

NATIONAL BUREAU OF STANDARDS REPORT

NBS PROJECT

NBS REPORT

0201-20-2301
0201-20-2327
0201-30-2348

December 1957

5664

Development, Testing, and Evaluation of Visual Landing Aids

Consolidated Progress Report
to
Ship Installations Division
Bureau of Aeronautics
Department of the Navy
Washington 25, D. C.

For the Period
July 1 to September 30, 1957

For
Bureau of Aeronautics Projects

TED No. NBS-AE-10002
TED No. NBS-AE-10011

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U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

Development, Testing, and Evaluation of
Visual Landing Aids

July 1 to September 30, 1957

1. REPORTS ISSUED

<u>Report No.</u>	<u>Title</u>
5445	Development, Testing, and Evaluation of Visual Landing Aids, Consolidated Progress Report for the Period April 1 to June 30, 1957
5466	Field Tests of Runway Distance Markers

II. RESEARCH AND DEVELOPMENT, LABORATORY TESTING, AND CONSULTATION SERVICES IN CONNECTION WITH VISIBILITY, AIRFIELD LIGHTING, AND FOG MODIFICATION PROBLEMS (TED NBS-AE-10002).

a. Visibility Meters and Their Application.

Difficulty in obtaining suitable trigger tubes (V102 of the transmissometer receiver) continues. The performance of nearly all of the tubes of this type now being received is inferior to that of the tubes received a few years ago. Problems have been encountered in high leakage currents, stability, and abnormally high voltages required for the plate and the starter-anode. The manufacturer and the Instrument Division of the Weather Bureau are cooperating in an effort to obtain satisfactory tubes. Sample tubes are checked at the National Bureau of Standards.

One trigger tube at the National Bureau of Standards in Washington was found to generate pulses at about one-half the proper rate in a GMQ-10 transmissometer. A similar failure had been observed earlier in an NBS transmissometer by the Field Laboratory at Arcata. Following the finding at Washington of a tube of this type, a check was made of a number of tubes which had been classed as defective, either when new or after a period of use, using the circuit modification proposed by Arcata to remedy the failure. This modification is to reduce the time constant in the plate circuit of V201 to that used in the 300 pulse-per-second NBS transmissometers. The modification consists of

changing the value of R102 to 0.5 megohm and of C102 to 0.005 microfarad. A number of "defective" tubes operated satisfactorily in the modified circuit. Since transmissometers using the modified circuit have operated satisfactorily for nearly 10 years, it is recommended that the receiver circuits of all transmissometers be modified by this change in order to eliminate the possibility of failures of this type.

b. Airfield Lighting and Marking.

An inspection trip to the plant of the Hevi Duty Electric Company was made with Mr. Lewis of the Bureau of Aeronautics on August 5 and 6 and the preproduction brightness-control transformer for shore-based optical glide-path systems was inspected.

In cooperation with representatives of the Bureau of Aeronautics, tentative requirements for a light-weight optical glide-path system for forward area use have been developed. The system would consist of a number of source lights aimed in the direction of the approach and located 50 to 75 feet behind datum bars. No mirror or its equivalent would be used. The datum bars would be elevated so that the plane through these bars and the source lights would be the plane of the glide path. The total power consumption would be about 1.5 kilowatts. Lamps (type 4519, 100-watt, 13-volt) and color filters sufficient for field evaluation have been ordered.

c. Seadrome Lighting.

Four corner identification lights have been completed and shipped to NAS Norfolk for installation in the sealane lighting system now being installed there.

A sample 500-watt, 20-ampere, C-8 filament, T-24 bulb lamp for buoy-mounted, cable-fed sealane lights has been received from the General Electric Company. Preliminary tests indicate that this lamp will be very satisfactory. A quantity of 180 lamps of this type are being purchased for field evaluation of medium-intensity sealane lights. Delivery of these lamps is expected next quarter.

A design for a photoelectric control for turning the type FM6B battery-operated, buoy-mounted sealane lights on and off has been developed. This system would use lights of two colors, red and "minus-red" to control the lights. The control would be operated from a projector on a service boat. It is expected that the controls could

be operated from a distance of as much as 50 feet. This would be much more convenient than the use of the present switch which is operated by a boat hook. In addition, daylight would turn off the lights. Parts for an experimental unit have been ordered.

A number of conferences have been held with representatives of the Bureau of Aeronautics and the Naval Engineering Facility to develop standard drawings for seadrome lighting systems.

d. Carrier Lighting and Marking.

The joint Navy-Contractor meetings held at the Naval Air Engineering Facility, Philadelphia, Pennsylvania, on July 19 and at the Burroughs Research Center, Paoli, Pennsylvania, on September 11 were attended. At these meetings the results of NBS studies in this field were presented and their bearing on the designs of optical glide path systems proposed by the contractors discussed.

e. Lights for Carrier-Deck Personnel

An improved version of the NBS lighted suit equipment for carrier landing signal officers is now in production and fleet deliveries are expected shortly. Figures 1 and 2 are photographs of this equipment.

A development program is under way for new and improved lighting aids for carrier deck personnel. Models of an improved director's wand have been designed and constructed. The new wand is appreciably smaller and lighter than the old one and provides higher, more uniform brightness with lower powered lamps. An added feature is the use of rechargeable batteries of long life. With these batteries, the wands can be plugged into suitable chargers when not in use and will be available, fully charged, when needed.

For the use of directors, in addition to the usual wands, a strip of lights to be fastened across the chest or belt has been developed. It is anticipated that the chest strip may be helpful in two ways: 1) as an identification of different directors or of the operative director, and 2) as a means of providing a relatively stable reference line to aid the pilot in orienting himself with respect to the director's signals.

Another development is the "eyeball" light, consisting of a pair of light fixtures mounted on goggles or on a headband, aimed in the direction the wearer is looking, which serve either as a

work light, replacing a hand-held flashlight, or, in combination with suitably mounted retroreflective materials, as a means of finding key locations such as catapult slots, attaching gear, etc.

To study the operations of deck personnel at night and thereby to help in the development of lighting aids, and to demonstrate some preliminary model equipment, two members of the section went out on the Saratoga for a cruise. The cruise was helpful in defining the problems precisely. The equipment demonstrated was found of considerable interest by carrier personnel, and discussion with several officers and men was fruitful in setting up basic requirements and detailed design requirements.

f. General Laboratory and Consultive Services.

Photometry of Flashing Lights. The material in NBS Report 4554 "Computation of the Effective Intensity of Flashing Lights" was prepared for formal publication. It is expected that this paper will be published in the December issue of Illuminating Engineering. This paper was also presented at the National Technical Conference of the Illuminating Engineering Society held at Atlanta in September. The material in NBS Report 5294, "Photometer for the Measurement of the Effective Intensity of Condenser-Discharge Lights," has also been prepared for formal publication and has been accepted for publication in Illuminating Engineering.

Kinorama. The Kinorama, which had been shipped from this Bureau to the School of Aviation Medicine, Randolph Air Force Base, on October 17, 1956, was installed, at the request of Colonel Richard S. Fixott, in the laboratory of the Department of Ophthalmology, Clinical Medicine Division. The device will be utilized in an evaluation and research program being conducted under the direction of Dr. Siegfried J. Gerathewohl. The immediate objective is an evaluation of the relative merits of runway and approach-light configurations. The research aspect of the program will include investigations such as one to determine if there can be isolated from a configuration some basic elements each of which conveys to an observer some elementary bit of information regarding his attitude, position, or motion.

g. Personnel.

Mr. David B. Sirota, GS-7, returned to leave-without-pay status on September 15, 1957 to continue work toward his Master's degree.

III. VISIBILITY AND BRIGHTNESS TESTS, SURVEYS, EVALUATION AND ANALYSIS OF VISUAL LANDING AIDS, BASIC TESTS AND EQUIPMENT, AS A FIELD SERVICE AT ARCATA, CALIFORNIA (TED NBS-AE-10011).

a. Airport Lighting and Marking.

Turn-off Lights. Runway lights were installed at one taxiway turn-off for turn-off indication. These lights were installed in line with the existing runway lights and spaced 10 feet apart longitudinally, the first one from the taxiway being in line with the point of tangency of the fillet with the runway paving edge. The lights were mounted on metal stakes driven into the ground. Pipe flanges are being mounted on heavy square metal plates to replace the stakes to facilitate different arrangements and placement at this and other intersections with taxiways. It is proposed that moving pictures be taken from an airplane of the different arrangements and placement of these turn-off indicator lights. Results of observations and pilot reports to date are inconclusive.

Approach Beacons. Construction of two approach beacons has been completed. The beacons will be installed at an air station for operational evaluation. Six transformers and contactors meeting the requirements given in the Progress Report for April to June 1957 (NBS Report 5445) have been ordered for this and other field installations.

Runway Distance Markers. A report describing the results of field tests of runway distance markers of the type specified in Bureau of Aeronautics Instruction 11012.1 has been completed and released (NBS Report 5466). The results of this work indicate:

1. That the effective range in daylight of the specified marker (1600 feet in clear weather) is satisfactory.

2. That the effective range at night of the floodlighted marker (1300 feet in clear weather) is marginal in fog when the runway lights are operated at high brightness settings.

3. That the use of fluorescent orange paint for the background of the marker in place of the specified international orange paint is undesirable by day and by night.

4. That the type 75PAR38/FL lamp is a suitable lamp for illuminating the markers. If two 75-volt lamps of this type (one for each side of the marker) are connected in parallel across the secondary of a

200-watt isolating transformer with a 6.6-ampere secondary, the marker lights may be supplied from the runway-lighting circuit. The illumination on the marker is satisfactory at all brightness settings of the runway light.

5. That glare from spill light may be a problem. In an effort to overcome the disadvantages of a floodlighted type of marker, tests are being made of a "domino-type" marker described in NBS Report 5445. A new domino marker was constructed in order to increase the separation between the individual lamps. This sign is 4 by 6 feet and is mounted with the lower edge one foot above the ground. Observations were made in restricted visibility using "beehive" lenses on the lamps. Results of this work are given in figure 3.

b. Electrical Engineering.

Survey Trip. The first draft of the report of the visual landing aids survey of seven West Coast air stations was reviewed carefully. All of the data and notes of conference discussions have been studied to obtain additional worthwhile suggestions which should be included in the report. The final draft of the report should be completed during the next quarter.

Maintenance Manual. Following a request from the Bureau of Aeronautics for 400 copies of NBS Report 5243, "Maintenance of Air-field Lighting Systems, Part III, Troubleshooting of Series Circuits," the text of the report was reviewed carefully and several minor clarifications and corrections made. The troubleshooting charts, pages 27 to 36, are being redone in larger type to improve their legibility. Work on the remainder of the manual is expected to be resumed soon.

Cable Tracing. The preproduction model (Serial No. 1) and a production model (Serial No. 44) of Cable Test - Detecting Set TSM-11 have been received from the manufacturer after replacement of the defective electrolytic capacitors with tantalum capacitors. The sensitivity and selectivity of both units were checked in the laboratory in Washington and found to meet the specification requirements. A preliminary check of Unit No. 1 was made in the field, using the circuit for the flush runway lights on runway 01-19. The sensitivity of the unit was much better than the last time it was used and the 60- and 120-cycle interference was much lower. Thus it appears that the results of earlier tests of this unit are not representative of the performance of a satisfactory unit.

c. Research on Visibility and Visibility Measurement.

Effective Intensity of Composite Light Sources. The final draft of the report giving the results of effective intensity measurements of composite light sources has been completed and the report is being prepared for reproduction.

Effective Intensity of Flashing Light Sources. Field observations in low visibility of the effective intensity of a Westinghouse krypton light have been completed. The light has been shipped to Washington for photometry.

Brightness Meters and Illuminometers. The horizon-brightness and vertical illuminometers were received from Washington and placed in service again. One of the autopots that had been repaired recently would not operate. Investigation of the cause showed that the upper suspension wire of the galvanometer had broken. This unit will be repaired by a local jeweler upon receipt of a length of suspension wire.

Transmissometers. Operational checks of performance of the modified indicator bridge are being continued. The zero and calibration settings of the modified bridge are much more stable than the settings of the present 5-milliampere bridges and are somewhat more stable than the settings of the 1-milliampere bridge, particularly during periods of low transmission and during warmup periods.

d. Facilities.

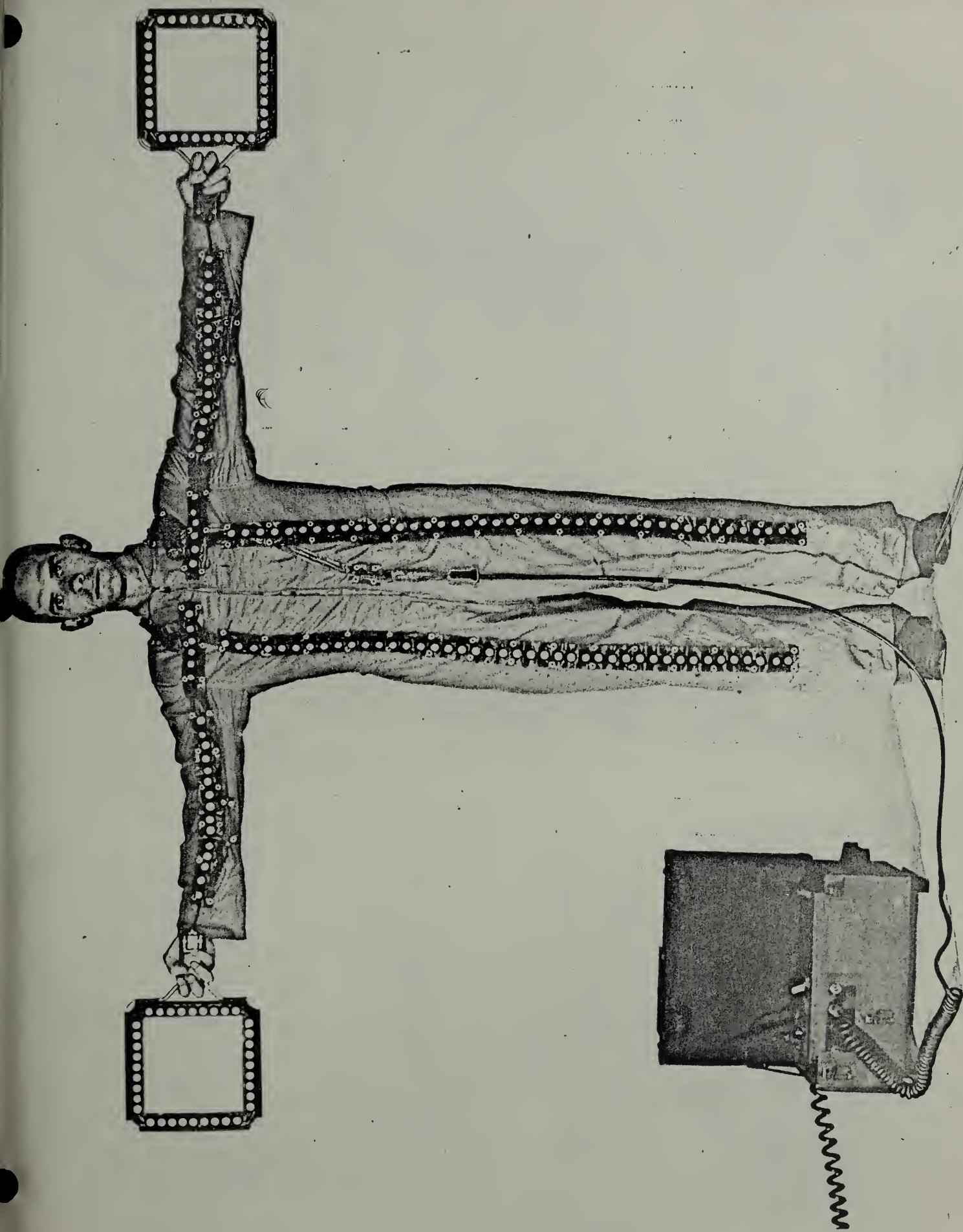
The Humboldt County Department of Aviation has offered to provide space for a 35-foot photometric range in the former Administration Building. This range will provide a convenient place for the calibrating and checking of equipment which must be done either in Washington or with temporary setups in the warehouse.

On July 6 a navy aircraft from VS-21, San Diego, crashed into the ocean off Trinidad Head. Search and rescue operations were set up in the control tower on the airport. Vehicles, radio and telephone communications facilities of the Field Laboratory were made available to the Navy personnel assigned to this search and rescue mission.

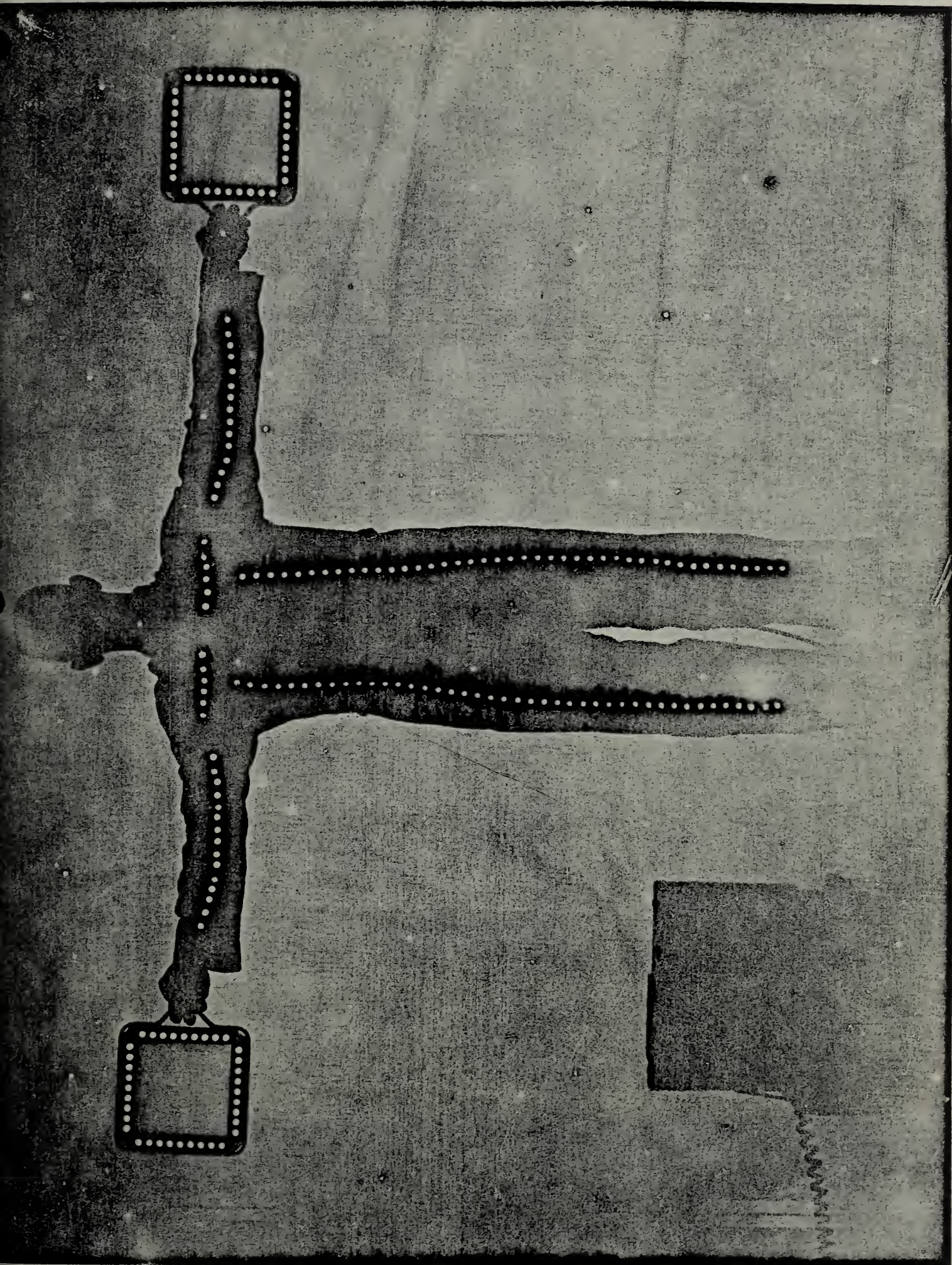
e. Personnel.

Mr. Richard L. Woodcock, GS-5, resigned on August 9, 1957 to accept employment in another field.

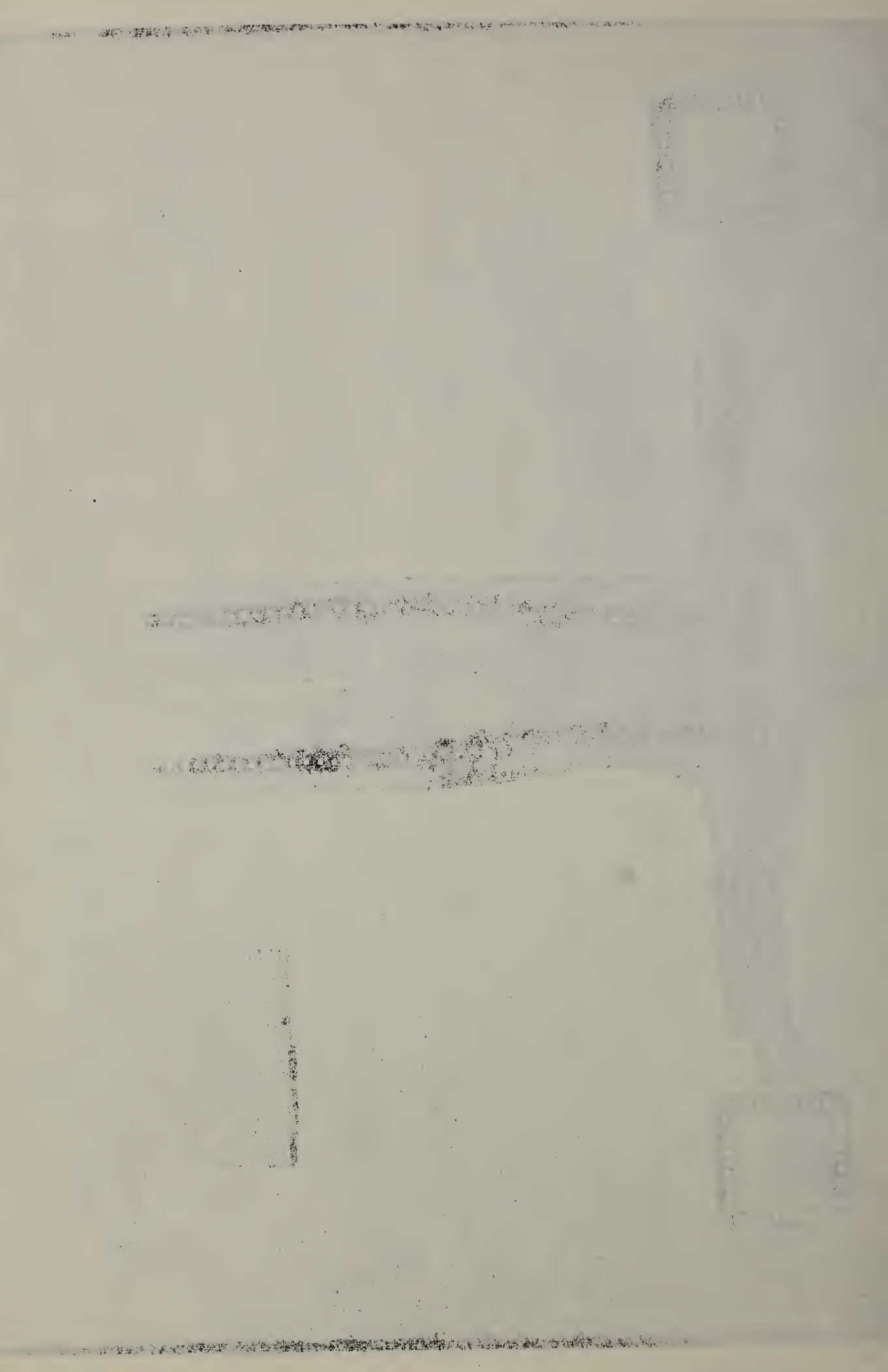
Mr. James E. Freiheit, GS-4, returned to WAE status on September 8, 1957 to continue his studies.

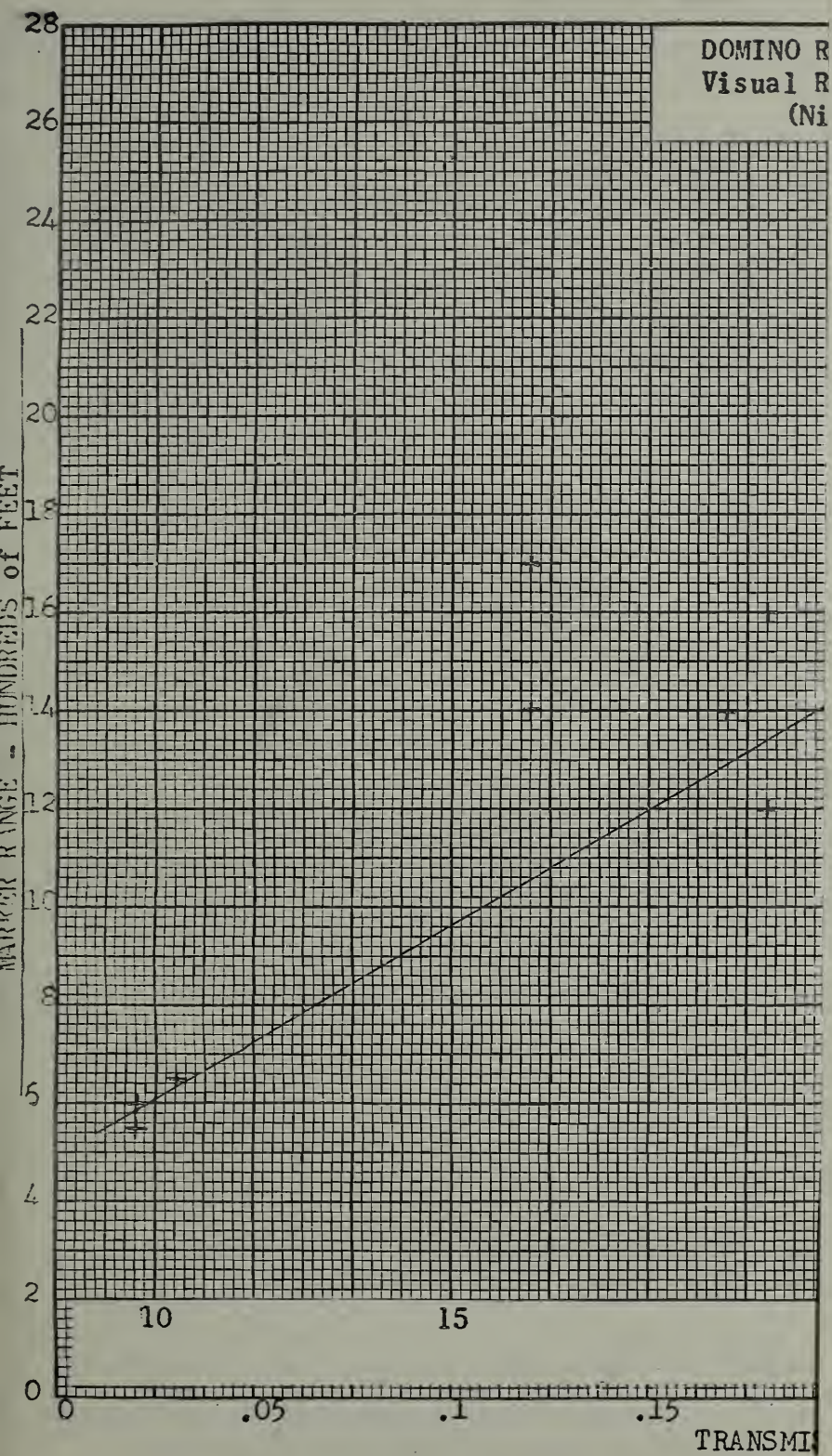


Lighted Suit for Landing Signal Officer (Day View)



Lighted Suit for Landing Signal Officer (Night View)





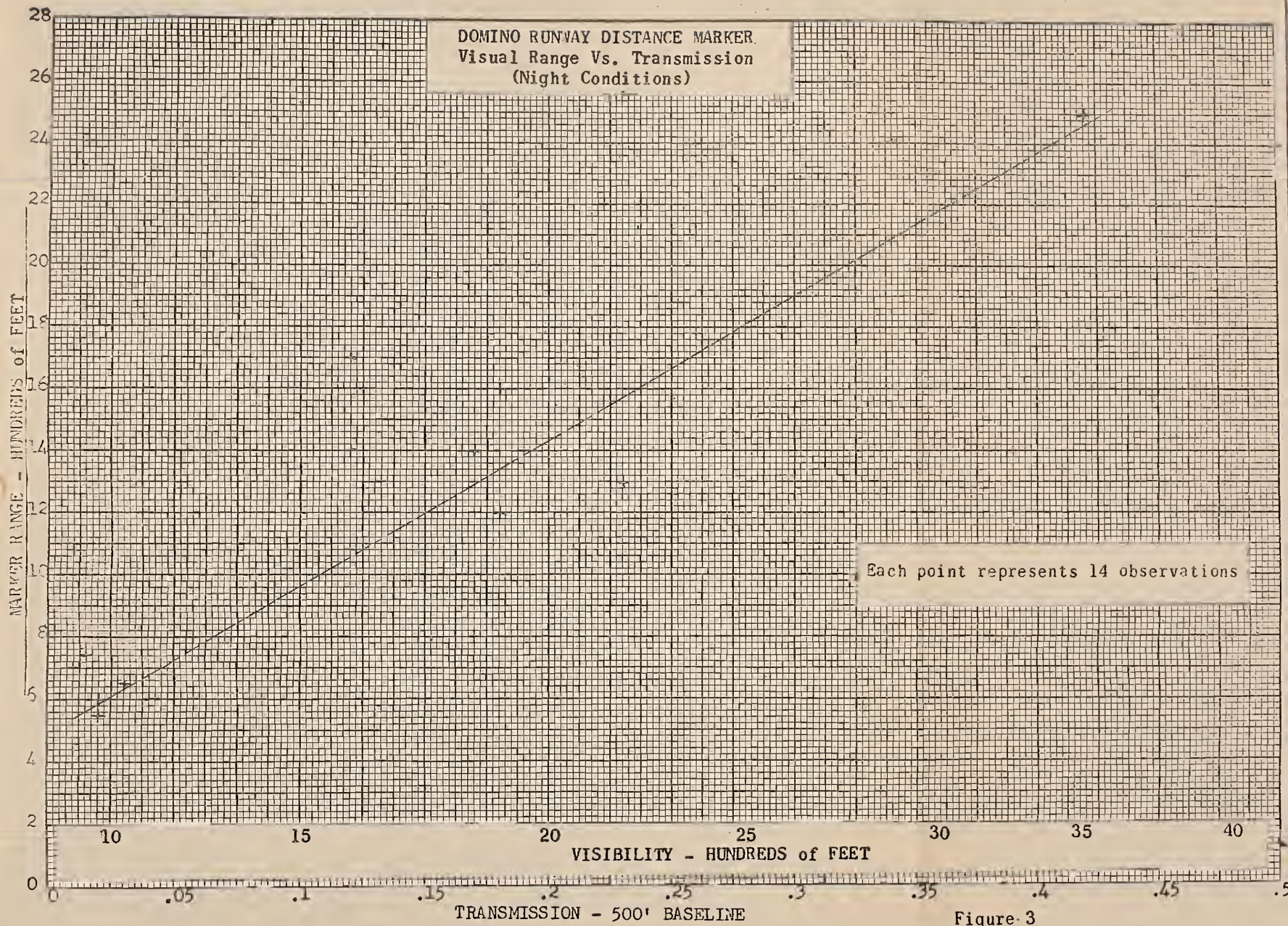


Figure 3

