Section I

AIRCRAFT MiG-25PD “FOXBAT”

FLIGHT TRAINING MANUAL

- *The present Manual may be used as a guide for training of the pilot personnel on the MiG-25PD aircraft.*

FOREWORD

Thank you for downloading the MiG-25 for MSFS 2020. This is the third project developed by a young team, who set a very challenging task of reconstructing the iconic MiG-25. We do believe 10 months of development have not been lost labor, and this remarkable aircraft will bring you many hours of enjoyment in the virtual skies of MSFS 2020.

MiG-25 is an utterly complex aircraft, and implementation of each system and function would take a lot of time. Therefore, some systems were not included in the initial release and will be released as they are ready in nearest product updates. Already implemented gauges and systems were elaborated very carefully based on actual functionality, and almost all were implemented exactly as described in the original MiG-25 Pilot's Manual. Foxbat is one of the most beautiful military aircraft, so a lot of effort was made to elaborate the visual part of both the interior and exterior of the plane

Versions

This manual applies to PRODUCT VERSION 1.0.4

Copyright Information

Credits and Acknowledgements

I would like to gratefully acknowledge the development team for their superb work and dedication to this project. Many of you wondered if we would ever get it done, so the day has come.

Features

- Big, powerful, fast, extremely high-altitude & hedgehopping, all-weather, interceptor MiG-25 FOXBAT was designed to be the best.
- Fly high and fast: above 75,000 feet and 2.85 Mach
- Try full power of two Tumansky R-15 engines with realistic controls and monitoring systems.
- Flight model is based on actual performance characteristics at diverse altitudes and speeds taking into account external stores and overall configuration of aircraft.

Cockpit Systems and Gauges are made with ultimate realism according to the original MiG-25 Pilot's Manual and real cockpits

1. Fuel Supply System
2. Electrical Power Supply System
3. Landing Gears, Air Brakes, Intake's system
4. The full functional Autopilot with more than 8 different modes of flight.
5. Warning, Caution and Indicator Lamps
6. Lighting System.
7. Communication Equipment
8. RSBN Navigation system

Very detailed model of Exterior and Virtual Cockpit with full 3D gauges and many animated parts:

1. Wing Flex animation taking into account loading and sweep angle
2. Different variants of payloads
3. End many more…

Custom FX for the ultimate in realism is taken far beyond what is available by default:

1. Afterburner effect
2. High angle of attack and stall vortex effects
3. Sonic boom effect
4. And much more…

Custom Sound to improve immersion we have added custom sound effects:

1. Cockpit sounds
2. Environment sounds
3. Sonic boom
4. Engines Afterburner custom sounds

Future plans

1. Notification system
2. Radar
3. Homing system

CUSTOM KEY MAPPINGS

AUTOPILOT

"AUTOPILOT MASTER ON/OFF" toggles autopilot stabilization mode.

Note, modes of autopilot are specific and can be set only by switches in Virtual Cockpit.

AIRBRAKE

"SPOILERS TOGGLE" toggles airbrake

PAYLOAD JETTISON

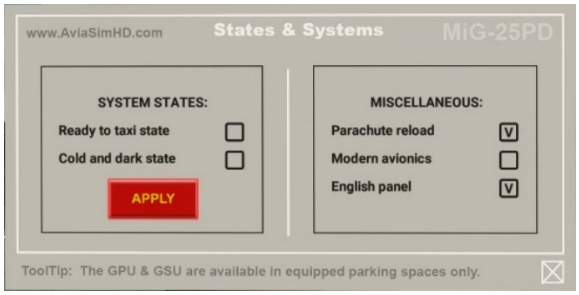
“Smoke ON” toggles payload jettison trigger

Drag Chute Deployment / Jettison
“Smoke ON” toggles payload jettison trigger

Panels Menu

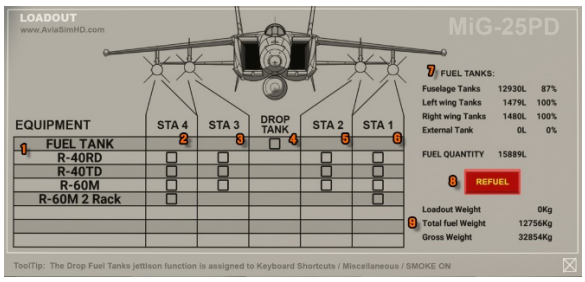
Panels menu is located on the front instrumental panel (Pic 2, p4)

Setting menu



The States menu is designed to set all systems and switches into one of two states:
"Cold and Dark" or **"Ready to Taxi."**
In addition, this menu allows you to **reset the drag chute**, switch the avionics to a modern configuration, and change the text on the indicator panels to English**.**

Loadout panel



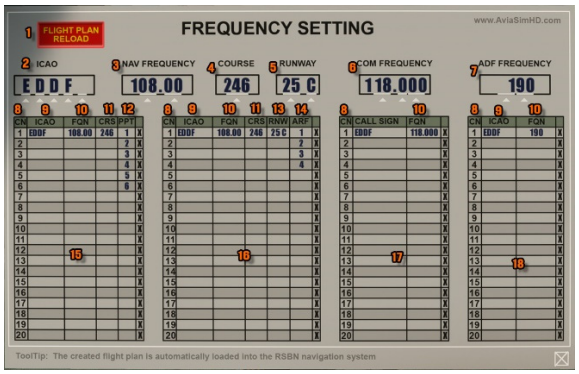
1-Equipment name
2-6 – Pylons
7-Fuel Tanks Info
8-Refuel button
9-Weight Info

The External Stores menu is designed for attaching external fuel tanks and missiles to the aircraft's external pylons. It also allows you to monitor fuel levels and control the aircraft's takeoff weight.

To unlock the ability to equip weapons on the pylons, you need to install the Weapons Module into the Community folder. This module is available for download on our website in the Downloads section.

https://www.aviasimhd.com/download/

Radio/RSBN frequency setting panel



The Radio Frequency Setup Menu is designed to configure the required navigation information for the RSBN system, as well as for the NAV and COM radio channels.
For more detailed information, please refer to the "Navigation" section

Important Flying Tips

Aircraft weight

Total fuel weigh is 14.570 kg.
Weight of the aircraft with internal and external fuel tanks fully filed is 19.020 кг, which is exceeding takeoff and landing weight.
Maximum gross weight:

- Taxi and takeoff 36.720 kg
- In-flight 33.00 kg
- Landing 34.920 kg

MAX Range

- M>1 1635 / 2130 (with FT)
- M<1 1865 / 2400 (with FT)

Speed

Takeoff speed
- V1 – 300 km /h
- V2 Max TO weight - 350 km /h

Landing - 270-290 km/h

Maximum Rated Speed

The maximum speed 3.0 M can be reached in certain conditions: Weight about 33.000 kg, Altitude 80,000 feet or higher, no external stores, full afterburner.

During supersonic flight in all altitudes, the Total Temperature indicator (aircraft forward surface temperature) should be constantly monitored in order to prevent the aircraft overheating.

HISTORY

The MiG-25PD is a twin-engine, single-seat, supersonic interceptor developed and manufactured by aerospace group Mikoyan-Gurevich of the Soviet Union. The MiG-25 prototype took its maiden flight on March 6, 1964, and it entered service in 1970. It set 29 speed and altitude records, several of which remain standing to this day.

The MiG-25 was developed to fulfill three primary roles: high-altitude interception of supersonic strategic bombers, reconnaissance, and deep strike. The Soviets primarily sought to counter the capabilities of the emerging threats posed by America’s Convair B-58 Hustler and the North American B-70 Valkyrie, the latter of which never proceeded past the prototype (XB-70) phase. Due to its high-altitude capabilities and speed, Mikoyan-Gurevich also developed strategic reconnaissance and long-range strike variants. In addition to the Soviet Union, the militaries of several countries have operated the MiG-25, including Ukraine, India, and Bulgaria. It remains in service with the Syrian Air Force.

Engineers developed the MiG-25 to be as fast and high flying as possible. The group based the aircraft around The MiG-25PD measures 78 feet, 2 inches in length, stands 20 feet tall, and has a wingspan of 46 feet. It is powered by two Turmansky R-15B-300 afterburning turbojet engines that each develop up to 16,500 pounds of thrust in military power and up to 22,500 pounds of thrust with afterburner. It has a maximum range of 1,600 miles, a service ceiling of 79,000 feet above sea level, and it cruises at Mach 2.35 (under partial afterburner). It has a top sustained speed of Mach 2.83 the output capability of two Tumansky R-15 engines, enormously powerful afterburning turbojets. To accommodate the two powerplants, engineers crafted an exceptionally large airframe with broad wings. Mikoyan-Gurevich constructed the MiG-25 primarily out of stainless steel to ensure structural integrity under the high temperatures generated by aerodynamic friction at high speeds. It can fly at up to Mach 3.2, although speeds beyond Mach 2.83 damage the engines. In 1977, a specially modified MiG-25 set an absolute altitude record of 123,524 feet (37,650 meters) above sea level, which remains unbroken to this day.

The MiG-25 features a swept main wing design, an empennage comprising two vertical stabilizers, and enormous twin intakes. Mikoyan-Gurevich developed several variants to fulfill its various roles, both one- and two-seat versions. The MiG-25PD is an all-weather interceptor that entered service in 1979 and boasts improved engines, radar, and avionics. It can carry up to four long-range air-to-air missiles.

Section II

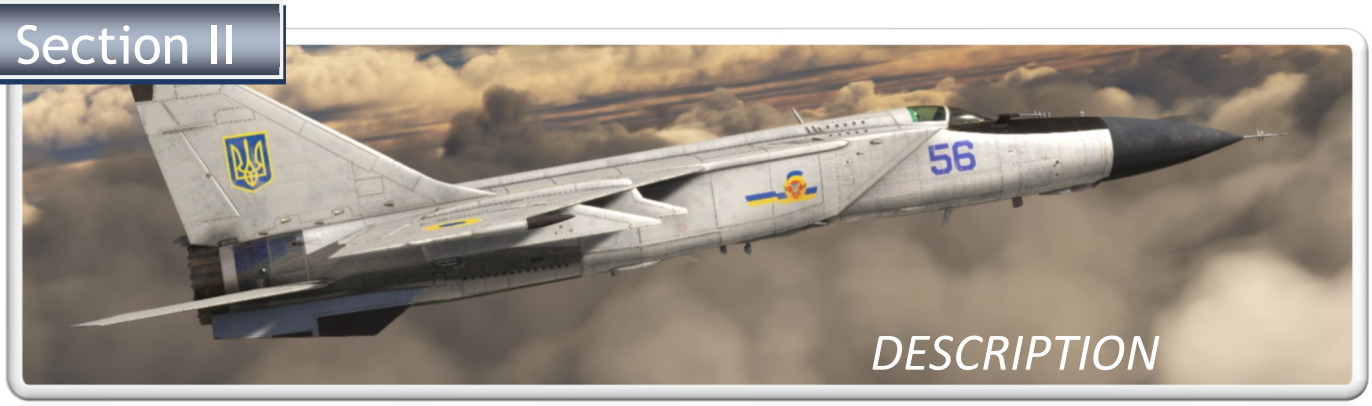
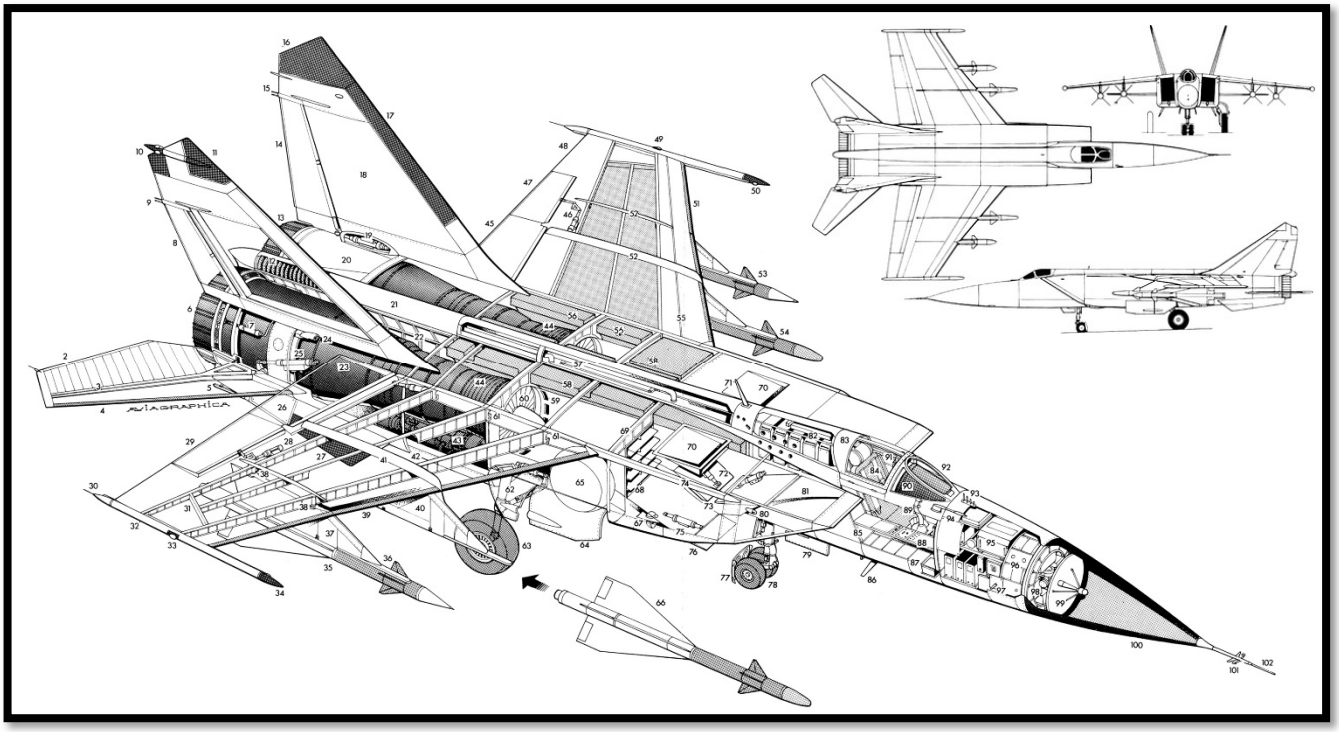


TABLE OF CONTENTS

General Arrangement Diagram



1. **Movable air intake**
2. **Right stabilizer (elevator for manual control)**
3. **Fixed stabilizer plane**
4. **Front landing gear**
5. **Central fuselage section**
6. **Fully adjustable rudder**
7. **Engine nacelle**
8. **Right aileron (main control surface)**
9. **Primary electrical systems compartment**
10. **Right-side flap system (automatic and manual)**
11. **Lower antenna of high-frequency communication system**
12. **Right-side outer flap system**
13. **Left aileron (main control surface)**
14. **Left vertical stabilizer (rudder)**
15. **Right vertical stabilizer (rudder)**
16. **Horizontal stabilizer on the tail (elevator)**
17. **Upper antenna of the high-frequency communication system**
18. **Right airbrake panel**
19. **Left airbrake panel**
20. **Left side flap system**
21. **Inner antenna of air collision avoidance system**
22. **Left-side inner flap system**
23. **Left flap system (automatic and manual)**
24. **Right outer antenna for high-frequency communication**
25. **Right-side main landing gear**
26. **Right-side external fuel tank pylon**
27. **Right-side missile pylon (air-to-air missiles)**
28. **Right wingtip**
29. **Right inboard wing**
30. **Left-side outer wingtip**
31. **Left-side main landing gear**
32. **Left-side missile pylon (air-to-air missiles)**
33. **Missile suspension systems for air-to-air missiles**
34. **Tail fin upper tip**
35. **Antenna of identification friend or foe system**
36. **Autopilot power supply switch**
37. **Radar altimeter compartment**
38. **Main oxygen tank**
39. **Radio antenna for communications**
40. **Hydraulic fluid tank for brake systems**
41. **Main rear control panel (flight instruments)**
42. **Left engine nacelle**
43. **Main central fuselage (housing equipment and fuel)**
44. **Right engine nacelle**
45. **Engine fuel injectors**
46. **Engine fuel control units**
47. **Engine afterburner igniters**
48. **Right wing leading-edge slats**
49. **Left wing leading-edge slats**
50. **Main engine thrust controls**
51. **Brake chute housing**
52. **Flap retraction system**
53. **Main engine fuel tanks**
54. **Nose landing gear compartment**
55. **Main landing gear doors**
56. **Right wing missile hardpoint pylon**
57. **Primary hydraulic fluid tank for nose landing gear**
58. **Main fuselage fuel tanks**
59. **Air duct for engine intake bypass system**
60. **Main landing gear assembly**
61. **Compressor unit for engines**
62. **External oxygen tank for crew cabin pressurization system**
63. **Right landing gear doors**
64. **Canopy opening and pressurization mechanism**
65. **Oxygen supply control valve for crew cabin**
66. **UR-40T class missile with homing head**
67. **Landing gear control lever**
68. **Control panel for wing flaps**
69. **Controls for the nose gear and steering system**
70. **Right-wing fuel tank pylon**

71. **Right-wing missile hardpoint with air-to-air missile guidance system**
72. **Left-wing missile hardpoint pylon**
73. **Fuel system oxygen tank pressure relief valve**
74. **Main air conditioning and cabin pressurization system duct**
75. **Hydraulic pump system for flight control surfaces**
76. **Adjustable air intake duct outlet**
77. **Front landing gear strut and retraction assembly**
78. **Nosewheel retraction mechanism**
79. **Front landing gear door**
80. **Air refueling probe**
81. **Internal structure of air intake duct**
82. **Fuel transfer panel in forward fuselage**
83. **Communication systems antenna**
84. **Pilot's control stick**
85. **Aft fuselage avionics bay**
86. **Left-side missile pylon**
87. **VHF communication antenna**
88. **Engine exhaust nozzle**
89. **Flight control panel**
90. **Radar altimeter housing**
91. **Emergency radio beacon antenna**
92. **Right-side missile pylon for UR-40T class missile**
93. **Control surface servo motors**
94. **Engine pressure sensors**
95. **Forward avionics bay with radio and navigation equipment**
96. **Missile control panel**
97. **Flight instrument system cooling ducts**
98. **Forward avionics bay access panel**
99. **Nosewheel steering system**
100. **Forward radome compartment for radio system**
101. **Antenna for "Smerch" radar**
102. **Air pressure sensors**
103. **Dual cockpit of the training version of MiG-25PU**
104. **Instructor’s cockpit (MiG-25PU version)**
105. **Microwave landing system antenna**
106. **Dissipation vents for cooling system of radar electronics**
107. **Integrated reconnaissance equipment and navigation systems bay**
108. **Side antenna for MiG-25RB combat version radar**
109. **Antenna for radar altimeter**
110. **Forward nose radar for ground target detection**

COCKPIT LAYOUT

1. Left panel 2. Left Console 3. Front panel 4. Right Panel 5. Right Console (Pic. 1)

Front Panel (Pic. 2)

1. Drop External Tank
2. Emergency Jettison of External Stores
3. Weapon System Power Switch
4. Menu (Settings Menu, Stores Menu, Radio Frequency Menu)
5. Weapon Control System Switches
6. Aileron Trim Control
7. Rudder Trim Control
8. Indicated Airspeed
9. ARU Position Indicator
10. Anti-Ice System Lever
11. Landing Markers Signal Lamp
12. Nose Gear Steering Lever
13. Intake Position Indicator
14. Command-Pilot Instrument (KPP)
15. DME Indicator
16. Vertical Speed Indicator
17. Warnings Light Panel
18. Failure Indicators Panel
19. Combined G-Force and Critical Flight Conditions Indicator
20. ARK (ADF) Signal Lamp
21. NPP Course Set Switch (Manual / Automatic from RSBN)
22. Emergency Microphone Switch
23. Fuel Dump
24. ADF Receiver Mode Switch (Radio / Compass)
25. NPP Navigation Signal Control Switch (From ADF / From RSBN)
26. Gyro System Switch (Primary / Backup)
27. Pitot Tube Receiver Switch (Primary / Backup)
28. True Airspeed and Mach Number Indicator
29. Altimeter
30. Horizontal Situation Indicator (Navigation-Pilot Instrument or NPP)
31. Radio Altimeter
32. Aircraft Chronograph ASCH-2
33. Backup Altimeter
34. Autopilot Control Panel (SAU)
35. Radar Control Panel
36. Radar Sight
37. Radar Display Adjustment Panel
38. RSBN Pre-set Frequency Table
39. Engine RPM Indicator
40. Exhaust Gas Temperature (EGT) Indicator
41. Pitot Tube Heater Switch
42. Cabin Air Conditioning Control
43. System and Equipment Status Indicator Panel
44. Engine Second Compressor Bypass Valve Control Lamps
45. Air Conditioning System Operation Indicator
46. Combined Fuel Flow Indicator
47. Cabin Pressurization Indicator
48. Main Bus Voltmeter
49. Air Conditioning Temperature Control
50. Main and Backup Hydraulic Pressure Indicator
51. Brake Hydraulic Pressure Indicator
52. Oil System Pressure Indicator
53. Emergency Landing Gear Release Lever
54. Anti-Glare Sunshade Deployment

Left Panel (Pic. 3)

1. Transponder
2. Red Ambient Light Lamps
3. Compressor Stage Two Bypass Switches
4. Engine Start Unit Switches
5. Bleed Air Switch for Reverse Engine Start
6. Cold Crank / Start Switch
7. Ground Tests Switch for Engines
8. Left Engine Control Instruments Test Button
9. Right Engine Control Instruments Test Button
10. Altimeter Test Button
11. Vertical Speed Indicator Test Button
12. Voice Annunciator Test Button
13. Oxygen System Supply Valve
14. Oxygen System Pressure Indicator
15. Ignition Supply Switch (Main / Backup)
16. Emergency Abort of Engine Start Button
17. Left Engine Start Button
18. Right Engine Start Button
19. Suit Heating Switch
20. Helmet Quick Heating
21. Navigation Light Switch (Steady / Strobe)
22. Manual Control of ARU Switch (Increase Speed / Decrease Speed)
23. ARU Control Switch (Automatic / Manual)
24. Seat Height Adjustment Switch
25. Emergency Air Intake Return to Initial Position
26. Air Intake Control Switches (Automatic / Manual)
27. Repeat Last Voice Message
28. Fuel Supply Valve Shut-off Buttons
29. In-Flight Engine Start Switches
30. Engine Nozzle Control Switch
31. Oxygen Supply Adjustment Switches
32. Suit Ventilation and Conditioning Control
33. Radar Cursor Control Joystick
34. Drag Chute Release Button
35. Automatic Chute Release Switch
36. Autobrake Control Switch
37. Engine Control System Automatic Switches (Main / Backup)
38. Afterburner Stage Two Activation Switches
39. Fuel Pump Activation Switch
40. Left Engine Fuel Supply Valve Activation
41. Right Engine Fuel Supply Valve Activation
42. Engine Throttle Levers
43. Throttle Lock Lever
44. Cabin Lock and Seal Lever
45. Oxygen Reserve Indicator
46. Oxygen Pressure Indicator
47. Left Engine Fire Suppression System Activation
48. Right Engine Fire Suppression System Activation
49. Landing Gear Release Lever
50. Landing / Taxi Light Switch
51. Landing Gear / Flap / Air Brake Indicator Panel
52. Drag Chute Jettison Button
53. Flaps Extend and Retract Buttons
54. Parking Brake Lever

Right Panel (Pic. 4)

1. ADF Volume Knob
2. RSBN Navigation System Control Panel
3. Red Ambient Light Lamps
4. ADF Channel’s Group Switch
5. ADF Channels Panel
6. Gauge Backlighting Brightness Knob
7. Light Panel Backlighting Brightness Knob
8. Red Ambient Backlight Brightness Knob
9. White Console Backlighting Knob
10. Transponder and Friend-or-Foe Identification System Control Panel
11. Remote Control and Guidance System Panel
12. Friend-or-Foe Identification Panel
13. Transponder Channel Knob
14. Self-Destruct System for Secret Equipment Control Panel
15. Battery and External Power Switch
16. Left Engine DC Generator Switch
17. Right Engine DC Generator Switch
18. Left Engine AC Generator Switch
19. Right Engine AC Generator Switch
20. Engine Control Units Switch
21. VHF Radio Switch (COM1)
22. HF Radio Switch (COM2)
23. RSBN Radio Switch (NAV1)
24. ARC Radio Switch (ADF)
25. SRO Switch
26. SRZ Switch
27. RV Switch
28. Homing System Switch
29. Autopilot SAU Switch
30. SAU Limitations System Switch
31. First Group Gyroscopic Instruments Power Switch
32. Second Group Gyroscopic Instruments Power Switch
33. SVS (Computer) Switch
34. Equipment Heating System Power Switch
35. Voice Notification System Power Switch
36. BIA Switch
37. Weapons System Power Supply Fuse Switch
38. Internal Suspension Power Supply Fuse Switch
39. External Suspension Power Supply Fuse Switch
40. Emergency Release Internal Suspension Power Supply Fuse Switch
41. Emergency Release Internal Suspension Power Supply Fuse Switch
42. Air Intake Power Supply Indicator Lights
43. Navigation Lights Power Supply Fuse Switch
44. Cabin Power Supply Fuse Switch
45. Camera Power Supply Fuse Switch
46. Left Engine Systems Power Supply Fuse Switch
47. Right Engine Systems Power Supply Fuse Switch
48. Fuel Flow Meter Power Supply Fuse Switch
49. Fuel Gauge Power Supply Fuse Switch
50. Fuel Pump Power Supply Fuse Switch
51. Battery Heating Power Supply Fuse Switch
52. Nozzle Flap Power Supply Fuse Switch
53. Left Air Intake Power Supply Fuse Switch
54. Right Air Intake Power Supply Fuse Switch
55. Main APU Power Supply Fuse Switch
56. Backup APU Power Supply Fuse Switch
57. Trim Power Supply Fuse Switch
58. Main Power Supply Fuse Switch (Landing Gear, Air Brake, Flaps)
59. Backup Power Supply Fuse Switch (Landing Gear, Air Brake, Flaps)
60. Drag Chute Release Power Supply Fuse Switch
61. Cabin Glazing Ventilation Adjustment Valve
62. Cabin Ventilation Adjustment Valve

Right Console (Pic. 5)

1. HV Radio Signal indicators (COM2)
2. COM2 channel knob
3. Receive / Transmit switch
4. COM2 volume
5. COM1 volume
6. Radio / compass signal switch
7. Noise suppressor switch
8. COM1 Channel Number
9. COM1 Channel Knob
10. SAU MACH number setting knob (not implemented)
11. Autopilot Altitude mode (manual / automatic)
12. Altitude display
13. Altitude setting knob
14. Signal Encoder – Waves
15. Signal Encoder – Codes
16. Signal Encoder – Shifts
17. Canopy Ventilation
18. Menu Button (Switch to Modern Avionics)
19. Cabin Ventilation

Warning panels 1 & 2 (Pic. 6)

1. Left Engine Fire
2. Right Engine Fire
3. Remaining fuel: 1100 kilograms
4. No fuel supply to the engine
5. Automation Flight control system failure
6. High skin temperature
7. Check booster system pressure
8. Check hydraulic system pressure
9. Screen brightness (night/day)
10. Left DC generator failure
11. Right DC generator failure
12. Left AC generator failure
13. Right AC generator failure
14. Left engine combustion
15. Right engine combustion
16. Left intake control backup system engaged
17. Right intake control backup system engaged
18. Left engine control backup system engaged
19. Right engine control backup system engaged

Information panels 3 & 4 (Pic. 7)

1. **Left engine afterburner**
2. **Right engine afterburner**
3. **Left engine second-stage bypass valve open**
4. **Right engine second-stage bypass valve open**
5. **Engine’s nozzles open**
6. **External fuel tank mounted**
7. **Left inner pylon**
8. **Right inner pylon**
9. **Left outer pylon**
10. **Right outer pylon**
11. **Screen brightness (night/day)**
12. **Pitot heat on**
13. **Fuel remaining in tank 1**
14. **Elevator trim in landing position**
15. **Fuel remaining in rear tanks**
16. **Elevator trim in neutral position**
17. **Fuel remaining in wing tanks**
18. **Aileron trim in neutral position**
19. **Fuel remaining in tanks 5 and 6**
20. **Rudder trim in neutral position**
21. **Fuel remaining in tanks 2 and 3**

BRIEF INFORMATION ON AIRCRAFT INTERCEPTION

COMPLEX МиГ-25-40Д (МиГ-25-40ДС)

Aircraft interception complex is designed for destruction of aerial targets of strategic and tactical aviation and cruise missiles in the daytime and at night under VFR and IFR conditions (in clouds) including conditions of radiocontrast cloudiness and organized counter- measures both in the free airspace and against the surface background.

The МиГ-25-4ОД (МиГ-25-40ДС) complex comprises:

(1) the МиГ-25ПД (МиГ-25ПДС) fighter;

(2) the C-25 armament control system consisting of:

- airborne radar SAPFIR-25 provided with continuous illumination channel, an integrated direct vision display system, an integrated target designation system for the selected type of missiles, a moving target indication channel and a built-in joint check device;
- analog computer АВМ-25;
- heat direction finder ТП-26Ш1;
- equipment for objective check of the process of conducting an aerial combat throughout all its stages;

(3) the armament system comprising four missiles Р-40Д furnished with the radar and heat seeking heads, four close combat missiles Р-60 (Р-60М) suspended from the outboard pylons instead of two missiles Р-40Д, units for coupling with the SAPFIR-25 airborne radar, launchers, adapters and the launch automatic control system;

(4) the СР0-2 aircraft transponder and aircraft interrogator BRONZA;

(5) airborne direction end target designation equipment 5У15К-11 with radio receiving device BEKAS;

(6) integrated navigation end lending system POLJOT-l consisting of:

- short-range radio navigation end lending system РСБН-6С;
- aircraft automatic flight control system СЛУ-155ЦДБ on aircraft МИГ-25ПД or САУ-155П1ДБ on aircraft МиГ-25ПДС coupled

with the C-25 armament control system end equipment 5У15К-11;

- twin directional/vertical gyro system СКВ-2НЛ-2;
- air date computer system СВС-ПН-5А;

(7) the test system, consisting of the ПАУ-473-gun camera end the TESTER-У3-Л recorder, intended for checking the crew actions and operation of equipment;

(8) ground means for preparing the complex for combat em-ployment (integrated systems intended for the automated check of the airborne equipment serviceability, repair of the C-25 armament control system, checking and preparation of missiles).

The МиГ-25-4ОД (МиГ-25-4ОДС) complex cooperates with the following ground means:

- existing and perspective direction systems in the ground automatic control system network;
- radio aide system POLJOT.

Section III

AERODYNAMIC CHARACTERISTICS

Aircraft Aerodynamic Configuration

The MiG-25 features a classic aerodynamic design with a high-mounted wing (high-wing configuration) and twin vertical stabilizers (dual tail fins) for improved stability at high speeds and altitudes. Its wings are swept back at 41°, with a total wing area of 61.4 square meters (661 square feet), optimized for high-speed flight. The aircraft has a long, sleek fuselage, designed to reduce drag and enhance supersonic performance. The MiG-25 is 23.82 meters (78.2 feet) long with a wingspan of 14.01 meters (45.96 feet). Its large rectangular air intakes, located on either side of the fuselage, are designed to supply the engines with sufficient air during high-speed operations.

The MiG-25 "Foxbat" is a heavy interceptor designed primarily for high-speed, high-altitude missions. It is known for its relatively low manoeuvrability, as it was built to excel at straight-line speed and altitude rather than dogfighting agility. This aircraft is optimized for operations at extreme altitudes and supersonic speeds, with a focus on reaching targets quickly rather than outmanoeuvring opponents.

Key Aerodynamic Characteristics:

- **Operational Altitude Range**: The MiG-25 can fly at altitudes of up to 80,000 feet (24,000 meters), with its maximum performance reached at high altitudes.
- **Speed Range**: It can reach speeds of up to Mach 3.2 (approximately 2,190 mph or 3,524 km/h). However, sustained flight at speeds over Mach 2.83 can lead to engine damage.
- **Climb Rate**: The MiG-25 has an impressive rate of climb, reaching up to 39,370 feet per minute (12,000 meters per minute), which allows it to intercept high-altitude targets rapidly.
- **Weight and Maneuverability**: Weighing over 80,000 pounds (36,000 kg) at maximum take-off weight, it is not highly agile, with a large wingspan and relatively low wing loading designed for stability at high speeds rather than sharp turns.

Due to its aerodynamics and heavy frame, the MiG-25 sacrifices manoeuvrability for speed and altitude, making it highly effective for reconnaissance and interception at supersonic speeds. However, its limited agility means it is not suited for close-quarters combat or low-speed engagements.

Range of Flight Altitudes and Airspeeds

The maximum and minimum airspeeds of a sustained level flight at a preset position of the throttle lever and at various altitudes may be judged by referring to the graph of the required and available thrust curves (Fig. 6). A sustained flight et a given altitude will be possible if the required thrust is equal to the available thrust.

The greatest airspeed at which these thrusts are equal is called as the maximum airspeed of the sustained level flight. Each power setting has its maximum airspeed.

As an altitude rises, the maximum airspeed increases and may exceed the maximum permissible speed.

An airspeed interval at which the sustained level flight is possible is assumed as the level flight airspeed range.

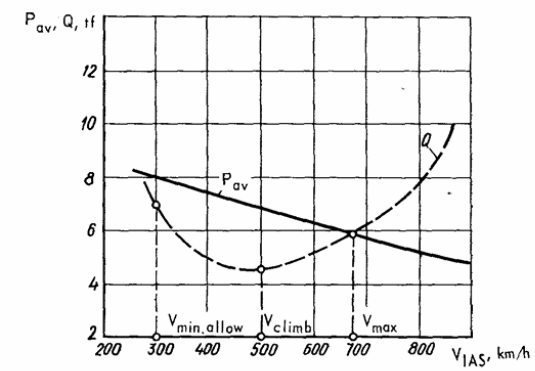


FIG. 6. CURVES OF REQUIRED AND AVAILABLE THRUSTS OF AIRCRAFT CARRYING FOUR MISSILES Р–40Д (non-reheat power setting, n_{en} = 80 %, H = 0)

For the МиГ-25ПД aircraft the level flight airspeed range is limited by the maneuvering indicated airspeed, selected from the conditions providing normal controllability when maneuvering, and the maximum permissible speed.

Fig. 7. presents the altitude and airspeed range of the МиГ-25ПД aircraft for various variants of external stores.

The maximum permissible indicated flight speed is limited with reference to the aircraft strength, as well as by a probability of flutter and it amounts to 1200 km/h to an altitude of 17,000 m.

The maximum Mach-number is limited with respect to thermal strength of the engines and it amounts to 2.83. For the same reason, the flight endurance at Mach-numbers exceeding 2.4 equals 15 min (at Mach-numbers M = 2.65 it amounts to 5 min, maximum). The flight time at Mach-numbers of M = 2.4 and less is not limited.

For the aircraft carrying two missiles Р-40Д and four missiles Р-60 the maximum Mach-number is limited due to the stability and controllability considerations, and it amounts to 2.35.

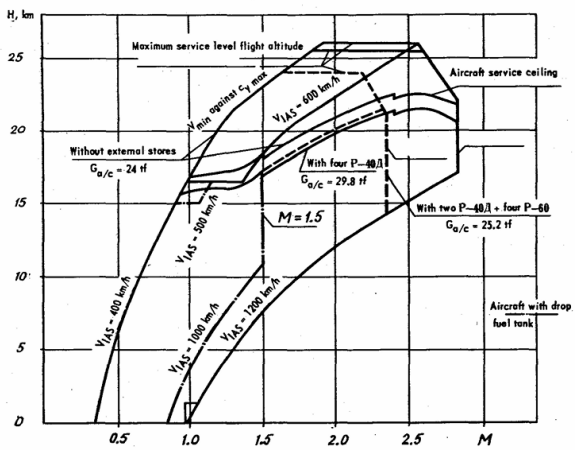


FIG. 7. ALTITUDE AND AIRSPEED RANGES OF AIRCRAFT МиГ–25ПД

The maneuvering indicated airspeed of flight, with the permissible variants of missiles carried, is equal to 400km/h at altitudes up to 16,500 m and 600 km/h at altitudes over 16,500 m.

Additional airspeed limitations are established for the aircraft carrying the drop fuel tank. The maximum permissible indicated airspeed is 1000 km/h, maximum M = 1.5, and the maneuvering airspeed is equal to 500 km/h at altitudes of 15,000 to 16,500 m.

The service ceiling of the aircraft carrying four missiles Р-40Д at the full reheat power setting is 21,500 m. In this case, the aircraft mass at the service ceiling equals 25,800 kg and the remaining fuel amounts to 3300 kg.

The minimum time of gaining an altitude of 20,000 m at M = 2.35 is equal to 8.9 min for the aircraft carrying four missiles Р-40Д and 8.7 min, when carrying two missiles Р-40Д and four missiles Р-60 (from the moment of the takeoff run).

Section IV

AIRCRAFT AUTOMATIC FLIGHT CONTROL SYSTEM

GENERAL

Aircraft МиГ-25ПД (МиГ-25ПДС), depending on the retrofit- ting series, have two modifications of the automatic flight control system: САУ-155ПДБ and САУ-155ШДБ, respectively. During preparation for flight the pilot should consider the particular modification of the automatic flight control system which he will employ during execution of the flight mission and be well familiar with its peculiarities.

The automatic flight control system is designed for automatic and director control of the fighter under all flight conditions as well as for improving the flight safety and characteristics during manual piloting.

The automatic flight control system has autonomous and external control modes:

(a) the autonomous (autopilot) modes of the automatic flight control system are as follows:

- damping of the aircraft short-period oscillations in roll, pitch and yaw;
- stabilization of the angles of roll (heading) and pitch with the control stick relieved of forces;
- aircraft levelling from any attitude with subsequent stabilization of the flight altitude and heading;

(b) the external modes of the automatic flight control system are as follows:

- ground direction with climb and descent according to the basic program with shaping of the discrete commands for control- ling the engine operation in descent;
- homing and breakaway;
- recovery from the limit altitude by a signal from the radio altimeter;
- en-route flight;
- return to a programmed airfield;
- landing approach to a programmed airfield;
- landing approach to a non-programmed airfield;
- repeated landing approach to a programmed airfield.

Moreover, the automatic flight control system ensures:

(1) limitation of a normal g-load and selected roll angle in compliance with the permissible values for the assigned flight conditions during automatic and director control;

(2) calculation of the permissible values of a normal g-load, angle of attack, maximum and minimum indicated air-speeds with shaping of signals announcing their approach to the limit values;

(3) compensation for momentary disturbances caused by mis-sile launching in the DAMPER mode in the entire range of combat employment, and up to a Mach number of 2.5 during automatic control.

The flight director indicator is used for indication of the present angles of roll, pitch and slip.

Arranged in the upper part of the flight director indicator is a horizontal dotted scale and a vertical bar (lateral channel position bar) indicating the position of the assigned flight path relative to the aircraft longitudinal axis in the horizontal plane.

The central circle is considered to be the longitudinal axis of the aircraft and the left (right) edge of the circle is considered to be the first dot.

In different modes the readings of the lateral channel position bar relative to the dotted scale (the 5th dot scale) correspond to:

(a) a deviation of the assigned flight path in the horizontal plane within ±30° in the ground direction mode, en-route flight, return, repeated approach and heading stabilization mode;

(b) an aiming error of ±60° in azimuth in the homing mode;

(c) a deviation from the localizer beacon equisignal zone within ±2° during landing approach.

Arranged in the left part of the flight director indicator is a vertical dotted scale and a horizontal bar (longitudinal channel position bar) indicating the position of the assigned flight path relative to the longitudinal axis of the aircraft in the vertical plane.

The combined course indicator is designed for indication of the present heading, preset course, relative bearing of the radio station (beacon) and the aircraft position relative to the equisignal zones of the landing beacons.

When the P/SET COURSE AUTO - MAN (КУРС ЗАДАН. АВТОМ. - РУЧН.) selector switch is set to the AUTO (АВТОМ.) position the present heading and preset course become slaved. When the external modes are engaged, the preset course signal is delivered from equipment 5У15К-11 or РСБН-6С.

The position bars of the combined course indicator show the position of the equisignal zones of the landing beacons relative to the aircraft axis.

USE OF AUTONOMOUS MODES OF AUTOMATIC PLIGHT CONTROL SYSTEM

Damping of Aircraft Short-Period Oscillations

The damping mode is intended for improvement of the aircraft stability characteristics during automatic, director and manual control.

The damping mode may be used in the entire range of flight altitudes and airspeeds excluding altitudes below 150 m at any airspeed and altitudes from 150 to 300 m at airspeeds exceeding 750 km/h.

Engagement of the damper results in improvement of the angle-of-attack stability.

When flying at high altitudes and Mach numbers equal to or exceeding 2.2 with a normal g-load, the aircraft features a higher roll response to deflection of the rudders (slipping). In this case, roll develops with a certain delay characteristic of high altitudes, while efficiency of the ailerons decreases with an increase of the g-load.

SAU (Automatic Control System)

1. **Button/ Indicator for Autopilot Damper Mode**
2. **Switch for Maximum Permissible Load**
3. **Button/Indicator for Activation of Automatic Control and Attitude Stabilization Mode**
4. **Button to Reset Current Autopilot Modes**
5. **Button/Indicator for Ground-Based Targeting Automatic Control Mode**
6. **Button / Indicator for RSBN Navigation Mode**
7. **Button /Indicator for Landing Mode**
8. **Button /Indicator for Go-Around Mode**

When the dampers are engaged, the aircraft roll response to slipping will significantly decrease. Therefore, all flights at high altitudes (H > 10,000 m) should be performed with the damping mode engage, which will considerably simplify the air- craft handling under these conditions.

When the Mach number exceeds 1.5 and voice message "Engage damper" is delivered, the pilot should enable the damping mode.

The damping mode is enabled by the DAMPER (ДЕМПФ.) light- button on the AFCS control panel. The light-button lights up after it is depressed. The damping mode is also automatically enabled when the pilot depresses the AUTO CTL (АВТ. УПР.) light-button arranged on the AFCS control panel or the LEVELLING ON (ВКЛ. ПРИВ. ГОРИЗ.), light-button located on the control stick.

The damping mode is disabled by depressing the AUTOPILOT OFF (ВЫКЛ. АП) button arranged on the control stick. In response, the DAMPER light-button goes out and the rods of the servo units return

to the neutral position, which may sometimes result in partial untrimming of the aircraft.

Stabilization of Aircraft Attitudes

The stabilization mode is intended for automatic maintaining of the selected angles of pitch and roll (heading) with the control stick relieved of forces.

The stabilization mode may be used in the entire range of flight altitudes and airspeeds, excluding altitudes below 150 m at any airspeed and altitudes from 150 to 300 m at airspeeds exceeding 750 km/h.

The stabilization mode is enabled by a short-live depression of the AUTO CTL light-button and is checked with reference to illumination of the AUTO CTL and DAMPER light-buttons arranged on the AFCS control panel.

The automatic flight control system ensures stabilization of the aircraft attitudes up to ±80° in roll, up to ±85° in pitch and within 0 to 360° in yaw at angles of roll within ±7° and angles of pitch within ±40°.

In case the angle to roll is beyond ±7° or the angle of pitch is beyond ±40° at the moment when the stabilization mode is enabled, the system stabilizes the aircraft roll rather than yaw.

Preparatory to enabling of the stabilization mode, the pilot should trim the aircraft with the help of the trim mechanisms.

In the stabilization mode the pilot may use combined control of the aircraft.

In order to change the flight conditions (yaw, roll and pitch) when the stabilization mode is enabled, the pilot should deflect the control stick to create the required angles of roll and pitch (when the, control stick force is applied, the stabilization mode gets disabled and the AUTO CTL light-button goes out), trim the aircraft with the help of the trim mechanisms and relieve the control stick of forces. In the course of combined control, auto trimming is disengaged in the control channel which is associated with application of the control stick force (in this case, the damping mode is still enabled.

After the control stick is relieved of forces, the AUTO CTL light-button lights up again and the automatic flight control system ensures stabilization of the newly selected aircraft attitude till the next interference of the pilot with the control.

In order to maintain the selected flight conditions, the pilot may- slightly change the angle of pitch by depressing the pitch trim selector switch without application of the control stick force.

The stabilization mode is disabled by the AUTOPILOT OFF button arranged on the aircraft control stick. In this case, the AUTO CTL and DAMPER light-buttons go out on the AFCS control panel.

Levelling Mode

The levelling mode is intended for levelling the aircraft from any attitude when the pilot loses spatial orientation.

This mode may be used during long-time straight-and-level flying for stabilization of the altitude and heading at altitudes of not less than 500 m over the ground relief.

The system operation in the levelling mode is based on bringing the aircraft to the zero values of roll and flight path angle. The levelling mode is enabled by depressing the LEVELLING ON light-button arranged on the control stick.

After the levelling mode is enabled, the aircraft is brought to the zero-roll angle.

When the roll exceeds 80°, stabilization of the angle of pitch occurs. When the aircraft is brought to a roll within ±80 ±5°, the system starts simultaneous levelling of the aircraft in pitch and roll to a straight flight path.

13 to 17 s after the aircraft is brought to the angles of pitch from -5 to +15°, the heading and altitude stabilization mode is enabled.

In order to enable the levelling mode, the pilot should depress the LEVELLING ON light-button on the control stick, with the pedals set to neutral, and relieve the control stick of forces. Check enabling of the levelling mode with reference to the illumination of the LEVELLING ON light-button on the control stick as well as of the AUTO CTL and DAMPER light-but- tons on the AFCS control panel (provided they have been dead).

When the levelling mode is enabled, all modes (including the director control modes) get disabled (except the damping mode).

The aircraft levelling is ensured:

(a) from roll at a rate of 15 to 25 deg/s (depending on the altitude at which the mode is enabled);

(b) from pitching-up at a g-load of not less than +0.35 g;

(c) from diving at a g-load of not more than +3 g.

It is not recommended to control the aircraft by the control stick and pedals when the levelling mode is enabled.

If the pilot interferes with the control when the aircraft is being levelled, the AUTO CTL light-button goes out on the AFCS control panel, the levelling rate decreases, and subsequently the levelling mode may discontinue altogether.

In case the levelling mode is enabled when the aircraft is in a strictly inverted position, the pilot should start levelling manually by deflecting the control stick in roll for a short time. After reaching an angular rate of 5 to 10 deg/s, the pilot should return the control stick to the neutral position.

In order to stabilize the altitude, it is recommended to enable the levelling mode at a zero vertical velocity of climb or descent.

In the barometric altitude and heading stabilization mode the position bars of the flight director indicator will read:

(a) the lateral channel position bar - a deviation from the stabilized heading;

(b) longitudinal channel position bar - a deviation from the stabilized altitude.

The levelling mode is disabled by the AUTOPILOT OFF button arranged on the control stick. In response, the LEVELLING ON light-button arranged on the control stick and the AUTO CTL and DAMPER light-buttons arranged on the AFCS control panel go out.

En-Route Flight

A flight along a selected route is performed by a directional method with the use of route turning points (RTP). The route is programmed in the short-range radio navigation and landing system before flight.

If an en-route flight is to be performed with the use of the automatic flight control system, take off and climb to 200 m in the manual control mode. Starting from 200 m fly the aircraft with reference to the lateral channel command bar of the flight director indicator keeping it within the circle.

Disengage the afterburner at an airspeed of not less than 600 km/h. At an altitude of 500 m zero the command bars and the longitudinal channel position bar, trim the control stick by the roll and pitch trim mechanisms, then relieve the control stick of forces and enable the automatic control mode.

If the climb involves levelling-off to a selected altitude, when the aircraft approaches the selected altitude the SET ALT LVL-0FF lamp lights up and the aircraft is automatically brough to the level flight.

When the distance to the RTP is 40 km, the D LESS THAN 40 KM (Д МЕНЬШЕ 40 КМ) lamp lights up on the control panel of the short-range radio navigation and landing system. When the lamp lights up, the pilot should depress the light-button of the next RTP. The aircraft will automatically turn to the next RTP. In this case, the roll angle will not exceed 45° at super-sonic airspeeds and 30° at subsonic airspeeds.

If the flight mission involves flying over a RTP, the pilot (without disabling the automatic control mode) should set the P/SET COURSE AUTO - MAN selector switch to the MAN (РУЧН.) position. Having flown over the RTP, the pilot should depress the light-button of the next RTP and set the P/SET COURSE AUTO - MAN selector switch to the AUTO position. It is necessary to place the preset course selector switch to the MAN position to preclude the aircraft oscillations in roll (±5°) at a distance of less than 25 km to the RTP in the automatic control mode.

When the SHORAN (РСБН) light-button goes out on the AFCS control panel, the system will automatically proceed with stabilization of the aircraft attitude (roll, yaw and pitch angles) that have been established at the moment of the lamp extinguishing. On this occasion, the pilot should proceed as follows:

- change over to the manual control mode (without disabling the automatic control mode by the AUTOPILOT OFF button);
- depress the SHORAN light-button on the AFCS control panel and make sure that it is alive;
- set the command bars within the circle and relieve the control stick of forces.

Throughout the en-route flight the command bars and position bars of the flight director indicator will indicate the following:

(a) the lateral channel position bar will indicate a deviation from the assigned flight path (in heading);

(b) prior to the illumination of the SEL ALT LVL-OFF lamp the longitudinal channel position bar will show a deviation from the programmed Mach number; after the illumination of the SEL ALT LYL-OFF lamp the bar will show a deviation from the selected flight altitude.

The selected roll is within ±30° at Mach numbers less than 0.95 and within ±42° at Mach numbers more than 0.95. The selected g-load is within 0.35 to 3 g.

Return to Programmed Airfield

(Will be implemented in next updates)

In the lateral and longitudinal channels the aircraft is controlled by the signals of the РСБН-6С short-range radio navigation and landing system.

To fly the aircraft during return to a programmed airfield either in the automatic or director control mode, the pilot should depress the AFLD (АЭР) and RETURN (ВОЗВРАТ) light-buttons (the CORR. (КОРР.) lamp should be alive) on the control panel of the short-range radio navigation and landing system. The P/SET COURSE AUTO - MAN selector switch should be set to the AUTO position. Depress the SHORAN light-button on the AFCS control panel.

If the aircraft proceeds at an altitude of higher than 9500 m and at a distance of more than 250 km from the airfield, the pilot should descend, controlling the aircraft manually in the longitudinal channel so that the aircraft is brought to the altitude of 9500 mm at a distance of 120 to 250 km from the airfield. In the course of descent, the pilot should control the aircraft in the lateral channel with reference to the vertical command bar.

After the aircraft is brought to the cruise altitude of 9500 m, the pilot should set the command bars of the flight director indicator within the circle and enable the automatic control mode.

At a distance of from 90 to 120 km, check the commencement of the break-through mode with reference to the deviation of the horizontal pitch command bar and longitudinal channel position bar of the flight director indicator and to the aircraft change-over to descent. While descending along the break-through path, the horizontal position bar of the flight director indicator will be located below the circle between the second and third dots, and the pitch command bar will be located in the centre of the circle. At an altitude of 600 m the aircraft will smoothly change over to a level flight and subsequently arrive at the area of either the base leg turn or the final turn depending on the return heading and landing heading.

In case the return mode is enabled when the aircraft is positioned above the break-through path in the area of the air- field, the preset course will be computed by the РСБН-6С system to a point located along the runway axis and set off beyond the prelanding maneuver area to such a distance that the angle of the descent path should not exceed 9°. In this case, the aircraft may turn even away from the airfield.

This being the case, the automatic flight control system does not provide either for automatic or for director altitude control.

As the aircraft descends, the off-set point moves along the axis towards the runway and as the aircraft intercepts the break-through path, the flight is performed similarly to the return according to the descent program.

Under these conditions, the break-through path is intercepted manually with the aircraft controlled in the lateral channel with reference to the commands of the vertical command bar. After the break-through path is intercepted, set the command bars within the circle and enable the automatic control mode.

WARNING

IF THE RETURN MODE IS ENABLED AT AN ALTITUDE ABOVE THE BREAK-THROUGH PATH, IT IS PROHIBITED TO USE THE AIRCRAFT DIRECTOR CONTROL IN THE LONGITUDINAL CHANNEL AND TO ENABLE THE AUTOMATIC CONTROL MODE UNTIL THE.BREAK-THROUGH PATH IS INTERCEPTED. OTHERWISE, THE AIRCRAFT WILL DESCEND WITH HIGH PITCH ANGLES AND AT A GROWING SPEED, WHICH IS FRAUGHT WITH DANGER.

The return mode terminates with the aircraft arrival at the estimated point of the prelanding maneuver at the altitude of 630 m with the РСБН-6С system and automatic flight control sys- tem changing over to the landing mode.

While proceeding in the return mode, the lateral channel position bar shows a deviation from the assigned flight path in heading and the longitudinal channel position bar shows, a deviation from the programmed flight path in altitude that is computed in the РСБН -6С system.

The selected roll angle is within ±30° when the Mach number is less than 0.95 and within ±42° when the Mach number is more than 0.95°.

The selected g-load is within 0.35 to 3 g.

Landing Approach to Programmed Airfield

The given mode is enabled at the final stage of the return mode. Preparatory to the fighter arrival to the estimated point at the altitude of 630 m, the pilot should check to see that:

- the RETURN light-button and the AFLD light-button (of a respective airfield) are depressed on the control panel of the short-range radio navigation and landing system;
- the CORR. lamp is alive;
- the ψ + 180° selector switch is set to the position corresponding to the selected landing heading;

- the MISSED APPROACH, LH - RH (ПОВТ ЗАХ. ЛЕВ. - ПРАВ.) selector switch is set in compliance with the selected direction of the missed approach;
- the SHORAN light-button is alive on the AFCS control panel;
- the readings of the combined course indicator and flight director indicator comply with the flight program.

Fly to the starting point of the turn to the landing heading keeping the command bars of the flight director indicator within the circle (in the manual or automatic control mode).

In the process of the turn to the landing heading performed with a roll of up to 30°, set the airspeed equal to 450 km/h.

Preparatory to interception of the landing heading, check to see that the landing mode has been automatically enabled with reference to the following:

- first the LOC flag and then (at a distance of not less than 20 km) the GS flag has dropped out on the flight director indicator;
- the LANDING (ПОСАДКА) light-button has illuminated on the AFCS control panel (the ommand bars oscillate in this case for 2 or 3 s);
- the vertical bar of the combined course indicator has deflected from the indicator centre, showing the position of the equisignal zone of the localizer beacon relative to the aircraft;
- the horizontal bar of the combined course indicator has abruptly moved upwards, showing the position of the equisignal zone of the glide-slope beacon;
- the preset course pointer of the combined course indicator points to the landing heading.

Bring the aircraft within the equisignal zone of the localizer beacon (and make sure that it keeps within this zone), maintaining the altitude of 550 to 700 m up to a distance of 12 to 14 km (until the equisignal zone of the glide slope beacon is crossed).

After the fighter intercepts the landing heading, beginning from the distance of 14 to 16 km the horizontal bar of the combined course indicator will start smoothly moving downwards to the centre of the indicator. When the horizontal bar of the combined course indicator approaches the central circle, the aircraft enters the glide slope.

At a distance of 12 km the pilot should check to see that the aircraft has started descending with a vertical speed of 5 to 7 m/s and that it keeps within the equisignal zone of the glide slope beacon.

To check the descent mode, the pilot should well remember the relation between the flight altitude and the distance to the runway.

Altitude, m	600	400	200	100	50
Distance, km	12 to 14	8 to 9	4	2	1

At an altitude of 50 m disable the automatic control mode by depressing the AUTOPILOT OFF button and change over to manual control. Visually check the landing approach planning and land the aircraft.

WARNING

1. IF DURING THE PRELANDING MANEUVER (AT A DISTANCE OF MORE THAN 12 TO 14 KM) THE STABILIZED ALTITUDE FAILS TO BE MAINTAINED WITHIN 550 TO 700 M, DISENGAGE THE AUTOMATIC FLIGHT CONTROL SYSTEM BY THE AUTOPILOT OFF BUTTON AND CHANGE OVER TO MANUAL CONTROL. PRIOR TO INTERCEPTION OF THE RADIO GLIDE SLOPE, THE AIRCRAFT CONTROL IN THE LATERAL CHANNEL SHOULD BE PERFORMED WITH REFERENCE TO THE VERTICAL COMMAND BAR OF THE FLIGHT DIRECTOR INDICATOR AND IN THE LANGITUDI- NAL CHANNEL THE AIRCRAF'T SHOULD BE CONTROLLED WITH REFERENCE TO THE READINGS OF THE УВ0-М1 INSTRUMENT. APTER INTERCEPTION OF THE RADIO GLIDE SLOPE (THE HORIZONTAL BAR OF THE COMBINED COURSE INDICATOR MOVES DOWNWARDS THROUGH THE CENTRE AND APPROACHES THE LOWER EDGE OF' THE CENTRAL CIRCLE), WITH THE DIRECTOR CONTROL MODE BEING O.K., ENABLE THE AUTOMATIC CONTROL MODE BY DEPRESSING THE AUTO CTL LIGHT-BUTTON ON THE AFCS CONTROL PANEL.

2. IN THE COURSE OF LANDING APPROACH IN THE AUTOMATIC CONTROL MODE AS WELL AS DURING EXTENSION OF THE LANDING GEAR AND F'LAPS, THE PILOT SHOULD TIMELY CORRECT THE ENGINE POWER SETTING IN COMPLIANCE WITH THE VARIATIONS OF THE FLIGHT CONDITIONS, AVOIDING LOSS OP AIRSPEED.

The automatic flight control system compensates for the nose-down moment (created as a result of speed

reduction) by deflecting the stabilizer and maintains the selected angle of pitch to maintain the assigned flight path.

In the course of further speed reduction, the aircraft (with the help of the automatic flight control system) will tend to maintain the assigned flight path by increasing the angle of attack up to the critical values.

When the landing gear is lowered, the angle-of-attack limitation circuit is disengaged.

Note

When aircraft МиГ-25ПД is on the glide path and the GS or LOC flag drops in on the combined course indicator, the LANDING light-button will go out and the LEVELLING mode will be automatically enabled. In this case, the LEVELLING ON light-button will light up on the control stick and the "Glide slope failure" voice message will be delivered. In this event, the pilot should disable the levelling mode by the AUTOPILOT OFF button and decide whether he should proceed with the landing approach or perform the go-around manoeuvre.

In the course of the landing approach the indications of the position bars of the flight director indicator will be as follows:

(a) the lateral channel position bar will indicate a deviation from the localizer beacon equisignal zone;

(b) prior to the interception of the radio glide slope the longitudinal channel position bar will indicate a deviation from the 630-m altitude and after the radio glide slope is intercepted, the bar will indicate a deviation from the equisignal zone of the glide slope beacon.

The selected roll is within ±30°.

The selected g-load is within 0.8 to 1.7 g.

The vertical and horizontal position bars of the combined course indicator show a deviation of the aircraft from the equisignal zone.

Landing Approach to Non-Programmed Airfield

If it is necessary to perform the landing approach to a non-programmed airfield, the pilot should enable the mode of the landing approach to a non-programmed airfield by the RESET (СБРОС) light-button on the РСБН-6С system control panel. In this mode, the navigation circuit of the РСБН -6С system does not deliver control signals to the automatic flight control system.

Controlling the aircraft manually, the pilot should bring the aircraft to the coverage zone of the localizer and glide slope beacons with reference to the radio compass, the values of present heading and landing heading.

After the LOC flag drops out on the combined course indicator, it is necessary to select manually a landing heading by the selected course knob of the combined course indicator and enable the mode by the LANDING light-button on the AFCS control panel.

The aircraft is controlled in the lateral channel in a way similar to that used during the landing approach to a programmed airfield.

Prior to the interception of the descent path, stabilization of the altitude selected on the altitude and airspeed selector takes place in the longitudinal channel.

To perform the landing approach to a non-programmed airfield, the pilot should proceed as follows:

- depress the RESET and RETURN light-buttons on the РСБН -6С system control panel;
- select the channels of the navigational and landing beacons of the landing airfield by the NAVIGATION (НАВИГАЦИЯ) and LANDING (ПОСАДКА) knobs;
- set the P/SET COURSE AUTO - MAN selector switch to the MAN position;
- select the landing heading by the selected course knob of the combined course indicator;
- in the course of the turn to the landing heading or while descending from the level flight at an altitude of 600 m and at a distance of 19 to 21 km turn on the LANDING switch on the РСБН -6С system control panel;
- after the LOC flag drops out on the combined course indicator, depress the LANDING light-button on the AFCS control panel;
- check to see that the SHORAN and LANDING light-buttons are alive on the AFCS control panel and that the roll and pitch flags have dropped out on the flight director indicator;
- after the command bars of the flight director indicator settle within the circle, depress the AUTO CTL light-button on the AFCS control panel and perform the landing approach in the director control mode similarly to the landing approach to a programmed airfield.

Prior to the interception of the radio glide slope, the automatic flight control system stabilizes the altitude at which the LANDING light-button is pressed on the AFCS control panel.

In the process of the landing approach the indications of the position bars of the flight director indicator will be as follows:

(a) the lateral channel position bar will indicate a deviation from the localizer beacon equisignal zone;

(b) prior to the interception of the radio glide slope the longitudinal channel position bar will indicate a deviation from the altitude selected on the altitude and airspeed selector; after the interception of the radio glide slope the bar will indicate a deviation from the equisignal zone of the glide slope beacon.

The selected roll is within ±30°.

The selected g-load is within 0.8 to 1.7 g.

Missed Approach Mode

(Will be implemented in next updates)

The missed approach mode is effective only for the landing approach to a programmed airfield, since the automatic flight control system controls the aircraft in the lateral and longitudinal channels by the signals of the РСБН-6С system computed for the return to a programmed airfield.

The РСБН-6С system supplies a pre-set course signal to the lateral channel of the automatic flight control system to turn and fly along the flight path with a reciprocal heading at a distance of 8 to 9 km from the runway centre line. The flight path is plotted relative to the navigational beacon of the short-range radio navigation and landing equipment of the given airfield.

Starting from the distance of 19 to 21 km (the beginning of the base leg turn), the РСБН-6С system operates in the same way as in case of a prelanding maneuver in the return mode. At the beginning of the base leg turn the MISSED APPROACH light-button goes out on the AFCS control panel and the automatic landing approach is accomplished in a way similar to that used in the return mode.

In the longitudinal channel the automatic flight control system stabilizes the altitude of 630 m of the prelanding maneuver.

In case of a go-around maneuver, arrival at the altitude of 630 m cannot be performed automatically. Therefore. the automatic control mode can be enabled only after the aircraft has arrived at this altitude. In the missed approach mode, the indication and limitation of the control signals are similar to those in the return mode.

Section V

DAYLIGHT FLYING UNDER VFR CONDITIONS

GENERAL

Mastering the daylight VFR flying technique is the primary stage of handling the aircraft.

Flying technique is the basis of flight training. High quality of flying technique ensures successful mastering of the elements of air navigation and combat employment in various conditions. Besides, it is one of the factors determining flight safety.

Flying technique training is aimed at forming firm habits of the pilots in handling the aircraft and engines at all stages of flight from take-off to landing. High individual proficiency in flying technique within the entire range of operational altitudes and airspeeds with the proper use of aerodynamic characteristics of the aircraft is the fundamental principle required for training of a pilot as a fighter.

All actions of the pilot in handling the aircraft and controlling the engines should be based on profound and fundamental knowledge of aerodynamic characteristics of the aircraft, operational limitations and peculiarities involved in flying technique of the МиГ-25ПД aircraft.

The pilots acquire the necessary knowledge and habits of flying in the course of theoretical training, exercises on simulators and cockpit drills, as well as during familiarization, check and training flights performed for mastering flying technique.

Practical training of the МиГ-25ПД aircraft pilots in flying technique under daylight VFR conditions includes circling flights, maneuvering flights, instrument flights, as well as flights at supersonic airspeeds and flights in stratosphere.

CIRCLING FLIGHT

General

The elements of flying technique practised in the course of circling flight are the major components of any flight. Success in further mastering of the flying technique and combat skill depend on successful and proficient mastering of the circling flight elements.

The training circling flights consolidate the habits of the pilot in performance of take-off, estimation of landing and landing proper, as well as in handling of the aircraft during flight. Besides, in the course of circling flights the pilot acquires habits in employment of the airborne and ground navigation aids during landing approach. The initial stage of training landing approach includes complex employment of the two-beacon landing system and ground-controlled approach system, and further, use of the POLJOT-IИ system.

Pilot's Actions at Different Stages of Preparation for and Execution of Circling Flight

Preparatory to starting the engine the pilot must:

(1) give the "Close the canopy" command to the aircraft technician (the technician will remove the safety pins, show them to the pilot and help the pilot to close the canopy);

(2) close the canopy;

(3) move the lock control handle to the extreme forward position;

(4) check to see that:

- the safety pins are removed;
- the canopy is closed;
- the locking pins are visible in the holes of the canopy-carrying panel;
- the LOCK CANOPY (ЗАПРИ ФОНАРЬ) lamp is dead;

(5) don the oxygen mask (close the pressure helmet visor);

(6) turn on the HELMET VENT ON (ВЕНТИЛ. ШЛЕМА ВКЛ.) switch;

(7) establish communication with the technician over the intercom system;

(8) request clearance for starting the engine;

(9) check to see that:

- communication over the intercom system is O.K.;
- engine starting is cleared;

(10) give the "Starting" command and receive the acknowledgement;

(11) check the throttle lever for easy travel and reliable fixing at the stops and set it to the STOP (СТОП) position;

(12) turn on the FUEL PUMP NITROG (ТОПЛИВ. НАСОС АЗОТ) and БИА circuit breakers;

(13) check to see that:

- the circuit breakers and switches are turned on;
- the NO FUEL FEED (НЕТ ПОДК. ТОПЛ.) lamp in the annunciator is dead;
- the WATCH BOOST SYS PRESS (СЛЕДИ ДАВЛ. БУСТ. СИСТ.), WATCH MAIN SYS PRESS (СЛЕДИ ДАВЛ. ОБЩ. СИСТ.), DC GEN OFF (ГЕНЕР. = ВЫКЛ.) (two lamps), AC GEN OFF (ГЕНЕР. = ВЫКЛ.) (two lamps), STAB FOR LDG (СТАБИЛИЗ. НА ПОСАД.) and ROLL FOR LAND (КРЕН НА ПОСАД.) lamps should be alive in the annunciator.

When starting the engines, the pilot must:

(14) give the "Clear the engines" command to the technician and receive the acknowledgement;

(15) set the throttle lever of the right engine to the idling position;

(16) press the stopwatch button;

(17) press the GROUND STARTING RH (ЗАПУСК НА ЗЕМЛЕ ПРАВ.) button for 1 or 2 s;

(18) check to see that:

- the TS DOORS OPEN (СТВОРКИ ТС ОТКР.) lamp is alive;
- the IGNIT OFF (ЗАЖИГ. ВЫКЛЮЧ.) lamp is alive;
- the ENG AUTO DUPL (ДУБЛИР. АВТОМ. ДВИГ.) lamp is alive;
- the engine spinning-up is started (inform the technician of the fact);
- the oil pressure is built up when the engine speed is from 10 to 15 per cent;
- the bleed valve opens (the BLEED VLV OPN (ЛЕНТА ОТКРЫТА) lamp is alive) when the engine speed does not exceed 20 per cent;
- the exhaust gas temperature is not more than 840°C;
- the IGNIT OFF lamp goes out when the engine speed is 29 to 31 per cent;
- the pressure rises in the hydraulic systems (the WATCH BOOST SYS PRESS and WATCH MAIN SYS PRESS lamps go out);
- the ENG AUTO DUPL lamp goes out when the engine speed is 34 per cent;
- the starting cycle takes not more than 55 s;

(19) check the idling power parameters and make sure that:

- the engine speed is 40 to 43 per cent;
- the exhaust gas temperature is not more then 650°C;
- the oil pressure is not less than 1.7 kgf/cm^2;
- the pressure in the main hydraulic system is not less than 150 kgf/cm^2;
- the pressure in the booster hydraulic system (with the control stick being fixed) is not less than 200 kgf/cm^2;

(20) after the right engine is started, start the left engine proceeding in the above sequence;

(21) give the "Disconnect power" command to the technician;

(22) check the following:

- the technician's acknowledgement;
- extinguishing of two DC GEN OFF lamps and two AC GEN OFF lamps;
- the aircraft mains voltage of 28 to 29 V.

WARNING

1. THE REPEATED STARTING OR CRANKING OF THE ENGINE MAY BE PERFORMED ONLY AFTER THE ROTORS HAVE COHE TO A STOP AND NO SOONER THAN 2 MIN AFTER THE GROUND STARTING BUTTON IS DEPRESSED DURING THE PREVIOUS STARTING.

2. START THE RIGHT ENGINE FIRST.

3. PREPARATORY TO THE ENGINE STARTING FROM THE STORAGE BATTERIES, PROCEED AS FOLLOWS:

- TURN ON THE GRND SUP ACFT BAT (АЭРОД. ПИТ. БОРТ. АКК.) SWITCH AND THE ПТО START (ЗАПУСК ПТО), VHF RADIO (УКВ РАЦИЯ) AND FUEL PUMP NITROG CIRCUIT BREAKERS;
- CHECK THE VOLTAGE AGAINST THE VOLTMETER (IT SHOULD BE NOT LESS THAN 22 V);
- TURN ON THE DC GEN LH, RH AND AC GEN LH, RH AND БИА CIRCUIT BREAKERS;
- START THE RIGHT ENGINE;
- ADDITIONALLY CHECK THAT THE ENG AUTO DUPL LAMP IS ALIVE;
- NO SOONER THAN IN 14 S START THE LEFT ENGINE;
- AFTER THE ENGINES BECOME ACCELERATED TO THE IDLING POWER TURN ON THE REMAINING CIRCUIT BREAKERS ON THE CENTRAL PANEL OF THE CABIN STARBOARD.

After the engines are started, check the aircraft systems:

(23) set the engine speed to 50 per cent;

(24) check the operation of the hydraulic systems, proceeding as follows:

- check to see that the WATCH BOOST SYS PRESS and WATCH MAIN SYS PRESS lamps are dead;
- displacing the control stick diagonally with the maximum possible speed make sure that the pressure in the main and booster hydraulic systems does not drop below 180 kgf/cm^2;
- extend the flaps and air brake;
- check their extension with reference to the indication on the L.G. and flaps position indicator and by the report of the aircraft technician;
- retract the air brake and flaps;
- check their retraction with reference to the indication on the L.G. and flaps position indicator and by the report of the technician;

(25) check the aircraft control system, proceeding as follows:

- check to see that the STAB FOR LDG and ROLL FOR LAND lamps are alive;
- the STICK (РУЧКА) and STAB (СТАБИЛИЗАТОР) indices of the AFC indicator are located at the bottom;
- deflect the control stick to the left, to the right, forward and backward and deflect the pedals;
- make sure that the control stick and pedals are free from jerks and jamming;
- relieve the control stick and pedals of forces;
- check to see that the control stick and pedals return to the trimmed position;

(26) check the operation of the trim mechanism, proceeding as follows:

- first pull and then push the trim knob on the control stick. In response, the released control stick should deflect in the direction of movement of the trim knob;
- set the trim mechanism to the neutral position;
- check to see that the STAB TRIM (ТРИММ. СТАБИЛИЗ.) lamp is illuminated in the annunciator;
- press the aileron trim knob first to the left and then to the right;
- check to see that the released control stick displaces in the direction of movement of the knob;
- set the aileron trim mechanism to the neutral position;
- check to see that the ROLL TRIM (ТРИММ. КРЕНА) lamp is illuminated in the annunciator;
- press the rudder trim knob first to the left and then to the right;
- check the respective deflection of the pedals;
- set the rudder trim mechanism to the neutral position;
- check to see that the RUD TRIM (ТРИММ. Р.П.) lamp is illuminated;
- with the help of the technician make sure that the rudders are set to the neutral position;

(27) perform the following operations:

- fully depress the brake lever on the control stick;
- check the pressure against the pressure gauge which should read 105 to 120 kgf/cm^2;
- alternately deflect the pedals;
- make sure that the main wheels get positively braked and unbraked;

(28) check the operation of the voice message equipment, proceeding as follows:

- depress the SPEECH INFORM CHECK (ПРОВЕР. РЕЧЕВОЙ ИНФОРМ.) button;

- check that the "Limit g-load" voice message is delivered;
- depress and release the SPEECH INF COM RPT (ПОВТ. КОМ. РЕЧ. ИНФ.) button;
- check that the voice message is repeated;
- depress the RADIO (РАЦИЯ) button on the throttle lever for a short time;
- check that the voice message delivery is stopped;

(29) successively accelerate the engines to the maximum po-power (for 5 to 10 s);

while the engines are being accelerated to the maximum power, check to see that the bleed valves get closed when the engine speed is from 74 to 76 per cent (the BIEED VLV OPN lamp goes out), and when the engine speed exceeds 76.5 per cent, the AIR INT MONIT L R (КОНТР. ВХОДА ЛЕВ., ПРАВ.) lamp lights up;

(30) with the engines running at the maximum power, check to see that:

- the speed of the engines does not exceed 94.5 per cent;
- the exhaust gas temperature is not more than 820°C;
- the oil pressure is not less than 3.5 kgf/cm²;
- the jet nozzle flaps close (to be checked with reference to an intensive growth of the exhaust gas temperature);
- the TS DOORS OPEN lamps go out;

(31) set the throttle lever to the IDLE (МАЛЫЙ ГАЗ) stop.

Note

The engine run-up should be performed at the beginning of the flying day.

After the engines are started, proceed as follows:

(1) request clearance for taxying;

(2) having been cleared for taxying, brake the wheels and order the technician to remove the chocks;

(3) having received the technician's acknowledgement, tell him "Over" and accelerate the engines up to 55 to 60 per cent;

(4) release the braking lever and start taxying;

(5) after the aircraft gains sufficient speed, move the throttle levers of the engines to the IDLE stops;

(6) prior to starting a turn, depress the STR (МРК) button on the control stick when the pedals are neutral, and then smoothly deflect the pedals in the direction of the turn;

(7) the taxying speed should not exceed 30 km/h;

(8) during the turns the speed should not exceed 15 km/h;

(9) the distance between the taxying aircraft should be at least 200 m; at a wind velocity of 10 m/s and higher, the distance should be at least 250 m;

(10) while taxying, avoid abrupt turns at a high speed;

(11) while taxying, pay special attention to proper operation of the directional system, automatic direction finder, short-range radio navigation and landing system, navigation instruments.

Prior to taxying out to the runway, the pilot must:

(1) turn on the ПВД, ДУА HEATING (ОБОГР. ПВД. ДУА) circuit breaker;

(2) lock the harness;

(3) check to see that:

- the pointers of the УВО-М1 indicator read zero;
- the pressure in the main and booster hydraulic systems is normal;
- the engine parameters are normal;
- there are no glowing lamps in the emergency annunciator;
- the pressure in the pneumatic systems (both main and emergency) is normal;

(4) taxy out to the runway;

(5) taxy 5 to 10 m straight and align the aircraft with the runway centre line;

(6) smoothly brake the aircraft, fully depress the braking lever;

(7) check to see that:

- the present heading read by the combined course indicator complies with the takeoff heading;
- the ADF pointer shows the direction to the outer marker beacon;

(8) depress the flaps extension button and check their extension with reference to the lamp of the L.G. and flaps position indicator;

(9) actuate the nosewheel brake,

(10) start the clock;

(11) turn on the LANDING switch on the РСБН-6С system control panel and check to see that the LOC flag drops out;

(12) turn off the LANDING switch;

(13) request clearance for takeoff;

(14) set the throttle lever to the MAXIMUM (МАКСИМАЛ) position;

(15) check to see that:

- the bleed valves are closed (the BLEED VLV OPN lamps go out);
- the turbostarter doors are closed (the TS DOORS OPEN lamps go out);
- the AIR INT MONIT L R lamps go out;
- the engine speed complies with the maximum power setting;
- the gas temperature does not exceed the maximum permissible value but is not less than 600°C (the jet nozzle flaps are closed).

Takeoff

The pilot must do the following:

(1) having been cleared for takeoff, set the throttle lever to the REHEAT (ФОРСАЖ) position;

(2) check to see that:

- the REHEAT (ФОРСАЖ) lamps light up;
- the exhaust gas temperature is not less than 600°C;
- the engine speed drops for a short time and then rises;
- shocks characteristic of the reheat power engagement rate are present;

(3) release the braking lever;

(4) in the first half of the takeoff run, maintain the direction by operating the pedals and brakes. Transfer attention as follows:

- direction;
- speed - within 100 km/h;
- direction.

Apply 2/3 of back stick at a speed of 220 to 240 km/h. Transfer attention as follows:

- direction;
- determining the moment of nosewheel lift-off (at a speed of 280 to 290 km/h);
- direction;

(5) set and fix the takeoff angle by the control stick;

(6) maintain the direction by operating the pedals.

Transfer attention as follows:

- direction;
- takeoff angle - the horizon is projected on the lower base of the windshield, and the flight director indicator reads a pitch angle of 10 to 11°;
- speed (it approaches 350 km/h);
- engine operation (to be checked aurally);

(7) having determined the aircraft separation from the runway, maintain the takeoff angle and shift the glance on the ground looking through the left front glass panel;

(8) make sure that the height is 10 to 15 m;

(9) maintaining the takeoff angle constant, throw the landing gear control valve catch up and set the landing gear control valve for retraction.

Transfer attention as follows:

- flight director indicator (pitch angle is 10 to 11°, roll angle is zero);
- airspeed indicator (airspeed is about 400 km/h);
- altitude indicator (altitude keeps growing);
- flight director indicator (pitch, roll angles are equal to zero);

(10) at an altitude of more than 100 m depress the flaps re-retraction button, shift the finger on the FLAPS EXT (ЗАКРЫЛКИ ВЫП.) button and keep it there until the FLAPS DOWN (ЗАКРЫЛКИ ВЫПУЩЕНЫ) lamp goes out on the L.G. and flaps position indicator;

(11) check to see that the L.G. retraction position lamps light up;

(12) set the landing gear control valve to the neutral position;

(13) throw the catch of the landing gear control valve down. Transfer attention as follows:

- flight director indicator (roll, pitch);
- airspeed;
- altitude;
- flight director indicator;

(14) at an airspeed of 450 km/h check the following:

- illumination of the LOWER DOOR 2ND PSN (ОБЕЧАЙКА 2-Е ПОЛОЖ.) lamp;
- upward displacement of the AFC indices.;
- extinguishing of the STAB FOR LDG and ROLL FOR LAND lamps;

(15) at an airspeed of at least 600 km/h successively shift the throttle lever to the MAXIMUM position;

(16) check to see that:

- the REHEAT lamps go out;
- the engine speed corresponds to the maximum power;

- the exhaust gas temperature does not exceed the maximum permissible value and is not less than 600°C.

Route Plotting

At an altitude of 1000 m after disengagement of the after-burners look round and perform the turns on the crosswind and downwind legs with a bank of 30° at an airspeed of 600 km/h in close succession. In the course of the turn continue climbing.

Let us consider a wide pattern at an altitude of 2000 m with subsequent descent to an altitude of 600 m. Figs 39 and 40 present the route plotting and circling flight pattern.

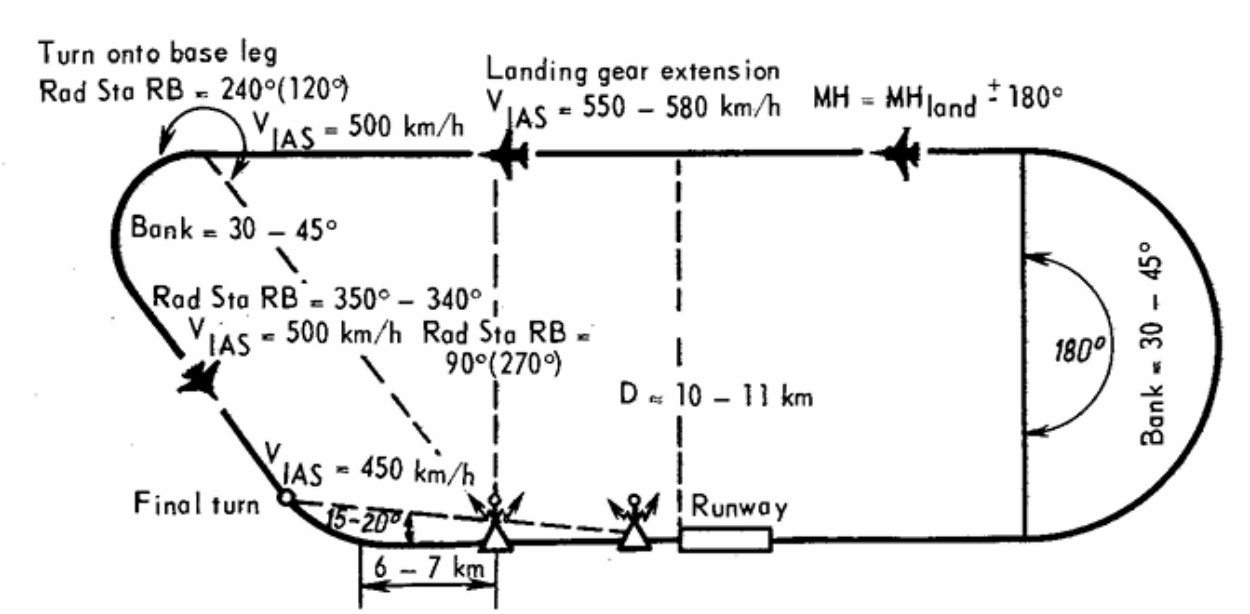


FIG. 39. ROUTE PLOTTING FOR CIRCLING FLIGHT

At 100 to 150 m to the assigned altitude start gradually decreasing the climb angle and engine speed. At an altitude of 2000 m maintain the airspeed of 600 km/h. An engine speed of 78 to 80 per cent corresponds to the airspeed 600 km/h.

The moment of the turn recovery is determined by referring to the combined course indicator and visually.

After reversing the course double your attention and make sure that other aircraft do not interfere with further circling.

Besides, continuously analyse the radio contact between the flight control officer and other pilots being in air. It allows to estimate indirectly the air situation within the area of the airfield.

When other aircraft perform circling flight, to provide for flight safety and normal landing approach, it is necessary to maintain the preset distance to a leading aircraft. As a rule, in this case, the pilots radio the flight control officer about the turns being affected.

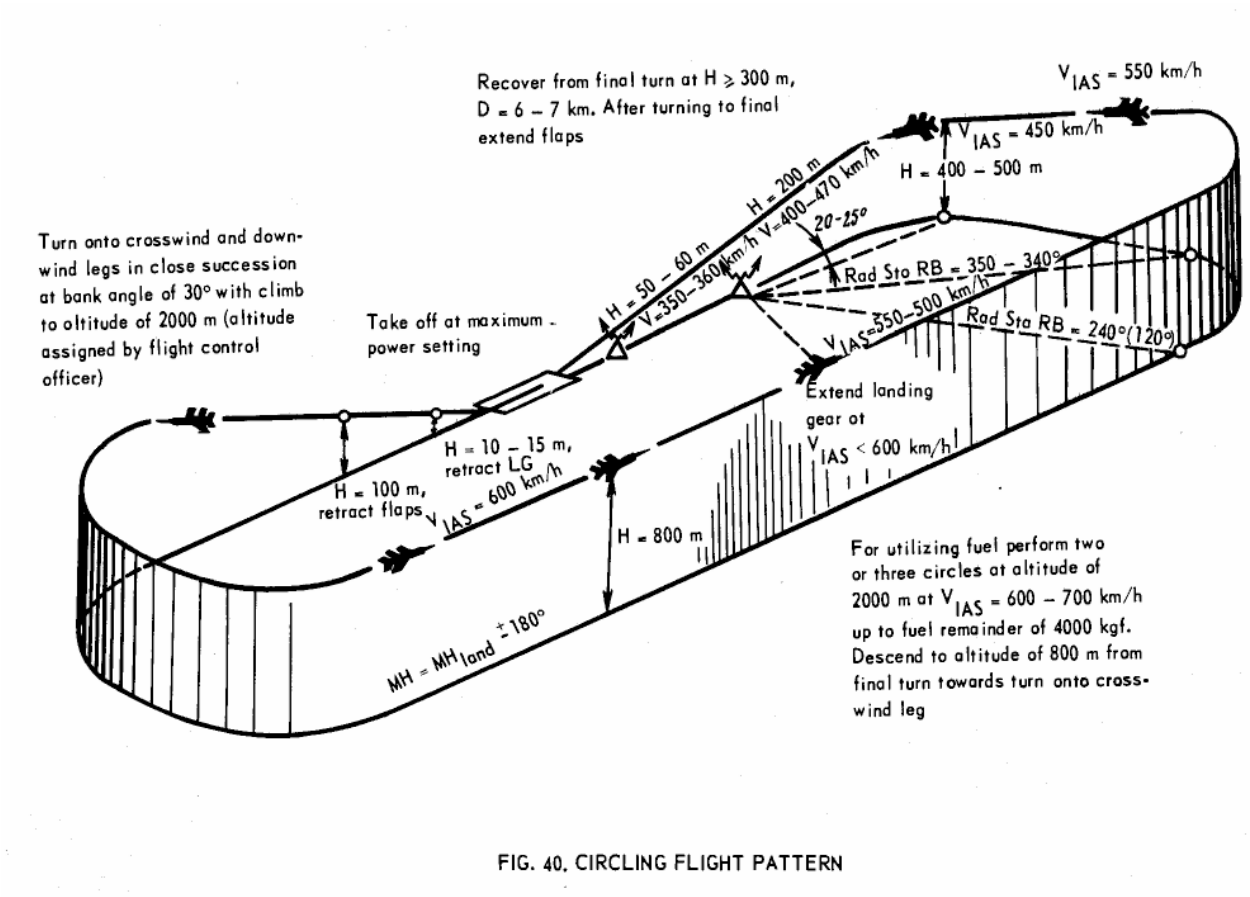


FIG. 40. CIRCLING FLIGHT PATTERN

At an altitude of 2000 m perform the circling flight until the fuel load amounts to 4000 kgf (or assigned by the commander). After that perform landing approach on permission of the flight control officer.

To perform landing approach, descend from an altitude of 2000 m to 600 m when flying from the final turn to the turn on the crosswind leg. While descending, maintain a progressive speed of 600 km/h and a vertical speed of 15 m/s down to an altitude of 1000 m. When descending from an altitude of 1000 m to 600 m, maintain a descent rate of 10 m/s.

At an altitude of 600 m bring the aircraft into level flight.

To maintain an airspeed of 600 km/h, an engine speed of 75 to 78 per cent is required.

The turns on the crosswind and downwind legs should be performed in close succession at a bank angle of 30° to intercept the course opposite to the landing heading.

From the turn on the downwind leg to the turn onto the base leg the aircraft should fly in parallel with the runway; the side distance amounts to 10 km. The side distance is checked by referring to the ППД-2 distance indicator and typical landmarks.

When abeam the outer marker beacon (Rad Sta RB= 270° with the left-hand traffic circuit or Rad Sta RB= 90° with the right-hand traffic circuit), reduce the airspeed to 550 km/h. After that place the landing gear control valve knob to the DOWN position and throw the valve catch down.

Check the extension of the landing gear by illumination of the green pilot lamps and restoration of the pressure in the hydraulic systems up to 210 kgf/cm², the position of the drag chute control switch (in first solo flights the switch should be in the MAN (РУЧН.) position), the engagement of the wheel brake control automatic unit, the engagement of the nosewheel brake. The wheel brakes should be released, the air pressure in the main and emergency systems should be 100 to 130 kgf/cm².

The landing gear control valve knob should remain in the extension position until the aircraft is parked.

With the landing gear extended, set an airspeed of 500 km/h. In this case, the engine speed will be within the range of 75 to 78 per cent.

Landing Approach and Estimation for Landing

Before turning onto the base leg it is necessary to look round, request clearance for landing and at Rad Sta RB = 240° (120°) perform the turn onto the base leg through an angle of 100 to 110° at an airspeed of 500 km/h with a bank of 30 to 45° in the horizontal plane.

Recovery from the turn onto the base leg should be completed at Rad Sta RB = 345 to 340° with the left-hand traffic circuit or at Rad Sta RB = 15 to 20° with the right-hand traffic circuit.

After turning onto the base leg, bring the aircraft into a descent at a vertical rate of 5 to 7 m/s, set the engine speed of 74 to 76 per cent and extend the flaps. In this case, make sure that the airspeed is 450 km/h. Accuracy in maintaining the airspeed is corrected by changing the engine speed within 1 to 2 per cent.

Check the extension of the flaps by referring to illumination of the FLAPS DOWN pilot lamp. If the wing flap extension causes energetic rolling of the aircraft, immediately retract the flaps, report the matter to the flight control officer and go around.

In this case, perform landing with the wing flaps retracted.

After turning to the base leg, descend the aircraft so as to enter a turn to final at an altitude of 400 to 450 m and at an airspeed of 450 km/h.

The final turn is performed at an airspeed of 450 km/h at a runway sighting angle of 15 to 20° so that the recovery from the turn is completed at an altitude of not less than 300 m at a distance of 6 to 7 km from the runway.

Accuracy of interception of the runway center line is adjusted by changing the bank in the course of the turn. In case of inaccurate interception of the landing heading, it is necessary to correct the error before flying over the outer marker beacon by turning the aircraft to the left or to the right through an angle of not more than 15°. If it is impossible to correct the error before flying over the outer marker beacon, the pilot must go around, report the matter to the flight control officer and effect a repeated approach with the errors made during the first approach taken into account.

After the final turn gradually bring the aircraft to the descent attitude at a vertical rate of 5 to 3 m/s. Depending on the direction and force of the wind, as well as on the fuel remainder, select an engine speed of 68 to 70 per cent. In this case, fly over the outer marker beacon at an airspeed of 420 to 400 km/h at an altitude of 200 m.

Landing

After flying over the outer marker beacon, the pilot should proceed as follows:

(1) align the flight heading with the runway center line;

(2) direct the aircraft so as to descend at the beginning of the runway;

(3) select the engine speed of 66 to 68 per cent;

(4) look through the canopy:

- estimate the direction of gliding and the aircraft descent angle;
- maintain the flight along the runway centre line and descend at the beginning of the runway;

(5) shift the glance inside the cabin and watch the following:

- airspeed indicator (check the amount and rate of the air-speed change);
- altimeter (check the present altitude);
- vertical-speed indicator (the vertical speed of descent amounts to approximately 5 m/s);
- glide slope deviation bar (deviation from the glide slope);

(6) while flying up to the inner marker beacon, distribute your attention as prescribed in Items (4) and (5). Operate the control stick and pedals to descent along the runway center line into the flare-out point;

(7) at an airspeed of 370 km/h accelerate the engines to 70 per cent;

(8) at an airspeed of 360 km/h select the engine speed of 72 per cent;

(9) operating one throttle lever (within ±2 per cent), maintain the gliding speed of 350 to 360 km/h up to the inner marker beacon;

(10) when passing over the inner marker beacon, check the following:

- direction (along the runway center line);
- descent to a point located 150 to 200 m from the runway;
- airspeed of 350 to 360 km/h;
- altitude of 60 to 50 m;

(11) decelerate one of the engines by approximately 2 per cent to ensure the airspeed of 340 km/h by the moment of flare-out;

(12) 500 m from the runway check the airspeed (the airspeed should be 350 to 340 km/h) and change the engine power, if necessary;

(13) shift the glance onto the ground, looking through the left glass panel of the fixed canopy;

(14) estimate the flight altitude when the flare-out procedure is initiated;

(15) starting from the height of 8 to 10 m, smoothly deflect the control stick to decrease the angle of descent so as to finish the flare-out procedure before the runway not higher than 1 m over it;

(16) smoothly set the throttle lever to the IDLE stop;

(17) as the aircraft approaches the ground, smoothly and proportionally apply back stick to decrease the vertical speed of descent, creating an appropriate landing angle of attack (10 to 11°);

(18) after touch-down, hold the control stick and check the speed;

(19) at an airspeed of not more than 330 km/h deploy the drag chute;

(20) shift the glance forward to check the direction;

(21) keep the control stick fixed until the aircraft lowers the nose wheel;

(22) prior to lowering of the nose wheel, set the pedals neutral;

(23) after the nose wheel is lowered, maintain the direction by smoothly deflecting the pedals;

(24) brake the aircraft taking into consideration the run-way length and landing roll speed by smoothly depressing the braking lever;

(25) prior to taxying out from the runway, proceed as follows:

- retract the flaps;
- disengage the nosewheel brake;
- release the drag chute;
- clear the runway and report the fact;
- turn off the ПВД, ДУА HEATING circuit breaker.

Taxying-In

The pilot must act as follows:

(1) taxy up to the technical inspection post and depress the braking lever (on the command of the technician) to stop the aircraft. Keep the braking lever depressed until the inspection is completed;

(2) set the trim mechanisms to the neutral position. Check to see that the STAB TRIM, ROLL TRIM and RUD TRIM green lamps are alight;

(3) keeping the braking lever depressed with the left hand, depress the RM (PO) light-button on the РСБН-6С system control panel with the right hand. Turn off the LANDING switch (if it has been turned on).

Check to see that:

- the landing mode of the short-range radio navigation and landing system has been disabled;
- the RETURN lamp has gone out;
- the RM lamp is alight;

(4) having been cleared by the technician for further taxying, set the engine speed to 60 per cent,

Check to see that:

- the technician is safely away from the aircraft;
- no obstacles are ahead;

(5) release the braking lever and, having increased the speed to a value required for taxying, throttle the engines;

(6) in further taxying maintain the direction by deflecting the pedals towards the required turn, and the taxing speed, by varying the engine speed and applying the brakes.

Check the following:

- direction of taxying;
- obstacles ahead;
- safe taxying speed;

(7) when taxying in to the parking ground, make sure that there are no obstacles and aircraft with started engines in the way (in case of any obstacles, stop the aircraft).

Check to see that:

- there are no obstacles ahead;
- taxying is cleared (by referring to the green light of the ground traffic signal lights or by the command of the zone attendant).

On the command of the aircraft technician, taxy into the parking ground at the minimum speed. Smoothly brake the wheels and stop the aircraft.

Check to see that:

- the technician is safely away from the aircraft;
- collision is avoided, the aircraft is stopped.

Shut-Down

The pilot must act as follows:

(1) shut down the engines by pressing the STOP catches and shifting the throttle levers of both engines to the STOP position (fully backwards);

(2) turn off the FUEL PUMP NITROG circuit breaker.

Check to see that:

- the BLEED VLV OPEN lamps in the annunciator are dead;
- the NO FUEL FEED (НЕТ ПОДК. ТОПЛИВА) lamp lights up;

(3) disconnect the helmet ventilation unit and remove the oxygen mask (open the pressure helmet visor);

(4) switch off all power consumers except the GRND SUP ACFT BAT switch and ПТО START circuit breaker that should be switched off one minute after the throttle levers are set to the STOP position;

(5) having assured that the aircraft is stopped (the chocks are installed), release the braking lever.

FLIGHTS AT HIGH ALTITUDES AND IN STRATOSPHERE AT SUPERSONIC AIRSPEEDS

General

In compliance with the major purpose of the МиГ-25ДП aircraft, mastering supersonic flights at high altitudes and in stratosphere is one of the most important tasks of flight training of the units and subunits equipped with these aircraft.

During these flights the flying personnel should master climbing to the altitude of the non-reheat flight ceiling, acceleration and climbing to the service ceiling and zoom altitude of the aircraft, flying technique in stratosphere at supersonic airspeeds, as well as acquire firm habits in handling the cabin interior with the high-altitude pressure suit on.

Acceleration and climbing to the aircraft service ceiling are effected according to the specified program. If the pilot fails to maintain this program, the climbing time, distance covered and fuel consumption will increase.

Both during acceleration and in flights at the maximum Mach-numbers the МиГ-25ДП aircraft features good stability and satisfactory controllability.

At high altitudes and supersonic airspeeds, the damping of the aircraft oscillation slows down materially due to decrease of air density. With the dampers engaged, the lateral and longitudinal oscillations are damped more rapidly.

When flying at high altitudes and M > 2.2. with the dampers off and vertical g-loads amounting to 2.0, the aircraft features increased bank response to deflection of the rudders (creation of slipping). In this case, the bank develops with a certain delay typical for high altitudes. As the g-load increases, effectiveness of the ailerons decreases. Therefore, when introducing the vertical g-load, the aircraft energetically banks to the side which is opposite to the slip (the side which is opposite to deviation of the ball). In case of an asymmetrical thrust of the engines, the aircraft banks to the side of smaller thrust.

As the rate of the vertical g-load increases, the rate of roll also increases. Proceeding from this, the turns (360° turns), zooms and other manoeuvres with g-loads should be performed in a coordinated manner, never permitting the aircraft to slip. Prior to performing the maneuver, trim out the aircraft in yaw. attitude with the aid of the rudder trimming mechanism.

If the pilot fails to manipulate the controls in the coordinated manner when the aircraft performs the maneuver with the vertical g-load, this may result in failure to recover the aircraft from the bank and inadvertent nose dropping. If the aircraft fails to recover from the bank and lowers the nose, the pilot should proceed as follows:

(a) cut off the engine afterburners and decrease the vertical g-load up to 1.0;

(b) do not interfere with the aircraft nose dropping by pulling the control stick backward;

(c) eliminate slipping (bring the ball to the centre);

(d) as the g-load decreases, recover the aircraft from the bank.

When the dampers are engaged, the aircraft roll response to slipping considerably decreases. Therefore, fly at high altitudes and M > 2.2 with the dampers engaged that considerably simplifies handling the aircraft.

Besides, flying the aircraft at high altitudes and in stratosphere is also characterized by a number of other peculiarities the most typical of which are:

- decrease of the airspeed range;
- decrease of the aircraft angles of attack;
- deterioration of the conditions of visual orientation and visibility of the natural horizon as a result of which the pilot has to perform air navigation and flying mainly with the aid of instruments;
- decrease of the aircraft capabilities with respect to g-load which results in considerable increase of the radius and time for performing turns (360° turns).

Flight to Ceiling

Flights for gaining the aircraft ceiling are performed within the airfield area according to the established pattern.

Fig. 43 presents a variant of the pattern used for climbing to the ceiling. When effecting flights to the ceiling with the use of the POLJOT-1И system, it is necessary to program the flight route.

When climbing to the ceiling, the aircraft may be controlled manually and with the aid of the САУ-155 automatic flight control system in the director or automatic mode.

Climb to Ceiling in Automatic Control Mode. Preparatory to the flight, it is necessary to set $H_{lvl\text{-}off}$ = 29.9 km on the altitude and airspeed selector and the wafer switch to the H10 position.

Depress the first route turning point (RTP-1) button on the РСБН-6С system control panel and the SHORAN light-button on the AFCS control panel.

Take off at the reheat power setting. After the landing gear and flaps are retracted at an airspeed of not less than 600 km/h, disengage the afterburner. At an altitude of at least 300 m smoothly deflect the control stick and pedals to "zero" the command bars on the flight director indicator, avoiding reduction of the altitude. After that trim the control stick and pedals by the trim mechanisms and depress the AUTO CTL light button on the AFCS control panel. The pilot should remember that if the control stick is not relieved of forces, the automatic control mode will not get enabled.

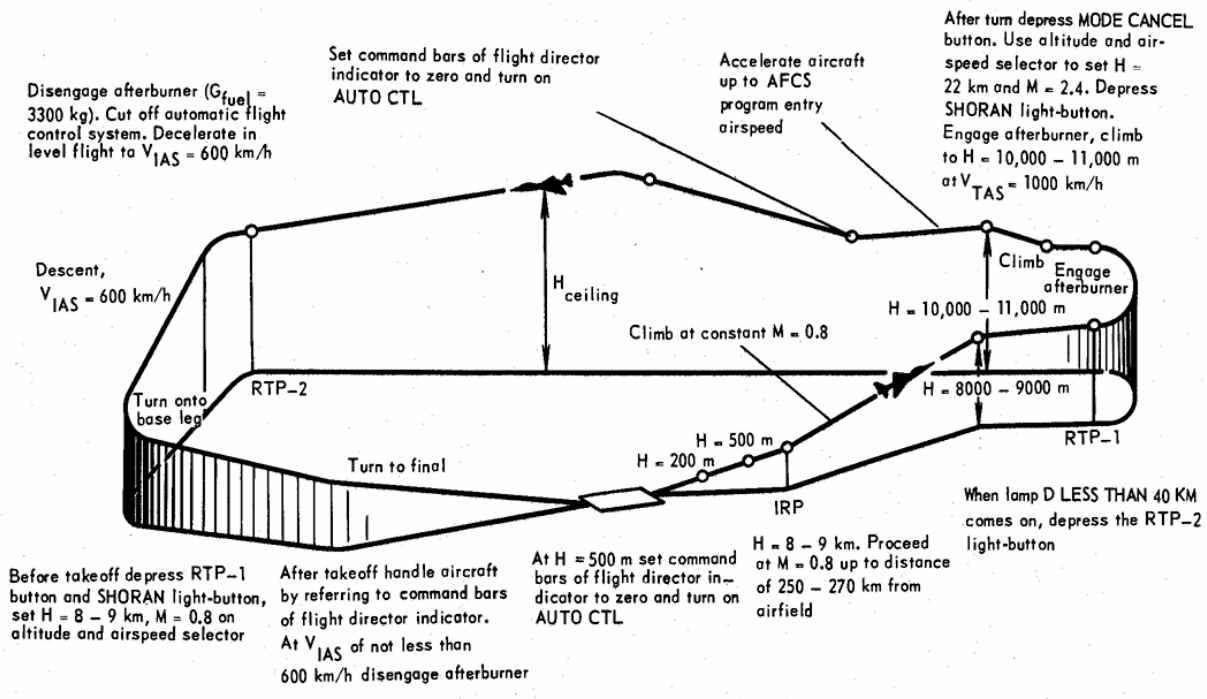


FIG. 43. FLIGHT TO SERVICE CEILING WITH USE OF AUTOMATIC MODE OF САУ–155П/ДБ AUTOMATIC FLIGHT CONTROL SYSTEM

After the automatic control mode is enabled, the aircraft will be controlled automatically. In this case, the aircraft will climb to the altitude of 3000 m with acceleration up to a Mach number of 0.85 and will further climb at the constant Mach number of 0.85.

When approaching the altitude of 10,000 m the SEL ALT LVL-OFF lamp lights up. The automatic flight control system stabilizes the altitude of 10,000 m, and the Mach number of 0.85 is to be maintained by varying the engine speed.

At a distance of 40 km from the route turning point, the D LESS THAN 40 KM lamp lights up on the РСБН-6С system control panel. After that, depress the light-button of the next RTP. The pilot may also depress the button of the next RTP at an estimated distance from the initial route point by referring to the ППД-2 distance indicator.

If the mission requires flying over the RTP-1, the RTP-2 light-button should be depressed 3 to 5 km (by referring to the ППД-2 distance indicator) before the RTP-2, since depressing the RTP-2 light-button at a close-to-zero distance may result in aircraft swinging in roll within ±10°. If it is required to make a turn after flying over the RTP-1, it is necessary to disable the automatic control mode over the RTP-1 and depress the RTP-2 light-button at the estimated distance. After that enable the aircraft automatic control mode again.

When the readings of the ППД-2 distance indicator pass zero, the preset course pointer turns through 180°.

If the aircraft turns towards the next RTP at subsonic airspeed in the automatic control mode, the roll angle does not exceed 30°. Accelerate the aircraft in response to the command from the control post (or from the estimated line).

To this end, proceed as follows:

- disable the automatic control mode by the AUTOPILOT OFF button arranged on the control stick;
- enable the damping mode by the DAMPER light-button on the AFCS control panel;
- select M = 2.35 on the altitude and airspeed selector;
- check to see that the AIR INT MONIT L R lamps are alight and engage the afterburner.

Check to see that the afterburner is engaged, check the exhaust gas temperature (it should be not more than 820 and not less than 600°C) and the fuel remainder that should amount to the estimated one. Select a true airspeed of 1000 km/h and climb at this airspeed to an altitude of 11,000 m. Proceeding at this altitude bring the aircraft to level flight and accelerate it to the airspeed required for entering the automatic flight control system program (altitude of 11,000 m, Mach-number of 1.62). 20 to 30 km/h before the program-entry indicated airspeed (1120 km/h), smoothly apply back stick to bring the aircraft to climbing.

As soon as the pitch position bar of the flight director indicator approaches the centre of the circle, relieve the control stick and pedals of forces by the trim mechanisms and enable the automatic control mode.

Subsequently check the automatic climbing mode with acceleration to M = 2.35.

While accelerating to M = 2.35, check to see that:

- the second afterburner is engaged at M = 1.5 (by the engine speed increase to 98.5 to 100 per cent);
- the air intake ramps start extending at M = 1.5 to 1.7;
- the LWR DOOR 2ND PSN lamp goes out in the annunciator at M = 1.9.

At an altitude of more than 15 km check the operation of the automatic transmission ratio controller by referring to the illumination of the STAB FOR LDG and ROLL FOR LAND lamps and deflection of the indicator pointers to the lower position.

Perform the flight at the aircraft ceiling at a stabilized Mach-number of 2.35.

At a fuel remainder of not less than 3300 kg (at a distance of not more than 200 km from the airfield) disengage the afterburners of the engines, disable the automatic control mode, enable the damping mode and descend.

Climbing to Ceiling in Director Control Mode. Preparatory to takeoff, select $H_{lvl\text{-}off}$ = 29.9 on the altitude and airspeed selector and set the wafer switch to the H10 position.

Depress the RTP-1 light-button on the РСБН-6С system control panel and the SHORAN light-button on the AFCS control panel.

Take off at the reheat power setting. After the landing gear and flaps are retracted, fly the aircraft from the altitude of 300 m with reference to the command bars, keeping them within the circle of the flight director indicator.

When the airspeed is more than 600 km/h, disengage the afterburners of the engines and proceed climbing at the maximum power, keeping the position bars within the centre of the circle of the flight director indicator.

The SEL ALT LVL-OFF lamp will light up at an altitude of 10,000 m. While climbing, check M = 0.85.

In level flight maintain M = 0.85, selecting a respective power setting.

En-route flying is similar to flying in the automatic control mode. Keep the position bars in the centre of the circle of the flight director indicator by operating the control stick.

Following the command from the control post (or on the assigned line) engage the afterburner. Check the engagement of the afterburner and the engine parameters. Climb to an altitude of 11,000 to 11,500 m at a true airspeed of 1000 km/h. When the altitude is gained, level the aircraft and accelerate it to the airspeed required for entry into the automatic flight control system program (H = 11,000 m, M = 1.62). When the indicated airspeed is 1100 km/h, smoothly apply back stick to bring the aircraft to climbing. Keeping the position bars in the centre of the circle of the flight director indicator, perform further climb with acceleration to M = 2.35. When the Mach number is 2.35, climb to the service ceiling.

Sequence of Pilot's Actions and Order of Attention Distribution during Climb to Service Ceiling in Director Control Mode

Preparatory to Flight:

(1) select $H_{lvl\text{-}off}$ = 29.9 on the altitude and airspeed selector;

(2) set the wafer switch to the H10 position.

Preparatory to Take off:

(3) depress the RTP light-button on the РСБН-6С system control panel;

(4) depress the SHORAN light-button on the AFCS control panel.

After Take off:

(5) disengage the afterburner at an airspeed more than 600 km/h;

(6) at H = 300 m smoothly deflect the control stick and pedals to "zero" the command bars of the flight director indicator without losing the altitude.

In C1imbing:

(7) keep the command bars within the circle of the flight director indicator;

(8) climb to the non-reheat ceiling. Enable the DAMPER mode at an altitude of 10,000 m;

(9) by the command from the control post (or starting from the estimated line) accelerate the aircraft. To this end, proceed as follows:

(10) select M = 2.35 on the altitude and airspeed selector;

(11) depress the DAMPER light-button on the AFCS control panel;

(12) engage the afterburner;

(13) check to see that:

- the afterburner is engaged;
- the exhaust gas temperature does not exceed 820°C;
- the engine speed corresponds to the maximum power;
- the fuel remainder amounts to the estimated one;

(15) at a true airspeed of 1000 km/h climb to an altitude of 11,000 m;

(16) at the altitude of 11,000 m apply forward stick to level the aircraft;

(17) accelerate the aircraft to an indicated airspeed of 1100 km/h;

(18) bring the aircraft to a climb, keeping the horizontal command bar in the centre of the circle of the flight director indicator;

(19) transfer attention as follows:

- flight director indicator (roll, pitch);
- airspeed;
- altitude;
- flight director indicator;
- vertical-speed indicator;
- check the engine parameters;
- airspeed;
- flight director indicator.

C1imbing:

(20) climb at a constant indicated airspeed with the Mach-number increasing to 2.35. If V_{IAS}= 1100 km/h, M = 2.35 can be attained at an altitude of 16 to 18 km;

(21) avoid slipping by maintaining the ball in the centre with the help of the pedals;

(22) check the following:

- at M = 1.5 - engagement of the second afterburner;
- at M = 1.5 to 1.7 - initiation of the air intake ramp extension;
- at M = 1.9 - extinguishing of the LWR DOOR 2ND PSN lamp in the annunciator;
- at H = 15,000 m - operation of the automatic transmission ratio controller by referring to the illumination of the STAB FOR LDG and ROLL FOR LAND lamps and deflection of the indicator pointers to the lower position;

- the exhaust gas temperature (does not exceed 820°C);

(23) transfer attention as follows:

- flight director indicator (roll, pitch);
- airspeed (indicated airspeed is constant, Mach-number is growing);
- engine speed (at M = 1.5 the engine speed has inreased to 98.5 to 100 per cent);
- flight director indicator;
- exhaust gas temperature (does not exceed 820°C);
- oil pressure (3.5 to 4.5 kgf/cm²);
- flight director indicator;
- extension of the air intake ramps;
- APУ-9 controller;
- combined course indicator;
- flight director indicator;
- annunciator (no lamps are illuminated in the warning annunciator);
- flowmeter, fuel gauge, indication of fuel consumption;
- flight director indicator;

(24) climb to the ceiling at a Mach-number of 2.35 up to a vertical speed of 3 to 5 m/s.

F1ying on Cei1ing:

(25) keep the command bars within the small diameter circle of the flight director indicator;

(26) transfer attention as follows:

- flight director indicator;
- vertical-speed indicator;
- combined course indicator;
- flight director indicator;
- airspeed;
- altitude;
- flight director indicator1
- engine speed;
- exhaust gas temperature;
- oil pressure;
- flight director indicator;
- air intake ramp position indicator;
- flowmeter, fuel gauge, indication of fuel consumption;
- flight director indicator;

(27) when the fuel remainder is less than 3300 kg (the aircraft is not more than 200 km away from the airfield), set the throttle levers to the MAXIMUM position and check to see that the afterburner is disengaged.

Descent:

(28) smoothly applying back stick, maintain level flight to an indicated airspeed of 750 to 800 km/h;

(29) apply forward stick to bring the aircraft into descent at an angle of pitch of 8 to 10°;

(30) pushing (pulling) the control stick, maintain the indicated airspeed of 750 to 800 km/h down to an altitude of 15 to 16 km;

(31) transfer attention as follows:

- flight director indicator (roll, pitch);
- vertical-speed indicator;
- airspeed;
- flight director indicator;
- altitude;
- ramp position (ramps are retracting);
- engine speed (maximum);
- exhaust gas temperature;
- airspeed;
- warning annunciator;
- flight director indicator;

(32) at an altitude of 17 km smoothly apply back stick and level the aircraft at an altitude of 15 to 16 km;

(33) at M = 1.5 check to see that:

- the engines have changes over from the 2nd to 1st maximum power;
- the ramps have fully retracted;
- the STAB FOR LDG, ROLL FOR LAND lamps have gone out and the LWR DOOR 2ND PSN lamps is alight at an altitude below 15 km;

(34) smoothly applying back stick, maintain level flight to an indicated airspeed of 600 km/h;

(35) apply forward stick to set a descent angle of 8 to 10° with a simultaneous reduction of the engine speed to the idling power;

(36) vary the angle of pitch to maintain the indicated airspeed of 600 km/h;

(37) at an altitude of 11 to 11.5 km, check to see that the aircraft has changed over to a subsonic airspeed;

(38) transfer attention as follows:

- flight director indicator;
- airspeed;
- vertical-speed indicator;
- altitude;
- flight director indicator;
- engine parameters;

(39) at an altitude of 9.5 km increase the engine speed and apply back stick to level the aircraft;

(40) depress the RETURN light-button on the РСБН-6С system control panel;

(41) depress the SHORAN light-button on the AFCS control panel;

(42) Perform the descent and landing approach with the use of the POLJOT-1И system.

Climb to Ceiling in Manual Control Mode.

When mastering flights for supersonic climb to the ceiling in the manual control mode (without employment of the САУ-155 automatic flight control system), the pilot should take off at the full reheat power setting. At an indicated airspeed of at least 600 km/h successively disengage the afterburners of the engines by setting the throttle levers to the MAXIMUM position.

If the aircraft carries four missiles, the pilot should accelerate the aircraft to a true airspeed of 920 km/h up to an altitude of 1000 m; if the aircraft carries no missiles, it should be accelerated to a true airspeed of 960 km/h. Further climb should be performed at the respective gained true airspeeds.

To relieve the control stick of forces in climbing, make use of the stabilizer trim mechanism.

At an altitude of 10,000 m depress the DAMPER light-button. Upon gaining the altitude of the subsonic service ceiling, level the aircraft and proceed with ceiling flight at M = 0.85 as fuel is being consumed.

While flying level at a distance of 250 to 270 km from the airfield (or in response to a command from the control post), switch on full reheat and climb to an altitude of 11,000 to 11,500 m at a true airspeed of 1000 km/h.

Upon gaining this altitude, level the aircraft and accelerate it to an indicated airspeed of 1070 km/h. At the end of acceleration the fuel remainder should amount to not less than 6000 kg.

Turn towards the airfield with a roll of 45° and with climbing. In climbing maintain the indicated airspeed of 1070 km/h until a Mach-number of 2.4 is attained. Climb further maintaining M = 2.4 until the vertical speed becomes equal to 3 m/s.

With the fuel remainder being not less than 3300 kg, disengage the engine afterburners. In this case, the aircraft should be not more than 200 km away from the landing airfield. If the distance exceeds 200 km, the engine afterburners should be disengaged earlier with due account of the fact that every additional 100 km require 700 kg of fuel.

Flight for Aircraft Acceleration to Maximum Mach-Number

The flight for the aircraft acceleration to the maximum Mach-number should be planned after the pilot has accomplished the flight to the service ceiling.

Fig. 44 presents an approximate pattern of the flight for the aircraft acceleration to the maximum Mach-number.

The flight for the aircraft acceleration to the maximum Mach-number is performed with the engines running at the reheat power setting. After taking off, climb to an altitude of 1000 m with acceleration of the aircraft to a true airspeed of 1000 km/h. Perform further climbing to an altitude of 10,000 to 11,5000 m at the constant true airspeed of 1000 km/h. At an altitude of 10,000 m enable the DAMPER mode.

At an altitude of 11,000 to 11,500 m bring the aircraft into level flight, accelerate the aircraft up to an indicated airspeed of 1070 km/h, trim out the aircraft with the aid of the trim mechanism and bring it into a climbing attitude.

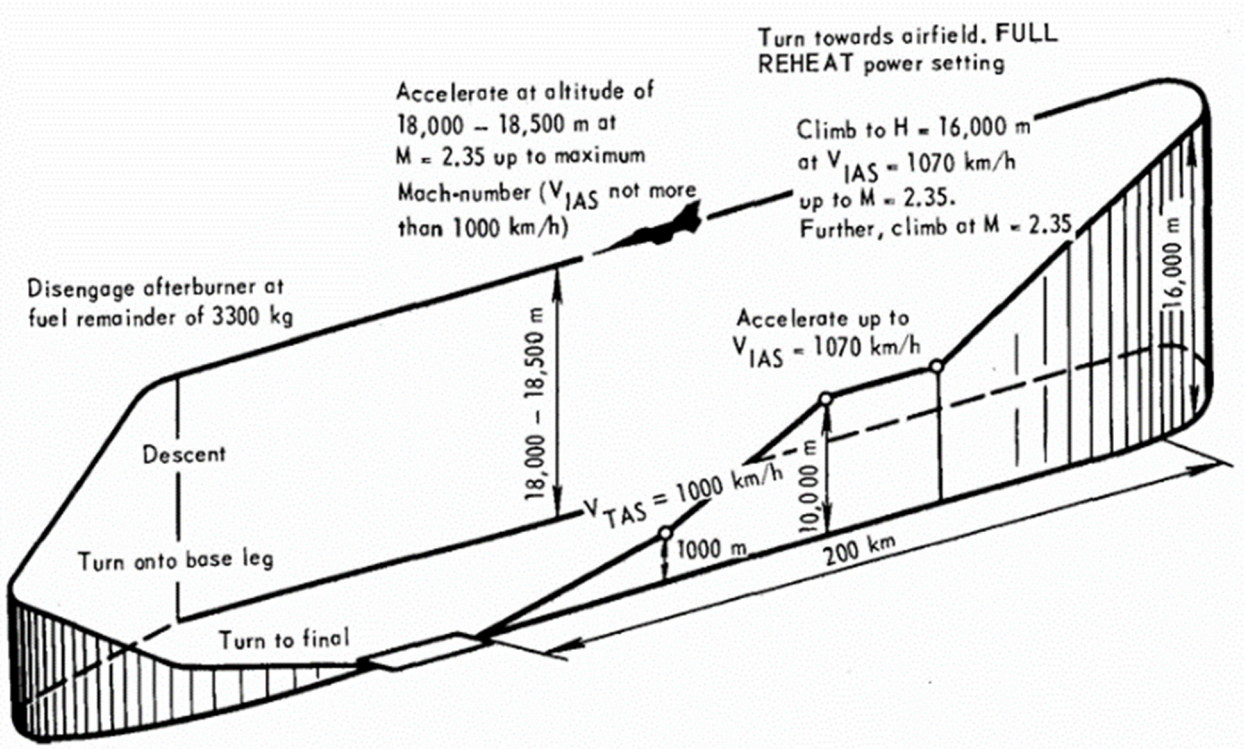


FIG. 44. PATTERN OF FLIGHT WITH ACCELERATION TO MAXIMUM MACH-NUMBER

When climbing at M = 1.5 ± 0.1, check the engagement of the REHEAT II power setting by referring to increase of the exhaust gas temperature (it should not exceed 820°C) and smooth increase of the engine speed up to 98.5 to 100 per cent. Besides, at M = 1.5 to 1.7 the pilot checks the beginning of extension of the air intake ramps and at M = 1.9, the extinguishing of the LWR DOOR 2ND PSN lamp.

Check the operation of the automatic control system of the air intakes and the position of the ramps by referring to the УПЭС-34 indicator and two AIR INTAKE CONTROL DUPLICATION (ДУБЛИР. УПР. ВХОД) lamps in the annunciator. When the automatic control system operates normally, the above-mentioned lamps are dead.

At an altitude of more than 15,000 m the STAB FOR LDG and ROLL FOR LAND lamps should be alight, and the pointers of the rudder and stabilizer transmission ratio mechanism indicator should go down.

Gain an altitude of 16,000 mat an indicated airspeed of 1070 km/h until M = 2.35 is attained. In this case the distance from the airfield should be not more than 200 km.

At an altitude of 16,000 m start turning in the direction of the airfield. When turning, climb at M = 2.35.

If during the turn the Mach-number starts decreasing, reduce the vertical climb speed or turn even with a descent (especially when the aircraft carries missiles), if necessary.

The aircraft attitude in climb is checked with the aid of the gyro horizon on the flight director indicator, whereas the flight conditions are checked by the Mach-number indicator, vertical speed indicator and altimeter.

After performing the turn, at an altitude of more than 16,000 m move the throttle levers to the position of partial reheat. This is required not to exceed the time of continuous operation of the engines at the full reheat power setting.

Wait for one minute and shift the throttle levers to the FULL REHEAT position and in level flight at an altitude of 18,000 to 18,500 m continue accelerating the aircraft up to the maximum Mach-number.

In the course of acceleration check the indicated airspeed avoiding its increase in excess of 1100 km/h. Disengage the engine afterburners when the fuel remainder amounts to 3300 kg.

When the radar indicator starts blinking (in case the radar is enabled) and the "Limit speed" voice message is heard in the earphones, check the current airspeed so as to avoid exceeding the airspeed limitations:

(a) in performing level flight or climb, turn off the after- burners and bring the aircraft into climb (increase the angle of climb) at a g-load of up to 2.5 g;

(b) in descending, bring the aircraft into the level flight attitude at a g-load of up to 2.5 g, throttling the engines simultaneously (at a Mach-number not exceeding 2.2).

Flight at Maximum Rate of Climb

Flight at a maximum rate of climb should be performed at the full reheat power setting as follows. After taking off, climb to an altitude of 1000 m with the aircraft acceleration to a true airspeed of 1000 km/h. Then climb to an altitude of 11,000 to 11,500 m and maintain a constant true airspeed of 1000 km/h by changing the climb angle.

At an altitude of 11,000 to 11,500 m level off the aircraft and, without changing the engine power setting, accelerate the aircraft to an indicated airspeed of 1150 km/h. In the course of acceleration it is necessary to constantly check the airspeed increment rate, since in level flight at the reheat power setting and at an indicated airspeed of about 1000 km/h the airspeed increases by approximately 15 to 20 km/h per one second. Therefore, it is necessary to bring the aircraft into climbing somewhat in advance, at an airspeed which is 20 to 30 km/h less than the assigned one.

As an indicated airspeed of 1150 km/h is attained, bring the aircraft into climbing.

Climb to an altitude of 13,000 m at this airspeed.

When approaching the altitude of 14,000 m, increase the climb angle to establish an indicated airspeed of 1070 km/h and proceed climbing at this airspeed until a Mach-number of 2.35 is attained. Climb to an altitude of 20,000 m at the constant Mach-number of 2.35.

Flight to Dynamic Heights

Flights to dynamic heights are performed according to the pattern specified for a particular airfield. When an altitude of 18,000 to 18,500 m is reached, accelerate the aircraft with the engines running at the full reheat power setting until the maximum Mach-number is achieved and bring the aircraft into climb at a g-load of n_y = 1.5 to 1.75 g. When climbing, to maintain n_y = 1.5 g, smoothly deflect the control stick backward. As an altitude of 22,000 to 22,500 m is reached, gradually decrease the g-load to 1.0 g. At n_y = 1.0 g the aircraft continues climbing with the pitch angle decreasing. As soon as the pitch angle decreases to 10 to 15°, apply back stick pressure again to avoid descending. When doing so, it is necessary to take into account the fact that in case of premature deflection of the control stick backward, the aircraft rapidly loses the airspeed, lowers its nose with the control stick fully deflected backward and starts descending.

Late deflection of the control stick backward will result in the aircraft nose dropping and acceleration. Further deflection of the control stick backward somewhat slows down increase of the airspeed and results in energetic loss of the altitude.

When at the dynamic height, proceed with level flight for 20 to 30 s, decelerating the aircraft to an indicated airspeed of 600 km/h.

When performing runs, deceleration increases and the time of flight at dynamic heights decreases. At great roll angles the airspeed energetically drops; therefore, it is necessary to bring the aircraft into descent avoiding the airspeed dropping below the maneuvering one.

When the fuel remainder amounts to not less than 3300 kg, it is necessary to disengage the afterburners and start descending. Disengage the afterburners at an airspeed of not less than the maneuvering one.

The major flight parameters of the МиГ-25ПД aircraft carrying four missiles are presented in Table 6.

Table 6

Parameter	Value of parameter in time t, s						
	0	**20**	**40**	**50**	**60**	**70**	**78.5**
Mach-number	2.75	2.66	2.45	2.37	2.33	2.30	2.28
V_{true} km/h	2916	2626	2592	2520	2469	2437	2416
Altitude, m	18,000	19,000	22,000	23,700	24,800	25,400	25,600
G-load	1.5	1.5	1.5 to 0.5	0.5	0.5	0.5	-
V_y, m/s	0	50	150	170	114	55	20
L, km	0	15.6	30.4	37.3	44.1	50.9	56.6
Fuel consumption, kg	0	176	312	354	390	422	443
Pitch angle, deg	0	0.7	15	11.4	7.6	3.5	0

The table shows that it takes 78.5 s for the aircraft to gain an altitude of 25,600 m beginning from an altitude of 18,000 m. By the end of the climb the Mach-number amounts to 2.28. The engine afterburners are disengaged when the fuel remainder amounts to 3300 kg and the distance to the airfield does not exceed 200 km.

Aircraft Deceleration and Descent from Service Ceiling

In level flight, after accomplishment of the mission, disengage the engine afterburners. To disengage the afterburners when flying at M > 2.2, proceed as follows:

- shift the throttle levers from the FULL REHEAT position to the MINIMUM REHEAT stop;
- then depress the latches and move the throttle levers to the MAXIMUM stop. Check the disengagement of the afterburners by referring to extinguishing of the REHEAT (ФОРСАЖ) lamps in the annunciator and decrease of the exhaust gas temperature.

In case of failure to disengage the afterburners by shifting the throttle levers to the MAXIMUM stop (the REHEAT lamp in the annunciator does not go out), disengage them using the appropriate switch labelled REHEAT on the left-hand console.

After the afterburners are disengaged, decelerate the aircraft to an indicated airspeed of 750 to 800 km/h proceeding in level flight with the engines running the 2nd maximum power.

Descend to 15,000 to 16,000 m at this airspeed. At an altitude of 17,000 m smoothly apply back stick and level the aircraft at an altitude of 15,000 to 16,000 m. Smoothly apply back stick to maintain level flight until the indicated airspeed becomes equal to 600 km/h.

With the Mach-number decreasing, check the following:

- at M = 1.9 - illumination of the LWR DOOR 2ND PSN lamp;
- at M = 1.5 - change-over of the engines from the 2nd to 1st maximum power.

At an indicated airspeed of 600 km/h bring the aircraft to descent at an angle of pitch of 8 to 10° and set the throttle levers to the IDLE position.

At an altitude of not less than 15,000 m check to see that the STAB FOR LDG and ROLL FOR LAND lamps go out. The effectiveness of the stabilizer will grow with descent due to a change in the nature of airflow.

At supersonic airspeeds the required angles of the stabilizer deflection are greater than at subsonic airspeeds. Therefore, when passing by the sonic speed (M = 0.95 to 0.97) with the stabilizer deflected for pitch-up, a short-time increase of the g-load may occur ("tuck-in" mode).

In straight-line descent, the aircraft experiences a slight "tuck-in" which practically manifests itself as a slow nose-up of the aircraft. This phenomenon takes place due to smooth deceleration.

At altitudes higher than 10,000 m a "tuck-in" is dangerous because of a possible increase of the g-load involving a loss of the airspeed, whereas at altitudes lower than 10,000 m the aircraft may attain the limit g-load. When descending, it is necessary to trim out push forces by means of the stabilizer trim mechanism in due time and move the control stick forward in case of a "tuck-in".

Section VI

AIR NAVIGATION

GENERAL

The main peculiarities of air navigation of the МиГ-25ПД aircraft are determined by the high airspeed of flight, wide range of altitudes, possibility of flying with an alternating profile, as well as possibility of complex employment of the flight-control and navigation equipment. Adequate knowledge of technical capabilities of this equipment and its efficient use in flight in combination with dead-reckoning and visual orientation ensure an accurate target (the interception line) approach at the assigned time under various conditions of the navigational and tactical situation.

As a rule, air navigation effected by the pilot in flight is supplemented by the control produced from the command and direction posts. Por successful interception of air targets the pilot should exactly maintain the assigned flight conditions (course, airspeed and altitude), quickly and in due time execute the commands delivered from the command post by voice or over the radiotelemetry line.

A great power-to-weight ratio of the МиГ-25ПД aircraft allows the pilot to perform the flights with an alternating profile. Such a flight is accompanied by variation of the flight condition which complicates air navigation. Besides, it makes the flying personnel to quickly transfer from air navigation effected with the help of radio aids to the visual air navigation and vice versa. During preparation for the flight, all this requires a thorough study of the procedure of complex employment of the airborne air navigation aids and methods of their use for each stage of the route depending on the flight conditions, navigational and tactical situation.

COMPLEX SYSTEM "POLJOT-1И" AND ITS EMPLOYMENT

General

The POLJOT-1И system is a complex of an airborne interconnected flight-control and navigation equipment which incorporates the following systems:

- short-range radio navigation and landing system РСБН-6С;
- automatic flight control system САУ-155;
- directional/vertical gyro system СКВ-2НЛ-2;
- air data computer system СВС-ПН-5А.

The POLJOT-1И system when operating in conjunction with the РСБН-4Н rho-theta radio beacon and the ПРМГ-4М landing radio beacon group provides for execution of the following flight tasks under the VFR and IFR conditions in the automatic and director control modes:

(1) programmed climb with subsequent levelling-off and stabilization of the assigned altitude or Mach-number;

(2) return to the airfield of departure or to one of the three programmed landing airfields;

(3) enroute flight involving three programmed route turning points and four airfields;

(4) break-through clouds from the cruising altitude up to the prelanding maneuver;

(5) execution of the prelanding maneuver;

(6) landing approach to a height of 50 m;

(7) missed approach procedure.

Throughout the flight the pilot is able to check the position of the aircraft relative to the radio beacon of the selected airfield, determine aircraft attitude, check

whether the assigned parameters of the flight are maintained and interfere with the automatic control, if necessary.

In case of failure of the САУ-155 automatic flight control system, the POLJOT-1И system ensures execution of the enroute flight, return to the landing airfield and landing approach with the manual control of the aircraft.

The system provides for approaching the programmed route point at a mean radial error of 3.75 km, maximum, when flying at an altitude of 10,000 m within the zone of radio correction and at a distance of 150 to 175 km from the РСБН-4Н rho-theta radio beacon.

Deviations of the aircraft from the equisignal zones of the ПРМГ-4М landing radio beacons (with the glide-slope beacon installed in front of the runway approach end at a distance of 130 m) at a distance of about 1000 m and altitude of 50 m in the automatic and director control of the aircraft are:

- 1.5 to 4.5 m in the longitudinal channel;
- 8 to 15 m in the lateral channel.

For solving navigational problems, the POLJOT-1И system uses the great-circle system of co-ordinates. The РСБН-6С system is provided with the modified great-circle system of co-ordinates (Fig. 45)

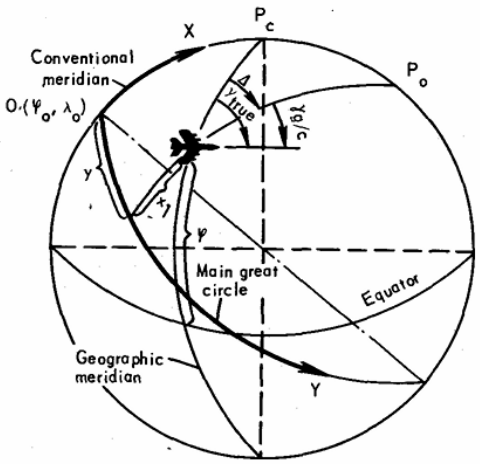


FIG. 45. GREAT-CIRCLE SYSTEM OF COORDINATES
X – conventional meridian; Y – great-circle equator (main great circle); O – point of origin with coordinates: φ_o – latitude; λ_o – longitude; x, y – great-circle coordinates of aircraft fix; Δ – meridian convergence angle; γ_{true} – true heading; $\gamma_{g/c}$ – great-circle course

In this system of co-ordinates the conventional meridian aligned with the geographical one and passing through the point of the origin is assumed as axis X. The rules of readout of heading, conventional latitude (co-ordinate x) and conventional longitude (co-ordinate y) are given in compliance with the geographical system of co-ordinates. The positive direction of axis X is the north, whereas that of axis Y is the east.

Origin of co-ordinates 0 (φ_o, λ_o) is selected so that the system covers the flight area (the battle area). Sometimes, the point corresponding to the location of the home airfield is assumed as the point of origin. In this case, the point of origin should be at a distance of not less than 20 km (along the X and Y axes) from the place where the home airfield beacon is installed.

The position of the aircraft is determined by great-circle co-ordinates z and y, where: x is the distance from the aircraft to the main great-circle course along the conventional meridian, whereas y is the distance along the main great-circle course from the point of co-ordinate origin to the spherical perpendicular dropped from the point of the aircraft position.

Fig. 45 shows that the great-circle course (γ_o) differs from the true course (γ_{true}) by the map ang1e. In the РСБН-6С equipment this angle is termed as the meridian convergence ang1e which is marked with ▲. It is an angle between the North direction of the geographical meridian in the point where the РСБН beacon is installed and the North direction of axis X (great-circle meridian). Angle ▲ is read out from the geographical meridian towards the great-circle meridian in the clockwise direction (Fig. 46).

If the radius of the flying area does not exceed 750 to 800 km, the great-circle system of co-ordinates is plotted on the flight maps as interperpendicular straight lines as presented in Fig. 47.

Employment of System СВС-ЛН-5А

The POLJOT-lИ system uses the Mach-number for shaping the g-load limitation signals during manual flying, computation of the magnitude of deviation of the flight director indicator commands bars during director control, as well as for shaping the control signals during climb.

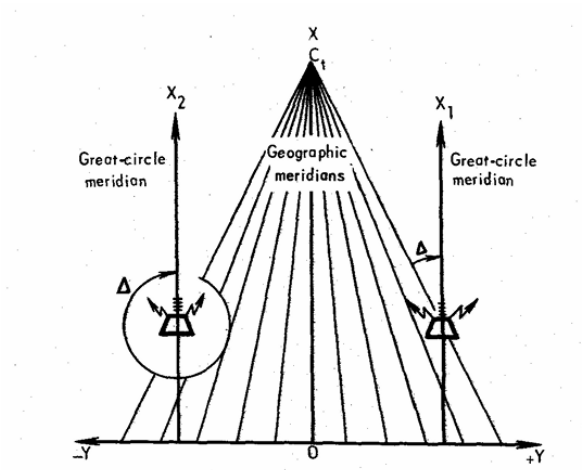


FIG. 46. DETERMINATION OF MERIDIAN CONVERGENCE ANGLE

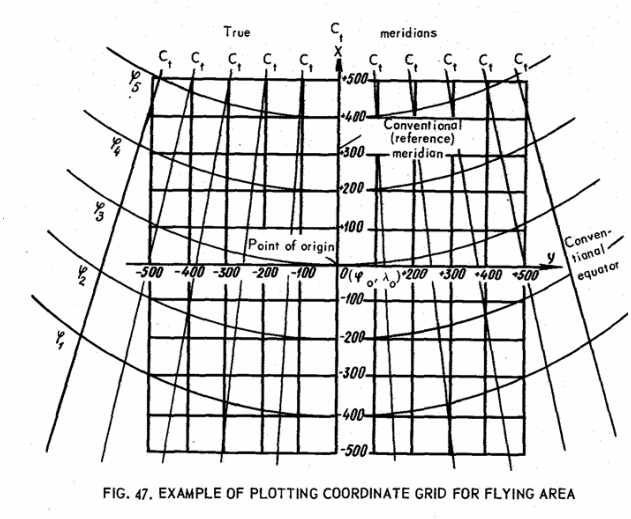


FIG. 47. EXAMPLE OF PLOTTING COORDINATE GRID FOR FLYING AREA

The true airspeed is used for dead-reckoning and controlling the flight conditions.

The true barometric altitude is used for correcting the autopilot gain and obtaining the control signals during climb, while the relative barometric altitude is used for shaping the control signal in the clouds break-through conditions and for checking the altitude at the ground command post.

The signals proportional to deviation of the true barometric altitude from the assigned value are used for stabilization of the aircraft altitude.

Employment of System СКВ-2НЛ-2

The СКВ-2НЛ-2 directional/vertical gyro system is designed for determining and continuous delivery of the roll and pitch angles and great-circle course, required for flying and solving the navigational problems, to the consumers.

The above parameters are applied to the combined course indicator, flight director indicator, as well as to the САУ automatic flight control system, РСБН short-range radio navigation and landing system and the C-25 armament control system. The roll and pitch angles and course are delivered without limitations with an accuracy of not more than ±2°.

Employment of Short-Range Radio Navigation System РСБН-6С

Purpose and problems solved. The РСБН-6С short-range radio navigation and landing system is the navigation and landing airborne equipment of the POLJOT-IИ system.

The РСБН-6С airborne equipment is a conjugated complex of the radio navigational and independent systems of determining the coordinates used for shaping the trajectory of flight and control signals in compliance with the assigned program during automatic or director control of the aircraft.

The radio navigational equipment of the РСБН-6С system operates in conjunction with the РСБН-4Н ground rho-theta radio beacons, while in the landing mode it operates with the ПРМГ-4М landing radio beacon group which includes: the runway localizer (КРМ), glideslope beacon (ГРМ) and distance retransmitter (РД). The radio navigational equipment serves for determining the polar co-ordinates of the aircraft, i.e. measuring the azimuth and range with respect to the РСБН beacon, and on its basis it corrects the data of the independent system.

The independent equipment of the РСБН-6С system estimates the data for the flight, using the present course of the aircraft and the true airspeed.

Principle of Operation. The navigational problems are solved by the РСБН-6С short-range radio navigation and landing system on the basis of the independent dead-reckoning of the coordinates of the aircraft position by the signals of the true airspeed and great-circle course corrected by the radio beacons.

The radio navigational equipment of the РСБН-6С system possesses a high accuracy in determining the aircraft co-ordinates, but it is not protected against jamming and features a limited radius of action.

The independent system features a high reliability, has a great radius of action. Besides, it is not subjected to jamming but it has a low accuracy.

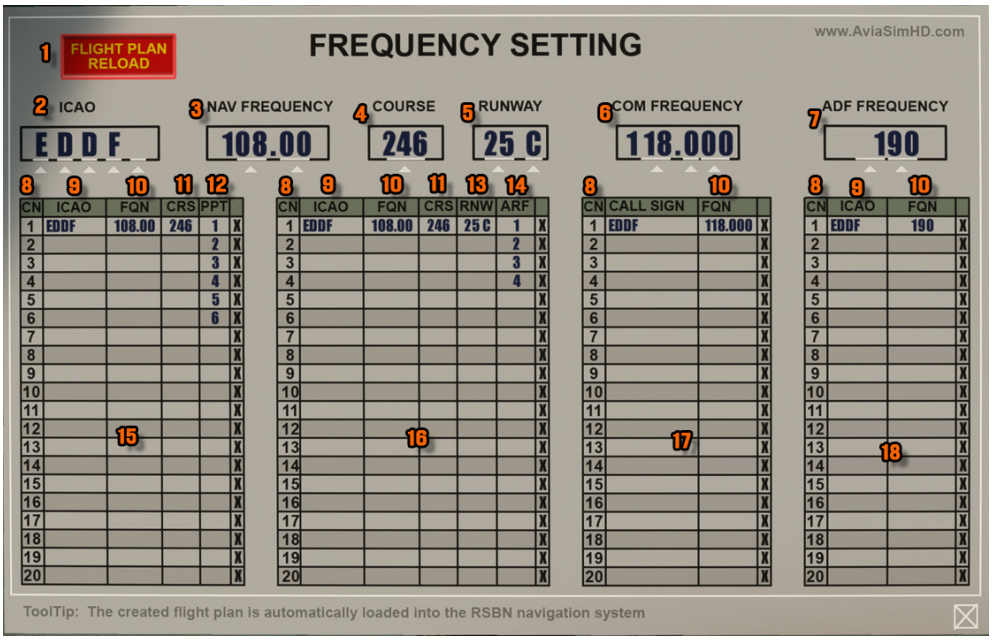
The combined operation of the radio navigational and independent systems ensures high accuracy in determining the co-ordinates, high reliability, jamproofness and great radius of action.

The in-flight remote control of the РСБН-6С system airborne equipment in all modes is ensured from the control panel arranged on the starboard side of the cabin. Arranged on the control panel are the following controls and indicating lamps (Fig. 48):

- four light-buttons labelled AFLDl, AFLD2, AFLD3 and AFLD4 which are intended for the in-flight selection of the programmed airfield;
- three light-button labelled RTP1, RTP2, and RTP3 which serve for selecting the programmed route turning point;
- the RADIO MARKER (RM) light-button which becomes energized in using any of the programmed radio beacon of the short-range radio navigation and landing system or airfield as a route turning point;
- the RETURN (ВОЗВРАТ) light-button which is intended for changing over the equipment to the mode, ensuring the flight of the aircraft to the programmed airfield and landing;
- the RESET (СБРОС) light-button which serves for cancelling the previously furnished data of all the programmed radio beacons of the РСБН system and the ПРМГ radio beacon group. Upon resetting, the equipment can be manually tuned in flight to the channels of the radio beacons of the РСБН system and the ПРМГ radio beacon group of the non-programmed airfields;
- the LANDING (ПОСАДКА) selector switch which is intended for manually changing over the navigation equipment to the channel of the ПРМГ-4М radio beacon group during landing on a non- programmed airfield;
- the ψ +180° selector switch which becomes energized (occupies the upper position) when the aircraft is going to land on the programmed airfield with a heading which is reverse to the programmed one;

Fig. 48 - RSBN (Radio Navigation System, SHORAN)

1. System Integrity Control Buttons
2. Signal Lamp for Beacon Signal Presence
3. Friend-or-Foe Transponder Button
4-7. Programmed Airfield Indicator Buttons (1; 2; 3; 4)
8. Mode Reset Button
9-11. Programmed Waypoint Indicator Buttons (1; 2; 3)
12. Functional Button to Switch Airfields to Additional Waypoints
13. Base Return Mode Indicator Button
14. Current Heading Switch to 180 Degrees
15. Go-Around Pattern Switch (Left or Right)
16. Landing Switch for Non-Programmed Airfield
17-18. Set Channel Numbers (NAV1 and NAV2)
19. NAV1 Channel Setting Knob
20. Signal Lamp Distance to Waypoint 40 km
21. NAV2 Channel Setting Knob



Menu for data programming for RSBN navigation system

1. **Flight Plan reload button**
2. **Custom ICAO setting field**
3. **Custom NAV frequency setting field**
4. **Custom Course setting field**
5. **Custom Runway number setting field**
6. **Custom COM frequency setting field**
7. **Custom ADF frequency setting field**
8. **RSBN Channel number**
9. **Waypoint ICAO**
10. **VOR/ILS/COM frequency**
11. **Course to Waypoint / Runway**
12. **RSBN waypoint (ППМ 1-3) buttons (can be assigned by click / hold)**
13. **Runway number/designator**
14. **RSBN Airfield (АЭР 1-4) buttons (can be assigned by click / hold)**
15. **NAV1 (VOR) table**
16. **NAV2 (VOR/ILS) table**
17. **COM 1&2 table**
18. **NAV2 (VOR/ILS) table**
19. **ADF table**

- the GO-AROUND: LH - RH (ПОВТ. ЗАХ. ЛЕВ. - ПРАВ.) selector switch which is used for selection of the RH or LH traffic circuit during repeated approach;
- the NAVIGATION (НАВИГАЦИЯ) channels selector switch which is used for selection of the required channel when flying to a non-programmed airfield equipped with the РСБН short-range radio navigation and landing system radio beacon;
- the LANDING (ПОСАДКА) channels selector switch which is used for selecting the required channel when landing on a non-programmed airfield equipped with the ПРМГ-4М radio beacon group;
- the D LESS THAN 40 KM lamp which lights up when the distance to the route turning point is less than 40 km, thus indicating that it is necessary to switch over to other route turning point;
- the CORR lamp which indicates operation of the РСБН-6С system in the radio correction mode;
- the TEST (КОНТРОЛЬ) button which enables the pilot to check the serviceability of the РСБН-6С system. Pressing on this button must cause the combined course indicator and the ППД-2 distance indicator to reproduce the check azimuth and distance values, respectively. The check azimuth value accounts for 177°, and the value of the distance is equal to 291.5 km;
- the IDENT (ОПОЗН.) button which is used to ensure individual identification of the aircraft displayed on the plan position indicator of the РСБН ground short-range radio navigation and landing system;
- the AZIMUTH (АЗ) button and the ZERO slotted screw which are used for the equipment adjustment (setting of azimuth zero).

The output parameters processed in the РСБН-6С system are displayed on the combined course indicator, flight director indicator, and distance indicator.

Preparation for Flight with Use of POLJOT-1И System

The preparation for flight should be effected in accordance with the general rules with the due regard to the characteristic features of the POLJOT-lИ system.

In the course of the preparation for flight the pilot should:

(a) plot the great-circle coordinate system;

(b) plot and calculate the flight route;

(c) determine the great-circle coordinates of the route turning points and the radio beacons of the short-range radio navigation and landing system, angular corrections, track angles, and the initial flight data for the automatic landing approach;

(d) make up a program for en-route flight and landing on the main and alternate airfields;

(e) introduce the initial data (program) for the en-route flight and landing on the main and alternate airfields.

Flight route selection and plotting should be effected with due account of the tactical and navigational situation as well as of the capabilities of the POLJOT-1И system which makes it possible to program seven route points, namely, three route turning points and four radio beacons of the short-range radio navigation and landing system. The procedures for plotting the flight route are given in Fig. 49. To be marked first are the basic route points, that is, the initial route point, route turning point, target, and terminal route point. Then, these points, with due regard to the turning radius, should be connected with the geodetic lines which form the course line.

The geodetic lines marked on the modified polyconic projection maps having a scale of l:l,000,000 and composed of nine sheets may be substituted by straight lines.

Upon completion of flight route plotting, make flight calculations involving determination of the flying distance and time, track angles at each flight route stages, total flight endurance, flying time reserve, takeoff time to ensure timely target interception, and fuel reserve.

PERFORMING EN-ROUTE FLIGHT

Performing Assigned-Route Flight in Automatic Control Mode

Takeoff and climb to an altitude of 200 m shall be effected manually.

On attaining an altitude of 200 m the aircraft should be piloted in the director control mode.

On attaining an altitude of at least 500 m the pilot, keeping the command bars within the limits of the circle, should trim out the stick forces and enable the automatic control mode by depressing the AUTO CTL light-button located on the control panel of the automatic flight control system and ascertain that it has come on.

After the automatic control mode has been enabled the aircraft in-flight control becomes automatic. The engine operation control shall be effected by the pilot.

The flying speed and the engine power setting will depend on the climb program set on the altitude and airspeed selector.

In both the subsonic and supersonic climbing, when the aircraft approaches the selected altitude, the SEL ALT LVL-OFF lamp located on the instrument board comes on and glows for 3 to 5 s after which the aircraft is automatically recovered to level flight at the selected altitude on the preset course. Apart from this, the attainment of the selected altitude by the aircraft should be checked with reference to the longitudinal channel position bar which should cover the distance between the upper stop and the lower edge of the circle across the centre of the scale.

As the fuel is being consumed in subsonic flight at a constant altitude, the pilot should maintain the airspeed corresponding to a Mach number of 0.85 by gradually decreasing the engine speed.

To ensure a smoother levelling-off after attaining the selected supersonic flight altitude, on flashing-up of the SEL ALT LVL - OFF lamp the pilot should place the throttle lever to the MINIMUM REHEAT (МИНИМАЛЬНЫЙ ФОРСАЖ) position and in level flight establish an airspeed corresponding to a Mach-number of 2.35.

In straight flight, both at sub-sonic and supersonic air-speeds, the aircraft is steadily held on the assigned path. The command bars and position bars of the flight director indi-cator at the time should be within the limits of the respective circles.

The preset course pointer settles in the direction of the route turning point.

With the takeoff airfield radio beacon up-dating ensured, the CORR indicator lamp located on the control panel of the РСБН-6С system flashes up and the RB pointer on the combined course indicator will show the relative bearing of the radio beacon.

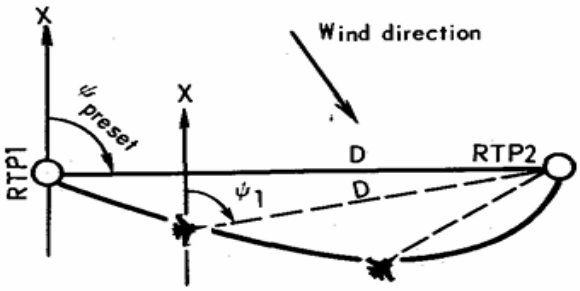


FIG. 53. AIRCRAFT FLIGHT PATH WHEN FLYING TO ASSIGNED POINT BY DIRECTIONAL METHOD IN WIND WITH RADIO UP-DATING ENSURED

Assigned point (RTP) interception flight under wind conditions, with the dead- reckoning up-dating en-sured by the short-range radio navigation and landing system radio beacon, should be effected with the use of the directional method involving the radio beacon up-dating procedure, as shown in Fig. 53.

When flying the aircraft beyond of the zone of coverage of the short-range radio navigation and landing system radio beacon in the independent dead-reckoning mode, the flight path is essentially a straight line as shown in Fig. 54.

When at a distance of 40 km from the RTP, the D LESS THAN 40 KM lamp located on the control panel of the РСБН-6С system comes on. Upon flashing-up of this lamp or after attaining a distance specified in the flight assignment, depress the light-button of the next RTP. Depressing of the above button results in the automatic turning of the aircraft, with the roll not exceeding 42° and 30° under supersonic and subsonic conditions, respectively.

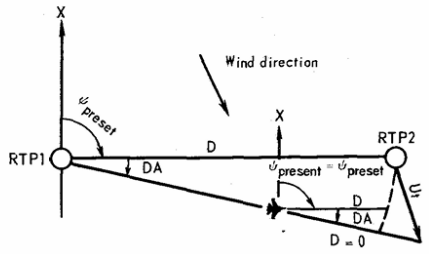


FIG. 54. AIRCRAFT FLIGHT PATH WITH INDEPENDENT DEAD-RECKONING OF COORDINATES IN WIND

Upon illumination of the light-button of the next RTP the preset course pointer of the combined course indicator shows the heading relative to this RTP and the ППД-2 distance indicator shows the distance from this RTP. The flight director indicator lateral channel command bar and position bar will deflect towards the preset course.

It is recommended that the throttle lever should be placed to the FULL REHEAT (ПОЛНЫЙ ФОРСАЖ) position when the aircraft is turned at a supersonic speed and returned to the original position upon completion of turning.

With the flight mission involving lying over the route turning point, proceed as follows:

- at a distance of 25 km disable the automatic control mode by depressing the AUTOPILOT OFF button on the control stick;
- change over to manual control and maintain the present heading;
- when the distance readings presented by the ППД-2 distance indicator become equal to zero, depress the light-button of the next RTP, start to turn the aircraft manually, set the command bars in the centre of the circle, and enable the automatic control mode.

Upon completion of turning the aircraft with the purpose of intercepting the preset course, the command bars and position bars should be within the limits of the respective circles.

In case the radio beacons of the short-range radio navigation and landing system, or en-route radio beacons, or beacons of the radio navigation points programmed in the system are used as route turning points, depress the AFLD and RM light-button located on the РСБН-6С system control panel. The subsequent procedures to be followed by the pilot are similar to those involved in flight to the RTP.

On getting beyond the zone of coverage of the takeoff airfield short-range radio navigation and landing system beacon (the CORR lamp located on the РСБН-6С system control panel does not glow) or intercepting the points specified in the navigator's flight chart, depress on the light-button of the next programmed radio beacon into the coverage zone of which the aircraft will enter.

When performing an en-route flight in the automatic control mode, a pilot must effect the engine operational control, check the correctness of the present heading indications, check the combined course indicator pointers and the flight director indicator position bars and command bars for correct positioning, note the readings presented by the ППД-2 distance indicator, check the flight director indicator for correct roll and pitch indications, and check the illumination of the

SHORAN light-button located on the AFCS control panel.

The fading-out of the SHORAN light-button results in the dropping-in of the roll and pitch flags on the flight director indicator and causes the automatic flight control system to stabilize the aircraft attitude registered at the moment of the light-button fading-out. This being the case, the pilot should change over to manual control without disabling the automatic control mode by means of the AUTOPILOT OFF button, ascertain that the CORR lamp located on the РСБН-6С system control panel has come on, depress the SHORAN light-button, set the command bars within the limits of the circle, and trim out the stick forces.

If the CORR lamp is dead, the return to the landing airfield should be effected by the use of the APK-19 automatic direction finder by placing the SHORAN - ADF (РСБН-АРК) selector switch to the ADF position. Upon setting the selector switch to this position, ascertain that the combined course indicator RB pointer readings vary by not more than 6 to 8° at a distance of more than 40 km to the landing airfield.

Besides, in the course of en-route flight and return to a programmed airfield, the pilot, especially when in doubt about the properness of functioning of the short-range radio navigation and landing system must periodically check the flight direction with the use of the APK-19 automatic direction finder, and the distance to the airfield, by using the information given from the control post.

Performing En-Route Plight in Director Control Mode

After takeoff the pilot should proceed as follows:

(1) on attaining an altitude of 200 m the pilot should depress the SHORAN light-button on the control panel of the automatic flight control system;

(2) check to see that:

- the SHORAN light-button on the control panel of the automatic flight control system is illuminated;
- the preset course pointer of the combined course indicator indicates the direction to the RTP-1;
- the distance indicator reads the distance to RTP-1;

KPP NPP (Control Panel Navigation Panel)

1. **Glideslope Signal Flag**
2. **Localizer Signal Flag**
3. **Heading Bar**
4. **Glideslope Bar**
5. **Bank Angle Indicator**
6. **Pitch Director Bar of Autopilot**
7. **Roll Director Bar of Autopilot**
8. **Gyroscope Reset Button**
9. **Slip Indicator**
10. **Pitch Scale Trim Knob**
11. **Moving Pitch Scale**
12. **Bank Angle Scale**
13. **Gyro Compass Scale**
14. **Course Indicator Needle**
15. **Bearing Indicator Needle**
16. **Flags for Glideslope and Localizer Signal**
17. **Glideslope Deviation Bar**
18. **Turn Entry Markers 2; 3; 4**
19. **Course Deviation Bar**
20. **Reverse Course Indicator**
21. **OBS Course Setting Knob**

- the flight director indicator lateral channel command bar and position bar have deflected towards the RTP-1;
- the flight director indicator longitudinal channel com- mand bar has deflected below the circle and the position bar, above the circle;

(3) keeping the lateral channel command bar within the circle, apply proportionately the stick and pedals to enter a turn;

(4) while climbing, accelerate the aircraft to M = 0.85 and smoothly move the control stick to zero the longitudinal channel command bar;

(5) fly with reference to the flight director indicator keeping the indicator command bars within the circle.

Transfer attention as follows:

- flight director indicator (pitch, roll, slipping, command bars within the circle);
- airspeed (M = 0.85);
- altimeter (climbing to the assigned flight level);
- combined course indicator (preset course to the RTP-1);
- flight director indicator (pitch, roll, slipping);
- engine instruments;
- fuel flowmeter, annunciator (normal sequence of fuel consumption);
- direct-reading distance indicator ППД-2 (decrease of distance to the RTP-1);
- flight director indicator (command bars within the circle).

When performing flight, the pilot must proceed as follows:

(1) as the SEL ALT LVL-OFF lamp lights up, smoothly apply forward stick to level aircraft at the assigned flight level;

(2) decrease the engine speed to keep the Mach-number equal to 0.85;

(J) make sure that the D LESS THAN 40 KM lamp on the control panel of the short-range radio navigation and landing system is illuminated when the distance to the route turning point becomes less than 40 km. Depress the light-button of the next route turning point;

(4) make sure that:

- the distance to the route turning point is indicated by the distance indicator;
- the command bar and position bar of the flight director indicator lateral channel are deflected in the direction of the selected route turning point;
- the preset course pointer of the combined course indicator indicates the course to the next route turning point;

(5) smoothly deflect the aircraft control stick to enter a turn keeping the command bars within the circle;

(6) after the aircraft is turned to the preset course set the command bars and position bars within the circles of the flight director indicator.

Transfer attention as follows:

- flight director indicator (pitch, roll, slipping, command bars within the circle);
- airspeed (maintaining the selected Mach-number);
- altimeter (assigned flight level);
- combined course indicator (preset course to the next route turning point);
- flight direct indicator (pitch, roll, slipping);
- engine instruments;
- fuel flowmeter, annunciator (normal sequence of fuel consumption);
- control panel of the short-range radio navigation and landing system (the CORR lamp, AFLD and selected RTP light-buttons are illuminated);
- flight director indicator (pitch, roll, slipping, command bars and position bars within the circles);

(7) on accomplishing the en-route flight mission, depress the AFLD (landing airfield) and RETURN light-buttons on the control panel of the short-range radio navigation and landing system;

(8) make sure that:

- the distance indicator indicates the distance to the landing airfield;
- the command bar and position bar of the flight director indicator lateral channel are deflected in the direction of the landing airfield;
- the combined course indicator preset course pointer reads the course to the short-range radio navigation and landing system beacon (to the beginning of the base-leg (final) turn) on the landing airfield;
- the CORR lamp and the AFLD (landing airfield) and RETURN light-buttons are illuminated on the control panel of the short-range radio navigation and landing system;

(9) smoothly deflect the aircraft control stick to enter a turn to intercept the preset course.

Peculiarities of Performing En-Route Flight in Manual Control Mode

The manual control mode should be made use of in the event of failure of both the automatic and director control modes. In this case, the pilot may use the preset course and radio beacon relative bearing readings presented by the combined course indicator. Upon depressing the SHORAN light-button on the AFCS control panel the pilot may also make use of the indications presented by the longitudinal channel position glide-slope deviation) bar of the flight director indicator when flying in the RETURN mode in response to the commands from the РСБН-6С system.

During the performance of an en-route flight in the manual control mode the preset course indicator pointer of the combined course indicator should be set to the required position by the use of the course selector knob and the P/SET COURSE AUTO - MAN selector switch, to the MAN position.

The monitoring of the navigational parameters delivered by the POLJOT-lИ system and use of the equipment in the manual control mode should be affected in the same scope and sequence as in the automatic or director control mode.

Landing Approach to Programmed Airfield with Use of POLJOT-1И System

Director Control Mode

After the mission is accomplished, the pilot should proceed as follows:

(1) check the radio up-dating (the CORR lamp is illuminated);

(2) set the P/SET COURSE AUTO - MAN selector switch to the AUTO position;

(3) depress the AFLD and RETURN light-buttons on the control panel of the short-range radio navigation and landing system (the AFLD and RETURN light-buttons will come on);

(4) check the position of the ψ + 180° selector switch;

(5) depress the SHORAN light-button on the AFCS control panel;

(6) after enabling of the director mode, the pilot should:

- zero the command bars of the flight director indicator by proportionate deflection of the aircraft control stick and pedals;
- trim out the control forces by the trim mechanism;

(7) in level flight the pilot should transfer attention as follows:

- flight director indicator (roll, pitch, command bars within the small-diameter circle);
- radio up-dating;
- combined course indicator (present heading is in compliance with preset course);
- flight director indicator;
- vertical-speed indicator;
- airspeed;
- flight director indicator;
- engine instruments;

(8) at a distance of 250 km from the airfield smoothly deflect the aircraft control stick and pedals to keep the flight director indicator vertical command bar within the small-diameter circle;

(9) at a distance of 90 to 120 km from the airfield proceed as follows:

- push the aircraft control stick keeping the horizontal command bar within the small-diameter circle;
- decelerate the engines to the idle speed;
- slightly vary the pitch and extend (retract) the air brakes to set up an airspeed of 600 km/h;

(10) during descent transfer attention as follows:

- flight director indicator (pitch, roll, command bars within the small-diameter circle, pitch angle is 6°, approximately);
- vertical-speed indicator (vertical speed of descent is 35 to 40 m/s);
- combined course indicator (present heeding is in compliance with preset course);
- flight director indicator;
- airspeed (600 km/h);
- engine speed (idle speed);
- flight director indicator;
- altitude;
- airspeed;
- flight director indicator;

(11) at an altitude of 1000 m establish an engine speed of 75 per cent and prepare for pulling the aircraft out of descent;

(12) keeping the flight director indicator command bars within the small-diameter circle, bring the aircraft to level flight at an altitude of 550 to 700 m;

(13) adjust the airspeed of 600 km/h by the engine speed;

(14) after bringing the aircraft to level flight, extend the landing gear and decrease the airspeed to 500 km/h;

(15) when approaching the base-leg turn at a distance of 19 to 21 km, enter a turn with a bank of 30° keeping the vertical and horizontal command bars within the flight director indicator small-diameter circle;

(16) decrease the airspeed to 450 km/h;

(17) while turning, transfer attention as follows:

- flight director indicator (pitch, roll, command bars within the small-diameter circle);
- vertical-speed indicator;
- combined course indicator (variation of the present heading towards the preset course, ADF readings, disappearance of the LOC flag);
- flight director indicator;
- airspeed (450 km/h);
- altitude (550 to 700 m);
- flight director indicator;

(18) prior to intercepting the runway heading, make sure that the LANDING mode is enabled. The LANDING lamp should light up on the control panel of the automatic flight control system;

(19) after intercepting the runway heading, set the RB, SHORAN - ADF (КУР, РСБН - АРК) selector switch to the ADF (АРК) position;

(20) when on the runway heading, keep the command bars within the small-diameter circle on the flight director indicator;

(21) at a distance of 15 to 16 km extend the flaps and decrease the airspeed to 430 km/h;

(22) transfer attention as follows:

- flight director indicator (pitch, roll, command bars within the small-diameter circle);
- vertical-speed indicator (no vertical speed);
- combined course indicator (positions of the course and glide-slope deviation bars);
- flight director indicator;
- airspeed (430 km/h);
- combined course indicator;
- flight director indicator;
- vertical-speed indicator;
- altitude;
- combined course indicator;
- flight director indicator;

(23) as soon as the horizontal bar approaches the centre of the circle on the combined course indicator, start descending at a vertical speed of 5 to 7 m/s keeping the bar of the combined course indicator in the centre;

(24) set up an engine speed of 68 per cent;

(25) maintain the following descent conditions:

Distance read off distance indicator, km	12	10	8	6	4	2
Altitude, m	600	500	400	300	200	100

(26) decrease (increase) the engine speed to adjust the airspeed so as to pass the outer marker beacon at an airspeed of 400 to 420 km/h.

Automatic Control Mode

After the mission is accomplished, the pilot should proceed as follows:

(1) monitor the radio up-dating (the CORR lamp is illuminated);

(2) set the P/SET COURSE AUTO - MAN selector switch to the AUTO position;

(3) depress the AFLD and RETURN light-buttons on the control panel of the short-range radio navigation and landing system (the AFLD and RETURN light-buttons will light up);

(4) check the position of the ψ + 180° selector switch;

(5) depress the SHORAN light-button on the control panel of the automatic flight control system. In this case:

- the SHORAN light-button will light up;
- the preset course pointer will indicate the preset course;
- the LOC and GS flags will drop out;
- the vertical command bar of the flight director indicator will show the deviation from the assigned roll (in the direction of the deflection of the vertical position bar and preset course pointer of the combined course indicator);
- the horizontal command bar of the flight director indicator will show the deviation from the assigned g-load (in the direction of the deviation from the altitude of 9500 m and deflection of the horizontal position bar of the flight director indicator);
- the vertical position bar of the flight director indicator will show the deviation (in heading) from the assigned flight path;

- the horizontal position bar of the flight director indicator will show the deviation from the altitude of 9500 m;
- the direct-reading distance indicator reads the distance to the beacon.

After the director mode is enabled, the pilot should proceed as follows:

(1) zero the command bars of the flight director indicator;

(2) trim out the aircraft control stick forces by means of the trim mechanisms;

(3) depress the AUTO CTL light button on the control panel of the automatic flight control system;

(4) make sure that the AUTO CTL and DAMPER light-buttons are illuminated;

(5) relieve the control stick of forces. In level flight check:

- radio up-dating;
- operation of the command bars;
- preset course indication;
- deflection of the position bars;
- operation of the autopilot.

At a distance of 250 km the pilot should check the deflection of the preset course pointer of the combined course indicator, position bar and command bar of the flight director indicator in the direction of the base-leg (final) turn. The aircraft enters the turn automatically.

At a distance of 90 to 120 km from the airfield the pilot should check the beginning of the break-through procedure:

(1) the horizontal position bar of the flight director indicator deflects downward and settles below the circle between the second and third dots;

(2) the longitudinal channel command bar deflects downward;

(3) the aircraft starts descending at a pitch angle of 6°;

(4) the vertical speed of descent is 35 to 40 m/s.

The pilot must proceed as follows:

(1) decelerate the engines to the idle speed;

(2) set up an airspeed of 600 km/h.

Beginning from the altitude of 3000 m the pilot should check the decrease of the pitch angle and smoothly accelerate the engines. At an altitude of 1000 m the engine speed should be increased to 75 per cent.

On descending to an altitude of 550 to 700 m the pilot should check the aircraft recovery to level flight. For this purpose, he should make sure that:

(1) the horizontal position bar of the flight director indicator settles in the centre of the circle;

(2) the aircraft proceeds in accordance with the deflection of the command bar and automatically levels off;

(3) the stabilized level flight altitude is from 550 to 700 m.

After levelling off the aircraft the pilot should extend the landing gear and decrease the airspeed to 500 km/h.

While approaching the base-leg turn at a distance of 19 to 21 km the pilot should make sure that:

(1) the preset course pointer of the combined course indicator and the vertical position bar of the flight director indicator have deflected towards the turn;

(2) with the vertical command bar of the flight director indicator kept in the appropriate position, the aircraft has automatically entered the turn at a roll of not more than 30°.

In the course of the turn the pilot should decrease the airspeed to 450 km/h. Interception of the runway heading is checked by comparing the readings of the automatic direction finder and indications of the present heading.

Prior to bringing the aircraft to the runway heading, make sure that the LANDING mode is enabled automatically:

(1) the LANDING lamp has illuminate4 on the control panel of the automatic flight control system;

(2) the command bars hesitate during 2 to 3 s;

(3) on the combined course indicator, the LOG flag was the first to disappear and at a distance of 20 km, minimum, the GS flag became also out of view;

(4) the vertical bar of the combined course indicator has deflected towards the equisignal zone of the localizer beacon;

(5) the horizontal bar has jumped up;

(6) the preset course pointer of the combined course indicator indicates the runway heading.

On the runway heading the pilot should set the RB, SHORAN - ADF selector switch to the ADF position and make sure that:

(1) the vertical position bar of the flight director indicator deflects towards the equisignal zone of the localizer beacon;

(2) the horizontal position bar indicates the deviation from the altitude of 550 to 700 m;

(3) the vertical bar of the combined course indicator deflects towards the equisignal zone of the localizer beacon;

(4) the horizontal bar of the combined course indicator is in the extreme upper position;

(5) the roll and pitch command bars are in the centre of the flight director indicator circle;

(6) with the command bars of the flight director indicator kept in the centre of the circle the aircraft performs the maneuver in the direction of the deflected position bars.

At a distance of 15 to 16 km the pilot should extend the flaps and establish; an airspeed of 430 km/h.

At a distance of 14 to 16 km the pilot should make sure that:

(1) the combined course indicator bar moves downwards;

(2) as the combined course indicator bar passes the central circle, the horizontal command bar deflects downwards;

(3) following the movement of the horizontal command bar of the flight director indicator the aircraft starts descending automatically;

(4) the vertical speed of descent is 5 to 7 m/s.

The descent is checked as explained for the director control mode.

At an altitude of 50 m the pilot should discontinue automatic flight by depressing the AUTOPILOT OFF button, make sure that automatic control is disabled and change over to manual control.

Notes

1. *If the aircraft flies at an altitude higher than the cruising return altitude (9500 m) and at a distance of more than 250 km from the airfield, the pilot should disable automatic control by depressing the AUTOPILOT OFF button located on the control stick and depress the RETURN light-button.*

Further, the pilot should control the descent manually by referring to the lateral channel command bar so as to attain an altitude of 9500 m at a distance of 120 to 150 km from the airfield.

On attaining the cruising altitude of 9500 m, the pilot should accelerate the aircraft to the as- signed airspeed and enable automatic control having previously set the command bars of the flight director indicator within the circle.

2. To return at an altitude of lower than 9500 m the pilot should proceed as follows:

- *disable automatic control by depressing the AUTOPILOT OFF button;*
- *depress the AFLD (landing airfield) and RETURN light-buttons;*
- *fly level keeping the flight director indicator command bar and lateral channel position bar within the circles. The flight director indicator longitudinal channel position bar and command bar are above the respective circles and move towards the centre as the aircraft approaches the assigned descent path;*
- *as the command bar and longitudinal channel position bar approach the centres of the respective circles, enable automatic control and further on check the aircraft descent along the assigned path. Ering the aircraft to the runway heading in the vertical plane with the aid of the POLJOT-lM system as illustrated in Fig. 55.*

3. If an en-route flight has been performed beyond the radio up-dating zone, return to the programmed airfield proceeding as follows:

- *disable automatic control by depressing the AUTOPILOT OFF button;*
- *depress the AFLD (landing airfield) and RETURN light-buttons located on the РСБН-6С system control panel;*
- *depress the SHORAN light-button on the AFCS control panel;*
- *place the command bars within the circle on the flight director indicator, controlling the aircraft manually;*
- *depress the AUTO CTL light-button on the AFCS control panel and relieve the control stick of forces.*

Position Control Mode

The pilot should proceed as follows:

(1) perform a circling flight at an altitude of 600 m;

(2) extend the landing gear when abeam of the outer marker beacon;

(3) set up an airspeed of 500 km/h;

(4) fly to the base-leg turn at the altitude of 600 m;

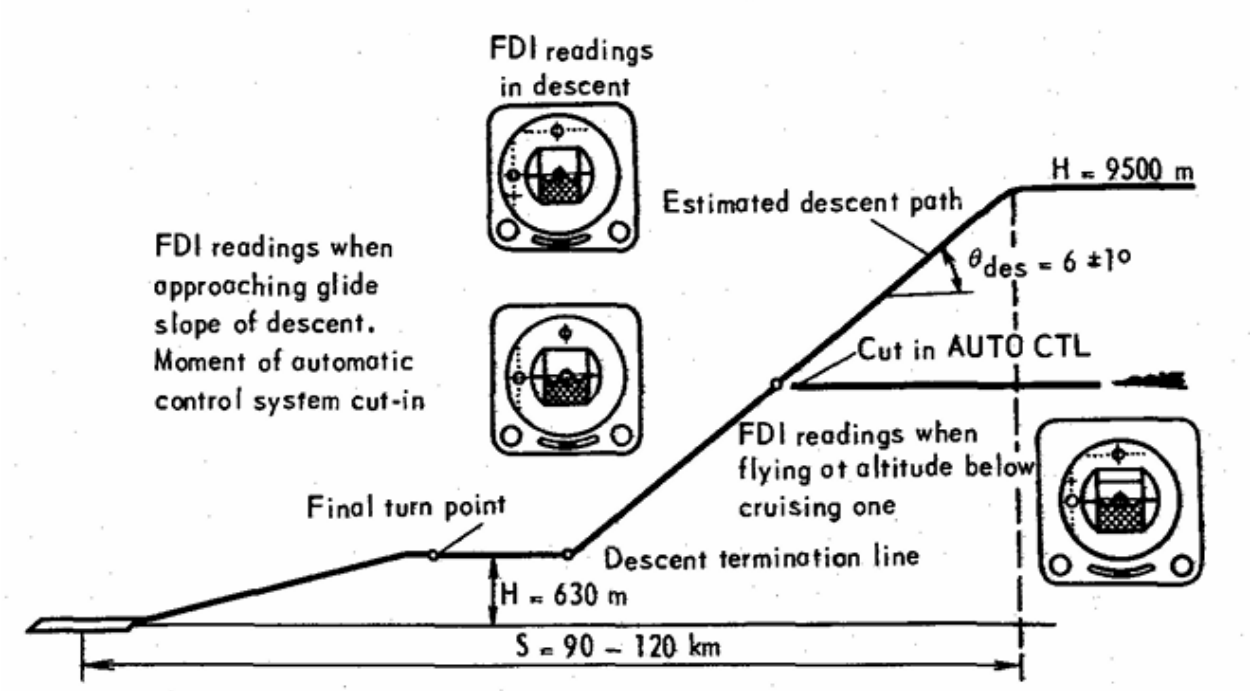


FIG. 55. BRINGING AIRCRAFT TO LANDING HEADING IN VERTICAL PLANE WITH USE OF "POLJOT–1И" SYSTEM

(5) at a distance of 19 to 21 km enter a turn at a roll of 30°;

(6) decrease the airspeed to 450 km/h;

(7) while turning, transfer attention as follows:

- flight director indicator (roll, pitch, slipping);
- vertical-speed indicator;
- combined course indicator (present heading, relative bearing);
- airspeed (450 km/h);
- altitude (600 m);
- flight director indicator;

(8) on approaching the runway heading, turn on the LANDING switch on the РСБН-6С system control panel;

(9) maintain the airspeed of 450 km/h and altitude of 600 m;

(10) check the enabling of the LANDING mode;

(11) perform the turn so as to have the vertical bar of the combined course indicator aligned with the tail of the RB pointer before the bar enters the central circle;

(12) as the vertical bar of the combined course indicator enters the circle, smoothly reduce the deviation from the runway heading to select a heading on which the vertical bar is kept within the circle;

(13) extend the flaps at a distance of 15 to 16 km and decrease the airspeed to 430 km/h;

(14) transfer attention as follows:

- flight director indicator (roll, pitch, slipping);
- vertical-speed indicator;
- combined course indicator (position bar, RB, present heading);
- airspeed (430 km/h);
- altitude;
- flight director indicator;
- engine speed;
- flight director indicator;

(15) control the aircraft by referring to the flight director indicator, position bars of the combined course indicator, readings of the combined course indicator course selector, automatic direction finder and direct-reading distance indicator;

(16) at a distance of 12 km start descending at a vertical speed of 5 to 7 m/s, keeping the bars of the combined course indicator in the centre of the circle;

(17) if the combined course indicator bars deflect from the centre of the circle, first correct the deviation

from the localizer beam and then from the glide-slope beam.

Peculiarities of Performing Flight to Non-Programmed Airfield with Use of POLJOT-1И System

During the performance of an en-route flight there may arise a necessity in landing the aircraft on a non-programmed airfield.

When clear of the zone of coverage of the non-programmed airfield short-range radio navigation and landing system beacon, the aircraft should be flown first on the estimated course. Upon entry into the zone of coverage of this beacon the aircraft must be piloted in the direction of the short-range radio navigation and landing system beacon.

Upon receiving a command or making an independent decision on landing the aircraft on a non-programmed airfield, the pilot must act as follows:

- when at a long distance from the landing airfield, that is when clear of the zone of coverage of the short-range radio navigation and landing system beacon, approximately determine the aircraft fix on the desired course proceeding from the distance to the next route turning point;
- visually determine the great-circle course to the landing airfield with reference to the map;
- use the radio set to request the team at the control (direction) post for the present distance and inbound course data and report the amount of fuel remaining in the tanks;
- disable automatic control by means of the AUTOPILOT OFF button;
- depress the MODE CANCEL (СБР. РЕЖ.) button and check to see the SHORAN light-button located on the AFCS control panel has faded out;
- perform a turn to intercept the desired course and climb to an altitude corresponding to the maximum flight range;
- set the P/SET COURSE AUTO - MAN switch to the MAN position; set the combined course indicator to the estimated inbound course by means of the course selector knob; perform corrective turns to align the preset course pointer with the fixed triangular index and fly the aircraft to the airfield;
- depress the RESET and RETURN light-buttons on the РСБН-6С system control panel; engage the operating channels of the short-range radio navigation and landing system beacon and radio beacon group with the aid of the NAVIGATION and LANDING channel selector switches;
- establish radio contact with landing airfield control post and report the new control team readiness to assume control to the previous control (direction) post;
- to start the airfield beacon up-dating, set the SHORAN-ADF selector switch to the SHORAN position and check the combined course indicator for proper relative bearing indications and the ППД-2 distance indicator, for correct reading of the distance to the radio beacon;
- set the RADIO - COMPASS (РАДИО-КОМПАС) selector switch to the COMPASS (КОМПАС) position and listen to the call signs of the landing airfield short-range radio navigation and landing system beacon; ascertain that they are correct, return the above selector switch to the RADIO (РАДИО) position and perform an inbound flight;
- depress the SHORAN light-button on the AFCS control panel;
- proceed on an inbound course, keeping the lateral channel command bar in the centre of the circle and checking the flight direction with reference to the relative bearing pointer;
- at a distance of 120 to 100 km from the airfield start manual descent so as to be able to pass the radio beacon at a flight pattern altitude; take into account the landing airfield pressure;
- after flying past the radio beacon effect landing approach in accordance with the flight pattern adopted at a given airfield.

Under VFR weather conditions the inbound course should be intercepted at a circling flight altitude.

To land the aircraft on a non-programmed airfield, follow the procedures given below:

(1) set the combined course indicator to the great-circle landing course with due regard to the conventional magnetic declination of the takeoff airfield;

(2) when on a final leg or at a distance of 20 km from the airfield, with the view of performing a straight-in approach, turn on the LAUDING switch on the РСБН-6С system control panel;

(3) check the combined course indicator localizer flag for dropping out and depress the LAMDING light-button on the AFCS control panel;

(4) check to see the SHORAN light-button flashes up and the roll and pitch flags drop out on the flight director indicator;

(5) set the command bars of the flight director indicator within the circle and depress the AUTO CTL light-button;

(6) check to see how the aircraft performs automatic landing approach to a height of 50 m. On descending to this height, disable automatic control and manually carry out the landing operations.

It should be borne in mind, that non-programmed airfield approach should be affected on the great-circle course delivered by the directional/vertical gyro system. The true heading data are computed by the РСБН-6С system only in the mode of return to the programmed airfield.

Employment of Automatic Direction Finder for Air Navigation Purposes

The МиГ-25ПД aircraft is provided with the АРК-19 automatic direction finder (the МиГ-25ПДС employing the АРК-10 automatic direction finder) which is intended for solving the problems of air navigation with the use of homing and broadcasting radio stations as well as for performing aircraft landing with the use of the two-beacon landing system in the event of failure of the ground or airborne short-range radio navigation and landing system.

The АРК-19 automatic direction finder makes it possible to solve the following problems:

- perform the inbound and outbound flights, with the combined course indicator presenting visual indication of the relative bearing of a certain radio station;
- determine the relative bearing of the radio station;
- perform landing planning and approach with the use of the two-beacon landing system;
- receive and reproduce the signals transmitted by the homing and broadcasting radio stations.

Besides, the automatic direction finder may be used as a standby receiver.

To ensure reception of the marker beacon call signs the pilot should turn on the ADF (РК) switch on the control panel of radio set Р-862 and set the COMPASS - ANTENNA (КОМП. -АНТ.) selector switch on the control panel of automatic direction finder АРК-19 to the ANTENNA (АНТ.) position.

To ensure reception of the flight control officer's commands by means of the АРК-19 automatic direction finder, the pilot should proceed as follows:

- turn on the ADF switch on the control panel of the Р-862 radio set;
- set the COMPASS - ANTENNA selector switch on the control panel of the АРК-19 automatic direction finder to the ANTENNA position and the RB, SHORAN - ADF selector switch to the ADF position.

Flying the aircraft on the inbound course with the use of the АРК-19 automatic direction finder may be accomplished by the passive, heading stabilization or active methods.

In the passive method of flight on the inbound course the pointer of the direction finder should be kept at zero.

Under wind conditions the aircraft heading will vary. As a consequence of this, the aircraft will move along a curve which is al.so known as a radio course line. An increase of the aircraft heading is indicative of left-hand drift while a decrease of the heading is an evidence of right-hand one.

The heading stabilization method is used when the aircraft is to take the inbound course under the conditions when the automatic direction finder fails to present steady readings and the distance from the airfield is great (up to 200 km).

To intercept the inbound course with the use of the heading stabilization method, set the ADF pointer of the combined course indicator to zero, note the aircraft heading, and maintain it for a certain period of time. In the event of steady pointer deflection off the zero mark, perform a corrective turn to reset it to zero and maintain a new heading, etc. The direction of drift should be determined by a change in the heading, the same principle being involved in the passive method of flight on the inbound course. Namely, an increase in the aircraft heading indicates left-hand drift while a decrease is indicative of right-hand one.

The active method of flight on the inbound course is commonly used in en-route long-distance flights.

With this method being used, it is necessary that the pilot should maintain the heading and such a relative bearing of the radio station at which the desired inbound course interception is ensured. Upon interception of the desired course, perform a corrective turn to take the course with due account of the drift angle. As a result, the movable heading dial will present the heading with the drift angle taken into account and the ADF pointer will deflect from the zero mark by the amount of the drift in the direction opposite to that of the drift. Keeping the combined course indicator pointers in the above positions ensures flight on the desired course, with the aircraft axis turned through the amount of the drift with respect to the course line.

Flight on the outbound course in the assigned direction should be performed with the estimated

course. The position of the aircraft relative to the desired course line should be checked with reference to the automatic direction finder.

When proceeding on the desired course, the ADF pointer will indicate RB = 180° only at zero drift. In flight the aircraft is subject to drift practically at all times. The existence of drift can be determined either by the left-hand or right-hand deflection of the ADF pointer relative to the 180° mark. To intercept the desired course, perform a corrective turn with reference to the movable heading dial in the direction of the ADF pointer deflection. The amount of the turn should be equal to the double drift angle.

Upon completion of the corrective turn, the pilot will find the ADF pointer deflected by the triple drift angle from the position corresponding to 180°. Further it is necessary that the heading should be maintained constant until the pilot intercepts the desired course. At the moment of the desired course interception the ADF pointer will deflect through the double drift angle from the position corresponding to 180°. Further on, perform a corrective turn so that the course correction should be equal to one drift angle.