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NPIC/TSG/RED-217-70

8 September 1970

MEMORANDUM FOR: Chief, Applied Photo-Science Division, TSG

SUBJECT : Request for Comments on Attached Draft Development Objectives for a Color Control Cell

1. In April 1970 we forwarded two contractor proposals for a Color Control Cell Design Concept to you for your evaluation. You responded in a timely and thorough manner with memos TSSG/APSD/IEB-067-70 and TSSG/APSD/IEB-072-70.

2. Subsequently, TSG/RED decided to accept neither proposal for contract and to rewrite our Development Objectives to include not only Design Concept, but Detailed Design, and Fabrication Consultation. Cost and work proposals will be requested from an expanded list of contractors, based on these new Development Objectives.

3. Since any contractual implementation of this effort will require your support and assistance, your comments and recommendations concerning the attached draft Development Objectives for a Color Control Cell are solicited on or before 17 September 1970. The Project Officer [redacted] [redacted] will be available for discussion.

4. It is our intention to solicit contractor proposals during September-October 1970 and request your assistance in their evaluation after receipt, in order to select the most capable contractor.

[redacted]
Chief, Research & Engineering Division, TSG

Attachments:
As stated above

Distribution:
Original - Addressee
2 - NPIC/TSG/RED
1 - NPIC/TSG/RED/SRB

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NIMA/DOD

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Excluded from automatic
downgrading and
declassification

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NPIC/TSG/RED/SRB-058-70
8 September 1970

MEMORANDUM FOR: Chief, Advanced Technology Branch, RED/TSG
ATTENTION : Color Program Manager
SUBJECT : Request for Comments on Attached Draft Development Objectives for a Color Control Cell

1. In April 1970 we forwarded two contractor proposals for a Color Control Cell Design Concept to you for your evaluation. You responded in a timely and thorough manner with memos TSSG/RED/ATB-099-70 and TSSG/RED/ATB-102-70.

2. Subsequently, TSG/RED decided to accept neither proposal for contract and to rewrite our Development Objectives to include not only Design Concept, but Detailed Design, and Fabrication Consultation. Cost and work proposals will be requested from an expanded list of contractors, based on these new Development Objectives.

3. As Coordinator of the Color Program and because any contractual implementation of this effort will require ATB support and assistance, your comments and recommendations concerning the attached draft Development Objectives for a Color Control Cell are solicited on or before 17 September 1970. The Project Officer [redacted] will be available for discussion.

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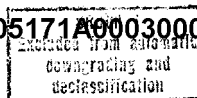
[redacted]
Chief, Systems Research Branch, RED

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Attachment:
As stated above

Distribution:
Original - Addressee
1 - RED/SRB
1 - File

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DEVELOPMENT OBJECTIVES
FOR A COLOR CONTROL CELL

1. INTRODUCTION

These development objectives describe requirements to be met in a multi-phase project for the development of a Color Control Cell, a facility which will provide the proper environment in which to carry out photo interpretation and photo-scientific experiments on a new family of high resolution, color reconnaissance photography taken at very high altitudes.

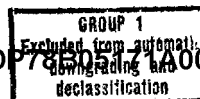
2. GENERAL

As one element in a program of related R&D projects--to prepare for the special problems anticipated with a large increase of high resolution, color reconnaissance photography--a Color Control Cell will be designed and built at the Sponsor's facility. Within this standardized, calibrated "laboratory", we will test and evaluate viewing equipment and conduct psychophysical experiments to determine the utility of color's hue and chroma to the search/detection and target identification PI tasks. Although primarily experimental in nature, the Color Control Cell may evolve into an operational configuration to directly support the PI and/or carry out photo-scientific assessments of the color film.

3. BACKGROUND

As a result of great improvements in the imaging characteristics of aerial color film in recent months, increasing amounts of such film are being flown for the assessment of Essential Elements of Information (EEI's) related to the use of color imagery in military reconnaissance. This

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trend is expected to accelerate in the next several years, as development continues on presently less-than-optimum copy film for reproduction of working copies. It is anticipated that product improvement of both original and copy material ~~as well as special unconventional sensor records~~ will continue, necessitating a continuing R&D effort in several categories of color reconnaissance film utilization. A number of initial studies within our color program have started, covering many research aspects of color film processing, viewing, measuring, reporting, as well as training of personnel who must exploit color photography for intelligence purposes. In particular, one task already on contract with a research laboratory is the development of a standard Color Vocabulary, including the selection of a Target Signature Color Reference System. The raw data for this study will be acquired by January 1971 and a Final Task Report is due in April 1971.

4. COORDINATION

The contractor selected for the Color Control Cell (CCC) development shall, under the direction of the Sponsor, thoroughly coordinate his efforts with these other research studies, and thus, avoid unnecessary redundancy and rapidly apply valuable research data to his immediate goals. In like manner, the contractor for the CCC development will be required to stay cognizant of continuing improvements in the development of the new high resolution color films, which involve unique coating and arrangement of film layers. Finally, the selected contractor, must be able to assign, in a timely manner, appropriate personnel with TOP SECRET clearances to the initial task of surveying the Center's operational and research components which will be using the Color Control Cell when finally constructed.

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4. SCOPE

The contractor's effort in the development of the Color Control Cell shall be scheduled in three phases: (I) Conceptual Study, (II) Detailed Design, (III) Fabrication Consultation. Specific deliverable items are required for each phase, as detailed below, including a re-estimate for each succeeding phase. The Government's evaluation of results and re-negotiation between phases will require 60 days. Before completing the Detailed Design, the contractor must apply the results of our Color Vocabulary Task (due April 1971), especially as they affect the CCC requirement for color definition techniques (see Paragraph 5.1.4, below).

5. REQUIREMENTS

5.1 Phase I: Conceptual Study

This phase shall generate a design concept of the general physical and functional characteristics of the Color Control Cell and equipment therein, leading in a natural manner to the approach to be taken with Phase II. Phase I shall consider five aspects: Preparation, Environment, Applications, Color Definition, and Deliverable Items.

5.1.1 Preparation. The selected contractor, with the guidance of the government Technical Monitor, shall review the other efforts of the Center's Color Program, study the operations of Center components which can utilize a Color Control Cell, and survey pertinent research by other organizations (governmental and private).

5.1.2 Environment. The CCC must be usable to conduct meaningful experiments to define and develop optimized techniques for interpreting and analyzing the new families of color reconnaissance films. To achieve such purposes, the selected contractor may determine that illumination (both environmental and instrument)

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should be "modifiable" as to color characteristics. Similarly, consideration must be given to convertible work space configurations and surface colors to permit testing of theoretical arrangements. In studying this, the response of the human eye and the limits and types of visual distractions permissible will be considered by the contractor. However, elaborate experimental construction and monitoring devices, involving, for example, remote sensing and recording equipment, will be avoided. Environmental control ~~can~~ ^{for experimentation} will be limited to luminance and spatial considerations, and not include such elaborations as atmospheric and audio manipulation.

5.1.3 Applications. In general the potential applications of the Color Control Cell cover the two broad categories of research and operational activities. In turn, each of these classifications should be applied to the Center's photo-interpretation and photo-scientific functions:

a. Photo-Interpretation.

(1) Human Factors. The contractor shall review current ~~Center~~ ^{Sponsor} human factors research and evolve a design concept for the Color Control Cell consistent with desired human factors experiments.

(2) Equipment Evaluation. The design concept shall accommodate experimentation with existing PI light tables, microstereoscopes, and projection viewers. Eventually, the CCC must permit test and evaluation of certain specialized light tables and rear projection viewers with light sources capable of chromatic manipulation. Such instrumentation is either under development or being con-

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sidered for funding under separate efforts. Affecting the design concept are the relevance and limits of luminance requirements and magnification while viewing color films, and the extent to which optics and light sources of viewing instruments must be modified or newly-developed.

(3) Operational Suitability. The design concept of the CCC will consider its eventual use to study the effect of new color films upon phases of PI activities (search/detection, target identification, detailed analysis) and target types (e.g., offensive and defensive military, industrial, electronics, and various geographic areas).

b. Photo-Scientific.

(1) Current. Several components of this Center carry on objective and subjective film assessments, which are those of the photo-scientist, as distinct from those of the photo interpreter. It may be possible to conduct such evaluations concurrently (or alternately) within a single cell configuration, or it may be necessary to differentiate between categories by setting up a second Color Control Cell. The design concept for the CCC must recommend between these choices and must accommodate expansions of such current evaluations as:

- Comparative studies ^{of the imagery from} ~~between~~ two different camera systems or missions.
- Changes in images produced by deviations within a mission.

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- Performance comparisons between emulsions, lenses, printers, and processors.
- System and film assessment ~~of assemblies~~ *with regard to* in resolution, density, contrast, color balance, color saturation, exposure, illumination, obliquity, focus, image motion compensation, astigmatism, chromatic aberration, light leaks, vibration, contaminated processing solutions, chemical precipitation, improper light sources, filtration, magnification.
- ~~Special studies~~ *Special studies with reference to* preparing optimum density/contrast reproductions.
- Special studies with regard to separation prints.*
- Color separation studies and analysis of the interactions between color film layers.
- Image quality grading studies.

(2) Future. As a special consideration, the selected contractor shall review and make recommendations as to the advisability of establishing a specialized production division which would perform color "measurements" in support of the PI's, much as an existing Center division does now for spatial aspects of reconnaissance film imagery. Furthermore, such a facility would not ~~be limited~~ *only respond* to PI support requests, but would also work *closely* with photogrammetrists, photo-lab technicians, graphic arts personnel, etc. Conceptually, a functional division such as this would require sophisticated equipment and, in particular, highly skilled personnel with commensurate training. It is realized that a final recommendation concerning this potential evolution of the

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first experimental Color Control Cell would depend upon the experience and information gained from working with the initial CCC and, therefore, would not be a requirement under the current contract.

5.1.4 Color Definition.

a. Standards/Coordination. Many authorities and organizations (e.g., the Inter-Society Color Council, the USA Standards Institute, the Illuminating Engineering Society) are attacking the problem of accurately "measuring" or defining "color". This Center's effort towards a Color Vocabulary is expected to produce a standard system or "language" by which photo interpreters can properly identify film image colors. The selected contractor for the Color Control Cell will be required to very carefully coordinate with results of this and other research studies to consider techniques and equipments for accurate color definition within the CCC.

b. Techniques. Without duplicating the analysis of prior studies, the CCC contractor will formulate techniques by which image colors may be effectively differentiated and identified, in the context of the yet-to-be-established color viewing and reporting standards. Determination of tolerances to which color information should be obtained may well depend upon the optimum method. It is required that consideration be given to both human visual and photo-electric (machine) techniques, even though the foregoing CCC design concept emphasizes the visual effects. Equipment candidates for visual techniques including existing PI light tables, microstereoscopes, and

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projection viewers; versions of commercial photo assessment viewers () a proposed visual tri-chromatic colorimeter; an existing monoscopic colorimeter design; and optical techniques of split field and "flicker", in general. Among the "machine" techniques, the contractor should consider the utility of existing or conceptualized photo-electric colorimeters, densitometers, spectrophotometers, and spectral radiometers. In this area, also, coordination with other in-house efforts in this office will be required. While the selected contractor must consider all these concepts, he should not be limited to them in developing the overall design concept.

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c. True Color Analysis. This Center has sponsored--and coordinated with--various efforts to predict true object and surface colors on the ground, using computer programming to manipulate known variables, and, thus, enhance the accuracy of photo interpretations otherwise depending upon color identification directly from the film record. Even the best and most modern photographic films ~~frequently~~ do not reproduce "true" object and ground colors. The selected contractor for the CCC will be required to investigate these past and current efforts (with the guidance of this office) for potential application to both the analytical and reporting functions of an operational Color Control Cell. He must, therefore, provide personnel with appropriate backgrounds to understand and conceptually apply ^{to the CCC concept} these computer models for true color identifications, ~~to the CCC.~~

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5.1.5 Deliverable Items.

- a. Final Concept Report. A final report, summarizing technical activities of Phase I and recommending follow-on action, shall be delivered to the Contracting Officer approximately four (4) months after contract initiation. In addition to ^{specifying a} ~~the CCC~~ ^{design plan for the} structure, surface colors, and illumination requirements ^{of the CCC,} the Final Concept Report will contain recommendations for equipment for the Color Control Cell--including off-shelf items, modifications of standard devices, and completely new instruments requiring new development.
- b. Estimate for Phase II. Accompanying the Final Concept Report shall be a Work Statement, with Cost and Schedule estimates for Phase II.
- c. Monthly Reports. Each month the contractor will forward five (5) copies of a report summarizing the previous month's activities. In format and content, they will correspond to the DB-1001 specification attached.

5.2 Phase II: Detailed Design

Upon approval of Phase I and notification by the Contracting Officer, the contractor will commence a Detailed Design of the Color Control Cell.

5.2.1 Coordination. Initially, the contractor will correlate the results of his prior studies with those of other on-going color programs. In particular, the results of the Color Vocabulary Final Report will be considered.

5.2.2 Deliverable Items. A Final Report, containing a Detailed Design for the Color Control Cell, shall be delivered approximately

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four (4) months after initiation of Phase II. It will be supplemented by appropriate engineering drawings, material parts lists, and directions for construction of the CCC at this Center by GSA personnel. Also to be delivered at this time will be a description of appropriate advisory duties of the contractor and estimate for Consultation Services to GSA and this Center during Phase III. Monthly Progress Reports to the Contracting Officer will continue throughout Phase II.

5.3 Phase III: Fabrication Consultation

5.3.1 Coordination. This phase shall consist of engineering, logistics, and other appropriate consultation by the contractor with components within this Center responsible for the final fabrication of the Color Control Cell.

5.3.2 Deliverable Items. These will consist of the aforementioned consultation services, continued monthly reports to the Contracting Officer, and a Final Summary Report, succinctly ^{summarizing} the work accomplished under all three phases.

6. PROPOSAL FORMAT

All proposals in response to the Development Objectives for the Color Control Cell must include all of the following information and conform to the indicated format.

- I. TASK ABSTRACT: Contents - Synopsis of task within 12 lines, plus estimated cost of direct labor, material, overhead, G&A, fee, total.
- II. Introduction: Contents - Covering background and task justification rationale.
- III. Technical Discussion. Contents - Detail and subsections as a function of the task such that all technical problem areas are adequately treated in detail. The Contracting Officer is

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- facilitated and (2) the resulting contract can be properly monitored and results accurately measured.
- IV. Work Statement: Contents - This statement should succinctly describe the individual tasks to be done and should be sufficiently definitive that one may read this section alone to understand the purpose and scope of the tasks.
- V. Management Plan & Key Personnel. Contents - Provide both a graphical and textual description of project management, responsibilities, and resumes of key personnel to be assigned. The contractor must assure that these key personnel with adequate experience in areas of human factors, photo interpretation, and color film technology will be committed to the project for an appropriate percentage and schedule of their time.
- VI. Deliverable Items. Contents - (1) Interim and Final Reports, as appropriate; (2) Monthly Progress Reports; (3) Fabrication Consultation Services.
- VII. Project Schedule. Contents - Schedule of the project percentage of completion of performance by months and related schedule of percentage of project expenditures by month in tabular form.
- VIII. Time Bar Chart: Contents - Keyed to the performance and expenditure schedule, the time bar chart will also provide appropriate milestones to enable progress monitoring.
- IX. Company Experience & Capability: Contents - Specific descriptions of the contractor's past experience relating to the intended work on the CCC and other appropriate statements concerning the contractor's capability in this endeavor. To repeat and emphasize, this should

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adequately cover the fields of human factors, photo interpretation, and color film technology.

- X. Financial Considerations: Contents - Cost details, summary, GFE required, etc.

7. DOCUMENTATION

Documentation for this contract shall substantially follow the specifications of DB-1001. For this specific project, the contractor shall provide monthly progress reports throughout all three phases, a Final Concept Report after Phase I, a Final Detail Design Report after Phase II, and a Final Summary Report after Phase III.

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to *date 8/1/70.*
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DEVELOPMENT OBJECTIVES FOR A COLOR
CONTROL CELL

1. INTRODUCTION

2. BACKGROUND

3. COORDINATION

4. SCOPE (multi-phase)

5. REQUIREMENTS

5.1 Phase I: Conceptual Study

5.1.1 Preparation

5.1.2 Environment

5.1.3 Applications

a. PI

(1) Human Factors

(2) Equipment Evaluation

(3) Operational Suitability (PI Phases, etc.)

b. Photo-Scientific

(1) Current

(2) Future

5.1.4 Color Definition

a. Standards/Coordination

b. Techniques

c. True Color Analysis (interact with "Insight" & "Kaleidoscope")

5.1.5 Deliverable Items

a. Final Concept Report (w/Recommendations)

b. Work Statement, Cost & Schedule estimate for Phase II

5.2 Phase II: Detailed Design

5.2.1 Coordination (re schedule start)

5.2.2 Deliverable Items : *Final Report*

- a. Engineering Drawings
- b. Material/Parts List
- c. Construction Directions
- d. Phase III Consultation Estimate

5.3 Phase III: Fabrication Consultation

5.3.1 Coordination (w/RED, Logistics Branch and GSA)

5.3.2 Deliverable Items (i.e., Services during GSA construction)

6. PROPOSAL FORMAT (expanded)

6.1 Task Abstract

6.2 Introduction

6.3 Technical Discussion

6.4 Work Statement

6.5 Management Plan/Key Personnel (Responsibilities & % of their time)

6.6 Deliverable Items (summary)

6.7 Project Schedule/Percentage Completion, Exper.

6.8 Time Bar Chart

6.9 Company Experience & Capability

6.10 Financial Considerations

7. DOCUMENTATION (requirements)

DEVELOPMENT OBJECTIVES
FOR A COLOR CONTROL CELL

1. INTRODUCTION

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As one element in a program of related R&D projects--to prepare for the special problems anticipated with a large increase of high resolution, color reconnaissance photography--a Color Control Cell will be designed and built at ^{the Spomer's facility} this Center. Within this standardized, calibrated "laboratory", we will test and evaluate viewing equipment and conduct psychophysical experiments to determine the utility of color's hue and chroma to the search/detection and target identification PI tasks. Although primarily experimental in nature, the Color Control Cell may evolve into an operational configuration to directly support the PI and/or carry out photo scientific assessments of the color film.

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sidered for funding under separate efforts. Affecting the design concept are the relevance and limits of luminance requirements and magnification while viewing color films, and the extent to which optics and light sources of viewing instruments must be modified or newly-developed.

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- System and film assessment of anomalies in resolution, density, contrast, color balance, color saturation, exposure, illumination, obliquity, focus, image motion compensation, astigmatism, chromatic aberration, light leaks, vibration, contaminated processing solutions, chemical precipitation, improper light sources, filtration, magnification.
- Studies in preparing optimum density/contrast reproductions.
- Color separation studies and analysis of the interactions between color film layers.
- Image quality grading studies.

(2) Future. As a special consideration, the selected contractor shall review and make recommendations as to the advisability of establishing a specialized production division which would perform color "measurements" in support of the PI's, much as an existing Center division does now for spatial aspects of reconnaissance film imagery. Furthermore, such a facility would not be limited to PI support, but would also work with photogrammetrists, photo-lab technicians, graphic arts personnel, etc. Conceptually, a functional division such as this would require sophisticated equipment and, in particular, highly skilled personnel with commensurate training. It is realized that a final recommendation concerning this potential evolution of the

first experimental Color Control Cell would depend upon the experience and information gained from working with the initial CCC and, therefore, would not be a requirement under the current contract.

5.1.4 Color Definition.

a. Standards/Coordination. Many authorities and organizations (e.g., the Inter-Society Color Council, the USA Standards Institute, the Illuminating Engineering Society) are attacking the problem of accurately "measuring" or defining "color". This Center's effort towards a Color Vocabulary is expected to produce a standard system or "language" by which photo interpreters can properly identify film image colors. The selected contractor for the Color Control Cell will be required to very carefully coordinate with results of this and other research studies to consider techniques and equipments for accurate color definition within the CCC.

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projection viewers; versions of commercial photo assessment viewers a proposed 25X1 visual tri-chromatic colorimeter; an existing monoscopic colorimeter design; and optical techniques of split field and "flicker", in general. Among the "machine" techniques, the contractor should consider the utility of existing or conceptualized photo-electric colorimeters, densitometers, spectrophotometers, and spectral radiometers. In this area, also, coordination with other in-house efforts in this office will be required. While the selected contractor must consider all these concepts, he should not be limited to them in developing the overall design concept.

c. True Color Analysis.

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5.1.4

c. True Color Analysis. This Center has sponsored and coordinated with various efforts to predict true object and surface colors on the ground, using computer programming to manipulate known variables, and, thus, enhance ^{the accuracy of} photo interpretations otherwise depending upon ~~the~~ color identification directly from the film record. Even the best and most modern photographic films frequently do not reproduce "true" object and ground colors. The selected

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required to investigate these past and current efforts (with the guidance of this office) for potential application to both the analytical and reporting functions of an ~~production~~ operational Color Control Cell. He must, therefore, provide personnel with appropriate backgrounds to understand and ^{conceptually} apply these ~~computer~~ computer models for true color identifications to the CCC.

5.1.5. Deliverable Items

a. Final Concept Report. A final report, summarizing technical activities ^{of Phase I} and recommending follow-on action, shall be delivered to the Contracting Officer approximately four (4) months after contract initiation. In addition to the CCC structure, surface colors, and illumination requirements, the Final ^{Concept} Report will contain recommendations for equipment for the Color Control Cell ~~is~~ - including off-shelf ^{items} modifications of standard ~~instruments~~ devices, and completely new instruments requiring new development.

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① b. Estimate for Phase II. Accompanying the Final Concept Report shall be a Work Statement, with cost and schedule estimates for Phase II

c. Monthly Reports. Each month the contractor will ~~submit~~ forward five (5) copies of a report summarizing

① the previous month's activities. In format and content, they will correspond ~~to~~ to the DB 1001 specification attached.

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5.2 Phase II: Detailed Design

① Upon approval of Phase I and notification by the Contracting Officer, the contractor will commence a Detailed Design of the Color Control Cell.

5.2.1. Coordination. Initially, the contractor will correlate the results of his^{prer} studies with those of other on-going color programs. In particular, the results of the Color Vocabulary Final Report will be considered.

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5.2.2. Deliverable Items. A Final Report ~~for this phase~~, containing a Detailed Design for the Cola Control Cell shall be delivered approximately four (4) months after initiation of Phase II. It will ~~be~~ be supplemented by appropriate Engineering Drawings, Material/Parts lists, and directions for construction of the CCC at this Center by GSA personnel. Also to be delivered at this time will be a description of ~~the~~ appropriate ~~the~~ ~~will be an estimate~~ advisory duties of the contractor and estimate for Consultation Services to GSA and this Center ~~and~~ during Phase III. Monthly Progress Reports ^{to the Contracting Office} will continue throughout Phase ~~III~~ IV.

5.3 ~~Fabrication~~ Phase III: Fabrication Consultation

5.3.1 Coordination. This phase shall consist of engineering, logistics, and other appropriate consultation by the contractor with components within this Center responsible for the final fabrication of the Cold Control Cell.

5.3.2. Deliverable Items. These will consist of the aforementioned consultation services, ~~and~~ continued monthly reports to the Contracting Officer, and a Final Summary Report, succinctly the work accomplished under all three phases.

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6. PROPOSAL FORMAT

All proposals in ~~response~~ to the Development Objectives for the Color Control Cell must include all of the following information and conform to the indicated format.

I. ~~Task~~ Task Abstract: Contents - Synopsis

of task within 12 lines, plus estimated cost of direct labor, material, overhead, G&A, fee, total.

II. Introduction: Contents - covering background and task justification rationale.

III. Technical Discussion: Contents - Detail and subsections as a function of ^{the} task such that all technical problem areas

are adequately treated in the proposal to the extent that ① selection of the contractor is facilitated and ② the resulting contract can be properly monitored and results accurately measured.

IV Work Statement: Contents - This statement should succinctly describe the individual tasks to be done and should be sufficiently definitive that one may read this section alone to understand the purpose and scope of the tasks.

V Management Plan & Key Personnel: Contents - Provide both a graphical and textual description of project management, responsibilities and ^{presumes of} key personnel to be assigned. The contractor must assure that these key personnel with adequate experience in areas of human factors, photo interpretation, and color film technology will be committed to the project for an appropriate percentage and schedule of their time.

VI. Deliverable Items : Contents -

- 1) Interim and Final Reports, as appropriate
- 2) Monthly Progress Reports
- 3) Fabrication Consultation Services.

VII. Project Schedule : Contents - Schedule

of the project percentage of completion of performance by months and related schedule of percentage of project expenditures by month in tabular form.

VIII. Time Bar Chart : Contents - Keyed

to the performance and expenditure schedule, the time bar chart will also provide ~~appropriate~~ appropriate milestones to enable progress monitoring.

IX. Company Experience & Capability : Contents-

specific descriptions of the contractor's past experience relating to the intended work on the CCC and other appropriate statements concerning the ~~company's~~ contractor's ~~experience~~ capability in this endeavor. To repeat and emphasize, this should

~~adequately~~ adequately cover the fields of human factors,

X Financial Considerations: Contents - Cost details, summary, GFE required, etc.

7. DOCUMENTATION.

~~To summarize~~ Documentation for this ~~project~~ contract shall substantially follow the specifications of DB-1001. ~~For~~ For this specific project, the contractor shall provide monthly progress reports throughout all three phases, a Final Concept Report after Phase I, a Final Detail Design Report after Phase II, and a Final Summary Report after Phase III.

D R A F T /
9 March 1970

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DEVELOPMENT OBJECTIVES

~~DESIGN CONCEPT FOR A COLOR CONTROL CELL~~

1. INTRODUCTION

These development objectives describe requirements to be met in ~~the~~ a multi-
~~phase project for the development of a~~
~~preparation of a Design Concept for a Color Control Cell, a facility which will~~
provide the proper environment in which to carry out photo interpretation
and photo-scientific experiments on a new family of high resolution, color
reconnaissance photography taken at very high altitudes.

2. BACKGROUND

2.1. As a result of great improvements in the imaging characteristics
of aerial color film in recent months, increasing amounts of such film are
being flown for the assessment of ~~color~~ Essential Elements of Information
(EEI's) ^{related to the use of color imagery} in military reconnaissance. This trend is expected to accelerate
in the next several years, as development continues on presently less-than-
optimum copy film for reproduction of working copies. It is anticipated
that product improvement of both original and copy material ~~will continue~~
~~will continue~~ will continue, necessitating a continu-
ing R&D effort in several categories of color reconnaissance film utilization.

2.2. Specifically, several initial studies are starting in the areas
of: (a) Establishing processing, viewing, and reporting standards for
color-oriented Essential Elements of Information (EEI's); (b) Developing
and modifying equipment to permit optimum copying of photographic color
originals; (c) Analyzing the effect of the new color film structure on the

*Started ~~to~~ to
redo the D.O. for
full job*

continuing requirement for accurate mensuration of photographic images; (d) Developing a plan for training all types of personnel who must exploit color photography.

2.3. These studies are not a part of this project; however, ~~the progress and results from these programs need to~~ ^{subject} findings in each must be correlated with the Design Concept for the color Control Cell (CCC). ^{to the extent possible within the time frame of this contract} Similarly, the contractor for the CCC Design Concept will ^{stay cognizant of improvements in the development} be required to coordinate with Continuing efforts of the ~~manufacture~~ of the new high resolution color films, which involve unique coating and arrangement of film layers. ~~Additional studies will be added, demanding further coordination among contractors, under the control of Government Project Officers.~~ ^{may}

3. CONCEPT

3.1. Purpose - It is the primary purpose of this study to develop a Design Concept for a facility with which to ^{first, neutralize the environment and then} study the effect of manipulating ^{that} the environment while conducting PI and photo-scientific tasks. An important sub-task, and perhaps the guiding principle behind the Design Concept, is accommodation for accurate color discrimination (identification). In other words, the CCC should neutralize visual phenomena which would otherwise interfere with accurate film image color identification by the human visual apparatus.

3.2. Scope - This study shall produce a thorough report detailing the results of the contractor's analyses and defining, in general terms, the physical and functional characteristics of the Color Control Cell and equipment therein. ^{scope of this} This effort will not include ~~Detailed Designs and Fabrication~~ at this time.

During the course of his study, the contractor will examine the ^{theoretical} problems of using existing PI and photo-scientific equipments to analyze the new color films and make general recommendations for ^{their} modifications.

*Cost of study
Accounted for*

4. REQUIREMENTS

4.1. Functions of the Color Control Cell

4.1.1. Environment - The CCC must be usable to conduct meaningful experiments to define and develop optimized techniques for interpreting and analyzing the new families of color reconnaissance films. To achieve such purposes, the selected contractor may determine that illumination (both environmental and instrument) should be "modifiable" as to color characteristics. Similarly, consideration must be given to convertible work space configurations and surface colors to permit testing of theoretical arrangements. In studying this, the response of the human eye and the limits and types of visual anomalies permissible will be considered by the contractor.

Photo interpretation Experiments -

4.1.2. The Design Concept for the Color Control Cell shall be consistent with later human factors research ^{accommodate intermittent use} and experimentation with existing PI light

tables, microstereoscopes, and projection viewers. ^{When completed} Eventually, the CCC must permit ^{the} test and evaluation of certain specialized light tables and rear projection viewers ^{equipped} with light sources capable of chromatic manipulation.

Such instrumentation is either under development or being considered for funding under separate efforts. In follow-on programs ^{to this Design Concept study} the impact of the ~~new color films, displayed on the above equipments~~ ^{the impact of the} will be categorized ^{in the CCC,}

and studied as to phases of PI activities (detection, identification, interpretation) and target types. ^{To the degree possible within the scope} Also to be considered at a later time (but ~~from~~ ^{of this conceptual study, the contractor will consider} affecting the Design Concept) ^{image} the relevance and limits of luminance

requirements and magnification while viewing color films, and ^{the} extent to

^{which} optics and light sources of viewing instruments must be modified or newly-developed to be in accord with the ranges of environmental adjustment recommended in the resulting Design Concept for a Color Control Cell,

4.1.3. Photo-Scientific Experiments - Within the Color Control

Cell, numerous objective and subjective color film assessments and evaluations must be made, which are those of the photo-scientist, as opposed to those of the photo interpreter. ^{must recommend between these choices as} The Design Concept for the CCC must accommodate expansions of such current evaluations as:

- Comparative studies between two different camera systems or missions.
- Changes in images produced by deviations within a mission.
- Performance comparisons between emulsions, lenses, printers, and processors.
- System and film assessment of anomalies in resolution, density, contrast, color balance, color saturation, exposure, illumination, obliquity, focus, image motion compensation, astigmatism, chromatic aberration, light leaks, vibration, contaminated processing solutions, chemical precipitation, improper light sources, filtration, magnification.
- Studies in preparing optimum density/contrast reproductions.
- Color separation studies and analysis of the interactions between color film layers.
- Image quality grading studies.

Does this need definition? Or will it be covered by other work?

4.2. Color Definition

4.2.1. Standards - The selected contractor will coordinate with a parallel effort under way to establish a system of standards by which photo interpreters can properly identify film image colors in a manner useful for intelligence purposes. ^{With emphasis on utilization} ~~A method utilizing the Munsell Color System, modified for transparencies is being considered, however, measurement techniques~~ ^{all pertinent color measuring systems} ~~are being considered; in support of~~ ^{the latter physical technique, generation of a} ~~chromaticity grid to determine C.T.E. coordinates in~~ ^{the new original color film has been proposed for funding.}

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~~are being considered; in support of the latter physical technique, generation of a chromaticity grid to determine C.T.E. coordinates in the new original color film has been proposed for funding.~~

It may be possible to conduct such evaluations concurrently (or alternately) within ^{a single cell configuration} ~~an experimentation~~ or it may be necessary to differentiate between categories by setting up a second Color Control Cell.

start from a base defined recently by the USA Standards Institute for viewing and comparing color transparencies in the Graphic Arts and related industries, supplemented by specifications from the Illuminating Engineering Society. From that base, appropriate modifications will be applied for dealing with any special requirements for photo interpretation and photo-scientific analysis and these modifications will be made available for the CCC Design Concept.

4.2.2. Techniques - It is required additionally that the Design Concept formulate techniques by which image colors may be effectively differentiated and identified, in the context of the yet-to-be-established color viewing and reporting standards. Determination of tolerances to which color information should be obtained may well depend upon the optimum method. It is required that consideration be given to ~~both~~ human visual and photo-electric (machine) techniques, even though the foregoing CCC Design Concept emphasizes the visual effects. Equipment candidates for visual techniques include existing PI light tables, microstereoscopes, and projection viewers; versions of commercial photo assessment viewers (Macbeth T&R 240 and PLT-510, for example); a proposed Visual Tri-chromatic Colorimeter; an existing monoscopic colorimeter design; and optical techniques of split field and "flicker", in general. Among the "machine" techniques, the contractor should consider ^{the utility of} existing or conceptualized photo-electric colorimeters, densitometers, spectrophotometers, and spectral radiometers. In this area, also, coordination with other on-going efforts in this office will be required ^(as indicated in section 4.2.1). While the selected contractor must consider all these concepts, he should not be limited to them in developing the overall Design Concept.

5. MISCELLANEOUS

5.1. Reporting - The contractor will be required to provide monthly reports and a Final Report. The monthly reports will follow the DB-1001 specification attached. The Final Report will provide a complete Design Concept, upon which a follow-on Detailed Design can be directly based. The Final Report must be completed within 30 days of the completion of the investigations and within the allowable cost of the contract.

5.2. Proposal Format - The submitted proposal will conform to the attached Guide for Proposal Format.

5.3. Level of Effort - It is desired that this study consume no more than four months from contract initiation.