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INSTRUCTOR PILOT INFORMATION/OPERATION GUIDE

FOR

SYNTHETIC FLIGHT TRAINING SYSTEM

(2B24)

OCTOBER 1973

DEPARTMENT OF UNDERGRADUATE FLIGHT TRAINING

UNITED STATES ARMY AVIATION SCHOOL

FORT RUCKER, ALABAMA

INSTRUCTOR PILOT

INFORMATION/OPERATION GUIDE FOR SYNTHETIC FLIGHT TRAINING SYSTEM (2B24)

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PART I. INTRODUCTION

1. General information.

Model: 2B24

Manufactured by: Singer Simulation Products Division, The Singer Company, Silver Springs, Maryland

Prototype Cost: $4.5 Million

Production Model Cost: $2.3 - 3 Million

Prototype Delivered: December 1970

Future model's expected delivery date: March 1974

Functions: Helicopter instrument simulation and cockpit/emergency procedures

2. Characteristics.

a. Sound and motion simulation.

b. Flight control response through 5 degrees of motion.

c. Three digital computers.

d. 98 radio and navigation aids.

e. Turbulence levels through light, moderate, and severe.

f. Winds to 99 knots.

g. Ground track generation for student and instructor pilot.

h. 5-minute playback of flight to include radio calls.

i. Freeze capability.

j. Cockpit seat positions for P-CP-IP.

3. Radios. All communication radios have a 50-mile range or line-of-sight limitation. FM is usually used by IP's to call console operators and FM range is governed by the line-of-sight limitation of the transmitter, located 3 miles north of the Banks Intersection, which is the center of gaming area. The range of all navigation radios is as published in the IFR supplement—10 degrees right or left of a localizer and 10 degrees above or below an ILS—a reliable signal will not be received.

Facilities:

VOR (17 Max)		ADF (9 Max)	ILS (6 Max)	GCA (5 Max)
OZR	EUF	OZ	OZR	OZR RWY 06
DHN	VPS	MG	LSF	MAX RWY 14
HEY	SEM	ETP	MGM	HEY RWY 17
MFM	MXF	LOR	CSG	LSF RWY 32
ABY	LGC	LS	DHN	TOI RWY 07
CSG	LSF	AWS	TOI	
TGE	TOI	XLE		
MAI	MVC	CS		
CEW		TO		

APP PLATES

DHN

MGM

OZR

CSG

LSF

TOI

4. CRT displays. CRT displays - On/Off switch in the cockpit can be turned off at console.

SIZE	SCALE	DISPLAY TIME
100x100 miles	10 miles/inch	51 minutes
25x25 miles	2.5 miles/inch	15 minutes
12.5x12.5 miles	1.25 miles/inch	8 minutes
Alt blow up	10:1 to small chart	15 minutes
A/S blow up	10:1 to small chart	15 minutes

VISUAL ALERTS

PP partial panel
COP autocopilot
GCP ground call in progress
WV wind velocity
WD wind direction
WOS weight on skids
RDY trainer ready
AID instructor call
TRB turbulence level

Displays can be centered on aircraft position, center of gaming area, or navaid on programed approach charts.

5. Parameters. Parameters are factors or conditions constituting simulated flight which may be induced as a quantity or constant whose value varies with the circumstances of its application.

Flight controlled parameters - Those conditions controlled from the cockpit. These conditions measure finite values describing flight. They can be programed for a specific constant or quantity as an initial condition. These program changes are difficult; however, flight parameters can be frozen easily.

Console controlled parameters - These parameters are conditions that can be controlled or changed within limits from the console. These parameters are conditions that the IP can change in coordination with console operators.

PARAMETERS

FLIGHT CONTROLLED PARAMETERS

		SCALE	LIMITS	ALERT	CRASH
1.	ALT Altitude	Feet	0-25,000	-	-
2.	A/S Airspeed	Knots	0-143	110	120
3.	HDG Heading	Degrees	000-359	-	-
4.	RL Roll	Degrees	-	25°	45°
5.	PT Pitch	Degrees	-	10°	20°

		SCALE	LIMITS	ALERT	CRASH
6.	YW Yaw	Ball widths	0-2	.5	-
7.	VV Vertical Velocity	Ft/Min	-	-	-
8.	RT Rate of Turn	Degrees/ sec	-	6°/sec	-
9.	TP Torque Pressure	Psi	0-60	40	50
10.	RR Rotor Rpm	Rpm	0-380	-	Below 259; above 341

CONSOLE CONTROLLED PARAMETERS

		SCALE	LIMITS	NOTES
11.	YPOS Y Position	East-West	±50	1
12.	XPOS X Position	North-South	±50	1
13.	FLWT Fuel Weight	Lbs	0-1430	2
14.	C.G. Center of Gravity	Inches	144-130	2
15.	GRWT Gross Weight	Lbs	6800-9600	3

		SCALE	LIMITS	NOTES
16.	BARO Barometric Pressure	In of hg	30.99-28.01	
17.	OAT Outside Air Temp	Degrees	0^{o}-110^{o}	4
18.	WV Wind Velocity	Knots	0-99	
19.	WD Wind Direction	Degrees	000-359	
20.	Turb LVL Turbulence LVL	Level	0-9	5
21.	SND LVL Sound Level	Level	0-7	
22.	RD STC	Not used	Not used	
23.	APU AUX PWR Unit	Yes-No	Batt-APU	

NOTES:

1. The units of measurement is a scale in XY coordinates. The console operator can easily move you to a known location (i.e., DHN VOR, Echo Intersection, etc.) in freeze or while flying. To reposition to any other place in the gaming area, you must tell the console operator the direction and distance from a known point. You can fly outside of the gaming area, but console cannot

"XY" you out of the area. Some NAVAIDS are located outside of the gaming area.

2. At zero pounds, of fuel, the engine will fail.

3. 6800 pounds is minimum gross weight that can be programed; however, you can burn off 1430 pounds of fuel to reduce weight to the minimum.

4. Air temperature is the temperature at mean sea level in degrees Fahrenheit. The indication in the cockpit will be in degrees centigrade. Standard lapse is applied. Icing will accumulate at temperatures lower than 0 degrees C. (Note: Standard lapse rate 2 degrees C/1000 feet or 3.5 degrees F/1000 degrees.)

5. The turbulence level can be changed from inside the cockpit. There is a hail sound at level 6 and above. To set turbulence from the cockpit, proceed as follows:

   a. Set right thumb wheel to zero (0).

   b. Set middle thumb wheel to desired turbulence level (0-9).

   c. Press MALF button and turbulence will change to new setting.

6. Initial condition set. Standard sequencies of commonly used parameters are considered initial conditions used to save time at the start of the flight period.

	GR WT	7200
	CG	141
	FL WT	1430
	BARO	29.91
	APU	Yes
Cairns	ALT 305 HDG 059°	999 Alt 3000 5 miles east OZR HDG 360 A/S 80k
Hanchey	ALT 311 HDG 360°	
Lowe	ALT 244 HDG 059°	
MGM	ALT 221 HDG 090°	
LAWSON	ALT 343 HDG 199°	

PART III. MALFUNCTIONS

7. Introduction. There are 104 malfunctions. (See list.) Five malfunctions are the maximum, and must be programed by the console operators. Programed malfunctions may be activated from the console, or may be activated from the cockpit. Activated malfunctions will indicate brighter on CRT. To activate malfunctions from the cockpit, proceed as follows:

a. Right thumb wheel set to malfunction number in order displayed.

b. Press MALF button to activate.

c. Press MALF button again to deactivate.

All malfunctions can be completely disabled except the ones that trip circuit breakers. Circuit breakers must be reset in cockpit after the malfunction is deactivated. As long as the malfunction is activated, the circuit breaker will not reset. Malfunctions can also be programed to activate on time (computer time). Fifteen seconds prior to failure, the CRT will flash failure.

8. Malfunction list.

GROUP

01 Indicators
- 01 Attitude Indicator - Pilot
- 02 Attitude Indicator - Copilot
- 03 Turn Needle
- 04 Gyro Magnetic Compass Heading Indicator
- 05 Gyro Magnetic Compass - Slave Failure

06 Pitot System Failure (Icing)
07 N_1 Tachometer
08 Rotor Tach
09 Torquemeter
10 Engine Oil Temperature Indicator
11 Engine Oil Pressure Indicator
12 Transmission Oil Temperature Indicator
13 Transmission Oil Pressure Indicator
14 Fuel Quantity Indicator
15 Fuel Pressure Indicator
16 Glide Slope Ndl

GROUP

02 Eng/Trans
01 Transmission Oil Loss - Abr
02 Transmission Oil Loss - Grad
03 Engine Fuel Pump
04 Engine Fire
05 Flame Out
06 Hot Start
07 Hung Start
08 No Start
09 Total Engine Failure
10 Compressor Stall
11 Governor rpm Inc/Dec Switch
12 Inlet Guide Vane Actuator
13 Governor Low Side
14 Governor High Side
15 Governor (Linear Actuator)
16 Engine Tach

03 Flight
01 Main Rotor Blade Track
02 Main Rotor Blade Balance

03 Tail Rotor Track
04 Tail Rotor Gear Box Loss
05 Tail Rotor Loss
06 Tail Rotor Thrust
07 Tail Rotor Fixed Pitch
08 Lateral Cyclic
09 Lateral Cyclic Hard Over
10 Longitudinal Cyclic
11 Longitudinal Cyclic Hard Over
12 Total Hyd Failure

04 Electrical System
01 Complete Electrical Failure
02 Main Generator
03 Standby Generator
04 Main Inverter
05 Spare Inverter
06 Left Fuel Boost Pump
07 Right Fuel Boost Pump
08 Automatic Direction Finding (ADF)
09 UHF Transmitter
10 FM Transmitter
11 VHF Communication Transceiver
12 VHF Navigation Receiver
13 Marker Beacon Receiver

05 Indicator Circuit Breakers
01 Attitude Indicator Pilot #1 CB
02 Attitude Indicator Pilot #2 CB
03 Attitude Indicator Co-Pilot #1 CB
04 Attitude Indicator Co-Pilot #2 CB
05 CDI-CB
06 Gyro Compass
07 Turn and Slip Indicator
08 Engine and Transmission

09 Fuel Quantity Indicator
10 Fuel Pressure Indicator
11 Engine Oil Pressure Indicator
12 Transmission Oil Pressure Indicator
13 Torquemeter
14 Noness Bus VM CB

06 Navigation/Communication Circuit Breakers
01 VHF Transceiver
02 UHF Transceiver
03 FM Transceiver
04 Intercom Pilot
05 Intercom Co-Pilot
06 IFF Transponder
07 ADF Compass
08 VHF Navigation Receiver
09 Marker Beacon

07 Illumination Circuit Breakers
01 Instrument Panel Lights
02 Utility Lights
03 Dome Lights
04 Caution Lights
05 Instrument Secondary Lights
06 Console and Pedestal Lights
07 Generator Reset
08 Inverter Control
09 Main Inverter Power
10 Spare Inverter Power
11 AC 115V Relay Failure
12 AC 115V 28V Trans Failure

08 Miscellaneous Circuit Breakers
01 Starter Relay
02 Ignition System and Igniter Solenoid

03 Governor Control
04 Engine Anti-ice
05 Idle Stop Release
06 Fuel Valve
07 Right Fuel Boost Pump
08 Hydraulic Control
09 Force Trim System
10 Pitot Heater
11 RPM Warning
12 Fire Warning Light

9. Motion system. There are 5 degrees of motion cues—roll, yaw, pitch, lateral, and heave. Motion cues are in relation to control movements; however, if the motion system is not on, the controls will work with appropriate instrument response with the exception of the motion cues. To activate the motion system, you must call console (for safety) for clearance. When you press the motion button, the cockpit will come up on motion. Approximately 30 seconds after cockpit stops moving, one last bump will be felt, and the module will be ready. Motion off light will now go out, and the CRT RDY alert will be brighter. To come off motion, call for clearance. (SAFETY: The console operators insure that there is no one in the pit and assist with the ladder.) Press the motion button, and when the cockpit stops moving, you can get out. (SAFETY: Module will come off motion if any door is opened.)

10. Freeze mode. Press the freeze button; all flight instruments to include the clock and ground track are frozen, regardless of the movement of the flight controls. (Keep movement of controls to a minimum since the sum of all control movements will be induced when you press continue.) All communication and navigation radios will operate normally in the freeze mode. To continue, press continue button.

11. Slow mode. This mode slows reaction of module 50 percent. Example: In slow mode, it will take 2 minutes to climb 500 feet at 500 feet/minute or turn 180 degrees at standard rate, and the groundspeed will be slowed by 50 percent. Slow mode does not affect the clock.

12. Audio alerts. If any flight controlled parameter is exceeded, a prerecorded message will be heard in earphones. Alerts will work in one cockpit or all cockpits.

13. Playbacks. Request from console the instant replay. The instant replay will play back all control movements, instrument indications, motion movements, and radio calls for the last 5 minutes of flight.

14. Audio playback. This capability plays back 15 minutes total transmitting time and includes the audio only.

15. Stored plots. This capability recalls any portion of flight up to the first 105 minutes of flight.

16. Auto copilot. Ask the console operators to activate. Auto copilot can only be deactivated by pressing auto copilot button in cockpit. Auto copilot will hold the heading, airspeed, and altitude that you have when you transfer the controls. Do not use the auto copilot above turbulence level 4.

17. Common audio net. Ask console and all four cockpits can monitor all radio calls to console and have the capability to call each other.

18. GCA console. IP may monitor and control students who are solo by UHF and VHF frequencies only.

19. Crash override. OFF - aircraft will crash, which results in a loud bang through the sound system, and the aircraft will freeze when a crash parameter has been exceeded. To continue flying, the console operators must first place you in crash override on. Then you must press "Cont" to continue flying. After a crash, radios are dead. The only means to

call the console operator is with the instructor call button.
ON - if a crash parameter is exceeded, no crash will occur.

20. Instructor call. This capability used to call console when there is no answer to repeated calls. When you push inst call button, a light will come on at the console, and the operator will answer (by-passing all radios) by acknowledging your call through your headset.

21. Hard copy printer. The printer will print every time an alert parameter is exceeded, and record the time you were out of tolerance.

PART V. OPERATOR MAINTENANCE

22. Introduction. All instruments, controls, and circuit breakers should operate in the trainer EXACTLY the same as they do in the aircraft. If they do not, write up the discrepancies on the 2408-13 for the cockpit. There are a few exceptions that are noted here.

23. Altitude reset. If the altitude in the cockpit is different from the altitude on CRT and console, proceed as follows:

a. Press freeze button.

b. Pull the fuel valve circuit breaker.

c. RPM INC - DEC switch will move both altimeters together to correct altitude.

d. If both altimeters are different, pull the circuit breaker behind the fuel valve. The RPM - INC - DEC switch will then move one altimeter until both match. Reset the circuit breaker and repeat steps b and c.

24. Filter light. This is a light located aft right side of companion way. If it comes on, call maintenance.

25. Cockpit lights. Cockpit lights can be turned on and off by toggle switch located below filter light.

26. Fan switch. The fan switch is located under filter light—three-position toggle switch - High - Low - Off; normally, low is used.

27. Flood light. The flood light is used with closed-circuit TV. Dimmer switch is knob located above pilot's left shoulder next to TV camera.

28. Control loading. When all friction is off, the force trim is off, and the cyclic and collective are released; they should stay in the same position; however, if they move, call maintenance.

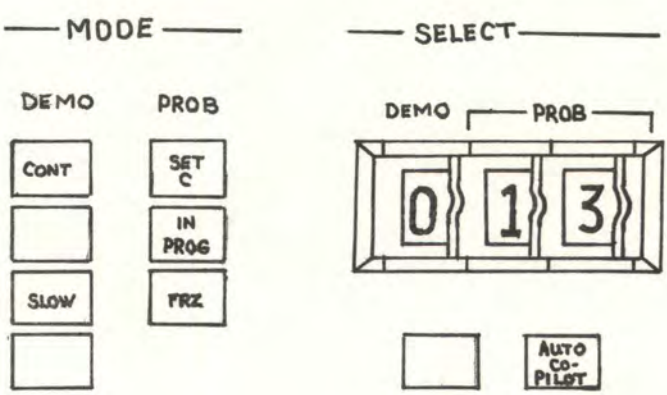
29. Computer time. Computer time is time the cockpit has been operated since the last data clear regardless of freeze time.

30. Data clear. Normally, data clear will be used at start of flight period, and will clear all stored plots and reset computer time to zero.

31. Ground track erase. Ask console to erase ground track on CRT. This operation will not erase stored plots.

32. Any other problems. Call console; if they cannot help you, they can call maintenance personnel.

AUTO PROG CONTROL



PART VI. RECOMMENDED TRAINING SEQUENCE

33. Introduction.

a. General. This training guide supersedes all previous syllabuses for Flight Instructor Training in the Synthetic Flight Training System (2B24).

(1) Purpose of this course: To qualify Instrument Flight Instructors as Flight Instructors in the Synthetic Flight Training System (2B24) to train rated and nonrated students for the awarding of a Standard Instrument Rating and to conduct refresher training for Instrument Rated Aviators.

(2) Location: Fort Rucker, Alabama.

(3) Duration: 1 week, 07:30 hours.

b. Required maneuvers and procedures. Maneuvers and procedures, required for the training, are shown in the recommended logical order of accomplishment. A schedule of flight time is provided for a self-paced program of progress. The schedule is so constructed that adequate time is available for review of previous maneuvers. Ground time should be used to the best advantage in preparation, briefing, and debriefing.

c. General requirements.

(1) Section II (Training Sequence) of this Flight Training Guide will dictate which maneuvers will be taught.

(2) Airspeeds utilized will be maintained within the limits of the appropriate -10 manual for that model aircraft to be flown to include Center/School Directives.

(3) For amplification of the maneuvers/procedures contained herein, consult the Instructor Pilot Information/Operation Guide, TM 1-215, TM 1-225, Rotary Wing Instrument Guide, and appropriate -10 for model being flown.

34. Training sequence.

Required Maneuvers and Procedures

2B24 Flight Instructor Qualification

Flight Period	Maneuver/Procedure	Grd Time	Flt Time	Total Time Grd	Flt
SF-1	1. Briefing	00:30		00:30	
	2. Flight planning	00:30		01:00	
	3. Demonstrate and practice 2B24 flight familiarization		01:30		01:30
	4. Debriefing	01:00		02:00	
SF-2	1. Briefing	00:30		02:30	
	2. Flight planning	00:30		03:00	
	3. Review and practice previous period		01:30		03:00
	4. Demonstrate and practice a. Motion system and flight controls b. CRT displays c. Controls of flight d. Malfunctions (GR01-02)				
	5. Debriefing a. Performance analysis	01:00		04:00	

Flight Period	Maneuver/Procedure	Grd Time	Flt Time	Total Time Grd	Total Time Flt
	b. Weak areas				
SF-3	1. Briefing	00:30		04:30	
	2. Flight planning	00:30		05:00	
	3. Review and practice periods		01:30		04:30
	4. Demonstrate and practice a. Cross-country flight b. Use of console as ATC control c. Malfunction (GP03-08)				
	5. Briefing a. Performance analysis b. Weak areas	01:00		06:00	
SF-4	1. Briefing	00:30		06:30	
	2. Flight planning	00:30		07:00	
	3. Review and practice previous periods		01:30		06:00
	4. Debriefing a. Performance analysis b. Weak areas	01:00		08:00	

Flight Period	Maneuver/Procedure	Grd Time	Flt Time	Total Time Grd	Total Time Flt
SF-5	1. Briefing	00:30		08:30	
	2. Flight planning	00:30		09:00	
	3. Flight/equipment check ride		01:30		07:30
	4. Debriefing	01:00		10:00	
	a. Performance analysis				
	b. Weak areas				

In SF-1, the student will fly from the right seat; all other periods, the student will fly from the left seat.

The student will be a Rotary Wing Instrument Instructor Pilot.