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Engineering Proposal

Proposal No. 603A

Advanced Light Table

STAT

April 1967

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Proposal 603A

1.0 INTRODUCTION

The following is a technical description of a film viewing table in accordance with "Design Objective Advanced Light Table Prototype" - 28 February 1967. The proposed design is based upon technology generated through the development of the 603 type light table, with considerable emphasis placed upon reduction of complexity, noise, weight, and ultimate manufacturing cost. The unit will carry the type number 603A.

2.0 PROPOSED EQUIPMENT

2.1 Weight

The current 603 design weighs over 150 pounds and is therefore, unwiedly to use in certain applications. The proposed 603A design will have a target weight of 60 pounds. To achieve this, judicious use will be made of sheet metal construction and aluminum extrusions. Castings will be of the investment mold type to eliminate excess metal and extra machining operations. A preliminary weight analysis has shown that substantial weight reductions are possible, however, 75 pounds appears at present to be a more realistic figure than the 60 pounds or less requested. We will however, retain 60 pounds as the design goal.

2.2 Manufacturing Costs

Our initial cost estimates have shown that the current 603 will be more costly to manufacture in production quantities than is desired. How costly.

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On the proposed 603A design, cost reduction will be effective by reducing the number of machining operations and by an overall simplification of the design. It is suggested that a target quantity manufacturing cost be established early in the design phase, so that we may monitor our projected manufacturing costs against this figure.

2.3 Reliability

Reduction in the complexity and number of components in the 603A design as compared with the 603 will result in a corresponding enhancement of the reliability. All mechanical and electrical components will be operated well within their maximum ratings to insure a high MTBF.

2.4 Maintenance

Maintenance of the proposed 603A should be relatively simple due to the reduction in complexity. Referring to Figures 1 & 2, photographs of the inside of the 603, the reader can readily appreciate the degree of complexity necessitated by the 603 requirements. The 603A will have considerably fewer components and electrical connections. Almost all active electronic components will be located in the base assembly, where they are readily accessible. The film drive motor (s) and the lamp grid, by necessity, are in the main light box housing, but are readily accessible for service. Requirements for mechanical adjustments will be vertually eliminated.

2.5 Film Transport Design

2.5.1 Film Capacity

The 603A design will be capable of viewing 500 foot rolls of 9 1/2 inch wide film or any smaller size. This is a considerable simplification over the two film requirement of the 603.

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2.5.2 Film Loading

Loading of the film spools on the 603A will be accomplished in the manner similar to that used on the 603. It is proposed to employ the same type of spring loaded, lockable drive spindles. Since there is only one film, the front gear boxes will remain fixed and the operator will position the back idler supports according to width of film being used.

2.5.3 Manual Drive

A single handwheel manual drive system will be provided on the 603A similar to that which was used on the 603. This permits bi-directional control of the film motion from a single control point. The ratio between the handwheel and the driven spool will be nominally fixed at 1:1. A larger crank handle will be supplied on the hand wheel to permit the operator to hold the handle in the palm of his hand rather than only with his fingertips. The handwheel will be disengaged during automatic mode of film transport. The power assist mode used on the 603 will not be available on the 603A.

2.5.4 Motor Drive - Automatic Mode

The film transport design will be re-investigated to see what improvements in performance and reduction in cost may be achieved. At present, we have two new systems under consideration. One system utilizes wound-spring type clutches in conjunction with two DC torque motors and the other employs a single torque motor and magnetic particle brakes for tension control. Either system has all the capabilities of the present 603 system, plus the advantages of much quieter operation, extended speed range, and considerably less complication. The reduction of the modes of operation from those required on the 603 permits the consideration of the alternate and improved drive systems. In the motor driven mode of operation, the operator will have bi-directional control of the film motion

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using a single control knob. Film tension will be maintained at all times and will be adjustable. The speed range will extend from less than 1/4 of one inch per second to over 300 feet per minute. This may have to be done in two speed ranges. During the automatic mode of operation, the handwheel will be declutched to prevent its spinning.

2.5.5 Automatic-Manual Interlock

When the automatic or powered drive mode is being employed, the manual handcrank will be disconnected from the driving mechanism to prevent accidental injury to the operator. This is done automatically in one of the drive systems under consideration as opposed to a manually operating clutch as on the 603. This feature is an added advantage of the unique wound-spring type clutch drive system under consideration. In the other system, the handwheel would have to be pulled out to be disengaged. An interlock switch would prevent operation of the film drive motors when the handwheel was engaged.

2.6 General Illumination

The general illumination source and control will be the same as specified in the referenced design objectives (2-28-67). It is interesting to note that the specified dimming circuit, developed by an independent company, is almost identical to that which we developed for controlling the lamp grids on the 604 and 605 designs. That is, the circuit consists of a Zener diode referenced RC ramp generator triggering a unijunction transistor which fires a silicon controlled rectifier which in turn fires a [redacted] Triac. STAT The only major difference in our circuit is that we include a compensating resistor network in the RC timing circuit which makes the

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control less susceptible output variations due to harmonic distortion of input wave form.

2.6.1 Intensity

2500 foot lamberts goal.

2.6.2 Uniformity

± 10% over viewing surface.

2.6.3 Dimming Range

Lamp brightness will be continuously variable over a ten to one intensity range.

2.6.4 Lamp Color

Lamp color may be specified by the customer's technical representative.

2.7 Viewing Surface

The illuminated viewing surface will be large enough to accommodate a single 9 1/2 inch wide X 18 inch long single frame. The surface itself will be of hard smooth glass.

At present, consideration is being given to the use of a high strength chemically treated glass (tradename-Chemcor) manufactured by Corning Glass Works. This glass is available in relatively thin lightweight plate (.090") and its use eliminates the need for safety glass since when shattered (which could not happen in normal service) release of internal stresses in the interior of the glass causes the whole pane to disintegrate into small non-cutting granules.

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2.8 Shade

A single shade will be used under the glass viewing surface, which will be positioned from the back edge of the format toward the front. A knob with a friction lock on the front of the instrument will control the position of the shade similar to that used on the 603. To simplify the design and reduce manufacturing costs, a number of different approaches to the shade have been considered. One of the most promising appears to be the use of one of the relatively new stretchable materials such as Dupont's Spandex which may be woven into a opaque fabric or B. F. Goodrich's PVC rubber. The intention here is to simplify the shade mechanism by letting the shade retract into a hidden area off the format using its own elastic force. The performance or appearance would be equivalent or better than that found on the 603 design.

2.9 Tilt and Rotation Mechanism

The tilt mechanism design will be completely modified to eliminate high noise level during operation. Simplified manual systems will be re-evaluated to reduce noise, weight and manufacturing cost. The overall weight reduction in the viewing table itself should greatly reduce the complexity of the elevating mechanism.

The manual rotation of the 603, using teflon coated bearing surfaces, appears to be acceptable and will be retained on the 603A.

The limits of tilt will be the same as those on the 603, i.e., 75 degrees about the short axis and 45 degrees about the long axis.

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2.10 Dimensions

The overall size of the instrument will be within that specified for the 603. Reduction in the required format size should permit a small reduction in the depth of about one inch. Every effort will be made to reduce the height of 11 inches of the film viewing surface to the top of the supporting table. The design goal will be 10 inches. This is possible because of the elimination of a good portion of the gearing.

2.11 Film Tensioning

The tensioning solenoids used on the 603 will be eliminated, thereby reducing complexity and noise and decreasing the amount of mechanism above the film plane. Film tensioning will be accomplished instead by application of a slight drag torque on the magnetic particle brake (or slight reverse motor torque if the two motor drive is used) even during manual operation.

2.12 Film Guide Rollers

The film guide rollers will be highly polished chrome plated types similar to those used on the 603. They will be of aluminum, rather than brass, to reduce weight.

2.13 Controls

The proposed 603A will have the following controls on the front panel:

a) Main Power Switch and Pilot Lamp - These will be located close to the center of the front panel and the power switch

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will have a distinctive appearance to distinguish it from other controls.

b) Automatic Film Transport Control - This will be a single knob of larger dimensions than that on the 603, located toward the left side of the panel. There will be a definite detent position to indicate the null or non-driving position. This one control will be used to drive film in both directions.

c) Brightness Control - The size and location of the brightness control potentiometer will be similar to that on the 603. The actual control will be that suggested in the Design Objectives (2-28-67).

d) Shade Control - Only a single shade control will be provided. It may be of a thumbwheel type as used on the 603 or it may be a small knob. In either event, its position will be close to that on the 603. A friction brake on the shade will keep it in position.

e) Film Drive Handwheel - This handwheel will be located slightly to the left of the panel center and will have a larger crank handle than that used on the 603. This position will permit an operator to use either hand when operating the film drive while facing the long dimension of the table, and use his right hand when operating from over the end of the table. A second coupled handcrank will be provided on the rear of the table, if desired, so that the operator may use either hand when operating from the end of the table.

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Depending on the drive system finally selected, the handwheel may have a push-to-engage clutch similar to that used on the 613. In either case, the handwheel will be mechanically decoupled from the drive train in the automatic mode.

f) Tension Control - Our present thinking indicates that a tension control will be provided to permit the operator to adjust film tension to his liking. This control, since used infrequently, will have a locking knob to prevent accidental movement.

3.0 DEVELOPMENT PROGRAM

The Development Program will be under the direct supervision of a project engineer who will be responsible for completing the design and fabrication within the time and budget allowed. Part of his responsibility, will be the maintenance of the projected-production-cost within certain limits. The projected-production-cost is that which will be required to produce the instrument in reasonably large production quantities - i.e., lots of fifty. It is [redacted] strong belief that this supervision is required in the development stage to ensure that the final product, in production quantities, is reasonably priced. To assist the engineer in performing this task, our Production Control Department, under the direction of [redacted] will analyze and estimate the future, large lot, production cost in addition to the projected cost of the prototype unit. This will be done a number of times during the design phase to allow cost saving design techniques to be employed before the prototype is fabricated. The target production price and our corresponding projected production cost will be submitted to the contractor's technical representative from time to time during the duration of the design phase.

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Delivery of the prototype instrument, along with an instruction manual and manufacturing drawings, will be approximately 6 months ARO. Letter type progress reports, giving current status, problem areas, and summarizing correspondence will be submitted on a monthly basis.

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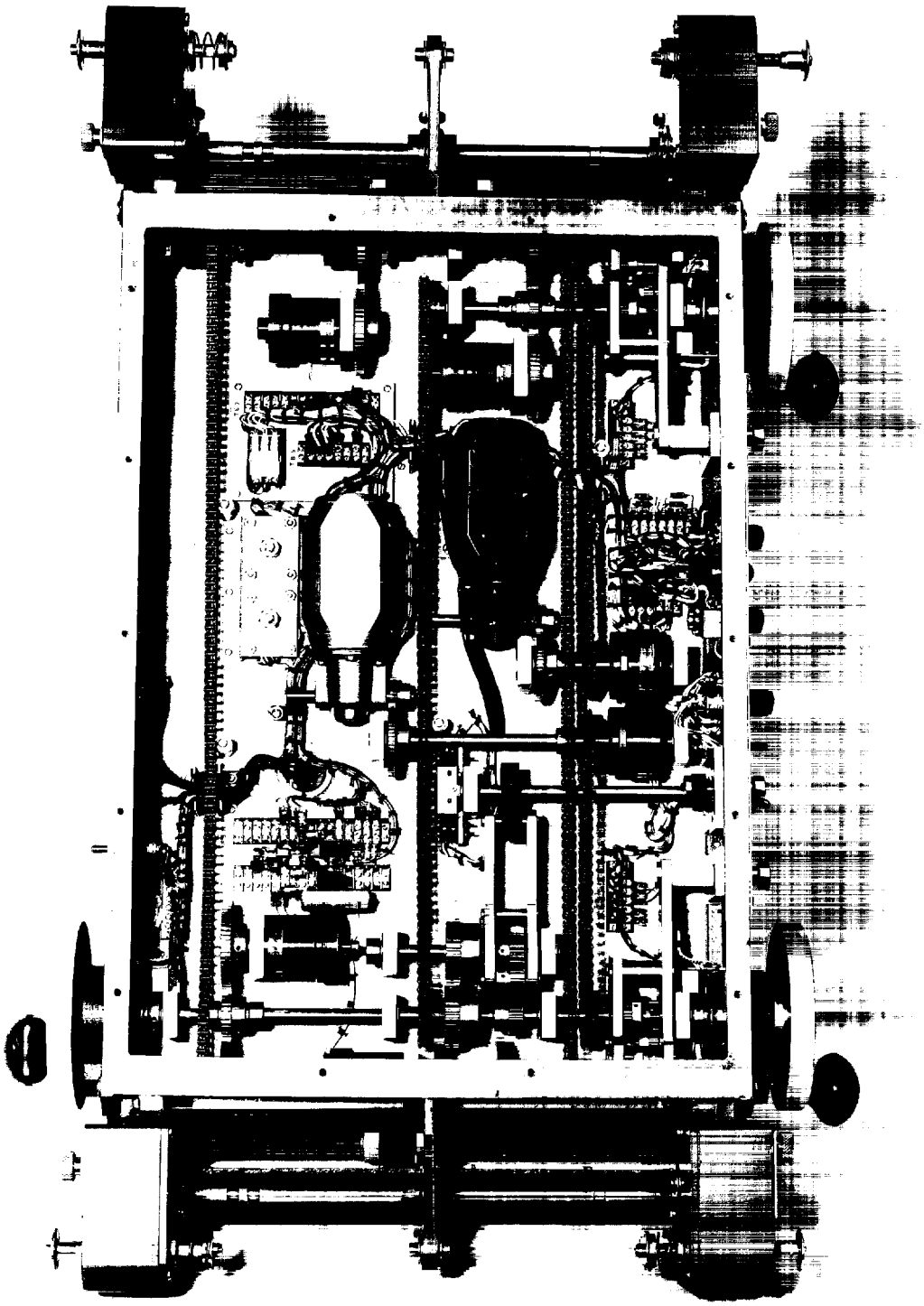

Figure 1
603 LIGHT TABLE

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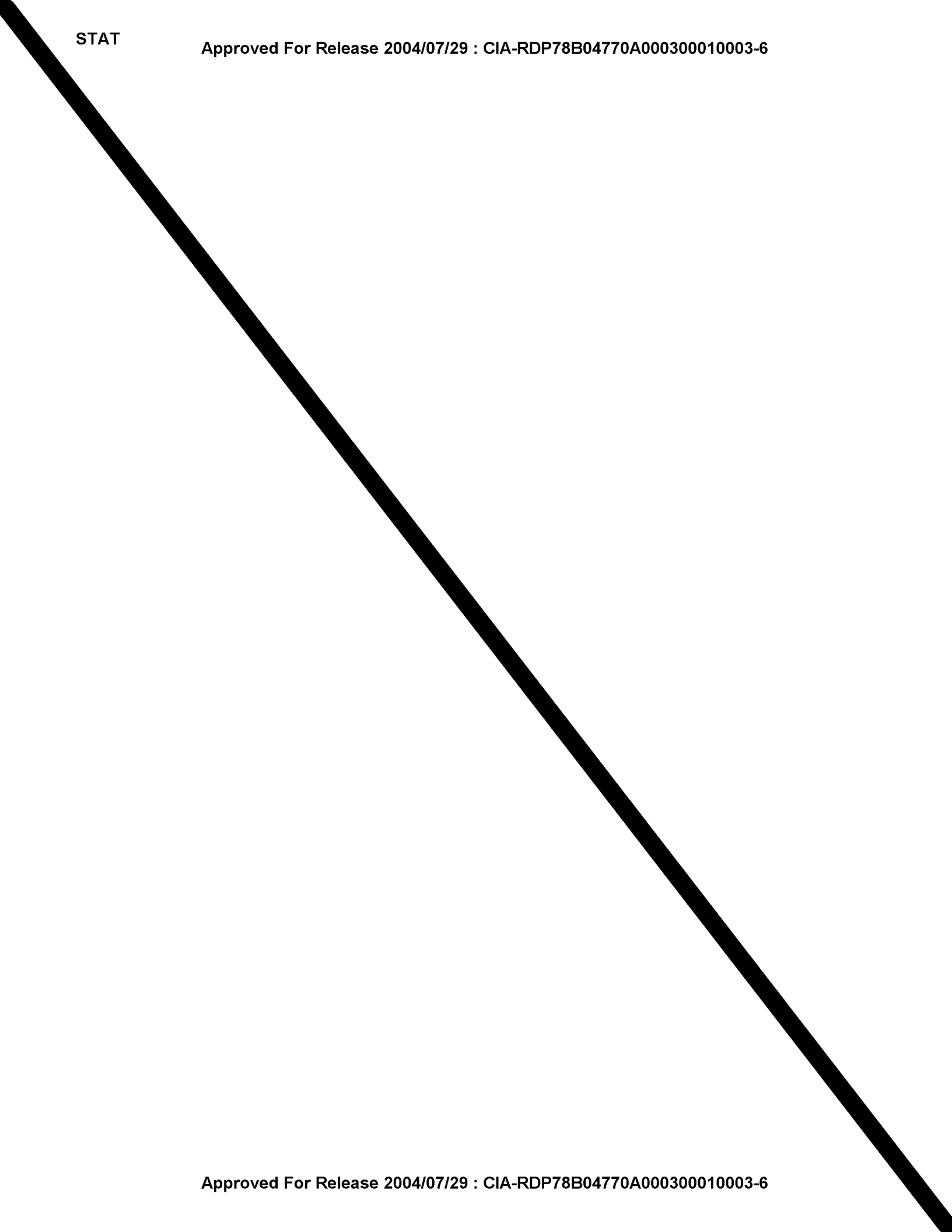

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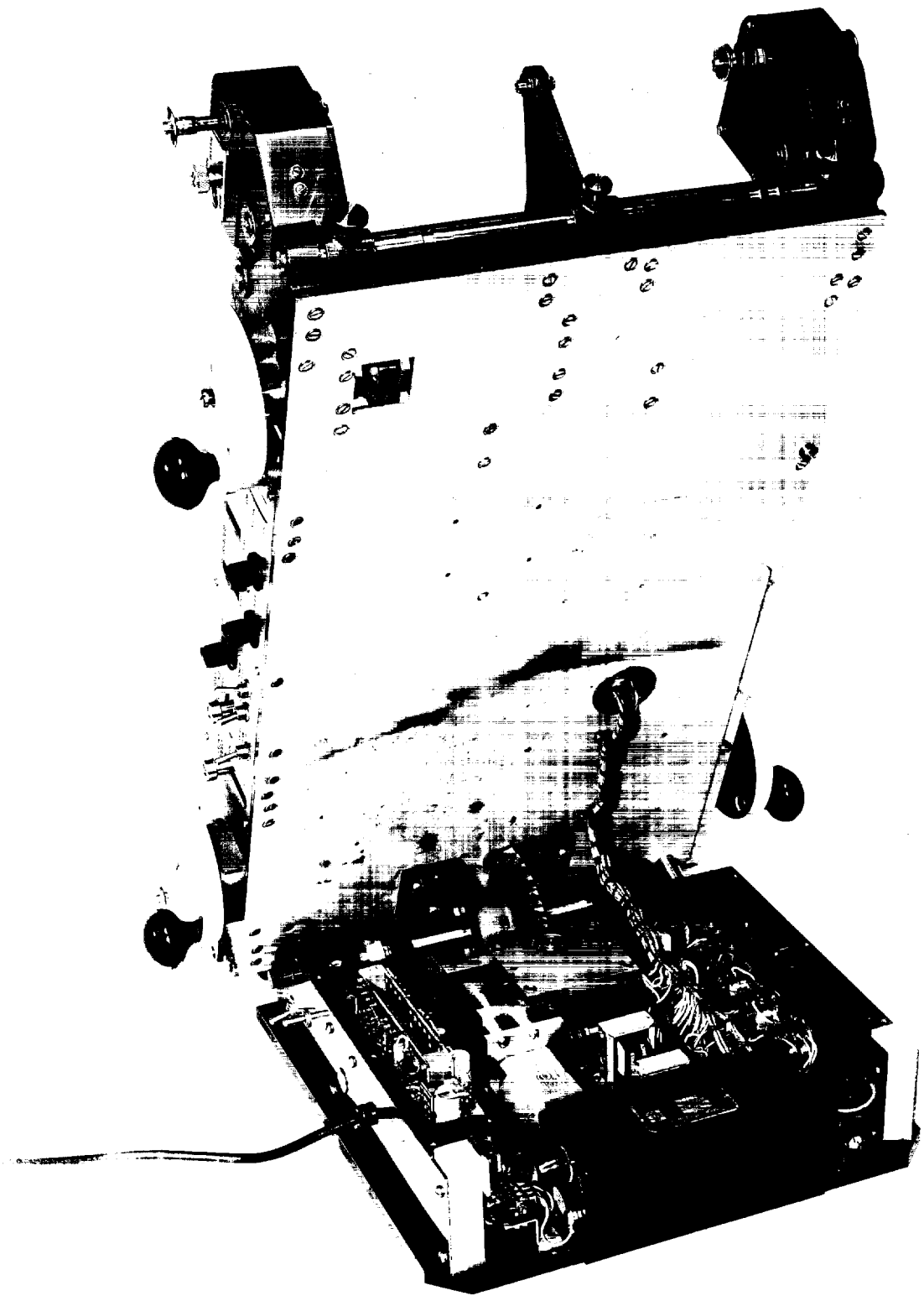

Figure 2
603 LIGHT TABLE

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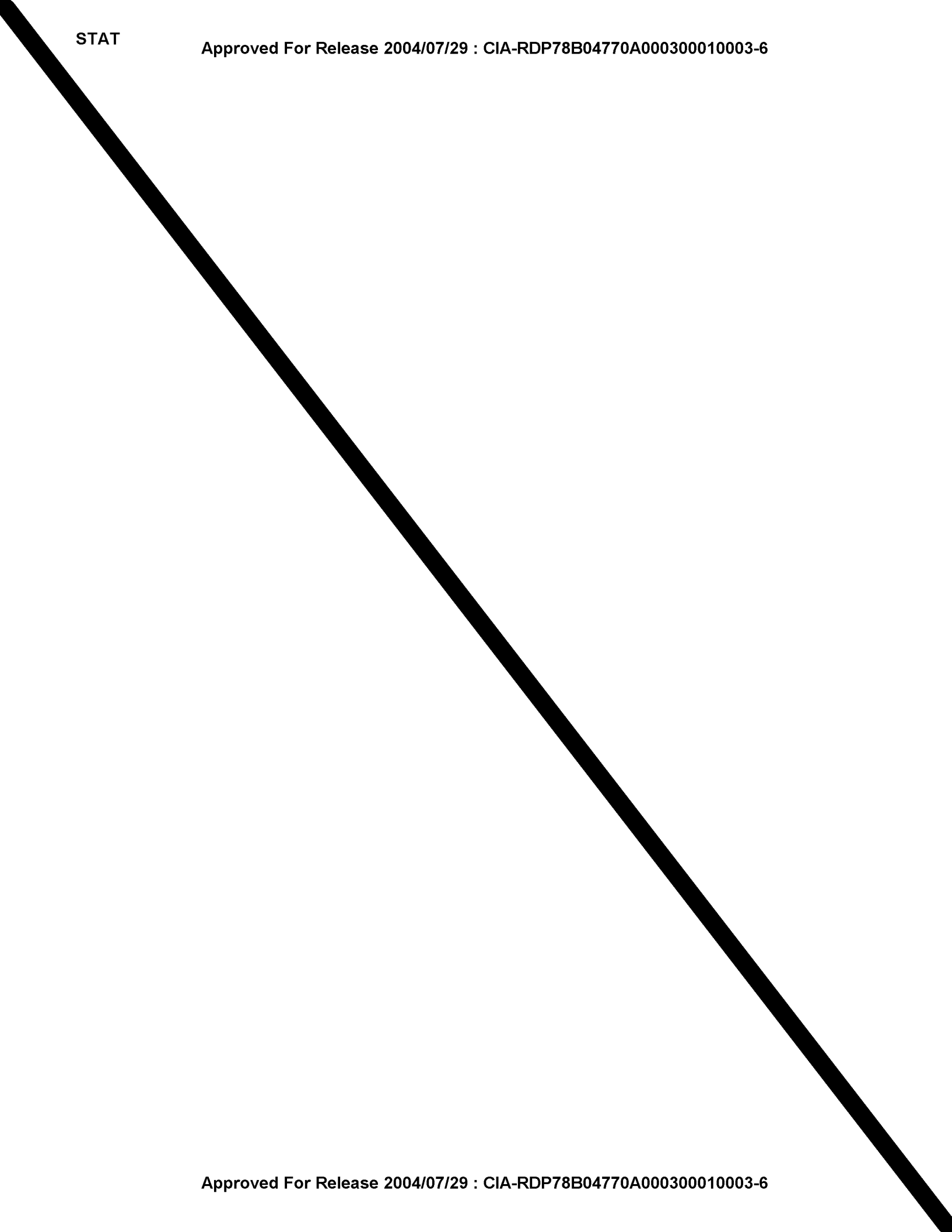

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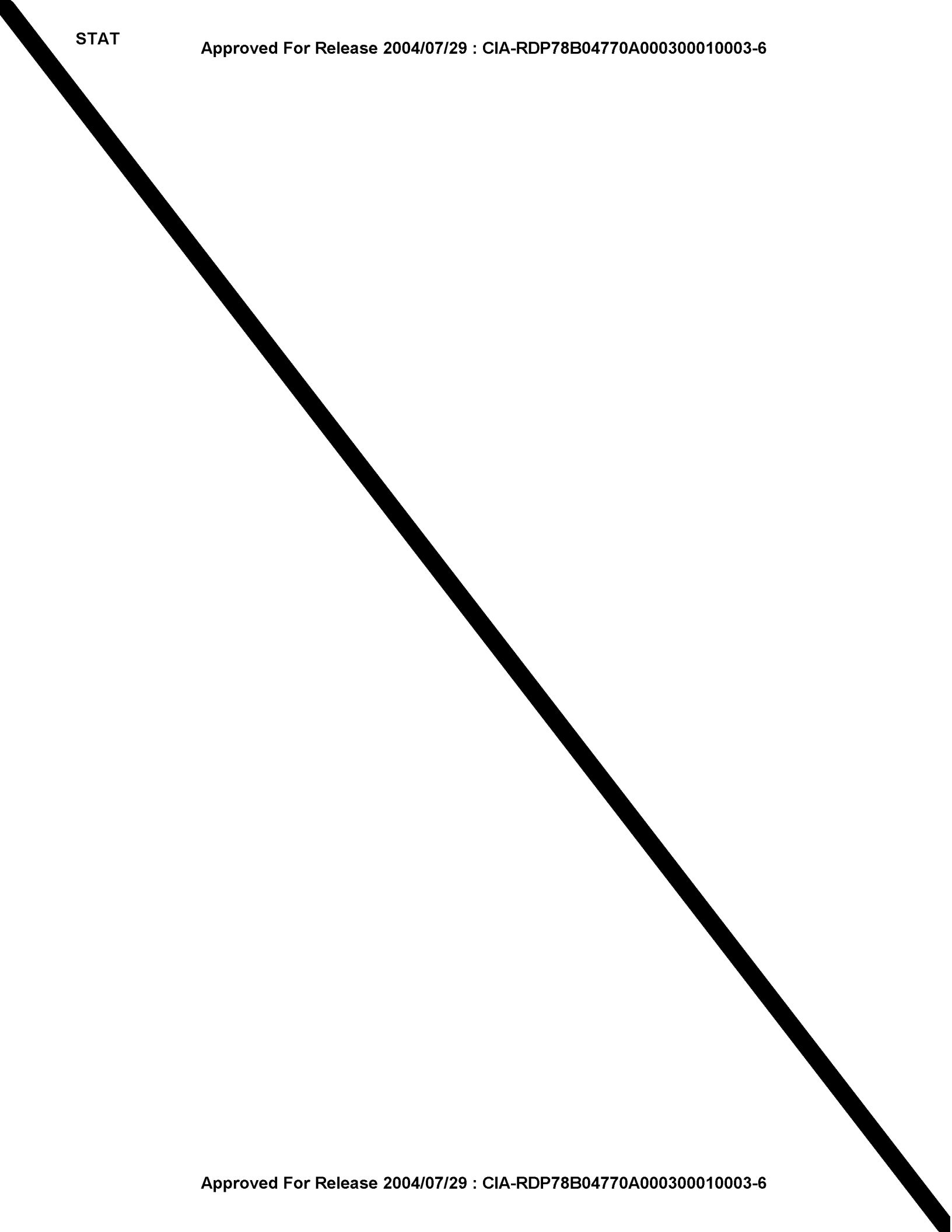

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CENTER ROUTING SLIP

FROM: IEG	DATE

TO		INITIALS	DATE	REMARKS
DIRECTOR				
DEP/DIRECTOR				
EXEC/DIRECTOR				
SPECIAL ASST				
ASST TO DIR				
ASST TO DEP/DIR				
CH/PPBS				
DEP CH/PPBS				
EO/PPBS				
CH/IEG				
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EO/IEG				
CH/PSG				
DEP CH/PSG				
EO/PSG				
CH/TSSG				
DEP CH/TSSG				
EO/TSSG				
CH/SSD/TSSG				
PERSONNEL				
LOGISTICS				
TRAINING				
RECORDS MGT				
SECURITY				
FINANCE				
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CH/DIAXX-4				
CH/DIAAP-9				
CH/SPAD				

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