~~SECRET~~ CONFIDENTIAL 25X1

NOT RELEASABLE TO FOREIGN NATIONALS

[redacted]

In Reply Refer To: [redacted] 2 April 1962

25X1

[redacted]

ATTENTION: [redacted]

SUBJECT: Proposal for DR-1 Digital Display Unit 25X1

REFERENCE: Government RFP, dated 2 March 1962 25X1

In response to referent RFP, and in accordance with discussions between the Technical Representatives of the Government and the Contractor, [redacted] 25X1
[redacted] is pleased to submit a formal proposal for a 25X1
Fixed Price Redeterminable Contract covering the furnishing of one hundred (100) DR-1 Units, accessories and manuals as set forth in the attached Technical Discussion. This proposal consists of the following:

Exhibit "A" - Statement of Work
Exhibit "B" - Technical Discussion
Exhibit "C" - Price Summary
Exhibit "D" - Delivery Schedule
Exhibit "E" - Government Furnished Property
Exhibit "F" - Special Terms and Conditions

The prices quoted herein, which are f.o.b. [redacted] 25X1
[redacted] are exclusive of royalty payments, warranty, federal, 25X1
state or local excise, sales and use taxes, may be considered firm until 30 April 1962. Said prices, together with the other Exhibits of this proposal may be considered the basis for the negotiation of a Fixed Price Redeterminable Contract containing the same General Provisions presently incorporated in Contract No. [redacted] 25X1

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Requests for additional information concerning this correspondence may be

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REF/smc

Enclosures: (6)
Exhibits "A", "B", "C", "D", "E" and "F"

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EXHIBIT "A"

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STATEMENT OF WORK

PHASE I

ITEM	QUANTITY	DESCRIPTION
1	5 each	DR-1 Digital Display Unit Sets consisting of one (1) each of the following: Digital Display Unit DR-1; Cable, Radio Receiver to DR-1; Test Cable, DT-1 to DR-1; Power Supply Cable, External 3 Volts to DR-1 and Indicating Lamp Removal Tool (if necessary), and three (3) each spare indicating lamps all to be in accordance with Exhibit "B" of this proposal.
2	10 each	Preliminary Instruction Manual in accordance with Exhibits "B" and "F" of proposal.

PHASE II

1	95 each	DR-1 Digital Display Unit Sets consisting of one (1) each of the following: Digital Display Unit DR-1; Cable, Radio Receiver to DR-1; Test Cable, DT-1 to DR-1; Power Supply Cable, External 3 Volts to DR-1 and Indicating Lamp Removal Tool (if necessary), and three (3) each spare indicating lamps all to be in accordance with Exhibit "B" of this proposal.
2	150 each	Operator's Instruction Manual in accordance with Exhibits "B" and "F" of this proposal.
3	50 each	Theory, Maintenance and Parts List Manual in accordance with Exhibits "B" and "F" of this proposal.
4	Lot	One (1) set of reproducible and two (2) sets of reproduced drawings in accordance with Exhibit "B" of this proposal.

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EXHIBIT "A"

STATEMENT OF WORK (CONT'D)

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PHASE II (CONT'D)

ITEM	QUANTITY	DESCRIPTION
5	Lot	Fabrication of special tooling required for Phase II production. Tooling is to be constructed to high commercial quality.

NOTES:

1. Upon completion of Government evaluation of Phase I, and Government concurrence that Phase I units meet the requirements of the specification, Contractor will construct ninety-five (95) units to the accepted design.

2. Quality Control to be in accordance with good commercial practice.

3. Preservation, packaging and packing shall be in accordance with standard commercial practice for domestic shipment and short term storage.

4. Final inspection and acceptance of the above items is to be accomplished at Contractor's facility by a Representative of the Government.

5. Acceptance of Phase II units will be to factory test specifications which do not include reliability or environmental testing. If further assurance as to reliability and environmental requirements on the Phase II units is desired, Contractor will be pleased to propose a program of additional testing.

DIGITAL DISPLAY UNIT, DR-1

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1.0 INTRODUCTION

This proposal is in response to a production requirement of 100 DR-1, Digital Display Units with instruction manuals and accessories. This production is to be accomplished in two phases. Phase I consists of the fabrication of five units built to production drawings. Upon acceptance of these units by the customer, fabrication of the remaining 95 units will follow; this is Phase II of the program.

2.0 BRIEF UNIT DESCRIPTION

The DR-1 Unit is a miniature tone receiver and display device. The display panel consists of numbered lamps illuminated in accordance with information derived from coded audio tones. The tones are supplied by an associated radio receiver, which is not part of the display unit.

3.0 APPLICABLE SPECIFICATIONS

For the purpose of this proposal and in the interest of economy, it is assumed that specification MIL-E-4158 shall be acceptable as a guide in the design and performance of the equipment. Where conflict exists between MIL-E-4158 and Specification No. 62-A-1140-A, the latter shall have precedence.

3.1 Fungus Treatment

All material used in the DR-1 shall be non-nutrient to fungus. If it is determined that suitable non-nutrient materials are not available, a waiver may be obtained; however, any nutrient material used shall be treated by a suitable fungus-resistant compound after machining or forming and prior to installation.

3.2 Environmental

3.2.1 Operation

The equipment shall be designed for continuous operation for a period of one year, alternating six hours on and two hours off with no more than normal maintenance and replacement of batteries and parts. After a warmup period of five seconds, the DR-1 shall meet the performance requirements of this specification.

3.2.2 Temperature

The DR-1 shall operate normally under temperature conditions of from -20°C to +40°C, after soaking for four hours. It shall be capable

of sustained storage under temperature conditions of -60°C to +60°C without impairing operation under applicable conditions. The foregoing requirement does not apply to the battery supply of the DR-1.

3.2.3 Relative Humidity

The DR-1 shall operate normally in 95 percent relative humidity.

3.2.4 Elevation

The DR-1 shall operate normally at elevations up to 15,000 feet above sea level.

3.2.5 Vibration

The DR-1 shall operate without impairment after being subjected to vibrations from 5 to 500 cps and having a double amplitude of 0.01 inch with a maximum acceleration of 2 g, whichever is the limiting value.

3.2.6 Shock

The DR-1 shall operate without impairment after dropping through an angle of 30° to a solid 2-inch fir table top using any edge of the case as an axis.

3.3 Electrical Requirements

3.3.1 Input Characteristics

The input impedance of the DR-1 shall be 2000 ohms. The unit shall operate properly with a 0.3-volt rms signal at a 3-db signal-to-noise ratio. The required signal-to-noise ratio is interpreted as meaning the ratio of desired rms-input signal panel to the rms-noise power appearing in a nominal 3-kc bandwidth at the input to the DR-1. At this input signal-to-noise ratio, the indication of the DR-1 shall contain not more than one error per thousand characters displayed. The unit shall operate over an input level range of 0.3-volt rms to 10.0-volts rms.

3.3.2 Signal Characteristics

Each digit transmitted is represented by a composite signal consisting of four sequential tones each of which is 40 ms in duration and which are separated by 40 ms. The transmitting speeds of the DR-1 ar 5, 7-1/2, 10, or 12 wpm. These different speeds are obtained by varying the spacing between groups of binary tones. The different spacings are: 2120, 1320, 920, and 729 ms, respectively. Two tones are used with frequencies of 1000 and and 1100 cps. The DT-1 tone generator maintains the accuracy of these tones to withing ±3.0 cycles. The digits to be transmitted are represented by the following binary code. In the following table, "0" represents a 4-ms 1000-cps tone, and "1" represents a 40-ms 1100-cps tone.

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Number	Binary Code
1	0000
2	0001
3	0011
4	1001
5	1000
6	1101
7	0010
8	1100
9	1111
0	0111

3.3.3 Power Supply

The DR-1 shall operate properly on supply voltages which range from 2.0 to 3.2 volts with the maximum current drain not exceeding 200 ma.

3.4 Mechanical Requirements

3.4.1 Size

The size of the DR-1 shall be 3 × 2 × 7/8 inches or less. Any improvements in packaging or circuitry shall not cause an increase in size.

3.4.2 Battery Holders

The battery supply for the DR-1 shall consist of two external size "D" batteries. They may be held in place by two-hinged doors which fold out from the bottom of the DR-1 as in the prototype unit. However, the contractor, in order to facilitate production, may propose another type of battery holder using the same concept. The battery holder shall be capable of accommodating zinc oxide, mercury, or rechargeable nickel-cadmium size "D" cells.

3.4.3 Control Panel

The control and display panel in the existing prototype shall be used in the production models. The only operator control on the DR-1, is an on-off-test switch. The test position allows the operator to determine whether his battery is usable by observing a test lamp which flashes when the momentary-hold test switch is depressed.

4.0 PROPOSED DESIGN

4.1 Electrical

The circuits to be used are essentially those employed in the Government-furnished prototype; however, the transistor Raytheon CK4A is to be substituted for the CK4.

4.2 Mechanical 25X1

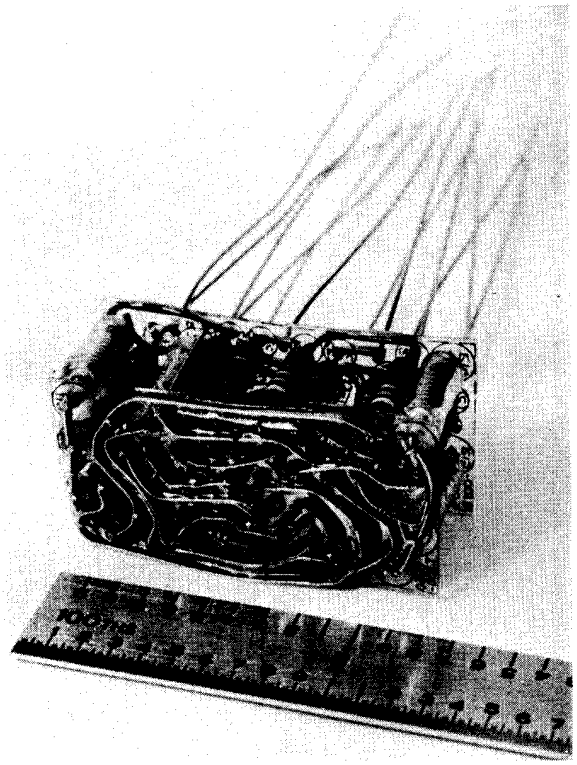

FIGURE 1. UNPOTTED FLIP-FLOP.

In order to make the DR-1 more suitable for large quantity production and at the same time increase the reliability of the unit, the circuits will be packaged as welded modules. An example of this module is shown in Figure 1. Usually the completed welded module is encapsulated in an epoxy resin, but for the application under consideration, this step is not recommended since space is at a premium. Instead, a dip coat of a suitable compound will be employed to produce a rigid enough package to withstand the vibration and shock requirements. The number of modules making up the DR-1 will be reduced by approximately three in order to simplify the interconnection problem. An etched circuit board is proposed as the means to interconnect the modules. Plated-through holes would be used where necessary and possibly hook-up wire would supplement the etched wiring in especially tight places. The use of large numbers of jumper wires as is evidently employed in the prototype will be avoided both from the standpoint of reproducibility as well as maintenance. A detailed description of welded module techniques as practiced at 25X1

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Welded Module Techniques

The lead material of each component to be used in the welded modules is specified, as well as the electrical characteristics, in order to assure proper welds when assembling the modules. Knowing the exact dimensions and material used in each component, it is possible to determine a weld schedule in advance which is posted for the assembly workers' reference. stored-energy welders are used to weld the modules. As 25X1 used on the assembly line, the welding machines consist of a power supply and two welding heads. Two heads are used so that different welding tips may be used without delaying the operator for different watt-second ratings. After a module has been welded, visual and microscopic inspections are performed before the module goes into dipcoating to determine that all welds have been properly made.

To ensure that the welding machines are operating properly, several weld samples each day are taken from each machine and tested

for weld strength. The weld strength test measures the number of pounds of force required to break the weld. Each module is electrically tested before and after dip-coating.

Advantages of Welding Over Soldering

Listed below are some of the advantages of welding over soldering.

1) Reproducibility of the process with semiskilled labor; using sequentially programmed and controlled welders greatly attenuates operator-induced variances.

2) High Strength of weld.

3) Presents a single molecular diffused interface (homogeneous fusion of base materials) as opposed to the two questionable interfaces obtained with soldering.

4) Fluxes and cleaners are not used, eliminating the entrapment of caustic agents with possible future corrosion.

5) Energy released during the welding process is concentrated in a very small area for as short as 10 ms, which virtually eliminates the possibility of heat damage to sensitive semiconductors.

6) Weight and size reductions frequently accomplished are 50 percent in volume and 30 percent in weight, compared with conventional packaging approaches.

7) Reliability, thermal shock, and bending tests have shown that welded electrical connections are more reliable than soldered connections. Shock tests conducted at MIT on 47,000 weld samples produced no failures. A bending test performed by Raytheon Company, Waltham, Mass., showed that an average of 1152 motions were required to fracture a welded joint, while an average of 70 motions fractured soldered joints.

Tests in Progress

The present life test program consists of evaluating and testing 30 welded modules of various digital circuits similar to those used in the DR-1. These circuits have an average of 20 to 25 components per welded module. This circuitry comprises a portion of the complete electronics of a typical unit of an over-all system.

The actual tests are comprised of an active input to the welded modules while monitoring the loaded output. The temperature is held to a constant +100°C. The rise time, delay time, and voltage outputs are measured.

Every 1000 hours the modules under test are subjected to four temperature cycles. One temperature cycle consists of lowering the temperature from 100°C to -55°C and remaining there for 30 minutes. At the end of the four temperature cycles, the modules are at +100°C and remain there for another 1000 hours. These temperature cycles test the effects of low temperature, expansion, contraction, and high temperature on the module.

The theoretical MTBF of a typical module under test at 100°C ambient was calculated, using as a reference document RADC-TR-58-111, RADC Reliability Handbook.

The calculations show that the theoretical MTBF for the modules under test is approximately 196,500 hours at 100°C. The actual tests have run for 3407 hours on the 30 modules for a total elapsed module test time of 102,210 hours. No failures or degradation have been experienced to date, so the actual measured MTBF is indeterminate. However, at this point in time, there is an 85-percent confidence that the MTBF of each module under test exceeds 34,000 hours.

4.3 Performance

The performance of Phase I units under applicable circumstances, will be equivalent to or better than that of the prototype to be supplied as Government Furnished Equipment. In the interests of improving reliability and with the approval of the contracting agency the contractor may employ design or packaging techniques which differ from those used in the prototype, except that:

1) Electrical compatibility with the associated receiver and tone generating equipment (DT-1) will be maintained.

2) Display and control functions of production units will be identical to those on the prototype.

3) The method of attaching batteries to the DR-1 will be essentially the same as that used in the prototype.

5.0 MANUALS AND PRODUCTION DRAWINGS

5.1 Preliminary Instruction Manual

The preliminary instruction manual will contain sufficient information for personnel to install and operate the equipment produced under the first phase of this program. It will be prepared in accordance with good commereial practice.

5.2 Operator's Instruction Manual

The operator's instruction manual will contain sufficient information for personnel to install and operate the equipment produced under the

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second phase of the program. It will be prepared in accordance with good commercial practice.

5.3 Theory, Maintenance and Parts List Manual

The theory, maintenance and parts list manual will be prepared in accordance with good commercial practice. It will contain sufficient data for personnel to understand and maintain the equipment developed under the second phase of this program.

5.4 Production Drawings.

Production drawings submitted under the contract will be of good commercial quality.

6.0 GOVERNMENT FURNISHED EQUIPMENT AND INFORMATION

The following Government Furnished Equipment and information is required to accomplish the proposed task.

1) DR-1 Digital Display unit prototype is to be used in comparing performance.

2) A complete and accurate schematic diagram and parts list for the DR-1 prototype.

3) An adapter DT-1 to be used for test purposes.

4) A complete and accurate Theory, Maintenance and Parts List Manual for the DR-1 prototype.

7.0 SPECIAL CONDITION

This proposal is predicated on the electrical characteristics of the customer's prototype units meeting the requirements of paragraph 5 of Spec No. 62-A-1140-A, dated 23 February 1962.

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EXHIBIT "C"

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PRICE SUMMARY

The below listed prices are contingent upon receiving contractual coverage by 30 April 1962 and completion of Government evaluation of Phase I within six (6) weeks after completion of said Phase I.

PHASE I

ITEM	QUANTITY	DESCRIPTION	TOTAL TARGET PRICE
1	5 each	DR-1 Digital Display Sets	$ 44,952.00
2	10 each	Preliminary Manuals	845.00
		Total Target Price - Phase I	$ 45,797.00
		Ceiling @ 20%	9,159.00
		Total Ceiling Price - Phase I	$ 54,956.00

PHASE II

ITEM	QUANTITY	DESCRIPTION	TOTAL TARGET PRICE
1	95 each	DR-1 Digital Display Sets	$ 119,394.00
2	150 each	Instruction Manual	1,456.00
3	50 each	Theory, Maintenance & Parts List Manual	5,935.00
4	Lot	Drawings	244.00
5	Lot	Production Tooling	28,942.00
		Total Target Price - Phase II	$ 155,971.00
		Ceiling @ 20%	31,194.00
		Total Ceiling Price - Phase II	$ 187,165.00

NOTE: The prices quoted above are predicated on the electrical characteristics of the customer's prototype units meeting the requirements of paragraph 5. of Specification No. 62A-1140-A, dated 2/23/62. In the event that it is subsequently determined that the prototype does not meet these requirements, the prices quoted above will be subject to negotiation.

Next 5 Page(s) In Document Denied

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EXHIBIT "C"

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PHASE II

MANUFACTURING COST BREAKDOWN

PRODUCTION DRAWINGS

ITEM 4

	AMOUNT
Material	$ 200
MANUFACTURING COST	$ 200

(Reproduction Costs Only)

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EXHIBIT "D"

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DELIVERY SCHEDULE

The below listed delivery schedule is contingent upon receiving contractual coverage by 30 April 1962, and upon receiving Government approval of the Phase I effort by 15 December 1962.

PHASE I

Items 1 and 2 - To be delivered complete by 31 October 1962.

PHASE II

Item 1 - To be delivered as follows:

Two (2) Sets in April 1963.
Fifteen (15) Sets in May 1963
Twenty (20) Sets in June 1963
Twenty (20) Sets in July 1963
Twenty (20) Sets in August 1963
Eighteen (18) Sets in September 1963

Items 2 and 3 - To be delivered complete by 15 May 1963 .

Item 4 - To be delivered complete by September 1963.

Item 5 - To be delivered complete by October 1963.

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EXHIBIT "E"

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GOVERNMENT FURNISHED PROPERTY

In the performance of this program the Contractor will require the following GFP by the dates indicated below:

QUANTITY	DESCRIPTION	DATE REQUIRED
1 each	Prototype DR-1 Unit	30 April 1962
1 each	Complete and accurate schematic diagram and parts list for the DR-1 Prototype	30 April 1962
1 each	DT-1 Adapter	30 April 1962
2 each	Operation, Theory, Maintenance and Parts List Manual for the DR-1 Prototype	14 September 1962

In the event that the above Items cannot be furnished by the dates indicated, the price and delivery schedules quoted herein will be subject to negotiation.

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EXHIBIT "F"

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SPECIAL TERMS AND CONDITIONS

1. Item 5 (Production Tooling), which is not to be delivered until the completion of Phase II, may be invoiced by the Contractor after Government acceptance of the first units to be delivered under Phase II.

2. The following conditions are applicable to all Handbook Items (Item 2, of Phase I and Items 2 and 3 of Phase II).

   a. Manuals will not be prepared in accordance with any military specifications, but will be prepared in accordance with good commercial practice.

   b. Contractor will retain all illustrations and other materials used to produce the manuals.

   c. Contractor does not contemplate submission of the manuscripts to the Government for review prior to production. In the event that Government review becomes a requirement, the prices and delivery schedule quoted herein will be subject to negotiation.