	154	19.7	-1	+4.1
	429	5241	154	19.6	+1	+4.1
	501	5239	148	19.4	-1	0
246	0	5942	94	21.8	--	---
	94	5942	95	22.0	0	+1.1
	208	5942	98	22.0	0	+4.3
	334	5942	110	21.9	0	+17.0
	429	5942	110	21.7	0	+17.0
	501	5942	107	21.5	0	+13.8
252	0	5937	19	19.5	--	---
	94	5939	20	19.5	+2	+5.3
	208	5940	21	19.5	+3	+10.5
	334	5940	23	20.0	+3	+21.0
	429	5940	25	20.5	+3	+31.6
	501	5938	26	20.5	+1	+36.8

Objective Specifications: ΔF = ± 8 Mc/S; ΔPo = ± 70%; Po = 1.0 mW min.

Ef = 6.3 volts, Ebb = 150 volts, T = 500 Hours.

provide optimum feedback for specific tubes, and careful adjustment of the output coupling.

Frequency stability over the required ambient temperauture range has not been fully evaluated due to the equipment limitations. Preliminary tests indicate that the requirements called for in specifications SCL-7001/83 can be met.

The first engineering samples to be furnished during the next period have been tested preparatory to submission. Shock, fatigue and life tests have been successfully completed. This infon :ion is included in Tables IV and V.

3.3 CW TRIODE, Y-1251

Tubes were fabricated with a slightly larger external anode diameter to pe-mit the use of standard tooling during machining of cavity parts. Orders for screw machine anodes will not be placed until dimensional requirements of the cavity have been established.

Tubes were fabricated with the larger anode diameter for an internal evaluation of the cavity design and for the second engineering sample. T-sting and evaluation has been started.

Tube design improvements, which were reported in the 7486 PEM Contract No. DA 36-039-SC-86738, have been successfully applied to the Y-1251. The new cathode spray masks were used during cathode coating to prevent loose particles of coating material. Heaters were used which had the surface of the heater coating darkened with tungsten. Tests on these tubes are still in progress.

3.4 PULSE OSCILLATOR, EL-PO(X-1)

Tables VI, VII, VIII, IX and X show the operating characteristics achieved with eighteen first engineering sample cavities. The areas where additional engineering effort is required are:

1. Develop techniques for pre-selecting grid resistors before assembly.
2. Improve the performance at the high frequency end of the band.
3. Reduce the frequency pulling with load variation.

Some progress has been made in establishing a correlation between the grid resistor required for 600 mA peak plate current in the tube test cavity and the value of grid resistor required in the type EL-PO(X-1) cavity for the same current. As more data from additional tubes and cavities are accumulated, this factor should resolve itself.

The power output response across the band and the frequency pulling can be optimized by careful adjustment of the output coupling and, where necessary, selection of grid cylinder lengths to match tube characteristics.

As in the CW cavities, temperature testing has not been completed due to equipment limitations, but preliminary data indicates that the requirements in SCL-7001/82 can be met.

The first engineering samples to be furnished during the next period have been tested preparatory to submission. Shock, fatigue and life tests have been successfully completed. This information

TABLE VI

TYPE EL-PO(X-1) C-BAND PULSED TRIODE
and CAVITY OSCILLATOR

Operating Characteristics - First Engineering Sample

	Peak Power Output - Watts Frequency - Mc/S					Peak Plate Current - mA Frequency - Mc/S				
SN	5350	5400	5650	5900	5950	5350	5400	5650	5900	5950
100	72	80	70	55	43	560	560	530	500	490
101	180	190	125	88	77	640	630	600	570	570
102	61	62	55	36	32	430	430	420	390	380
103	58	62	64	42	37	450	450	460	420	410
104	137	137	127	86	74	600	600	600	550	540
105	100	105	67	36	30	800	800	640	580	570
106	60	65	55	32	28	590	590	510	440	440
107	72	82	67	35	30	640	650	610	510	490
108	28	35	50	33	29	700	680	700	650	650
109	137	111	69	42	34	900	850	700	630	630
110	155	150	110	77	72	660	630	560	490	490
111	125	122	80	58	48	650	630	550	500	490
112	128	140	127	85	72	700	700	660	590	580
113	202	200	140	81	65	750	720	640	570	550
114	42	48	50	46	41	640	640	630	590	590
115	55	57	58	38	26	450	440	440	420	410
116	78	73	60	47	38	630	610	560	510	500
117	100	98	62	38	32	640	620	550	460	450

Objective Specifications

Peak Power = 30 watts min.
Freq. Range = 5350 - 5950 Mc
Peak Current = 600 mA max.

Ef = 6.3Vac
eb = 1000 V pk.
prf = 4000 pps
tp = 0.5 usec.

TABLE VII

TYPE EL-PO(X-1) C-BAND PULSED TRIODE
. and CAVITY OSCILLATOR .

Operating Characteristics - First Engineering Sample

Load Variation

SN	F = 5400 Mc				F = 5900 Mc			
	ΔF	Mc/S	Δpo	-db	ΔF	Mc/S	Δpo	-db
100	-3.6	+3.2	+0.4	-0.6	-1.2	+1.4	+0.7	-0.85
101	-2.1	+2.0	+0.2	-0.5	-0.3	+0.2	+1.05	-1.2
102	-4.5	+5.5	+0.75	-1.05	-1.7	+1.5	+1.0	-1.0
103	-4.9	+5.9	+0.6	-1.3	-1.4	+1.2	+2.0	-0.75
104	-4.2	+6.5	+0.5	-1.0	-1.4	+1.7	+0.6	-0.95
105	-3.2	+1.6	+1.1	-0.7	-0.3	+0.6	+1.35	-1.4
106	-4.5	+4.4	+0.9	-1.2	-1.0	+0.8	+0.75	-1.05
107	-2.9	+1.9	+0.7	-1.0	-0.6	+0.2	+1.1	-1.3
108	-2.6	+2.8	+0.9	-0.35	-1.0	+0.3	+1.35	-1.55
109	-5.6	+3.7	+1.3	-0.65	-0.9	+1.2	+1.3	-1.45
110	-2.6	+2.7	+0.4	-0.45	-1.6	+1.0	+0.7	-0.75
111	-2.8	+2.8	+0.3	-0.6	-1.0	+1.0	+0.35	-1.1
112	-2.0	+3.6	+0.2	-0.6	-0.8	+1.6	+0.35	-1.4
113	-2.8	+3.6	+0.5	-0.5	-1.1	+1.8	+0.75	-1.2
114	-3.4	+3.0	+0.9	-1.6	-1.0	+0.6	+0.7	-0.35
115	-2.7	+3.6	+0.35	-0.65	-1.0	+2.0	+0.5	-1.25
116	-2.5	+2.4	+1.0	-0.75	-1.2	+0.6	+0.9	-1.25
117	-1.8	+2.9	+0.3	-0.6	-0.8	+0.6	+0.95	-1.15

Objective Specifications

ΔF = ± 3 Mc
Δpo = ± 2 db
VSWR = 1.5 ± 0.1

Ef = 6.3 Vac
eb = 1000 V pk.
prf = 4000 pps
tp = 0.5 usec.

TABLE VIII

TYPE EL-PO(X-1) C-BAND PULSED TRIODE
and CAVITY OSCILLATOR

Operating Characteristics - First Engineering Sample

Supply Voltage Variation

SN	F = 5400 Mc ΔF Mc/S		Δpo -db		F = 5900 Mc ΔF Mc/S		Δpo -db	
100	-0.15	+0.9	-3.1	+1.9	-0.26	+0.67	-3.05	+2.7
101	-4.0	+4.0	-2.5	+0.7	-5.0	+4.0	-1.55	+0.6
111	-3.3	+4.38	-1.35	+0.2	-1.67	+1.93	-1.65	+0.45
116	-2.55	+3.09	-1.3	+0.45	-1.16	+0.79	-1.7	+0.75
117	-4.68	+5.4	-2.4	+0.5	-1.73	+0.85	-2.55	+1.2

Objective Specifications

ΔF = ± 8 Mc/S
Δpo= ± 3 db

Ef = 6.0 - 6.6 Vac
eb = 950 - 1050 V pk.
prf= 4000 pps
tp = 0.5 usec.

TABLE IX

TYPE EL-PO(X-1) C-BAND PULSE TRIODE
and CAVITY OSCILLATOR

Operating Characteristics - First Engineering Sample

Vibration

SN	Freq - Mc/S	po - Watts	Pos. XI ΔF - Mc/S	Pos. X2 ΔF - Mc/S	Pos. Y ΔF - Mc/S
100	5900	42	< 0.1	< 0.1	< 0.1
104	5900	85	< 0.1	0.2	0.1
105	5900	30	< 0.1	< 0.1	< 0.1
106	5900	33	0.3	0.4	0.3

Objective Specification: ΔF = ± 3.0 Mc/S Max.

Fatigue

SN	Freq - Mc/S	po - Watts	ΔF - Mc/S	Δpo - %
100	5900	42		
104	5900	85	NOTE	
105	5900	30		
106	5900	33		

NOTE: No detectable change in frequency or power output was seen.

Objective Specifications: ΔF = ± 8 Mc/S; Δpo = ± 20%.

Shock

SN	Freq - Mc/S	po - Watts	ΔF - Mc/S	Δpo - %
107	5900.00	46	-1.50	+15.2
108	5900.00	39	-1.79	-7.7
114	5900.00	44	-2.43	+18.2
115	5900.00	80	-0.13	-6.3

Objective Specification: ΔF = ± 8 Mc/S; Δpo = ± 20%

TABLE X

TYPE FL-PO(X-1) C- BAND PULSE TRIODE
and CAVITY OSCILLATOR

Operating Characteristics - First Engineering Sample

Life Test

SN	Hours Life	F-Mc/S	po-Watts	ip-mA	ΔF-Mc/S	Δpo-%
102	0	5391	91	440	--	--
	25	5393	67	400	+2	-26
	50	5392	77	400	+1	-15
	75	5388	63	360	-3	-31
	100	5387	57	360	-4	-37
103	0	5396	91	450	--	--
	25	5395	79	420	-1	-13
	50	5396	98	460	0	+ 8
	75	5390	86	440	-6	- 5
	100	5389	84	440	-7	- 8
112	0	5894	99	600	--	--
	25	5899	91	590	+5	- 8
	50	5898	101	600	+4	+ 2
	75	5892	91	560	-2	- 8
	100	5895	90	560	+1	- 9
113	0	5900	104	620	--	--
	25	5900	104	620	0	0
	50	5900	112	640	0	+ 8
	75	5894	97	600	-6	- 7
	100	5894	83	590	-6	-20

Objective Specifications

ΔF = ± 8.0 Mc/S Max
Δpo = ∓ 50% Max
po = 20 Watts Min
T = 100 Hours

Ef = 6.3 volts
eb = 1000 volts, tp = 1.0±0.5 usec
Prf = 2000 pps, approx.
F = 5900 and 5400 Mc

is included in Tables IX and X.

3.5 Y-1252 CERAMIC TRIODE FOR PULSE OSCILLATOR

Tube design improvements already discussed (3.3 - page 10) were also applied in the ceramic triode for pulse operation. A spray mask similar to that used for the .100" diameter cathode of the Y-1251 has been used during the coating operation on the .120" diameter cathodes of the Y-1252.

Testing and evaluation of tubes fabricated for the second engineering sample is now complete. Initial assembly of thes tube-cavity oscillators will be done during the next period.

Aging and stabilizing schedules are being studied to establish tube processing which will eliminate or reduce oscillator re-adjustment due to changing tube parameters during early life. The present technique is to allow for a run-in period in the oscillator, followed by re-adjustment or substitution of the grid resistor.

4.0 CONCLUSIONS

The first engineering sample is being prepared for submission. Shock, fatigue, and life tests have been successfully completed. Effort will be made to improve performance at the high frequency end of the band and to reduce frequency pulling with load variation. Satisfactory inclusion of darkened heaters and the use of improved spray masks has been done for ceramic triodes for both CW and pulse operation.

5.0 PROGRAM FOR THE NEXT INTERVAL

Work will continue toward optimizing cavity dimensions and establishing assembly techniques. Data will be accumulated to permit pre-selection of grid resistors and cylinder lengths to match individual tube characteristics. The temperature test chamber and associated equipment will be completed and tests will be run on cavities from the first engineering sample. Life testing of the CW cavities from the first engineering sample will continue to failure or until the positions are required for current production units.

Aging and stabilizing schedules will be established for both Y-125 and Y-1252. Life tests for evaluating effects on tube characteristics and oscillator performance will be started.

5.1 - PROGRESS CHART - C-BAND TRIODE-CAVITY OSCILLATORS
DA-36-039-AMC-01474(E)

	1963									1964												1965	
	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
TASK I - DESIGN																							
A. Test Equipment																							
1. Procure spectrum analyzer		(1)																					
2. Construction - pulse Po test set			(X)	(31)																			
3. Portable test set - CW & Pulse			(X)	(31)																			
4. Adaptors - CW Po test set				(X)	(15)	○																	
5. Adaptors - Pulse Po test set					(X)	(X	(29)																
6. 10 positions CW life test						(X)	(X)	1															
7. 10 positions Pulse life test						(X)	(X)	(1)															
8. Tube test cavities - Pulse & CW								(X)	X	31													
9. Procure test socket adaptors								X	X	31													
10. Load variation equipment								X	X	X	29												
11. Temperature coefficient test facilities								( )	X	X	29												
12. Request inspection of in-plant test facilities												29											
13. Inspection of in-plant test facilities													29										
14. Approval of in-plant test facilities														29									
B. Improved Manufacturing Methods																							
1. Anode turning jig (temporary)																							
a. Design		(15)																					
b. Procure		X	(7)																				
2. Anode solder shim welding jig																							
a. Design			(X)	(19)																			
b. Procure				(X)	(15)																		
3. Heater pin solder shim welding jig																							
a. Design			(X)	(19)																			
b. Procure				X	(15)																		
4. Procure screw machine anodes				X	(X)	X	X	X	15														
5. Heater insulator - sublimation shield																							
a. Design			X	19																			
b. Procure				X	X	X	X	X	15														

Notes:
X - Anticipated Progress
( ) - Actual Progress
○ - Completion
Numerical representations indicate terminal dates

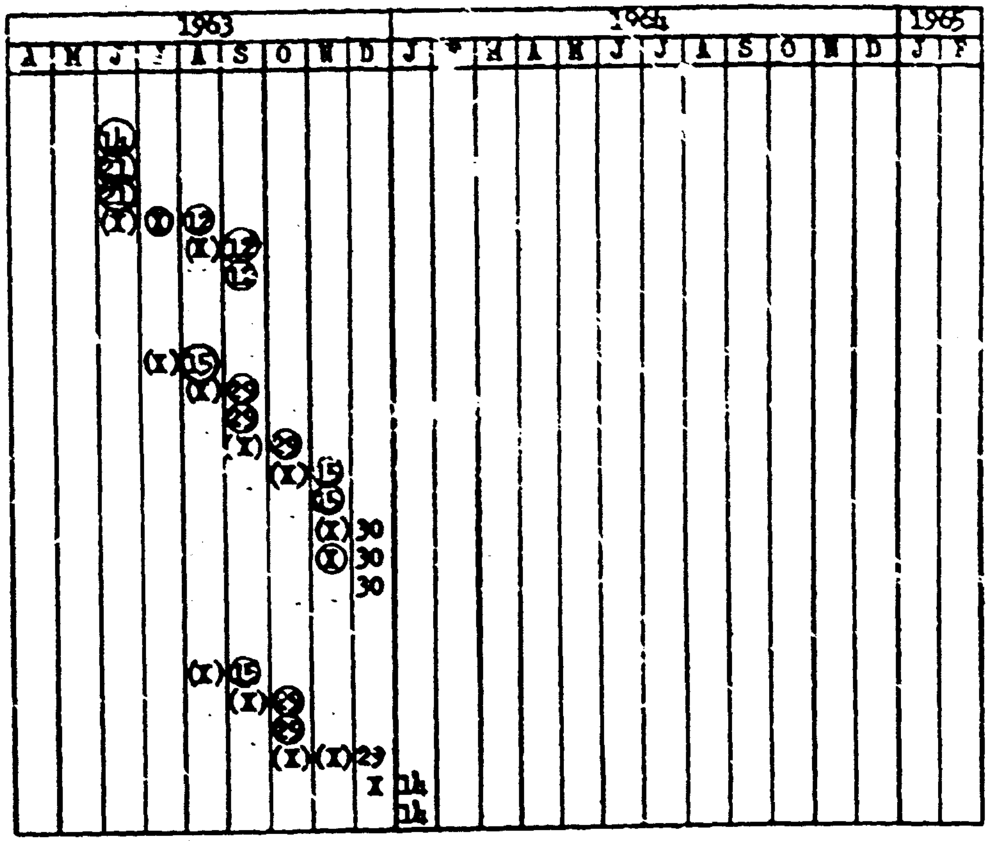
5.1 - PROGRESS CHART - C-BAND TRIODE-CAVITY OSCILLATORS
DA-36-039-AMC-01474(E)

TASK I - DESIGN (CONT'D)

C. Initial Evaluation - Internal
   1. Fabricate triodes
   2. Test & evaluate triodes
   3. Provide samples to cavity facility
   4. Procure cavity parts
   5. Assemble & test triode cavity oscillators
   6. Acceptance date for cavity parts

D. First Engineering Sample
   1. Fabr icate triodes
   2. Tes. & evaluate triodes
   3. Provide samples to cavity facility
   4. Procure cavity parts
   5. Assemble & test triode-cavity oscillators
   6. Acceptance date for cavity parts
   7. Life test & evaluate oscillators
   8. Perform shock & fatigue tests
   9. Deliver samples

E. Design Changes - Internal
   1. Fabricate triodes
   2. Test & evaluate triodes
   3. Provide samples to cavity facility
   4. Procure cavity parts
   5. Assemble & test oscillators
   6. Acceptance date for cavity parts



Notes:
X - Anticipated Progre...
( ) - Actual Progress
◯ - Completion
Numerical representations indicate terminal dates

.1 - PROGRESS CHART - C-BAND TRIODE-CAVITY OSCILLATORS
DA-36-039-AMC-01474(E)

	1963									1964												1965	
	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
TASK I - DESIGN (CONT'D)																							
F. Second Engineering Sample																							
1. Fabricate triodes								Ⓧ	15														
2. Fabricate fast warm-up triodes								(X)	15														
3. Test & evaluate triodes								( )	X	29													
4. Provide samples to cavity facility										29													
5. Procure cavity parts										X	29												
6. Assemble & test oscillators											X	29											
7. Acceptance date for cavity parts												29											
8. Life test & evaluate oscillators											X	X	29										
9. Perform shock & fatigue tests											X	X	29										
10. Deliver samples													29										
TASK II - PRE-PRODUCTION RUN																							
1. Fabricate triodes											X	15											
2. Test & evaluate triodes												X	29										
3. Provide samples to cavity facility													29										
4. Procure cavity parts													X	29									
5. Process capability study											X	X	X	X	29								
6. Assemble & test oscillators														X	29								
7. Acceptance date for cavity parts															29								
8. Life test & evaluate oscillators														X	X	29							
9. Perform shock & fatigue tests														X	X	29							
10. Deliver samples																29							
11. Acceptance date for pre-production run samples																		29					

Notes:
X - Anticipated Progress
( ) - Actual Progress
○ - Completion
Numerical representations indicate terminal dates

5.1 - PROGRESS CHART - C-BAND TRIODE-CAVITY OSCILLATOR
DA-36-039-AMC-01474(E)

	1963									1964												1965	
	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
TASK III - PRODUCTION RUN																							
1. Fabricate triodes																I	15						
2. Test & evaluate triodes																	I	29					
3. Provide samples to cavity facility																		29					
4. Procure cavity parts																		I	29				
5. Assemble & test oscillators																			I	I	29		
6. Acceptance date for cavity parts																					29		
7. Life test & evaluate oscillators																			I	I	29		
8. Perform shock & fatigue tests																			I	I	29		
9. Deliver samples																					29		
TASK IV - REPORTS																							
1. Quarterly					(29)			29			29			29			29			29			
2. Intent to use proprietary information in making triodes			(29)	O																			
3. Milestone or progress chart			(15)																				
4. Data requirements control plan			(15)																				
5. Inspection & quality control plan																		29					
6. Test reports on pre-production samples																29							
7. Bills of material																							27
8. General report																							27
9. Final report																							28

Notes:
I - Anticipated Progress
( ) - Actual Progress
O - Completion
Numerical representations indicate terminal dates

6.0 PUBLICATIONS, REPORTS AND CONFERENCES

6.1 PUBLICATIONS - None

6.2 REPORTS - First Quarterly Progress Report
29 April 1963 through 30 August 1963

6.3 CONFERENCES

1. Organizations and personnel present:

USAEMA
L. Coblentz

General Electric Co.
J. D. Campbell
L. F. Jeffrey
J. D. Marshall
H. L. Thorson

Place and Date:
General Electric Co.
Owensboro, Kentucky

15 October 1963

Subject:
Review of progress to date and to discuss future schedule.

2. Organizations and personnel present:

TRAK Microwave Corp.
B. F. Gregory

General Electric Co.
L. F. Jeffrey

Place and Date:
TRAK Microwave Corp.
Tampa, Florida

October 7 and 8, 1963

Subject:
To discuss cavity parts being supplied to G.E. under sub-contract and to witness inspection and testing of these parts.

GENERAL ELECTRIC COMPANY
ELECTRONIC COMPONENTS DIVISION
TUBE DEPARTMENT
OWENSBORO, KENTUCKY

Subject: Second (2nd) Quarterly Report
Order No. 21049-PP-63-81-81
Contract No. DA-36-039-AMC-01474(E)
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Philadelphia 3, Pennsylvania

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