Subject: Gem Development - A proposal on the continuance of the Gem activity.

During the course of the past year's investigation, a facility has been established and staffed for the purpose of evaluating the assessment of photographic image quality by means of Gems, that is, simulated photographic end items. To date, the study has produced realistic simulations of aerial photography, wherein the photographic parameters of exposure, haze, granularity, and modulation transfer function have been varied experimentally. In so doing, many problems have been engaged and resolved, others have been merely identified. This proposal is concerned with a logical extension of that work. The proposed effort is divided into six tasks described as follows:

a) Gem Study
b) Alternate Gem Technique
c) Gem Comparator - Design
d) Gem Comparator - Fabrication
e) Gem Matrix
f) Liaison and Reports

1.0 Gem Study

Thus far the Gem study has yielded realistic simulations of aerial photography wherein the effect of haze, exposure, modulation transfer function (MTF), and granularity were artificially contrived. This work shall be extended to provide a series of Gem sets such that the parameters of haze, exposure, and MTF shall be varied precisely one at a time in increments corresponding to "just perceptable differences" as determined with the aid of Tri-bar targets.

Incidentally, this effort shall necessitate the modification of the existing Gem making equipment to provide a higher intensity in the film plane, in order to avoid "Reciprocity Law Failure" such as has been the case in previous work.

Throughout the conduct of this work, image evaluation shall be performed by application of "Edge Gradient Analysis" supported as required with corroboration from sine-wave-target measurements.

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2.0 Alternate Gem Technique

The present technique of Gem fabrication has failed to produce photographic image qualities of better than 50 cycles per millimeter. Unless this restriction can be overcome, one will be compelled to circumvent the limitation by enlarging the camera negative that is being evaluated. Thus, a camera negative of 150 l/mm quality could be enlarged by a factor of three and compared to a Gem of 50 l/mm quality.

In order to avoid this complication in the application of the Gem technique it is proposed that an alternate method of Gem fabrication be explored. This is envisioned as a special copy system as opposed to the modified Gem printing technique that is now employed. A breadboard of the alternate equipment shall be made and high resolution Gems shall be produced as a test of the technique.

3.0 Gem Comparator - Design

It is acknowledged that a useful Gem matrix numbers at least in the hundreds of elements. To routinely apply a matrix of this extent clearly requires the utilization of some Gem handling equipment. It is proposed that such an equipment be designed with the objective of automatically searching a matrix for that element that most closely matches the photographic image quality of the camera negative that is being evaluated. This equipment is envisioned as a multiple bank of slide type projector magazines which can be automatically searched and presented to the comparison stage of a split field microscope. Under this task, the microscope comparator would be procured and a design layout would be formulated together with a fully developed specification of the Gem comparator.

4.0 Gem Comparator - Fabrication

Upon completion of the Gem comparator design layout, the estimated fabrication costs would be reviewed and the finalized design and cost estimates would be submitted for customer approval. The anticipated fabrication cycle is given in the attached program schedule.

5.0 Gem Matrix

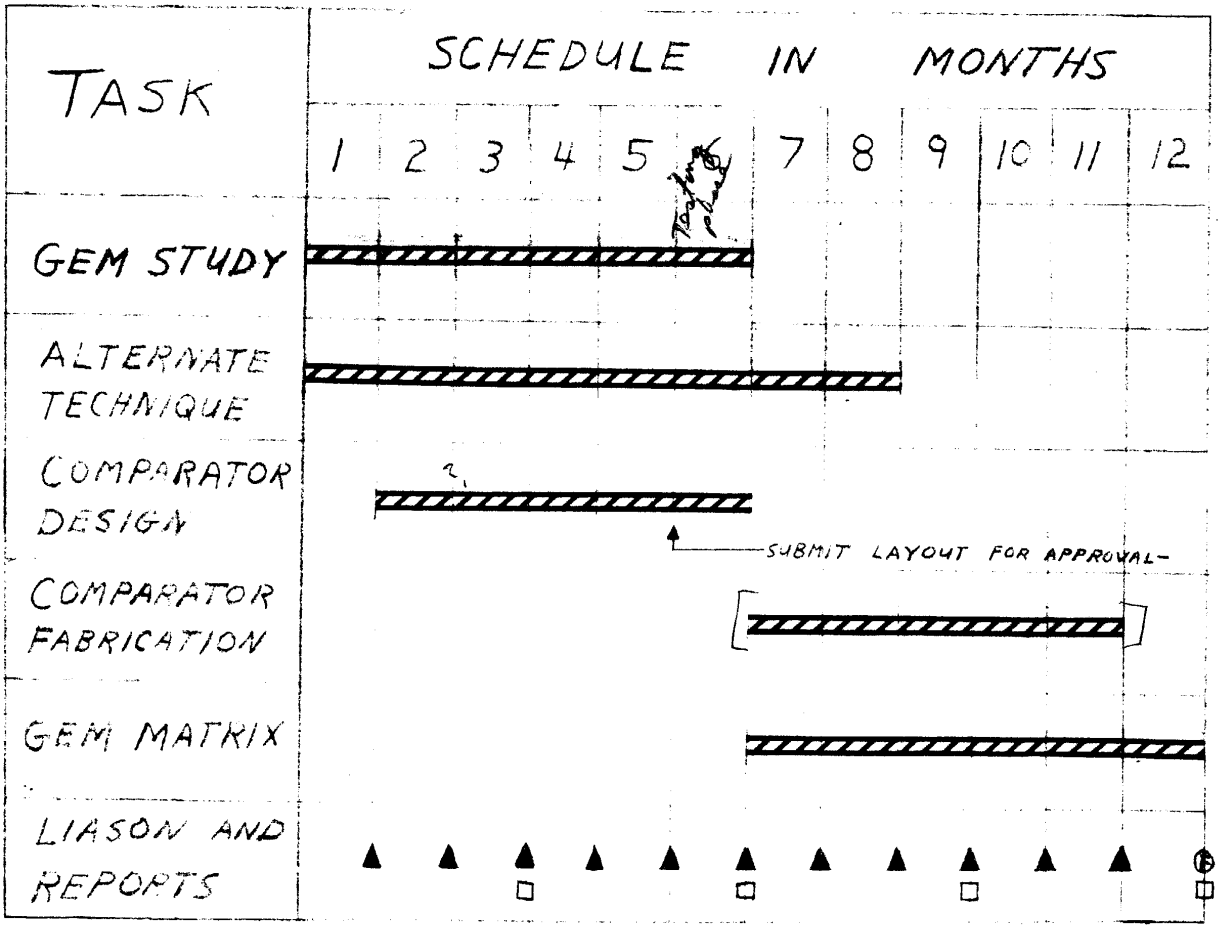
A Gem matrix shall be prepared in accordance with the most advanced technique resulting from the Gem study, and in a form appropriate to the development of the Gem comparator. The minimum number of elements in the matrix shall be 1250. At this time, it is proposed that the matrix be composed as follows:

Parameter	Number of Steps
Exposure	5
Haze	5
Granularity	1
M.T.F.	10
Scale Factor	3
Scene Content	2
D LOG E	1

6.0 Liaison and Reports

Throughout the conduct of the work, monthly letter reports shall be submitted in duplicate. At quarterly intervals, presentations shall be made at the customer's facility and finally a comprehensive report shall be submitted in conclusion of the contract

STATINTL [redacted] shall provide all of the personnel, services, and materials necessary to complete the tasks described herein. The work shall be conducted in accordance with the attached schedule of activities.



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