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Development, Testing, and Evaluation of
Visual Landing Aids

Consolidated Progress Report

to the

Airborne Equipment Division
Bureau of Aeronautics
Department of the Navy

For the Period
January 1 to March 31, 1955

for
Bureau of Aeronautics Projects

TED No. NBS-AE-10002
TED No. NBS-AE-10006
TED No. NBS-AE-10008
TED No. NBS-AE-10011

NBS

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

Development, Testing, and Evaluation of
Visual Landing Aids

January 1 to March 31, 1955

I. REPORTS ISSUED

Report No.	Title
21P-18/55	Electrical Characteristics of the Preproduction Model of a Cable Test-Detecting Set AN/TSM-11
3900	Development, Testing, and Evaluation of Visual Landing Aids, Consolidated Progress Report for the Period October 1 to December 31, 1954
	Operational and Technical Requirements, Identification Lighting of Tall Towers (Daylight Operation) Draft 1
	Operational and Technical Requirements, Obstruction Lighting of Tall Towers (Night and Twilight Operation) Draft 4.

II. TED No. NBS-AE-10002. GENERAL RESEARCH, LABORATORY AND CONSULTATION SERVICES IN CONNECTION WITH SPECIALIZED LIGHTING PROBLEMS, VISIBILITY AND FOG MODIFICATION

a. Visibility Meters and Slant Visibility

Transmissometers: A visit was made to the plant of the Crouse-Hinds Company where assistance was given the resident Inspector of Naval Materiel in the inspection of the 10 transmissometers being procured by the Navy Aerology Branch.

The revisions of text and illustrations of the transmissometer instruction manual (NBS Report #2588) have been completed and the manual sent out for reproduction.

Slant Visibility Meter: The details of the scan drive have been completed and tested. Wiring diagrams of the drive have been made, an intermittently defective capacitor and resistor in the detector have been located and replaced. The instrument has been sent to the field laboratory at Arcata for installation.

Brightness Meters: The ratio of ground to horizon sky brightness has a marked effect on the visual range of objects seen against terrestrial backgrounds, for example, runways and runway markings. Further exploration of the variations in this ratio with azimuth, solar elevation, type of weather and location, is planned for the Arcata Field Laboratory. To facilitate the work, photoelectric brightness meters and illuminometers which will automatically scan the horizon sky and record the measurements have been designed and are being constructed.

e. General Laboratory and Consultive Services

Marking of Tall Towers: Several meetings of Panels of the AGA Ad Hoc Group studying the lighting and marking of tall television and radio towers have been attended. Drafts of the operational requirements for night obstruction lighting and day identification lighting were prepared for the Ad Hoc Group. After minor changes these drafts were accepted for forwarding to the AGA Subcommittee. The day identification lighting is based on the system outlined in our Progress Report for October 1 to December 31, 1953 (NBS Report 3136).

Characteristics of Retroreflectors: The specific intensity data of 21 colored retroreflective samples have been prepared in report form and a report has been drafted.

Cable Test Detecting Set: The preproduction unit of the Cable Test-Detecting Set has been received, tested, and a report released. This set exceeds all the major specification requirements. It is approximately 7 times as sensitive as the Model OBB Cable Locator and has much better interference rejection.

Mirror Guidance System for Carrier Landings: A unit which will be used to demonstrate several proposed wave-off signals to pilots landing on the Mirror Guidance System has been designed and is being constructed.

Computation of the Effective Intensity of Flashing Lights: A mathematical analysis has been made of the effects of changing the limits of the integral of the Blondel and Rey relation

$$I_e = \frac{\int_{t_1}^{t_2} I\,dt}{a + t_2 - t_1}$$

on the effective intensity, I_e. It was found that the maximum value

of I_e is obtained when the times t_1 and t_2 are the times when the instantaneous intensity, I, is equal to I_e.

Use of this fact will facilitate the specification testing of flashing lights and provides a reliable means of determining the visual range of these lights. A report covering this work is being prepared.

Approach-Light System Design: Technical advice and assistance has been given members of the Visual Landing Aids Branch in developing the design of an approach-light system for field test at NAS, Atlantic City.

V. TED NO. NBS-AE-10011. FIELD SERVICE OPERATIONS

a. Airfield Lighting

Approach Beacons: Pilot reaction to the approach beacons has continued to be favorable. The pilots desire the beacons on for all approaches at night. Most pilots prefer to have the beacons on high intensity until they have located the runway lights and then, in clear weather, to have the intensity reduced to the low setting. In the past these changes in intensity with power on damaged the relay contacts since frequently the low intensity relay would close before the high intensity relay had opened. This has been eliminated by the installation of a suitable switch to control the relays. Pilot comment has indicated a need for threshold lights of higher intensity. To meet this need, 14-inch projectors with 250-watt, 12.5-volt, C-8 filament lamps have been installed.

c. Research on Visibility Measurements and Visibility Meters

Transmissometry: Checks of the total time required for maintenance and scheduled preventive maintenance checks of the transmissometers during this period indicate that approximately 8 hours per instrument per month is required.

A study has been made of the causes of stray light reaching the receiver of the transmissometer being used to measure the errors produced by scattered light. This light was found to be the result of diffraction around the disc which cuts off the direct light from the projector. Since this cannot be avoided, all measurements will be corrected for the increase in reading produced by diffraction.

Slant Visibility Meter: The slant visibility meter has been

received and the plans for the installation are being made. It is expected that the installation will be completed by May 1.

Effective Intensity of Flashing Lights ("Strobeacon") and of Composite Lights (Slopeline Units): The effective intensity data of the "Strobeacon" have been compiled and the reduction of the data has been completed except for corrections for the angular size of the light and of the comparison light. The effective intensity of this light is substantially independent of test distance (except for the effect of angular size). The effective intensity is about 6000 candles by night and 16,000 candles by day. Application of the Blondel and Rey Law to the intensity-time data given in LAES reports gives an effective intensity of about 9000 candles.

Editing of the draft of the report giving the results of specific intensity determinations of slopeline units has been completed. The "size" and "row" factors developed by DeBoer have been applied to these data. The agreement between our field measurements and DeBoer's laboratory data is good when the visual range of the units is more than about one-half mile. For very short visual ranges, our measured effective intensities lie between the effective intensities computed from the "size" and "row" factors and approach the intensity of a single lamp of the unit. In general, when the visual range of a unit is more than one-half mile, changing the number of lamps in the unit will produce a proportionate change in the effective intensity of the unit.

d. Electrical Engineering

Airfield Lighting Maintenance Manual: The introduction to the trouble shooting section for series circuits has been drafted and is being edited. The draft of the step-by-step trouble shooting procedure has been checked and revised. A detailed block diagram of airfield lighting circuits has been prepared. The preliminary design of the trouble shooting charts has been completed.

GENERAL

Mr. James E. Davis, Electrical Engineer (Airport Lighting, GS-9) has been reappointed. He reported for duty March 31. The complement of the Field Laboratory is again complete. There have been one or two vacancies since May 1954. Since there are only four positions, these vacancies have caused considerable delay in the progress of the work.

The high-voltage feeder cable to the visibility site deteriorated to the extent that 3000 feet of it required replacing.

A number of fogs of short duration occurred during this period. Tests in these fogs were confined largely to the determination of the effective intensity of approach beacons and to studies of recognition and detection thresholds.