

# STUDENT HANDOUT

## INSTRUMENT FLIGHT SUBJECTS

### BOOK II

5/69



JULY 1969

DEPARTMENT OF ADVANCED FIXED WING TRAINING  
UNITED STATES ARMY AVIATION SCHOOL  
FORT RUCKER, ALABAMA

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WRITTEN BY: MAJ Harry F. Baldwin

DATE: July 1969

APPROVED BY: COL Charles R. Shaw  
Director

DATE: July 1969

## NOTES

PERFORMANCE OBJECTIVES

ATC CLEARANCE PROCEDURES

1. KNOWLEDGES: Without the aid of notes, the student will be able to—

- test*  
*questions*
- 1 → a. State the five elements of an ATC clearance in the correct sequence.
  - 2 → b. State the aviator's responsibility for complying with an ATC clearance.
  - 3 → c. State the effect of an amended clearance upon the initial clearance.
  - 4 → d. Interpret standard ATC terms, abbreviations, and phrases by stating the action required of the aviator with 80 percent of the interpretations correct.

2. SKILLS: When read, a clearance at a standard radio speaking rate of approximately 100 words per minute, the student, without the aid of notes, will be able to copy and read back common types of ATC clearances with 90 percent correctness of the key items to include clearance limit, route, altitude, name of control facility, frequency, and points for additional reports.

NOTE: For extra practice copying clearances, call 2780, Fort Rucker, for taped clearances.

STUDENT OUTLINE

ATC CLEARANCE PROCEDURES

1. ATC clearance.

a. Definition.

*ats for IFR flights in control zone*

b. Types.

c. Sequence of initial.

- I identification
- C clearance limit
- R route
- A ~~altitude~~
- S special instructions

d. Effect of amended.

*it only affects that part which is amended*

- 1. first (1) Standard instr. Dept. 310
- 2. Holding
- 3. other (freq. safety position)

e. Aviator's responsibility.

*copy and check*

1. make sure you understand it
2. be sure you can comply with it
3. Be sure you can complete flight if you lose communication
4. you can request clarification
5. you do not have to accept any clearance, but if you do accept it you must follow it.

2. Standard ATC terms, phrases, and abbreviations.

3. Practical Exercise. (Copying and reading back of clearances.)

a. -2780

b. to alt.  
over VOR V75 M

c. at  
+  
V241 out  
M 5  
FR.  
2000 + Ban  
MM 36

e. alt.  
V241  
EFV  
M16  
IFR traffic up to that altitude.

f. ALB  
M7  
OMM-2500' 3200  
Rm 02  
L alt  
3.08  
X lower on 03

an AAF

MAC V56

h.

FLO V3E

FAT DRR SM

M 5000

i.

COT at Hoboc. 2

over MAC vor

j.

JAC 7

V 100

V3E

k.

l.

STUDENT HANDOUTATC CLEARANCE PROCEDURESSome Standard ATC Terms, Phrases, and Abbreviations

**NOTE:** Knowledge of terminology and procedures is essential to understanding of clearances or requests for information. Familiar terms are easier to copy. The following list of terms, abbreviations, and phrases along with the explanation should help the student aviator to copy, check, and understand most ATC clearances. A thorough survey of the route and available facilities is also helpful.

## 1. APPROACH CONTROL:

An air traffic control unit which provides air traffic service for arriving IFR flights in a terminal area. Unit may be located at one of the area's airports or at a separate terminal area control center. Locate specific name and available frequencies under destination airport listing in IFR Supplement.

## 2. APPROACH FIX:

The fix from which final IFR approach descent to landing minima for an airport is made.

## 3. CONTACT APPROACH:

An ATC cleared approach by an aircraft operation clear of clouds with at least 1-mile flight visibility which allows flight to the destination airport by visual contact with the surface instead of the prescribed instrument approach procedure.

## 4. CRUISE:

Used in a clearance instead of "maintain" (altitude) to indicate that climb to and descent from the indicated altitude may be made at the pilot's discretion. There is no other known IFR traffic up to that altitude.

## 5. CRUISING ALTITUDE:

An indicated altitude, using the appropriate altimeter setting, which is flown during a major portion of a flight whether VFR or IFR (maintain, cruise, or VFR-ON-TOP).

## 6. DEPARTURE CONTROL:

A function of approach control providing service for departing aircraft.

## 7. DISTANCE MEASURING EQUIPMENT (DME):

Special radio equipment, airborne and ground, from which the pilot can read slant range distance in nautical miles between the aircraft and the ground station.

8. "DO YOU HAVE INFORMATION (BRAVO, CHARLIE, ETC)?"

Refers to Automatic Terminal Information Service (ATIS) at certain high activity terminals which transmit a recorded traffic pattern, runway, wind, and altimeter setting information over a navaid or separate frequency to relieve tower frequency congestion. Service and frequency indicated on Enroute Chart near airport symbol.

9. "DO YOU HAVE NUMBERS?"

Numbers refers to runway, wind, and altimeter setting which could have been heard on previous tower transmission. Pilots stating "have numbers" when contacting the tower will relieve tower from having to repeat this information.

10. EXPECTED APPROACH CLEARANCE TIME (EAC):

The time at which an arriving aircraft can expect to be cleared to begin and instrument approach procedure.

11. EXPECTED FURTHER CLEARANCE TIME (EFC):

The time at which an aircraft can expect additional clearance beyond the present clearance limit.

12. FINAL APPROACH (IFR):

The flightpath from the final approach fix of an approved procedure to the airport, point where circling for landing starts, or point where missed approach begins.

13. GROUND CONTROLLED APPROACH (GCA):

Use of airport radar to talk an aircraft through an instrument approach. Surveillance approaches will use only airport surveillance radar **ASR** while precision approaches will also use precision approach radar **PAR**. Listed in IFR Supplement under subheading "Radar" for the specific airport.

14. OUTER FIX:

A fix in the terminal area from which aircraft are cleared to the approach fix via transition routes which are depicted on terminal charts. Aircraft may be "Cleared for (specified) approach," from an outer fix. The aviator is then expected to descend to appropriate altitudes, to execute the specified approach procedure, and to make the appropriate radio calls without further ATC clearance except tower clearance to land. CAUTION: Note the terminology carefully. "Cleared to the approach fix" does not mean the same thing. In this case the last assigned altitude is maintained until approach clearance is received.

15. RADAR CONTACT:

Air traffic controller terminology used to indicate that an aircraft is identified on the radar display and that position reports will be made only on request of the controller. "Radar contact lost" or "Radar service terminated" indicates that the pilot is to resume radio contact and position reporting procedure.

16. RADAR HAND-OFF:

Transfer of control of an aircraft to another controller without loss of radar contact.

17. RADAR TRAFFIC INFORMATION:

Clock position, range, and direction of travel of other radar observed targets in the vicinity of the alerted aircraft. The pilot normally reports "traffic observed" or "no contact." The clock position given is with respect to track rather than aircraft heading.

18. RADAR VECTOR:

Aircraft heading information to provide radar navigational guidance. When given a vector which deviated from previously assigned route, the pilot should be advised what the vector is to achieve so that in the event of lost communications the aviator will know how to proceed. When given a radar vector to the final approach, the aviator is expected to make a straight-in approach.

19. RUNWAY VISIBILITY VALUE (RVV):

A specific runway horizontal visibility figure reported in miles and fractions of miles.

20. RUNWAY VISUAL RANGE (RVR):

Specific runway horizontal visibility figure reported in hundreds of feet. RVV or RVR, when reported, will be used instead of prevailing visibility for determining landing minimums.

21. SINGLE FREQUENCY APPROACH (SFA):

After contacting approach control, the same communication frequency may be used through the approach and landing. Example: Approach control states "Contact \_\_\_\_\_ GCA on this frequency." The pilot then makes an initial contact call to \_\_\_\_\_ GCA without changing communication frequencies.

22. STRAIGHT-IN APPROACH (IFR):

Final approach is begun without executing a procedure turn or its equivalent. Three common situations call for a straight-in approach, (1) when the controller states "cleared for straight-in approach"; (2) when given a radar vector to a final approach position; (3) when cleared for an approach from an outer fix which has the transition route labeled "final" or "No PT" (no procedure turn) on the terminal chart.

23. TRANSPONDER:

Also called air traffic control radar beacon receiver/transmitter which, when set and operating properly on a particular "mode and code," allows a radar controller to readily identify aircraft. An "Ident" feature actuated by a toggle switch on the transponder control head intensifies the returned aircraft signal. Example of controller terminology: "Squawk Mode 3, Code 1100, and Ident."

24. VISUAL APPROACH:

An ATC cleared approach by an aircraft operating in VFR conditions which allows a VFR approach to the destination airport instead of the prescribed instrument procedure.

25. VFR-ON-TOP:

An IFR clearance which must be specifically requested by the pilot and granted by ATC. VFR altitudes are flown; VFR flight conditions must be maintained; traffic separation is the pilot's responsibility; but IFR position reports are made. The pilot may change altitude but should notify ATC when he does.

ADDITIONAL ABBREVIATIONS AND SYMBOLS:

A/C	Approach Control
CT	Contact
D/C	Departure Control
DLA	Delay
(HOU	Houston Center, etc., with frequency
M 8	Maintain 8000
RC	Reverse Course
RL	Report Leaving
RP	Report Passing
RR	Report Reaching
T/O	Take off
SI	Straight-in
↑	Climb
↓	Descend
LT	Left Turn
↶	Left Turn
RT	Right Turn
↷	Right Turn
X	Cross
@	At

See FLIP, section II, paragraph IID for additional symbols.

PERFORMANCE OBJECTIVESRADIO NAVIGATION

## 1. KNOWLEDGES:

- a. Without using references, you should state correctly the description of—
  - (1) Approach fix.
  - (2) Traffic control purpose of the radar transponder.
- b. Given a mockup or graphic of the APX-44, C-105C, and the C-506A transponders, you should, without using reference material—correctly identify the controls on the control panels of the three types of transponders.
- c. Given a mockup or a graphic of the APX-44 transponder, you should correctly state the sequence of operation—
  - (1) To prepare the set for operation.
  - (2) To respond to ARTC instructions using the transponder.
- d. Without using references, you should state correctly in which FLIP components to find the required data to use—
  - (1) VOT.
  - (2) VOR air checkpoints.
  - (3) VOR ground checkpoints.
- e. Without using references, you should state correctly the VOR control settings to check a VOR receiver, using VOT, air checkpoints, and ground checkpoints.
- f. Without using references, you should state correctly the acceptable tolerances of VOR accuracy for air-checks and for ground-checks.

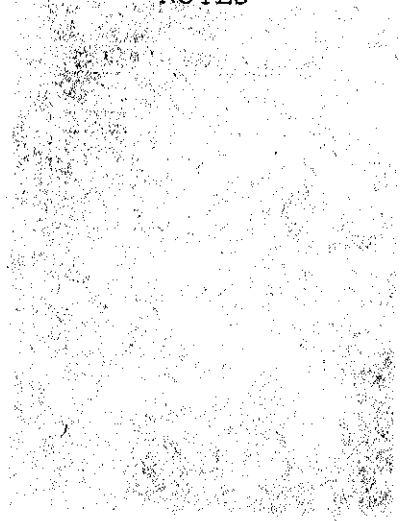
## 2. SKILLS:

- a. Given an appropriate set of RMI, magnetic compass, and ID-453 readings, you should correctly perform the following tasks:
  - (1) State the location of a radio station relative to the aircraft, or state the location of the aircraft relative to the radio station.
  - (2) State the proper heading to reintercept a given course, using the standard 30-degree method.

- (3) State the proper heading to intercept a newly assigned course, using the standard 45-degree or the standard 90-degree method.
  - (4) State when to use the 45-degree method (one case) and when to use the 90-degree method (two cases).
  - (5) State the aircraft's location relative to an airway intersection.
- b. Given an appropriate set of ILS indications, you should state correctly, without using references—
- (1) Your location relative to a projected runway localizer course and to a projected glide slope.
  - (2) What correction to make to get back on course and glide slope.

## NOTES

# NOTES



UNIVERSITY OF CALIFORNIA

BERKELEY, CALIFORNIA



GRAPHIC 2: [unclear] (5)

STUDENT OUTLINE

RADIO NAVIGATION

1. Brief review of the RMI.

a. Description.

b. Two modes of operation.

(1)

(2)

c. Mode 1; RMI is properly slaving.

(1) Verify by checking.

(a) *annunciator window*

(b) *red flag*

(c)

(2) Major index.

(3) ADF needle (No. 1 needle).

(4) VOR needle (No. 2 needle).

*is sensitive to the  
card fault.*

d. Mode 2; RMI is not properly slaving.

(1) Indications of malfunction.

(a)

(b)

(c)

(2) Major index.

(3) ADF needle (No. 1 needle).

Examples:

Examples continued:

(4) VOR needle (No. 2 needle).

(5) Stuck card or fixed card.

(a) Stuck card. How to find the bearing to the station when the card is frozen at a certain index mark.

Examples:

(b) Fixed card.

1. Definition.

2. Procedure.

3. Examples.

2. The VOR-ILS indicator (ID-453).

a. Components.

(1)

(2)

(3)

(4)

(5)

3. How to determine the aircraft's location relative to an intersection—

a. Using the RMI.

b. Using the ID-453.

(1)

(2)

(3)

4. ~~Intercepting a newly assigned course,~~ or selected course.

a. When to intercept at  $30^\circ$ .

*used for tracking*

b. When to intercept at  $45^\circ$ .

*when  $30^\circ$  or less to your present course,*

c. When to intercept at  $90^\circ$ .

(1)

*when  $> 30^\circ$*

(2)

*or told to expedite*

d. How to determine the transition heading to fly from the present location to the new course.

(1)

(2)

(3)

5. VOR tolerances and VOR check.

a. How often does the VOR aircraft receiver have to be checked?

(1) *every 10 hours*

(2) *and 10 days*

b. Ground-check tolerance.

*4° on ground  
6° in the area*

c. Air-check tolerance.

d. VOT check. Data and procedures.

(1) *sec II of flips*

(2)

(3)

(4)

*the frequency are in  
the IFR supplement.*

e. VOR ground-check or air-check.

(1) *sec II of flip*

(2)

*set me in the IFR  
supplement.*

(3)

*set 300° get course  
indicator in center, it  
should read from  
(180° read to)*

(4)

*48 tolerance*

6. The transponder.

a. Purpose. *to respond to the initial radar*

b. Mode.

c. Code.

d. Nomenclature of controls on APX-44 panel. (See graphic No. 1.)

(1)

(2)

(3)

(4)

(5)

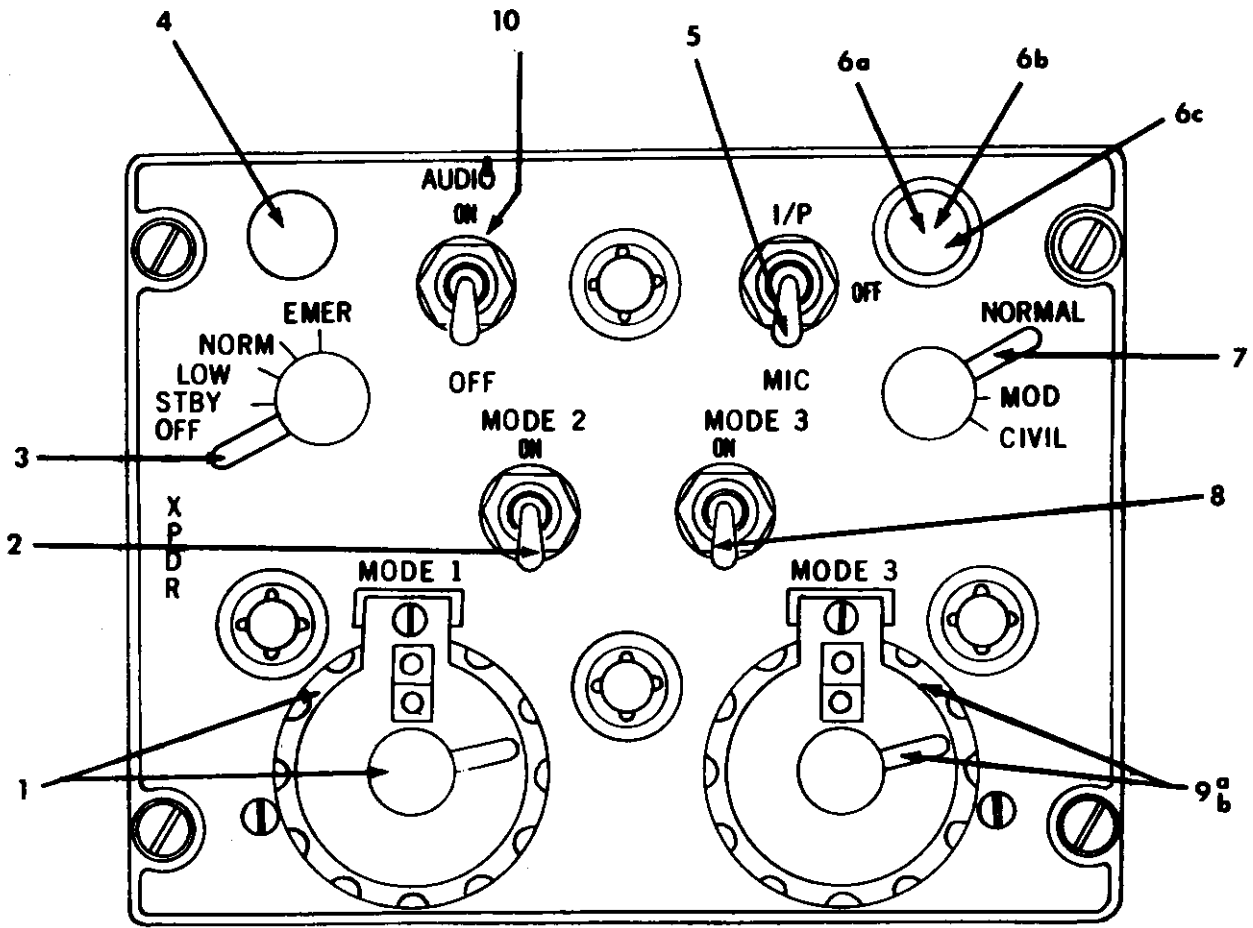
(6)

(7)

(8)

(9)

(10)



Graphic No. 1

e. Functions of the controls of the APX-44.

(1) Mode 1/ code control.

(2) Mode 2 switch.

(3) Master control.

(a) STBY position.

*for standby*

(b) LOW position.

*close to airport*

(c) NORM position.

*for greater distances*

(d) EMER position.

(4) Emergency barrier.

(5) I/P switch.

(a) I/P position.

(b) MIC position.

- (6) Light controls.
  - (a) Pilot light.
  - (b) Test button.
  - (c) Lens shutter.
  
- (7) Function control.
  - (a) CIVIL position.
  - (b) MOD position.
  - (c) NORMAL position.
  
- (8) Mode 3 switch.
  
- (9) Mode 3 or mode A/code . . . . . control.
  - (a) When to intercept at 45°.
  - (b) When to intercept at 90°.
  
- (10) Audio switch.

emergency code - 7700 for ATC.

f. Notes on the C-105C transponder.

g. Notes on the C-506A transponder.

## OPERATION

### 1. OPERATING CONTROLS.

Operating controls for the transponder are located on the C-105C Control Unit. Control switches for the transponder self-test feature are located on the self-test panel. All operating controls are illustrated in Graphic 1. Graphic 2 lists the designations and describes the functions of the controls.

GRAPHIC 1. OPERATING CONTROLS

Designation	Control	Function
<b>C-105C CONTROL UNIT</b>		
OFF-SBY-ON-LO	Function switch	Controls application of power to transponder and selects "low-sensitivity" function of the receiver.
—	Mode 3/A reply-code selector switches (4)	Select assigned Mode 3/A reply code.
—	Reply code indicator	Displays selected reply code.
ID	IDENT pulse selector switch	Selects IDENT pulse on command.
RPLY	Reply-monitor lamp	Provides visual indication of transponder operation.
<b>SELF-TEST PANEL</b>		
MODE A-C	Power control and mode selector switch	Turns on self-test feature, and selects mode of test signal applied to transponder.
RPLY ON-OFF	Reply-monitor lamp control switch	Turns off reply monitor lamp when reply monitor is not desired.

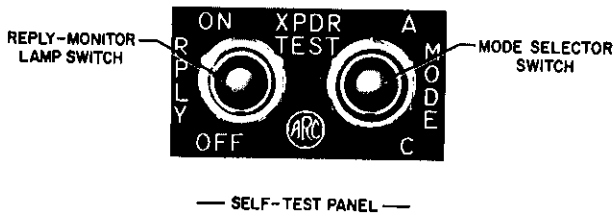
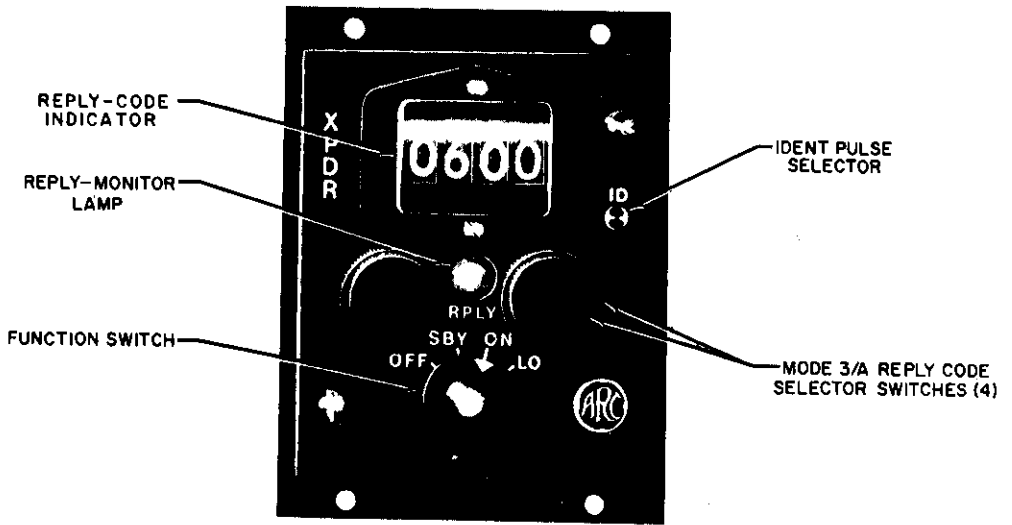
### 2. OPERATING PROCEDURES.

**General.** Except for power application, Mode 3/A reply code selection, and the selection on command of the IDENT pulse and the low-sensitivity function, operation of the transponder is automatic. The reply-monitor lamp provides a visual indication of operation.

**Power Application.** Turn the function switch to ON, and wait approximately two minutes for the set to warm up.

Turn the function switch to SBY while taxiing for take-off and after landing to eliminate undesirable interference and clutter on local radar displays.

**Mode 3/A Reply Code Selection.** Using the four reply-code selector switches, select the assigned code on the reply code indicator.



Graphic 2. 105B ATC Transponder, Operating Controls

IDENT Pulse Selection. When instructed by the controller to "squawk ident," momentarily depress the ID switch button. The IDENT pulse will be transmitted with the Mode 3/A reply for 15 to 30 seconds. Do not squawk ident unless requested to do so.

Low-Sensitivity Selection. When instructed by the controller to "squawk low," set the function switch to LO. The sensitivity of the receiver will be reduced.

Note

The transponder should be operated at normal sensitivity (function switch set to ON) except when the controller specifically requests low sensitivity.

Self-Test Operation.

Step 1. Turn on the transponder set and wait two minutes for the equipment to warm up.

Step 2. Set self-test RPLY ON-OFF switch to ON.

Step 3. Hold MODE A-C switch in A position. Reply-monitor lamp should light.

Step 4. Hold MODE A-C switch in C position. Reply-monitor lamp should light.

Note

The RPLY ON-OFF switch on the self-test panel interrupts the monitor signal to the reply-monitor lamp. It does not control the application of power to the self-test feature. The switch should be set in the ON position except when the reply-monitor indication is not desired.

3. OPERATING LIMITATIONS.

The transponder is designed to operate only to an altitude of 30,000 feet. If the aircraft is operated at altitudes over 30,000 feet, the transponder should be turned off to prevent high-voltage arcing in the transmitter cavity. Reliable operation cannot be expected beyond line-of-sight range so that high altitude is required for long range operation.

<u>Aircraft Altitude (feet)</u>	<u>Range in Nautical Miles</u>
1,000	40
5,000	80
10,000	115
20,000	160
27,000	200

## OPERATION

### 1. OPERATING CONTROLS.

Operating controls for the transponder are located on the C-506A Control Unit and illustrated in Graphic 3. Graphic 4 lists the designations and describes the functions of the controls.

### 2. OPERATING PROCEDURES.

When power is applied to the 506A Transponder Set, the equipment is capable of immediate and continuous operation in both Mode 3/A and Mode C. Special control circuits included in the C-506A permit diversified operation of the transponder. Detailed procedures for all transponder operating controls are outlined below.

**Power Application.** Turn the function switch to ON, and wait approximately 10 seconds for equipment warm-up. Turn the function switch to SBY or to OFF while taxiing for take-off and after landing to eliminate undesirable interference and clutter on local radar displays.

**Mode 3/A Reply Code Selection.** Using the four reply-code selector switches, select the assigned code on the Mode 3/A reply-code indicator.

#### Note

Check current copy of Airman's Information Manual for proper and prohibited reply codes.

**IDENT Pulse Selection.** When instructed by the controller to "squawk Ident," momentarily depress the ID switch button. The IDENT pulse will be transmitted with the Mode 3/A reply for 15 to 30 seconds. Do not squawk ident unless requested to do so.

### CAUTION

To prevent interruption of normal transponder operation, release ID switch button immediately after it has been depressed. Do not hold it down.

**Reply-monitor Lamp Operation.** The reply-monitor lamp provides a visual indication of transponder operation. Leave the MON LT switch set to ON except when the reply monitor indication is not desired. Set the switch to OFF to turn off the lamp.

**Low-sensitivity Operation.** When instructed by the controller to "squawk low," set the function switch to LO. The sensitivity of the receiver will be reduced.

#### Note

The transponder should be operated at normal sensitivity (function switch set to ON) except when the controller specifically requests low-sensitivity operation.

**Mode C Disable.** When instructed by the controller to disable Mode C operation, set the MODE A/C-A switch to A. The transponder will operate normally in Mode 3/A, and the Mode C altitude encoder will be disabled. For automatically selected operation in both Mode 3/A and Mode C, leave the MODE switch set to A/C.

**Self-test Operation.** For transponder self-test operation, proceed as follows:

**Step 1.** Turn on transponder, and set Mode A/C-A switch to A to select Mode 3/A self-test signal.

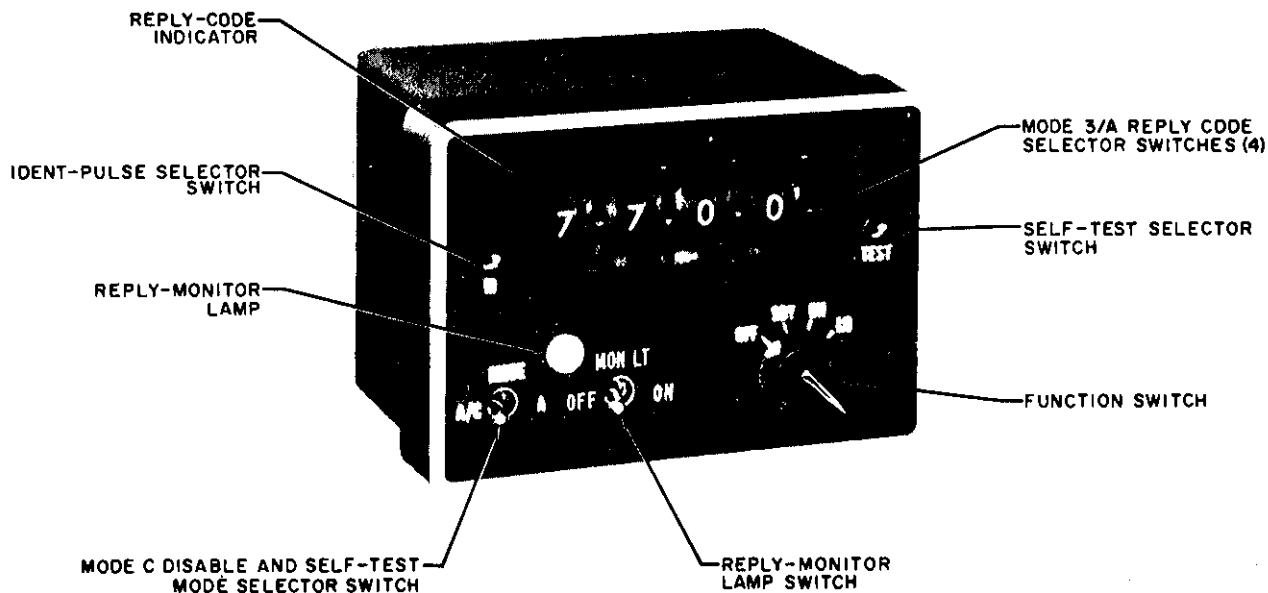
**Step 2.** Check that MON LT switch is set to ON, and depress TEST switch. Reply-monitor lamp should light.

**Step 3.** Set MODE A/C-A switch to A/C to select Mode C self-test signal.

**Step 4.** Depress TEST switch. Reply monitor lamp should light.

### GRAPHIC 3. OPERATING CONTROLS

Designation	Control	Function
OFF-SBY	Function Switch	Controls application of power to transponder and selects "low-sensitivity" function of receiver.
—	Mode 3/A Reply-code Selector Switches (4)	Select assigned Mode 3/A reply code.
—	Reply-code Indicator	Displays selected reply code.
ID	IDENT Pulse Selector Switch	Selects IDENT pulse on command.
MON LT ON-OFF	Reply-monitor Lamp Switch	Turns off reply-monitor lamp when reply monitor is not desired.
—	Reply-monitor Lamp	Provides visual indication of transponder replies.
TEST	Self-test Selector Switch	Selects self-test operation.
MODE A/C-A	Mode C Disable Switch and Self-test Mode Selector Switch	Mode A/C position allows transponder operation in automatically selected Mode 3/A or Mode C; selects Mode C self-test signal when TEST switch is depressed. MODE A position allows normal operation in MODE 3/A and disables altitude encoder so that only framing pulses are transmitted in reply to Mode C interrogation; selects Mode 3/A self-test signal when TEST switch is depressed.



Graphic 4. C-506A Control Unit, Operating Controls

7. Practical Exercise. Assigned by instructor.

ANALYSIS

8.

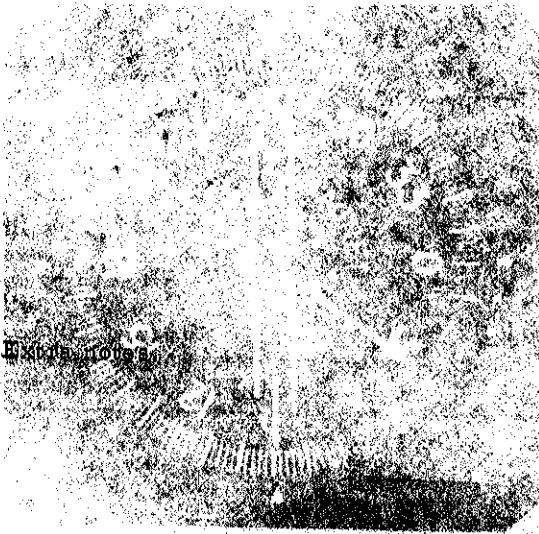
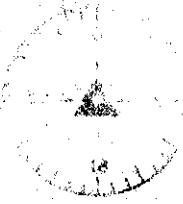


Exhibit 10000



COT

