STAT bc: [redacted]

30 June 1965

U. S. Government
Washington, D.C.

STAT Attention: [redacted] Contracting Officer

Subject: Task Order No. 3

Enclosure: Special Test Equipment List - Dated 6/30/65 - Four (4) copies

Gentlemen:

STAT [redacted] submits herewith, as requested, the list of Special Test Equipment required for subject task order.

The EPT Photographic and Electronic Processing Equipment items listed, except those designated by Notes 1, 2 and 4, are short lead time items for the program. If the government wishes to furnish any of the items listed, [redacted] STAT
STAT [redacted] should be so informed no later than 14 July 1965, in order to be able to initiate Purchase Orders prior to our plant shutdown 16 July 1965 to assure maintenance of the work schedule.

The equipment referenced as Notes 1, 2 and 4 are long lead items which are not required immediately. [redacted] will at a later date STAT
specify the appropriate equipment. We will then submit descriptions to you prior to placing Purchase Orders.

The short lead time items will be needed early in August 1965. The manufacturers of the Microdensitometer is presently building two such, one of which will be delivered elsewhere. We would appreciate an immediate indication of GFE, or not, on this item, because a new manufacturing lot would require a ninety day delivery cycle.

All costs indicated for equipment represent vendors prices and do not include percentage loadings shown on our previously submitted Price Analysis Summary.

Should you have any questions or desire further information in this matter, please feel free to contact the undersigned.

Very truly yours,
ORIGINAL SIGNED BY
[redacted] STAT
Contract Representative

ld

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INTERDEPARTMENTAL CORRESPONDENCE

STAT

STAT TO:

FROM:

DATE 29 June 1965

SUBJECT: Special Test Equipment for PIP

The special test equipment to be acquired for the PIP programs is specified below.

STAT

EPT (Photographic Processing)

Yoke Driver
Photo-Multiplier Supply
High-Voltage Power Supply
Film Dryer (Anhydrous)
Porta-Mixer
Combination Sink
  incl. Cabinet
  incl. View Lite
Photometric Microscope

Photometer/Calibrator

Micro Copier Camera
Microdensitometer
  incl. Ratio Arm
Sensitometer
Copying Lens
Step Wedge
Printer
Temp. Control, Twin
  Water Filter
Print Dryer

EPT (Electronic Processing)

Deflection Drivers (2)

Analyzer

Spectrum Analyzer

note 1 - equipment models still under review, to be specified by [ ] at later date.

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note 2 - step wedge to be developed, to be specified by [ ] at later date.

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note 3 - previously quoted price: [redacted] STAT

note 4 - analyzer model still under review, to be made firm
STAT by [redacted] at later date.

The equipment specified above for EPT (Photographic Processing) should be acquired as soon as possible. Any delay of permission to order this equipment will upset the program schedule. Long delays of permission to order all the equipment specified above could significantly affect the program completion dates.

[redacted] STAT

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The use of Fourier theory to image assessment, image quality.

Assessing spread function, granularity.

Fineness of detail due to close relation between spatial frequency (x, y direction).

Judicious choice of best film -developer combination - choosing of film where the greatest possible amount of information to be recorded by film. Slow film may yield better results than fast film.

Information content recorded in the emulsion per unit area - density level - contrast.

Selecting of film by means of information content.

Evaluation of maximum information capacity.

Numerical results to compare various film-developer combinations.

Ability of film to record low contrast objects efficiently.

Total information capacity of each film.

Variation in density level of the total capacity of film. Possible range of film. Range and application of each film to over-all efficiency within this range.

Perception of detail -

Information index - test objects of just detectable size, shape, contrast.

Square array.

Circular holes.

Cones.

Density variations in test objects.

Luminescence level.

Destruction of detail due to graininess.

Microscopic non-imaging spots in processed film.

Occurrence (detection - associated to scale)

low image density

high image density

regular shape

irregular shape

relation to image background

relation to magnification

relation to image detail obstruction

or degradation - micro image outline.

Causes -

Dust

Chemical (water spots, reticulation)

Packaging - storage

Fumes (Oxidant)

Handling

Film chemical composition

Storage (high humidity and condensation)

Age

Pattern Structure -

Circular

Filament

Clumped

Peppery

Uniform - random

Prevention -

Proper film storage temperature ($55^{o}F$).

Warming before exposure to surrounding air.

Constant humidity.

Constant purification of air.

Constant temperature.

Removal of oxidants.

Effective sealing of film.

Careful, clean handling.

Gold toning = if possible - very resistant to atmospheric attack - reduces fading - important for achival negative/positive.

Negative scanning by cathode ray tube.

Systematic method of determining photographic requirements.

1. Evanescence of CRT trace.
2. Photometer determination of radiance.
3. Exposure, density, as a function of CRT luminance range.
4. Photometric procedure and results to study of image modification and determination of exposure values, parameters on which exposure value depends.
5. Radiance of [illegible]

6. Photographic exposure (product of irradiance and time, or energy per unit area).
7. Value of energy for forming image as a function spectral components that are effective and ineffective.
8. Range of film spectral sensitivity.
9. Spectral distribution, or changes in spectral distribution during emission, or during decay of phosphorescence.
10. Spot size - irradiance of phosphor from center to edge of spot - may cause variations in exposure as the spot sweeps across.
11. Constant sweep velocity, or modulated sweep velocity.
12. Photoelectric photometer measurement, sensitivity, range. Sensitivity to increments of light flux interrelated to microimage density, transmission.
13. Total flux entering the photometer at instantaneous irradiance, or flux from negative/positive proportional to density, or modified density.
14. Integration of densities - such as image - background - for reduction of granularity.
15. If mask used - total flux measured by photometer - mask combination as the relative CRT spot irradiance, afterglow disappears, and the spot is eclipsed by portions of the mask.
16. Uniformity, distribution of radiance across trace - density relation - contrast. Reciprocity failure. Density edge gradient of image.

17. High velocity or low velocity - or variation of spot size as a function of spatial frequency - here it means the spacing between one density increment and the next - by this means given microdensity increments can be selected or integrated.
18. Astigmation in the electron-optical system - effect to spot size, shape, focus.
19. Electron-optical focus for sharpness of image detail.
20. Presence of electrical noise in trace. Detection, elimination, or suppression of noise.
21. Relation of noise to spot size, shape, irradiance.
22. Relation of beam current to total flux, density.
23. Effects of velocity variations when velocity is to be constant. Effects on intensity, exposure.
24. Determination of exposure per selected negative - positive - chemical processing combination.
25. Spectral selectivity response of negative - positive combination to match spectral distribution of phosphor.
26. Use of flash photometer, microphotometer with optical aid to magnify spot size.
27. Prediction of density of photographed trace.
28. Relative film speed by use of CRT operated at ? beam current. Exposure modulation obtained by varying spot velocity and number trace passages. Resulting curve. Estimation of relative speed.

29. Photographic - photometry - this use the comparison of source of known intensity with that of unknown intensity by means of photographic results.
30. Video scan lines only, no retrace scan line - video lines must cover entire neg.
31. Registration - linearity.
32. Correlation between density elements, content of negative-positive and actual video signal. The greater the number of negative micro-density elements scanned, the higher video resolution (1000, 2000, 8000) more negative detail can be modified. Higher the total number of picture elements increase in image detail resolution.

    35 mm film has 500,000 picture elements.

    16 mm film has 125,000 picture elements.

    Video should try to approach it so that discrete image detail is not lost and it is reproduced - modified for better perception.
33. Consideration of lens characteristics.
34. Scale factor - magnification.
35. Exposure related to magnification.

Macrosensitometry.

" contrast.

" density.

Sensitometric characteristics of micro-images.

Cannot be described by conventional H & D curve. If large area exposure, density relationship interrelation.

Effects of image size density as a function of light - chemical diffusion.

Macroimage sensitometry - image size, exposure, density of image and image background.

Construction of macrosensitometric curve based on H & D.

Construction of macrosensitometric curve for high-contrast densities.

Construction of macrosensitometric curve for low-contrast densities.

Variation of density with image size and contrast.

Cause of contrast by anti-halation coating.

Contrast improvement from use of anti-halation at varying image size density in macroimage regions.

Contrast variation in successive generation of negative-positive reproduction steps.

Prediction of detail degradation, improvement during successive reproduction steps.

High, and low contrast development for density modification during successive reproduction steps (successive exposure with electrophotomasking - photomasking).

Relation between density and chemical treatment.

Increase in macrocontrast with increased intensity modulated light for modification of image detail and image background detail.

Detail rendition of images at low-high contrast:

1. Contrast reduction, due to spread function, when image size is of the same order as the spread function of a point image.

2. Granular structure of developed image - influence on quality of detail.

3. Exposure value to minimize density fluct uation within image element with increasing or decreasing density.

4. Density point gradient - within toe and shoulder slope making these linear by expansion-contraction of incremental density gradients within toe and shoulder, or density modification of point gradients.

5. Quantum efficiency of emulsion versus CRT tube?

Preparation of experimental samples:

Processing variables.

Effects on images.

Analysis of data.

Characteristics of image.

Experimental results.

Experimental materials and procedure.

Effects of spread function on the formation of image detail:

1. Gran ularity of film - enlargement factor.

2. Graininess of film.

3. Diffusion of light by imaging systems and emulsion set limit to minimize size detail that can be recorded (point spread function).

4. Density packing permitted to minimize granularity.

5. Limits of spread function.

Factors limiting image detail rendition by CRT:

1. Beam power density to produce required concentration of energy to produce required detectable element, record on photographic film. Is it 1 uu sec exposure. At 10 u diameter? Writing need 10,000 miles/sec.?

2. Light level to detect, record low and high density levels.

3. Detection of incremental densities within .02 to 3.

4. Saturation of emulsion layer by CRT light exposure.

5. Maximum sensitivity of film to desired detail rendition and offset contrast and granularity.

6. Optical factors - transmission efficiency - direction of phosphor energy - transition to sensitive photocell, and emulsion with minimum aberration.

7. Beam density determines resolution-limit.

8. Intensity range, without damaging CRT due to beam penetration of phosphor layer.

9. Spot size limit due to scattering and multiple reflection within phosphor crystals.

10. Varying radiation of light by the phosphor due to mechanical application of the phosphor scan material.

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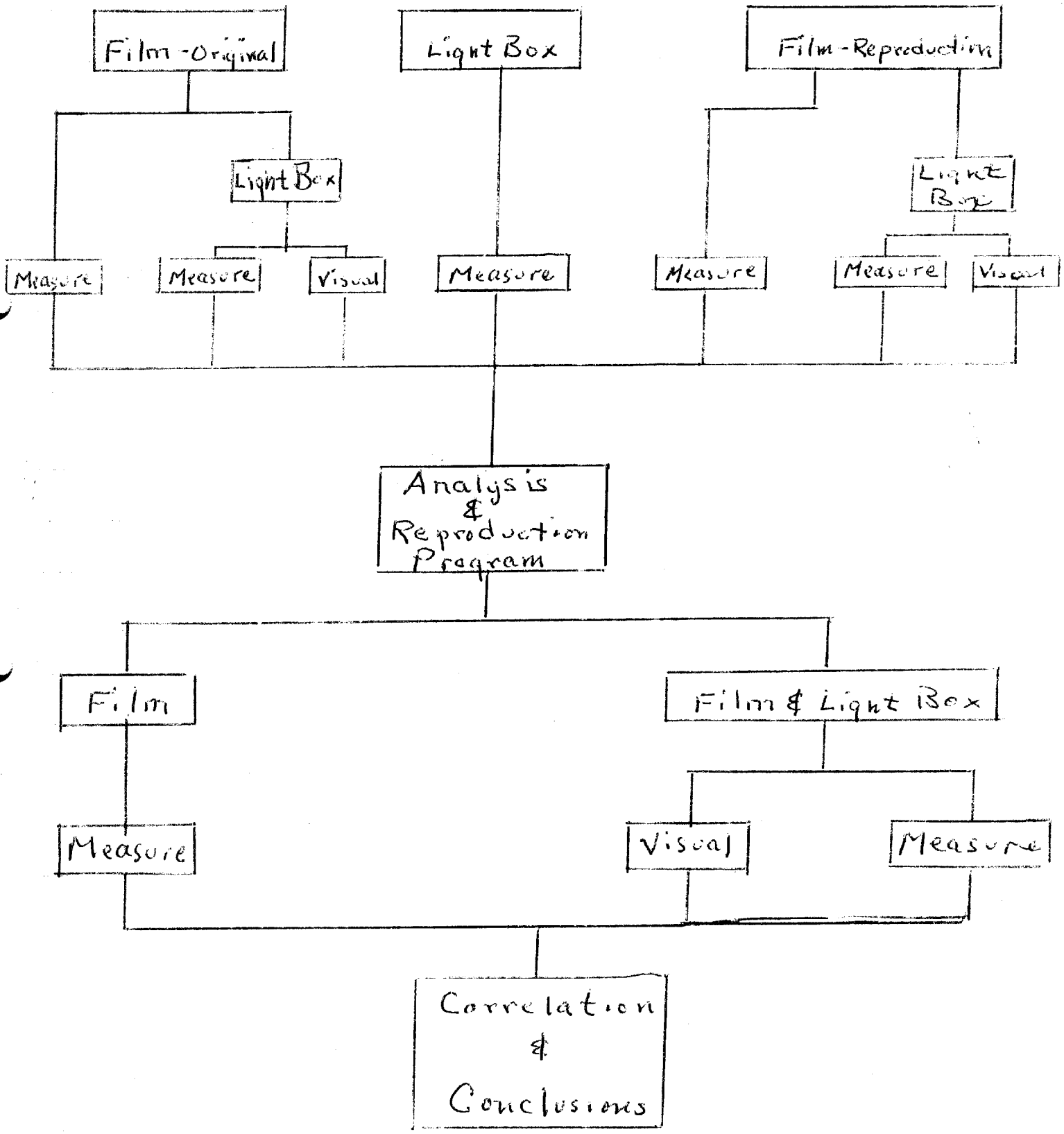
SHARPNESS/ACUTANCE EXPERIMENT



PROCEDURES

1. Light Box
   - Intensity
   - Uniformity
   - Spectrophotometry
   - Resolution

2a Original Film
   - Film characteristics
   - Density distribution (x, y)
   - Wiener-Khintchin evaluation

2b Original Film Plus Light Box
   - Microphotometric Measure
   - Visual inspection of density trace & film

3a Reproduction Film
   - Sensitivity (dD/ΔD)
     - Intensity (variable)
     - Exposure Time (step function)
   - Resolution
   - Characteristic curves

3b Reproduction film plus Light Box

Microphotometry (dI/ΔI)

Intensity distribution curves

Resolution

4 Application

Reproduction from original film

Highlight-lowlight correction

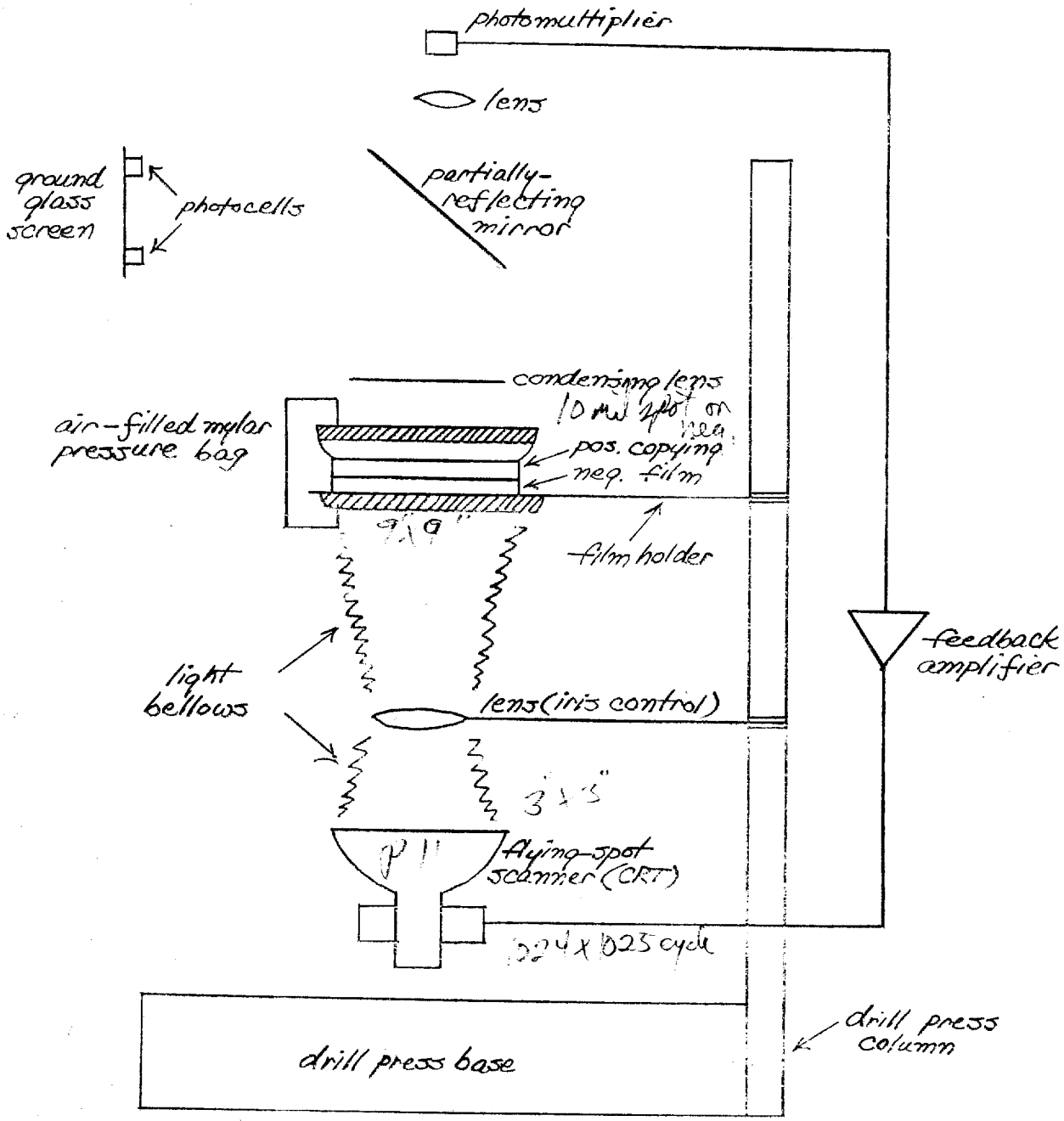
Density threshold cascading

Enlargement for density & resolution correction

Densitometric/microphotometric measurements

Visual study (with & without optical aids)

5 Correlation & Conclusions



Modulated-Light Contact Printer [redacted] Design)

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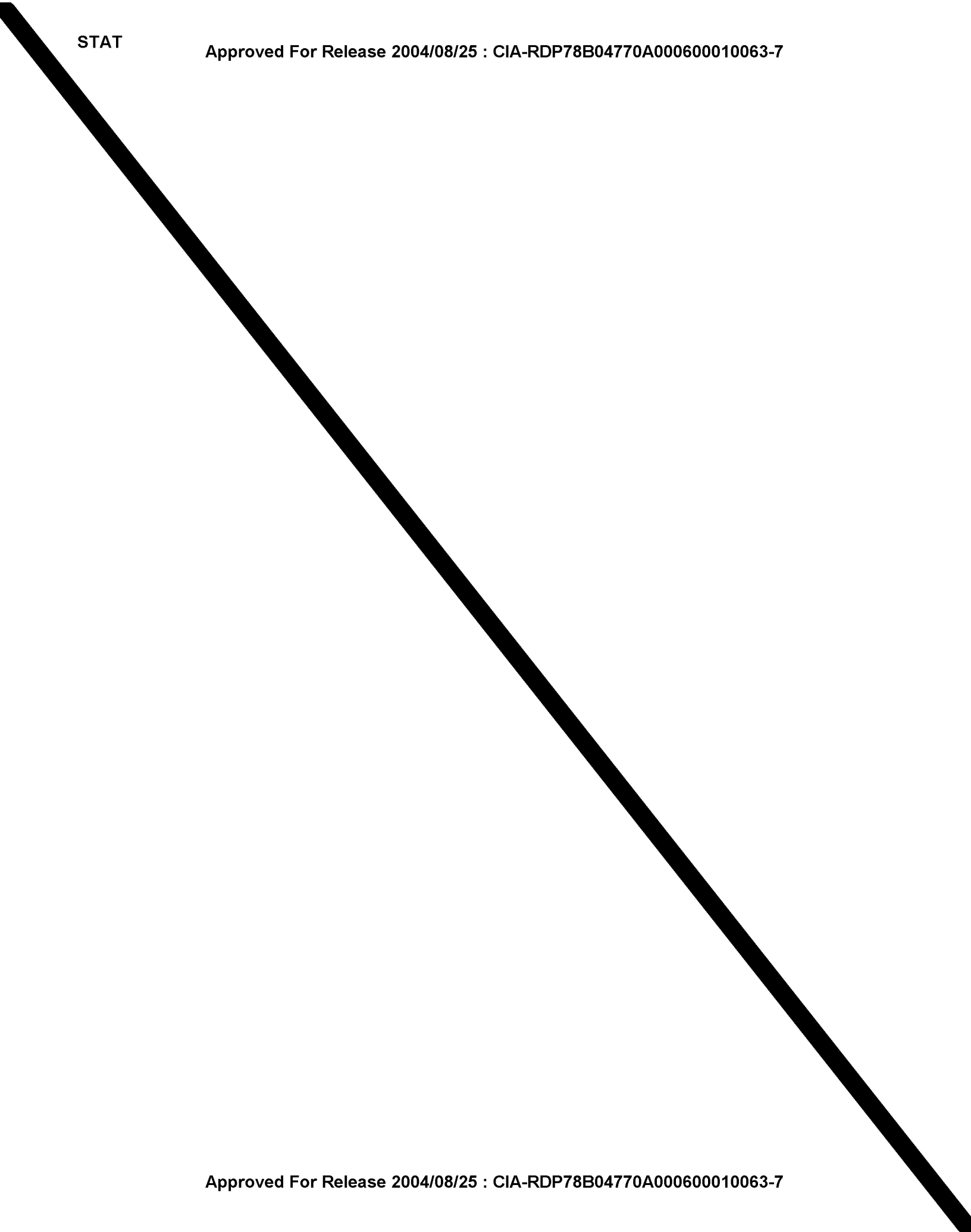
M. K. / J. A. I.

13 August 1959



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