

4 August 1961

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Please Reference: 610

United States Government

[Redacted]

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Attention: [Redacted]
Contracting Officer

Subject: Contract No. [Redacted]
Task Order No. 1
Image Enhancement Program

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Reference: Contractor's Letter 418 Dated 29 December 1960

Dear Mr. [Redacted] 25X1

Pursuant to the requirements under the subject Contract, the Contractor has been accomplishing continued analyses of the performance under Task Order No. 1 and computing estimates to complete. The most recent analysis indicates that completion of performance of this task, exclusive of fixed fee, will require funds in addition to those presently committed under this Task Order.

Substantiating data explicitly defining objective factors in support of this request is forwarded herewith as enclosures. Your attention is directed, in particular, to the following enclosures:

- A. Enclosure 1 - Program Status and Substantiating Technical Data for Additional Funding represents a review of present program status and an analysis of both retrospective and prospective technical problems which affect the completion of performance under this Task Order.
- B. Enclosure 2 - Contractual and Financial Substantiating Data delineates those factors which must be considered in detail in the evaluation of this request by representatives dedicated to the contract and financial disciplines.

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- C. Enclosure 3 - Cost Summary includes appropriate cost data to establish an estimate at completion.
- D. Enclosure 4 - Substantiation: Estimate to Complete includes estimating detail in support of the cost summary.
- E. Enclosure 5 - Delivery Schedule.

The organization and presentation of data under cover of this letter has been organized to facilitate the logical development of objective data which must be considered. It is our goal to present all data so sound conclusions may be reached. In accordance with these principles, I have directed the key members of our Contract and Engineering staffs to represent the Contractor in meetings held in Washington, D. C., with your representatives for the presentation and discussion of this program as well as this request. Suffice to state here that the developmental work accomplished objectively demonstrates the high probability that the Image Enhancement Device presently being produced will not only contribute new techniques for the achievement of enhancement, but also will concretely demonstrate greater image enhancement performance than previously tried techniques will allow. We have assigned, throughout the period of performance on this task order, key members of our senior technical staff. Our sole intent has been, and continues to be, the efficient, constructive, and continuous application of creative work to complete this program in a superior manner. Furthermore, our same technical personnel has been assigned to this program throughout this performance in order to assure the efficient application of continuous effort and to minimize the "blind alleys" that may otherwise be committed to design. Performance under this Contract represents research and development effort. We have pursued all reasonable courses, in accordance with good business practices, to review, control, and direct the performance under this Task Order. We believe that this is amply demonstrated in data which is included in the enclosures.

The net effect of the factors discussed in this letter results in a requirement for an additional [redacted] and an extension in delivery schedule as defined in Enclosure 5.

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It is requested that an appropriate contractual amendment be issued against Task Order No. 1 to provide for a revised total estimated cost of [Redacted] and a fixed fee of [Redacted] resulting in an aggregate total cost plus fixed fee of [Redacted] and the requested extension in delivery schedule. In the event additional information is required, please contact [Redacted]

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Very truly yours,

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[Redacted Signature]

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Enclosures

CC:

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Enclosure 1
Reference: 610
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PROGRAM STATUS AND SUBSTANTIATING TECHNICAL DATA FOR ADDITIONAL FUNDING - IMAGE ENHANCEMENT PROGRAM

Contract No.

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The original proposal for the development and fabrication of an operationally useful Image Enhancement Device envisioned the employment of techniques that analysis and engineering experience indicated would be feasible. But such a device had never been constructed; prior experience with the devices and techniques necessary to the achievement of the instrument was therefore not available anywhere. In view of the fact that performance under this Task Order represents research and development per se, those programming and planning techniques were applied which were necessary to evaluate problems, effect their solutions, and determine the affect upon the program cost and delivery. Of course, we have encountered problems which we did not anticipate; and the magnitude of effort and elapsed time required to research and develop satisfactory solutions has been, in many instances, difficult to establish in objective, concrete terms. We have consistently pursued our dual goals of high producibility and efficiency without sacrifices of technical integrity and adoption of questionable solutions. In achieving the degree of performance sought, the Contractor has found it necessary to deviate considerably from specifics in the theoretic technical approach proposed for the many functions incorporated within the device. In effect, we felt obliged to follow untried approaches because we are seeking to achieve more enhancement performance than tried techniques will allow. We could have taken the safer approach that rests on tried techniques; the Government would then receive a device that accomplishes little more than existing image enhancement devices. The original technical proposal did not contemplate the utilization of existing techniques in accomplishing the image enhancement desired.

Some of the specific areas in which deviations from the original proposal were necessary, and resulted in unexpected work, were described in our referenced letter. These concerned the necessity for a rocking mirror scanning device and its attendant massive framework for mounting, the need for a d.c. stabilized arc lamp scanning light source, and the necessity for a complex photomultiplier circuit.

Subsequent to the definitization of Supplemental Agreement No. 1 to Task Order No. 1, we encountered another serious problem in the realization of the approach. This concerned the modulated light source used in the re-forming of the enhanced image. The original approach simply would not work, in spite of the fact that the best data available showed it to be well within the workable range. Accordingly, we studied other approaches: A Kerr cell modulator; a galvanometer driven modulator (such as is used in sound-on-film recording); and an approach

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**PROGRAM STATUS AND SUBSTANTIATING TECHNICAL DATA FOR ADDITIONAL FUNDING
IMAGE ENHANCEMENT PROGRAM**

based on a moving spot of light on a cathode ray tube. The first approach was rejected in the study phase; the second and third approaches were each subjected to laboratory investigation. After exhaustive investigation and experimentation, we committed our design to the third approach since the experiments performed indicate that it will be satisfactory in every respect. This investigative effort was unanticipated; it could well be the subject of a separate program, since it relates to devices other than image enhancement instruments. In addition to the above mentioned investigation of basic approaches, the design and fabrication of the devices necessary to incorporate the selected approach into the enhancement instrument requires considerably more effort than that estimated for the original approach.

At the present time, all functional elements of the instrument, with the exception of the data block recording device and modulated light source, have been designed and fabricated. To the extent feasible, each component has been tested individually prior to its installation in the instrument. The individual optical and mechanical components are being assembled to the open framework, with the electronic components on adjacent tables and racks, in our laboratory. In this manner, trouble-shooting and "de-bugging" of the interoperability of the components is facilitated. At the present time, the following items are included in this assemblage:

- Optical Framework
- Collimating Lenses
- Arc Lamp
- Arc Lamp Condensing System
- Large Spot Incandescent Lamp
- Large Spot Condensing System
- Plane Mirrors for Folding Scanning Path
- Input and Output Dichroic Mirrors
- Rocking Mirror Subassembly, including horizontal drive
- Slow Scan (vertical) Drive
- Raster Lens Assembly
- Film Table and Platen Subassembly
- Half-Inch Raster Light Collection System
- Small Spot Photomultiplier
- Camera and Film Processor Subassembly
- Projector Lamp, Condenser, and Projection Station Subassembly
- Rack Mounted Version of Electronic Signal Processing Circuits
- All Required Power Supplies
- Viewing Optics Subassembly

**PROGRAM STATUS AND SUBSTANTIATING TECHNICAL DATA FOR ADDITIONAL FUNDING
IMAGE ENHANCEMENT PROGRAM**

The addition of the following elements will be accomplished during August 1961:

**Projector Mirrors and Screen
Modulated Light Source and Condensing Lenses
Electronics for producing operating voltages for modulated light source**

With the addition of these items, the essentials of the enhancement instrument will be available for test and modification, where required, during September and October 1961. Concurrent with this testing, the console wiring, controls, and covering hoods will be prepared.

The achievements to date on this program have resulted from hard, continuous, and creative work on the part of all who have contributed to it. Construction of the Image Enhancement Device (excluding installation in the console) will be completed by the first part of September, and a concrete demonstration of how much enhancement the embodied techniques will provide will occur as soon as the correct interoperation of all the components is achieved.

At the time of the Contractor's request for additional funds, we felt that the program was approximately one-half finished. However, with 50% of the program ahead of us, it was naturally not possible to foresee the remainder of the effort with sufficient clarity to estimate it accurately. At this point, however, the program is approximately 85% complete. The probability of additional over-run is therefore considerably lessened. The majority of the remaining effort is in the test and "de-bugging" phase. Because of the extensive testing applied to the individual components, a minimum of rework, during this latter phase, is expected.

Our research, analysis, and knowledge of the details of this program lead us to believe that the results will be outstanding and the program will represent a significant contribution to the achievement of an operationally useful Image Enhancement Device.

The design approach taken for this instrument is such that its enhancement capabilities, in terms of resolution, area scan filtering, and speed of operation may all be improved without alteration of the basic design philosophies incorporated.

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Enclosure 5
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DELIVERY SCHEDULE

It is requested that the completion date of work under Task Order No. 1 be revised in accordance with the following delivery schedule:

- | | | |
|-------------|---------------------------------------|---------------------------------------------------------|
| I. | Completion of Breadboard Model | 4 March 1961 |
| II. | Laboratory Service Model | 19 November 1961 |
| III. | A. Monthly Reports | No change |
| | B. Quarterly Reports | No additional quarterly reports will be required |
| | C. Informal Operating Manual | 19 November 1961 |
| | D. Final Report | 3 December 1961 |

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b. Image Quality Meter. A major problem area exists with this item in that no quantitative standards have ever been established for film resolution or acuitance. I believe this should be an item of extreme interest to [] but no interest has been generated at the working level. Without such standards, the machine calibration will be arbitrary and of prime benefit on only a comparative basis. I suggest a higher level approach to [] to instill interest at the top echelon, the results of which should then be reflected on a practical basis. [] will propose some changes to further improve the machine, in the form of viewing optics, electrical threshold gates and filters, which are not presently specified. Delivery, without the additional changes, could be as early as 20 August 1961.

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c. Image Enhancement Device. Will be ready for testing about 1 September, and delivery about 15 November 1961. The machine is presently limited to material of maximum quality of 80 lines per millimeter. This could be doubled, they say, by non-major circuitry changes and a new lens. They will propose this, including the specifications for the new lens. [] will have spent their entire [] by 6 August 1961. To get them to the 15 November delivery date will require another overrun to the amount of about [] This is caused by the extensive check-out procedures anticipated. The contracting officer had not been notified as of 19 July because they were waiting for me to arrive at the plant.

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6. []

a. Multiple Image Correlator. Still scheduled for delivery about 18 August 1961.

b. Edge and Line Detector. Still scheduled for delivery about 20 October 1961. Both items in fabrication at present, no problems being encountered or anticipated.

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7. [] Discussed with [] the proposed downward change in scope of contract to allow delivery of only the lens design. They are working on a set of tolerance specifications which I feel should be a part of the design if it were to be used for manufacture by other than [] This will delay the design by about six to eight weeks. No indication of additional cost, though some small amount may be incurred. [] the lens designers.

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8. [] Two prototype items are still scheduled for delivery before 1 September 1961. [] will make performance inspection about 15 August 1961. We should get our sensitive light meter back from TSD and lend to [] so that he can run foot-candle tests on the screen. Contract for the production items will be amended subsequent to [] of the prototype. [] will work with [] on readout code and format for the measuring readers and furnish to [] Projected deliveries:

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Physical Size - 5' x 3' x 4'
Weight - 450 pounds (estimated)
Power - 220 volts, 3 wire, 8 amps.