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Training Directive)
No. 39)

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NAVIGATIONAL TRAINER - MARK IV

1. General

This Directive deals with the use, care, and maintenance of the Mark IV Navigational Trainers made available to Civil Air Patrol by the Special Devices Division of the Bureau of Aeronautics, United States Navy and allocated to the forty-eight CAP Wings for use in the Training Program. The material presented herein is intended to supplement the "Operation Manual and Parts Catalog - 1-E-4 - Navigational Trainer - Mark IV", (NavAer No. 30-10R-79), a copy of which accompanies each trainer. For the benefit of those who are not familiar with this training device, certain descriptive material taken from the Operation Manual is included in this Directive.

2. Purpose

a. The primary purpose of the Mark IV Navigational Trainer is to provide ground facilities for training pilots in dead reckoning. It may also be used for navigation practice and check-out. Pilots may run through a simple mission or may execute a complicated search and interception. Students may be checked in radio procedure through a telephone installation simulating two-way radio.

b. It is important that all CAP flight personnel attain a high degree of proficiency in practical dead reckoning navigation. The excellent net-work of radio aids to air navigation provided on the airways through the United States tends to cause pilots to form the habit of relying largely on radio aids in cross-country flying. However, aircraft radio equipment may become ineffective due to mechanical failure of a component part or because of severe rain, snow, or thunder-storm conditions. Under such circumstances, the pilot who has neglected his dead reckoning is at a decided disadvantage. The ground training obtainable through the proper utilization of the Navigational Trainer affords an excellent means of raising the level of proficiency of CAP personnel in dead reckoning navigation.

3. General Description

a. The Mark IV Trainer is a complete mockup of the cockpit of a training plane. It is mounted on a cart which may be closed to simulate instrument flying. It is powered with storage batteries and in response to manipulation of all normal controls, moves over any reasonably level available

space at the rate of one foot of travel per nautical mile of flight. Thus, the Trainer travels two and one-half feet per minute at an indicated air speed of 150 knots.

b. The pilot controls the movement of the Trainer through the use of the throttle, stick and rudder, exactly as he would a training plane. The speed of the Trainer is governed by the throttle, and is registered on the airspeed indicator. Direction is controlled by the rudder pedals and is registered on the rate-of-turn indicator. Rudder pedals and the rate-of-turn indicator are coordinated to execute and indicate a standard turn at 150 knots; at other speeds inaccurate readings will occur.

c. The stick is used in the normal manner for climbing and diving and the corresponding maneuver is indicated on the rate-of-climb instrument. Thus, if the stick is pulled back, a climb is indicated, the registered altitude will increase and the throttle must be advanced to maintain constant air speed. If the throttle is not advanced, registered air speed will fall off and the speed of the Trainer across the deck will decrease proportionately.

d. In addition, an aircraft clock and a magnetic compass provide sufficient instruments to supply all data necessary for the solution of dead reckoning and navigational problems.

e. The course "flown" by the student is traced on the deck by means of a chalking device located at the pivotal point of the Trainer. Thus, an accurate record of all maneuvers and of the start and finish points is provided. A student's flight pattern can be checked against pre-computed reference points previously marked on the deck. Such reference points are visible to the student only through a sliding hatch at his feet. This hatch, when opened, automatically turns on a tell-tale light visible to the instructor.

f. With the hood closed, the student cannot take bearings on stationary objects and must rely entirely on his instruments. Should the instructor prefer not to mark points and headings on the deck, the student may fly with the hood up and have the finish point checked on the basis of an air plot.

4. Space and Storage Requirements

a. The area available for the use of the Trainer determines the scope of the problems that may be assigned. In general, problems requiring not more than 50 minutes to complete can be executed in a space measuring 75 feet square. If space is limited, longer problems can be worked out by assigning headings corresponding to the diagonals of the area.

b. Since the Trainer is battery operated it may be used anywhere, indoors or outdoors, wherever space is available. However, decks should be level and smooth and must be capable of sustaining the weight of the Trainer, which is approximately 1,000 lbs. If an outdoor space is selected, facilities for under-cover storage, with electric outlets for charging batteries, should be available.

c. The Trainer is adaptable to all climatic conditions, having a cockpit of sufficient size to accomodate students wearing winter flying gear, as well as an air circulating fan for comfort in warm climates.

5. Responsibility of Unit Commander

The Commanding Officer of each unit to which one of the Navigational Trainers is assigned will be held responsible to see that every possible means is used to insure that proper care is taken of this training aid. The following instructions will be closely followed:

a. Keep Trainer locked at all times when not in use.

b. Assign a responsible CAP instructor, with such assistants as may be necessary, in charge of Trainer.

c. Restrict use of Trainer to official CAP training operations conducted under the personal supervision of one of the assigned instructors.

d. Assign a qualified CAP mechanic in charge of inspection, maintenance, and repair of Trainer.

e. If possible, arrange for instructors and mechanic to visit some Naval Air Station in the vicinity and take instruction in the operation and maintenance of the Trainer.

f. If possible, arrange for a Navigational Trainer Operator from the nearest Naval Air Station to visit the unit and demonstrate the use of the Trainer.

g. Make every effort to eliminate breakage, as replacement parts are difficult to obtain.

h. Require those responsible for the operation and maintenance of the Trainer to become thoroughly familiar with the Operational Manual, to apply at frequent intervals the periodic check-up set forth on page 22 of the Manual, and to maintain the Trainer in strict accordance with the printed instructions.

6. Prerequisites for Training

CAP members, whether seniors or cadets, who have successfully completed the course of training in air navigation prescribed in either (a) Training Directive No. 13, this Headquarters, 14 February 1942, "Air Navigation", or (b) paragraph 45, "Air Navigation", Training Directive No. 35, this Headquarters, 1 January 1945, "CAP Ground and Preflight Training Program", and who desire to receive advanced instruction in practical dead reckoning are eligible for instruction in the Navigational Trainer.

7. Mark 3-A Aircraft Navigational Plotting Board

a. A Mark 3-A Aircraft Navigational Plotting Board, mounted on a movable tray attached to the inside right wall of the cockpit, is standard equipment of each Navigational Trainer. The Plotting Board consists of a transparent, matte-finish, plastic plotting surface upon which pencil marks can be made and erased. A compass rose stamped in black, an arrow indicating true north, and a Mark VIII Aircraft Navigational Computer attached to the lower right corner complete the transparent board, beneath which is a special plotting disc fastened at and rotating about the center of the compass rose. A glove snap holds the disc to the board and permits the use of either the high speed or the low speed side. To avoid complications, it is recommended that CAP units use the low speed side in their early experience with this device. The Mark 3-A board combines the functions of a small area plotting sheet, dead reckoning computer, plotter, protractor, parallel rules and dividers. Copies of NavAer 05-35-527, "Instructions for the Use of Aircraft Navigational Plotting Board", have been mailed to all Wing Headquarters in order that each unit receiving one of the Navigational Trainers may be supplied with two copies of these instructions, no additional copies of which are available for distribution. An understanding of the use and operation of the Mark 3-A Plotting Board is necessary if the student is to derive full benefit from the use of the Trainer. Students should become thoroughly familiar with the technique of solving the simple problems of dead reckoning navigation before going on to the more involved problems of interception and scouting.

b. All work on the Plotting Board should be done with a soft pencil, as hard lead will scratch the plastic surface; - a No. 2 lead is satisfactory. Either a red rubber or art gum eraser is recommended for cleaning the board after each problem has been completed. Avoid using a course rubber ink eraser.

c. All Wings have been supplied with large-scale working models of the Plotting Board and the Computer for instruction purposes. These training devices should be circulated within the Wings in order that all units having Navigational Trainers may take advantage of their use for classroom instruction.

(1) The model of the Plotting Board is an enlarged "blackboard" version (40" x 40" x 1") of the standard instrument. It is made of clear plastic with a matte surface on which calculations may be made and diagrams drawn in soft pencil or chalk. Operation and results are identical with those of the regulation plotting board. Instructors and students are cautioned to use only soft eraser or cleaning materials to preserve the surface of the plastic.

(2) The large scale Navigational Computer is an enlarged "blackboard" model (40" x 40" x 1½") of the standard MK VIII Navigational Computer. It is made of a tempered composition material with numbers and calibrations in black on a white painted surface and the operation and results are identical with those of the operational instrument.

8. Navigational Data Sheet

Attached hereto is a Navigational Data Sheet, developed by Navy personnel, which may be used as a part of the Mark 3-A Aircraft Navigational Plotting Board by cutting out the tabulation and fastening it to the underside of the upper right corner of the board with cellulose tape in such manner that the lettering is next to the board and visible thru the transparent plastic material. The data in the left column of the sheet pertains to the direction and force of the wind at the surface and at various altitudes; the middle column provides for data relative to a surface vessel, usually an aircraft carrier; and the right column is devoted to data pertaining to the navigation of the aircraft. The abbreviations used in the data sheet, familiar to most pilots, are listed in the accompanying glossary.

9. Operational Suggestions - Navigational Trainer

The following operational suggestions will serve as a supplement to the detailed information presented in the "Operation Manual and Parts Catalog" referred to in paragraph 1 of this Directive.

a. Fast Rate Clock

The use of the fast rate clock referred to on page 5 of the Manual is not recommended. This clock is geared to run at three times the rate of the regular clock, and while it allows the student to negotiate greater "distances" without increasing the actual distance the Trainer travels over the ground, it presents a distorted and disturbing influence on all timed turns. Use the standard type Navy aircraft clock on the instrument panel.

b. Rough Air Cleats

The use of rough air cleats referred to on pages 5 and 6 of the Manual should be avoided until such time as the student has obtained proficiency in the performance of simple missions in the Trainer.

c. Bank and Turn Indicator

The description of this instrument on page 9 of the Manual states, "In 2-needle position, the Trainer will make a standard 180° turn in one minute." The 2-needle position refers to a new type turn indicator and is equivalent to the 1-needle width turn of the instrument familiar to the average pilot.

10. Inspection, Maintenance, and Repair

a. All Mark IV Navigational Trainers will be inspected, maintained, and repaired by the CAP unit having jurisdiction, in strict accordance with instructions contained in the "Operation Manual and Parts Catalog", referred to in paragraph 1 hereof. Said work will be in the charge of a qualified CAP mechanic assigned to this duty by the unit commander, as provided in paragraph 5d hereof.

b. While the procedure to be followed in battery maintenance is set forth in detail on pages 21 and 22 of the Operation Manual, it is recommended that when batteries are initially placed in operation, they be serviced and charged by a reliable local battery service station.

c. Requests for repair and replacement parts will be prepared with complete nomen clature and parts numbers as listed in the Parts Catalog and forwarded to National Headquarters through CAP channels.

11. Restricted Use

The Navigational Trainer is an expensive piece of equipment, the use of which will be restricted to official CAP training conducted in accordance with the provisions of this Directive under the personal supervision of qualified CAP instructors assigned to such duty.

BY ORDER OF COLONEL JOHNSON:

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NAVIGATIONAL DATA SHEET

WIND DATA			ACFT. CARRIER				AIR NAVIGATIONAL DATA						
ALT	FROM	FORCE	NAME				LEG	1st	2nd	3rd	4th	5th	6th
			TIME				CH						
			CUS				MH						
			SPEED				VAR						
			LAT				TH						
			LONG				TAS						
			BRG				PA						
			DIS				T						
			FROM				CAS						
							IAS						
							DRM						
							SRM						
							MRM						
							CUS						
							TR						
							GS						
							MC						
							MTR						
							MIN						
							TD						
							LAT						
							LONG						
							TA						
							LAT						
							LONG						

GLOSSARY OF ABBREVIATIONS

ACFT	Aircraft
ALT	Altitude
BRG	Bearing
CAS	Calibrated Air Speed
CH	Compass Heading
CUS	Course
DIS	Distance
DRM	Direction Relative Motion
GS	Ground Speed
IAS	Indicated Air Speed
LAT	Latitude
LONG	Longitude
MC	Miles on Course
MH	Magnetic Heading
MIN	Minutes on Leg
MRM	Miles Relative Motion
PA	Pressure Altitude
SRM	Speed Relative Motion
T	Temperature
TA	Time Arrival
TAS	True Air Speed
TD	Time Departure
TH	True Heading
TR	Track
VAR	Variation