

## Quick Panel Manual



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Source: [www.avia-yk.ru](http://www.avia-yk.ru)

## YAK-42: A BRIEF HISTORY

Yak-42 is one of few Aeroflot aircraft that requires no introduction. It suffices to say that 9 world records have been set on Yak-42 aircraft. In one case, this airplane, designed for short-range flights only, managed to fly from Moscow to Khabarovsk (over 8,000 km) without a single landing. It is even more impressive that before creating the Yak-40, its predecessor, the Yakovlev Design Office was not engaged in the development of large passenger planes. It is well known that the Yakovlev Design Office chiefly specialized in the design of training, sports and fighter aircraft, with small passenger planes also created from time to time.

Yak-40 was the first jet passenger airplane from the Yakovlev Design Office, which brought comfort and speed to local routes. Utilizing the Yak-40 design with its straight wing and seating 120 passengers, the Yak-42, a far more perfect jet plane, was created for short-range flights.

In early 1974, Yak-42 was designed with a straight wing. B. Bugaev, Minister of Civil Aviation of the Soviet Union, personally reported on the Yak-42 design plans to the Central Committee, where the design was consequently approved by Leonid Brezhnev, which at that time had absolutely crucial importance. After receiving approval for the project, and having already constructed a full-scale model of the aircraft, the Yakovlev Design Office made a brave decision to release the aircraft one year earlier than planned. As a result of the bureau's efforts the plane rolled out of the assembly plant at the end of 1974.

During its first flight on March 7, 1975, the plane's crew consisted of renowned veteran pilot Arseniy Kolosov, test-pilot Yuri Petrov and flight engineer Yuri Viskovsky. The tests went well, but the speed of the straight-winged plane proved insufficient: the maximum cruising speed at altitude of 8000 meters reached 680 km/h. As a result, the Ministry of Civil Aviation issued a directive that the jet plane, designed for regional flights, must achieve cruising speed of 700-800 km/h. The Yakovlev Design Office reached a decision to build the plane with arrow-shaped wings at 30°.

The new design was executed expediently, and by early 1975 Yak-42 had the characteristic outlines familiar to us all: it had a low arrow-shaped wing, three compact engines close to the tail and a high arrow-shaped stabilizer. During their first flights, the test pilots remarked on the aircraft's exceptional thrust, its excellent flight qualities, its stability and ease of control, as well as convenient design of its gauges and controls.

By 1982 Yak-42's were utilized on a number of routes, flying regularly between the country's cities, as well as covering some international routes (Moscow - Berlin, Leningrad - Helsinki and Moscow - Prague, to name a few). In total, in the 18 months since its launch, nearly one and a half million passengers were transported by airplanes of this type.

Mass production commenced in Smolensk and, later, at the Saratov factories. The first official Yak-42 passenger flight took place on December 22, 1980, "having arrived on time" in accordance to standards personally set by the Secretary General. Early utilization of the aircraft proved highly successful. Unlike the heavy IL-86, which began transporting passengers practically at the same time, the "Yak" did not require new runways and taxiways to be built, and the number of flights quickly grew.

Then, on June 28, 1982, tragedy struck near Mozyr, Belarus. While at flight level, Pulkovos' Yak-42 with hull number 42529, suddenly experienced a failure of a stabilizer fitting, causing it to detach. There were no survivors. This accident had a grave impact on the Yakovlev Design Office. All Yak-42 flights were suspended immediately, and an investigation was launched. Whether the destruction of the stabilizer control unit screw was caused by breach of technical operations protocol or a design flaw (or both), the information never reached the public. For a full year and a half the "Yaks" remained under covers at base airports. The reintroduction of the aircraft occurred without much fanfare or press coverage and ever since then, the plane has remained somewhat in the shadow.

The A.S. Yakovlev Design Office had long-term experience with military, sports and small passenger aircraft, with low weight maintenance always being one of its top objectives. In recent years, with the advent of modern aerodynamics, mechanics and the use of new materials, there greater and greater opportunity exists to continuously pursue the quest for lowest aircraft weight. Designers of the Yak-42 in particular, focused their efforts both on weight reduction and an increase in the durability of the plane's construction. Thus, to reduce the weight of the glider (while maintaining same safety margin requirements) a wing of the new plane was executed as a one-piece element, which provided for optimal distribution of metal over all sections of the wingspan. Areas of possible corrosion and cracking of metal were minimized. The new flaps had an extremely simple, reliable and easy construction, while ensuring better weight bearing properties of the wing.

One more example of Yak's highly successful design is the center engine air intake installed in the tail part of the fuselage. The air intake, generally about 7 m in length and 1,300 mm in diameter, and with a complex curved shape, is rendered as a monolithic element. Structurally, it is built as a pipe with three-ply fiberglass walls fashioned on a special machine. In comparison to other similar aircraft, a weight decrease of approximately 70 kg was achieved, thus significantly extending its service life. At the same time, the manufacturing process was simplified significantly.

The Yak-42 planes were the first Russian aircraft where a two-pilot cockpit was implemented. This version appeared as a result of repeated testing of various configurations of control panels and gauges with the goal of identifying optimum configurations in terms of automatic and manual control. As a result, designers chose by far the most effective design, which permits flight without a navigator or flight engineer. However, high passenger aircraft efficiency does not just depend on pilot performance, but on all supporting ground services: dispatchers, maintenance personnel and loaders. A top priority facing aircraft developers was to minimize their workload to the greatest extent. Whenever possible, the A.S. Yakovlev design team strove to reduce aircraft service and maintenance, and worked to minimize aircraft downtime. To that end, the loading of passenger luggage and other cargo in standard containers was implemented.

Compared to its predecessors, An-24, Yak-40 and TU-134, Yak-42 demonstrates much less fuel consumption per 1 passenger-kilometer, leading to significant reductions in transportation costs. The aircraft's remarkable D-36 engines were designed by Vladimir Loktarev at Ivchenko Design Office in Zaporozhye. Marked by their double-flow feature (5.4, while similar engines are only at 2), these engines are much more reliable, have a greater service life and prove to be extremely efficient (0,65 kg/h on take-off and 0,35 kg/h at cruising speed). Engine noise has been significantly reduced and meets the most stringent international standards. At the same time the engines are nearly smokeless.

Today, the main civil aviation project at the Yakovlev Design Office is the Yak-42 passenger aircraft and its modification. At the present time, the Yak-42 and Yak-42D (depending on the owner's requirements) are equipped to transport between 39 and 120 passengers, with a variety of cabin modifications, including 1<sup>st</sup> class options.

## Modifications of Yak-42:

|                   |   |
|-------------------|---|
| Yak-42            | First serial modification   |
| Yak-42D           | Increased fuel capacity   |
| Yak-42E-LL        | Test aircraft for engines, demonstrated at the Paris Air Show in 1991   |
| Yak-42F           | Aerial photography modification   |
| Yak-42M           | Updated version of the Yak-42D.   |
| Yak-142 (Yak-42A) | A modified version of the Yak-42D with updated equipment with higher passenger comfort and reduced noise level. |

## The Yak-42 PROJECT

Lviv Yak-42 Group and Samdim Design present a second version of the popular Yak-42 aircraft. This version represents our continuing efforts on the project, and offers a new Yak-42 model, as well as a newly improved panel.

We used XML Sound Gauges by Doug Dawson as the sound server: [douglassdawson@netscape.net](mailto:douglassdawson@netscape.net).

We also used the TCAS system, clock and joystick gauge by Stepan Gritsevsky from the PRO-TU project in our instrument panel.

The Aircraft.cfg and .air files were modified and adapted for the new panel by Yuri Konjaev to match the real aircraft's characteristics as closely as possible. Since it takes a great amount of time to create aircraft dynamics, the panel includes newly upgraded Yak-42 flight dynamics, which, at the present time, represents the nearly finalized version.

We also utilized and upgraded Yak-42 Sounds by Mike Maarse.

This package includes the KLN-90B navigation system by Roman Petkevich's (RomanPE) from the PRO-TU Project ([www.protu-154.com](http://www.protu-154.com)), which was adopted by its author for the Yak-42 at our request, as well as the coordination gauge by Stepan Gritsevsky to tie in the KLN-90B system and the SAU-42 Autopilot.

Instead of the default GPS, we implemented the GNS-530 navigation system by Don Kuhn.

The Squawk SO-72 gauge by Andrei Shejbak was adapted for ON-LINE flights, using the squawk box.

There is no virtual cockpit in this model but the dynamic wing views are available.

The model contains all the standard animations, plus a number of custom animations:

- all steering controls are animated (flaps, spoilers, stabilizer). They can be blocked from the panel by the appropriate switch;
- landing gear (the undercarriage stays parallel to the ground independently from the aircraft's pitch, the steering can be blocked from the panel for the takeoff, the steering angle is preserved after the aircraft stops) ;
- passenger cabin and cargo doors, and the rear passenger loading stand;
- landing lights deployment (use appropriate panel switch);
- some new effects were added;

So, as each of has free time, the project will continue to develop.

*Our special thanks goes to:* Pilots of LVIV Airlines, for their help with testing the aircraft and for technical advise; Viacheslav Pavlovich Schipanov, for aircraft testing and critical notes; Igor Alexandrovich Yurin, for his help with the SAU-42 Autopilot system; Alexei Koroteev (SU-30), for testing the aircraft and his help in adapting the SO-72 for on-line flights and to AirSimmer team for the English translation.

## Used key combinations:

|  |  |
|--|--|
| Shift+2: Left AZR Panel<br>Shift+3: Right AZR Panel<br>Shift+4: KLN-90B Panel<br>Shift+5: GNS-530 Gauge<br>Shift+6: Throttle Panel<br>Shift+7: Lights Panel<br>Shift+8: Speeds Information Sheet | Deployment of rear passenger loading stand: "Choose exit", Shift+E;<br>Cargo doors – "Choose exit 2", Shift+E+2;<br>Front cabin doors: "Choose exit 3", Shift+E+3. |
|--|--|

## A Brief Overview of Cockpit Panel Configuration

### Main Panel (KVS) (figure 1):

- 1 Lights panel icon.
- 2 Systems failure annunciation indicators.
- 3 DME indicator from SD-75 unit.
- 4 DME SD-75 control panel.
- 5 Altimeter UVID-15-FK (feet).
- 6 Signal Panels.
- 7 IN-3B indicator; used to visually determine thrust in panel control wiring, relative to pitch, bank and heading in the Autopilot mode.
- 8 Combined air speed and MACH indicator USIM-1-1.
- 9 True air speed and MACH indicator UMS-1PB.
- 10 Rate-of-climb, turn and slip indicator DA-30P. Vertical speed measurement of up to 30 м/sec; coordinated turn; bank of up to 45° at airspeed of 400 км/h.
- 11 Electronic Attitude Direction Indicator (EADI) PKP-72-8.
- 12 Electronic Horizontal Situation Indicator (EHSI) PNP-72.
- 13 TCAS system Indicator IVA.
- 14 Barometric altimeter VB-10.
- 15 Flight level set control panel PZVE-1MPB, a part of flight level warning system.
- 16 Altitude indicator UV-5M-1 of the left radio altimeter RV-5M.



Figure 1

- 17 Navigation system control panel PU-1P. Select "NAV" mode from one of the two sets of navigation systems KURS-MP70, RSBN or CVM.
- 18 Attack angle and vertical speed indicator UAP5-7.
- 19 Standby gyro horizon AGR74-10.
- 20 Altimeter UV-75.
- 21 Radio magnetic indicator RMI-2B (part of the KURS-MP70 system).

- 22"Central light" signal board; registers system failures or changes in system status, together with annunciator at main and co-pilot panel.
- 23Flaps position indicator UP-46-02.
- 24Stabilizer position indicator IP-12-01.
- 25Pitch trim indicator IP-12-02.
- 26Ailerons and rudder trim indicator IP-49.
- 27Engine №1 failure early warning annunciator (left engine).
- 28Throttle position indicator IP21-08A (left engine).
- 29Three-pointer Left Engine tachometer indicator ITA-13. Pointer №1: fan rotor revolution; pointer №2: HP compressor revolution (KVD); pointer №3: LP compressor revolution (KND).
- 30Left engine EGT indicator UT7-A.
- 31Oil pressure and temperature/fuel pressure indicator UI3-9 (left engine).

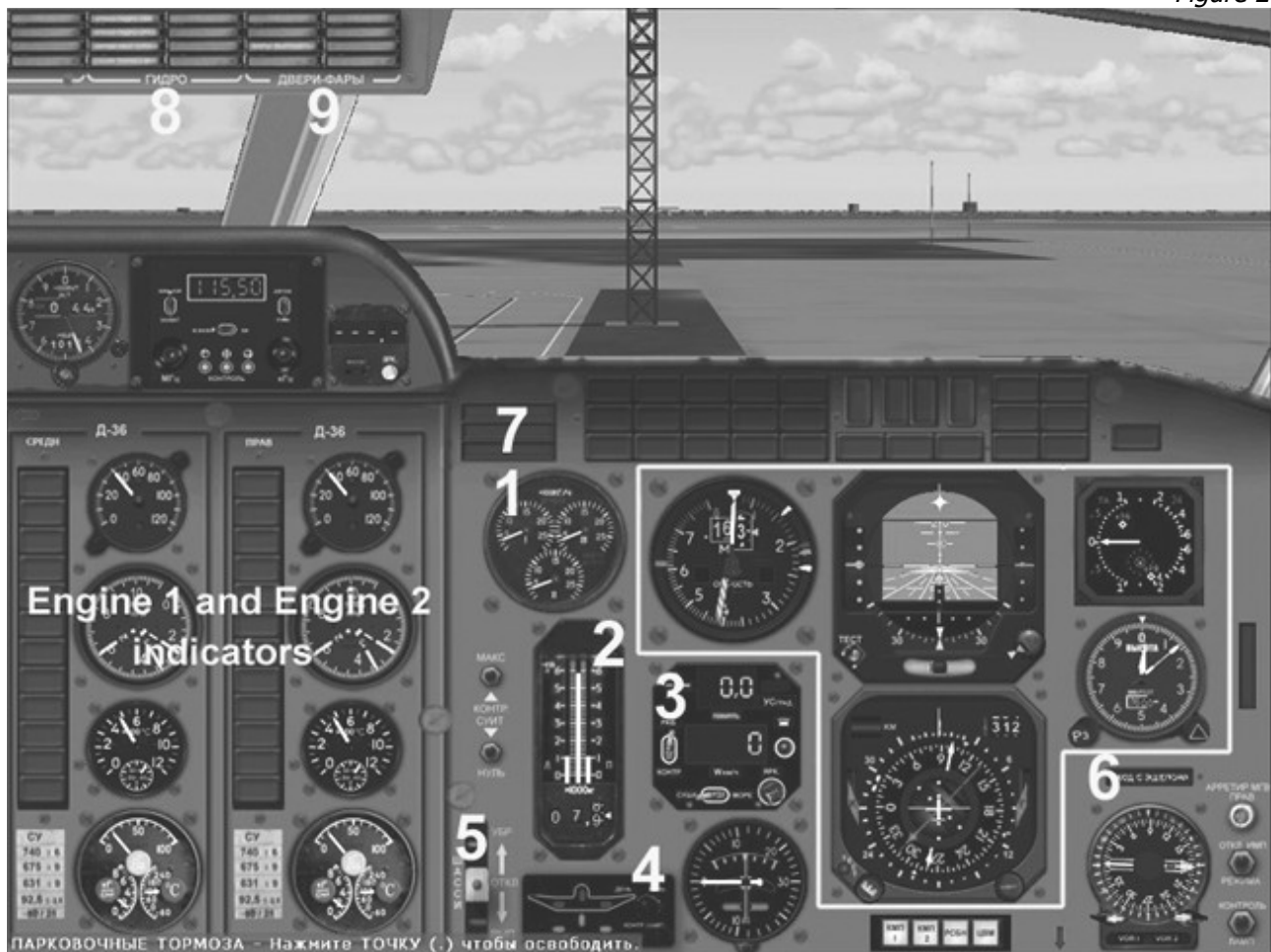
An additional panel of the KVS panel can be accessed by pressing on pointer position 4, contains:



- 1. Aviation clock ACS-1K
- 2. Main and emergency hydraulic system pressure indicator UI2-240B.
- 3. Left and right gear break pressure indicators UI2-150.

### Co-pilot panel (2P) ( Figure 2):

Figure 2



- 1Fuel flow indicator for all three engines IMRT-1.
- 2Fuel quantity indicator ITP-5.
- 3Doppler speed and drift angle indicator SO-13-5.
- 4Gears annunciator.
- 5"Gears UP-OFF-DOWN" switch.

6 "Cruise Altitude change" warning annunciator. On the KVS panel this warning system functions by displaying a blinking yellow light on the Flight Level Set indicator - control panel PZVE-1MPB.

7 Passing marker beacon indicator. A similar annunciator is located on the KVS panel.

8 hydraulic system failures indicator.

9 "DOORS-LIGHTS" indicator.

The other instruments have the same function as instruments listed in the KVS panel description.

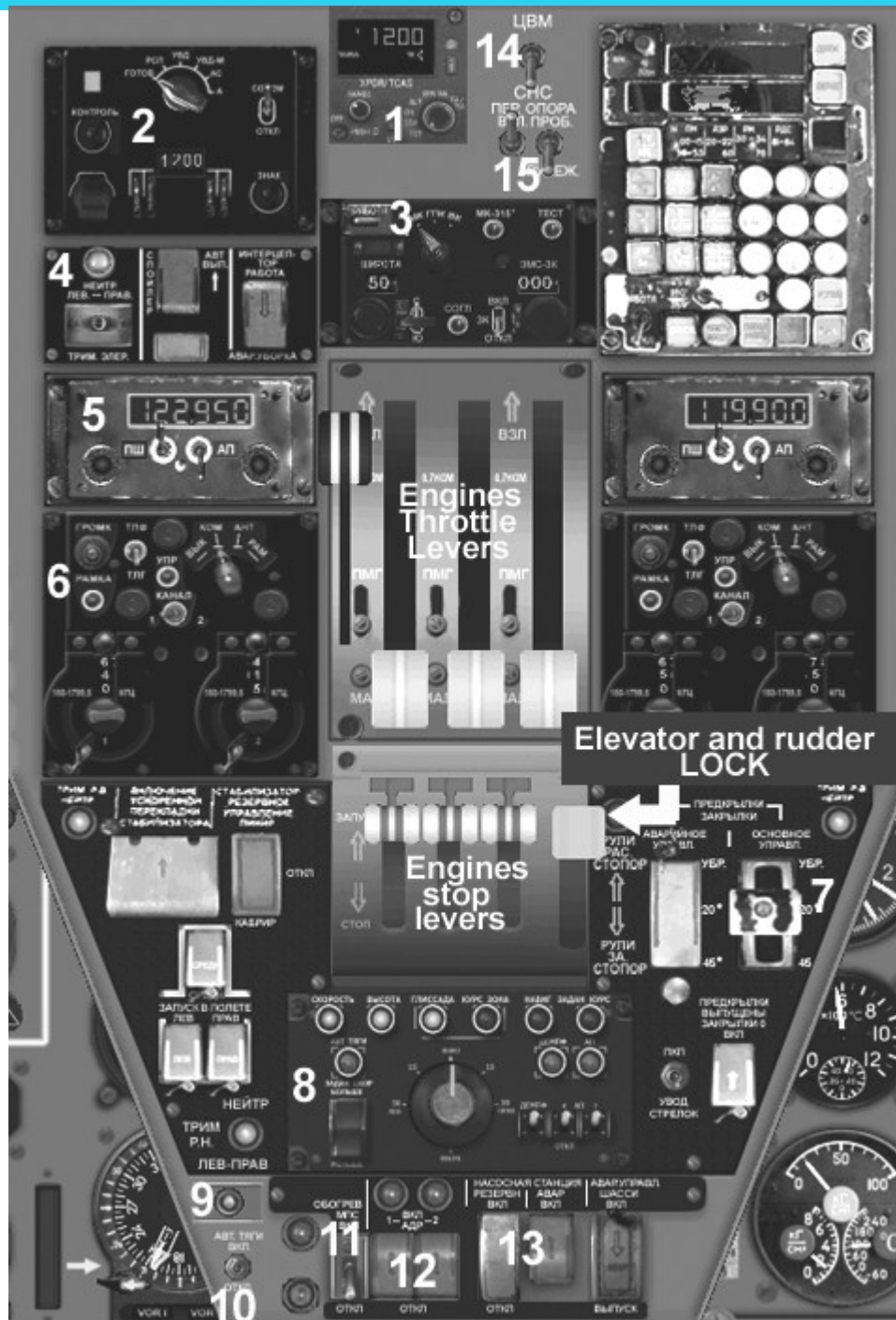
An additional 2D panel, which can be accessed by pressing on pointer Pos. 4, contains:



1. Outside air temperature indicator UT-1
2. Cockpit rate of climb indicator VR10-MK.
3. Altitude indicator UV-5M-1 of right radio altimeter RV-5M.

### **Throttle panel (figure 3)**

Use key combination Shift+6



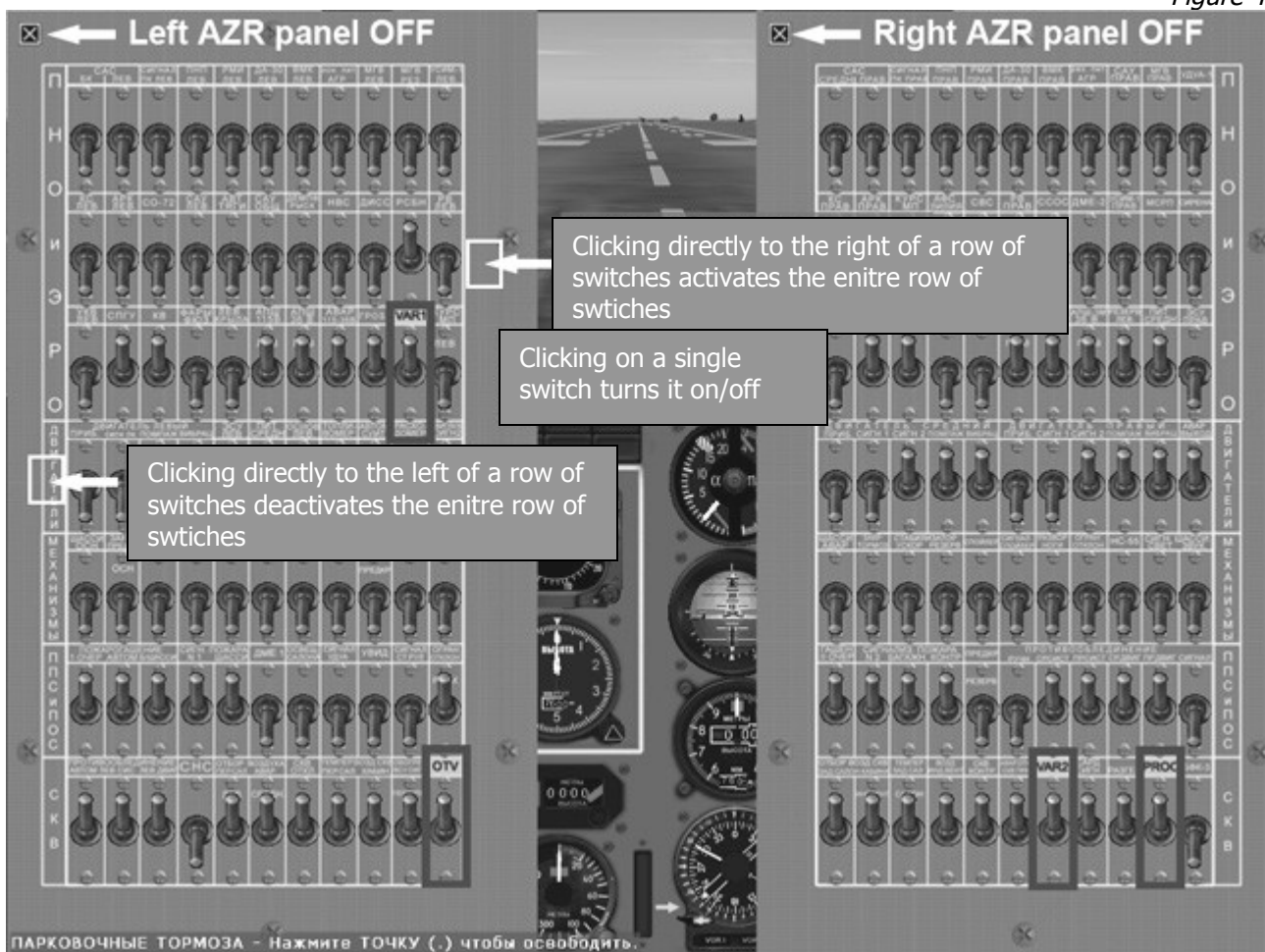
- 1TCAS system control panel.
- 2Squawk SO-72 control panel.
- 3Course system control panel.
- 4Aileron trim and automatic spoiler extension control panel.
- 5VHF radio stations "Baklan-20" control panels PDU-41.
- 6№1 and №2 ARK-15 radio compasses control panels (use mouse scroll function to change ARK frequency).
- 7Flaps extension switch.
- 8Autopilot SAU-42 control panel (PUL-162).
- 9Rudder trim switch.
- 10Auto throttle ON/OFF switch (AT).
- 11Stabilizer gear heating system ON/OFF switch (MPS).
- 12ADR ON/OFF switch.
- 13Main and emergency Hydro pumps switches.
- 14CVM or KLN-90B Navigation mode switch.
- 15"Steerable landing gear" turn ON/OFF switch and "RUN-TAXIING" switch.

#### LEFT and RIGHT AZR Panels (figure 4)

Use Shift +2 and Shift +3 combination keys, accordingly.

The switches turn ON the aircraft systems power.

Figure 4



**The 4 highlighted switches control the TCAS system ON/OFF function.**

## PANEL FEATURES

### Main panel (KVS) (figure 5)

- 1 Standby Attitude gyroscope slaving annunciator (MGV); the light switches off after slaving is performed and Pos. 7 button is released.
- 2 Additional panel DME №2 SD-75 ON/OFF switch (Flight Simulator only).
- 3 Co-pilot (2P) panel mode selection.
- 4 Annunciator for Autopilot SAU-42 OFF mode ("РЕЖИМ САУ"); press to switch OFF.
- 5 Additional icons for access to various panels: Autopilot, ARK-1, ARK-2, throttle panel, KLN-90B, GNS; also, standard SIM icons.
- 6 Stabilizer position indicator. Since stabilizer function in Flight Simulator is tied in to the elevator trim keys, elevator trim is locked. Incidentally, according to the Flight Manual, in real aircraft elevator trim operation is permitted only in emergency cases.
- 7 Left Attitude gyroscope slaving knob. Slaving is required before the flight (Left PKP-72 slaving). There is a 100 second delay after power switches ON.
- 8 Standby Attitude gyroscope slaving knob. Press 2-3 times to perform slaving. Slaving has been achieved successfully if Standby Attitude gyroscope slaving annunciator light (Pos. 1) switches off.
- 9 Heading selection knob (ZK), used for "HEADING" mode of the Autopilot.
- 10 OBS knob.
- 11 "КМП1" and "КМП2" annunciator buttons. Use the first or the second unit of the course system KURS-MP70 (automatic approach or navigation). VOR beacon frequencies are combined with DME and are selected on the SD-75 control panels (*RSBN and CVM modes are yet to be rendered by our team*). But in CVM mode, with Navigation mode ON selected on the SAU-42 control panel and the KLN-90B switched ON, navigation is

performed by KLN-90B. When KLN power is OFF, while GNS-530 power is ON, all navigation data is received from the GNS.

Figure 5



12Right click inside this zone to display the KLN-90B or CVM navigation select switch. In KLN-90B or GNS modes, use the CHC position of the switch for navigation. This switch duplicates the switch on the throttle panel.

**Attention:** the 4 screws found around the USIM-1-1 may be used to select color indexes for V1, VR, V2 and V3 speeds on the gauge (use the mouse).

### Throttle Panel (figure 6):

1Spoiler extension in automatic mode during landing. Right click mouse to open the cap. Left click mouse to change position of the switch.

2Course system operation mode select switch "Normal-Tuning". Right click mouse to open the cap. Left mouse click to change position of the switch.

3Course system mode switch: MK (magnetic course); GPK ("ГПК"); VK ("ВК") (MK + GPK + magnetic declination from CVM, works even without CVM. In other words, it's the TRUE HEADING).

4Course system slaving knob. Perform slaving in all three Switch 3 positions. To control slaving, stop rotating the course scale PNP-72 while knob is pressed. After slaving is complete, the course system operation mode select switch "Normal-Tuning" must be set to Normal (left position).

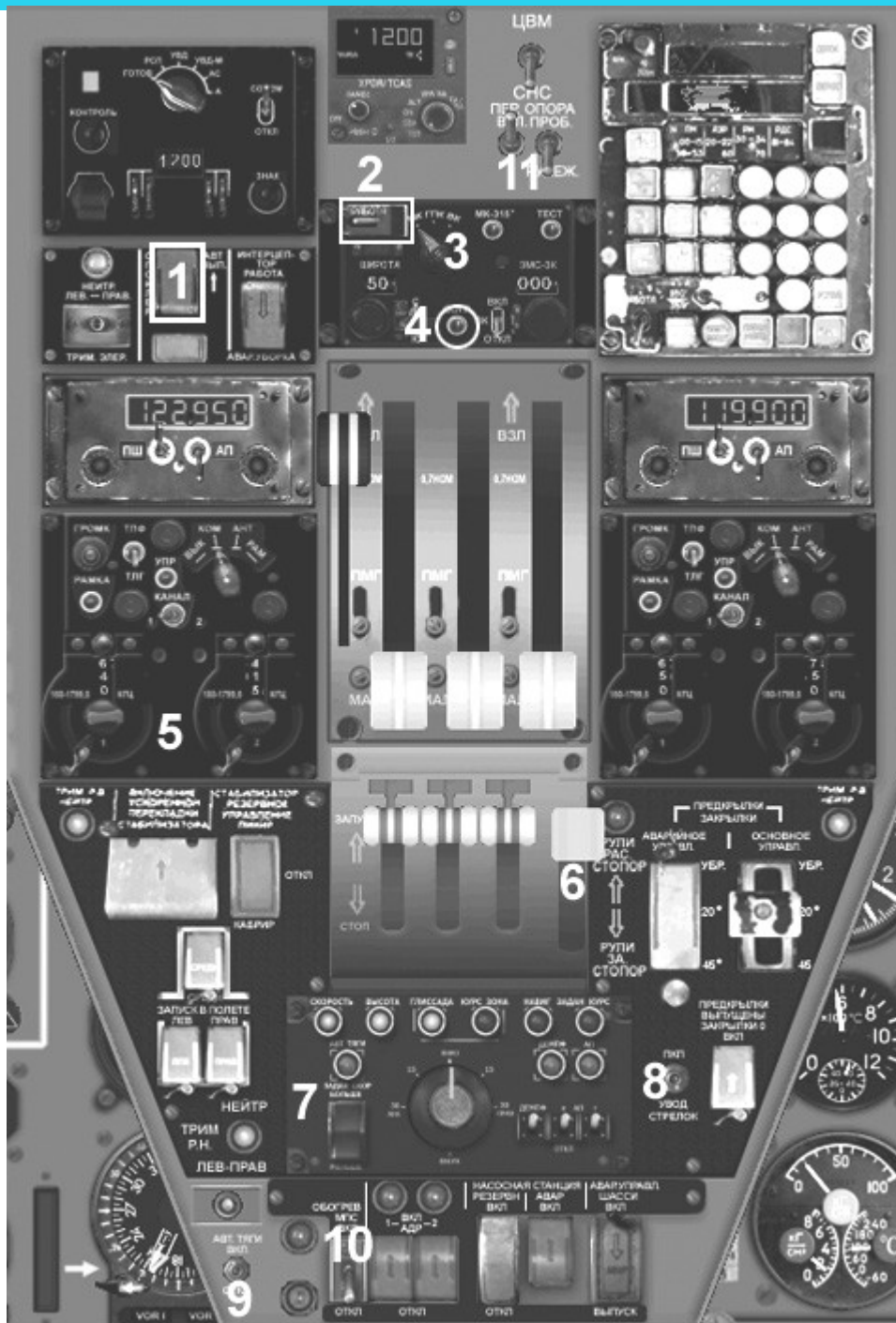
5Right click inside this area in order to enlarge the ARK-15 control panel. To close this control panel, right click one more time. Both ARK-15 control panels can be accessed by clicking on the appropriate icon on the KVS or 2P panels.

6Elevator and rudder lock.

**ATTENTION! Before engines start this lever must be unlocked; engines will not start otherwise.**

7Right click inside this zone to enlarge the SAU-42 control panel. The throttle panel will disappear and a new additional panel containing the Autopilot and some additional switches will be displayed (these have been installed only for convenience of aircraft operation in Flight Simulator). More information on this panel will follow. The Autopilot can also be displayed by clicking on the appropriate icon on the KVS and 2P panels.

Figure 6



8"PKP – command pointers OFF"("ПКП УВОД СТРЕЛОК"). Switches OFF the command pointers (Leaders) on PKP-72.

9Autothrottle enable mode switch (AT). Unless this switch is ON, autothrottle will not function when pressing the "АВТ.ТЯГИ" light indicator/button on the Autopilot control panel.

10Stabilizer heat switch (MPS). If this switch is not ON before takeoff, when outside temperature is less than +5°C during the flight, there will be a brief sound warning, and an annunciator light "ГИДРО" will switch ON on the KVS panel, while the annunciator on the 2P panel will warn that the switch is OFF.

11Steerable landing gear switches used for turning steerable landing gear during takeoff and taxiing. The left switch serves to turn the operation ON; the right switch has two positions: RUN (direction: up), which limits left and right gear turn to 8 degrees; and TAXIING (direction down), which limits gear turn to 55 degrees. Switch to RUN before takeoff. After landing, switch to TAXIING before clearing the runway.

### Co-pilot panel (2P).

Right attitude gyroscope slaving knob. Slaving is required before flight (Right PKP-72 slaving). There is a 100 second delay after power is switched ON, similar to the left attitude gyroscope slaving knob.  
 "КМП1" and "КМП2" annunciator buttons. Use the first or the second unit of the course system KURS-MP70 (automatic approach or navigation). VOR beacon frequencies are combined with DME, and may be selected on SD-75 control panels. Other units are similar to the KVS panel.

## AUTOPILOT SAU-42.

An additional panel on figure 7 demonstrates Autopilot operation. The control panel shown in this panel window and in the throttle panel are the same.



Figure 7

1IAS speed hold (during climb or descent) indicator button: "SPEED" mode. Press this button when desired speed has been achieved on the USIM-1-1. The vertical speed and the engines thrust are managed to keep the IAS constant.

2Altitude hold indicator/button. Press this button when desired flight altitude has been achieved; "SPEED" mode switches OFF at the same time.

3"Glideslope" hold mode indicator/button. Can be turned ON manually or automatically when glide slope pointer passes the ZERO deflection position. "COURSE" approach mode must be ON first during the automatic approach in order to activate the approach.

4"COURSE" approach hold mode indicator/button.

5"NAVIGATION" mode activation indicator/button.

**ATTENTION! VOR-DME frequencies must be set on SD-75 DME control panels. Also, monitoring the PU-1P control panel knobs position (under PNP-72) is essential, to be certain which KURS-MP70 beacon should be used for navigation. This mode switches OFF automatically after passing the beacon. With KLN-90B or GNS, navigation must be performed with "CVM" mode turned ON on the PU-1P (right knob).**

6"HEADING": set course hold mode indicator/button; heading must be set on the PNP-72 by rotating the ZK knob.

7Autothrottle activation mode indicator/button. This mode is activated only when the Autothrottle enable mode switch is turned ON on the throttle panel or at pos. 17, shown here.

8Damper light. Turns on automatically when Autopilot is ON, provided that pos.12 toggle switch is ON.

9Autopilot ON power switch.

10IAS set Key when autothrottle mode is active (pos.7). Large white index on USIM-1-1 moves also, indicating the speed.

11Bank and pitch select knob. Manipulating this knob will shut down altitude hold mode or set course mode. Annunciator indicator light "ПНО" and annunciator "РЕЖИМ САУ" blink and a warning sound signal is heard.

12Damper ENABLE/DISABLE mode knob.

13"K": bank channel operation mode ENABLE/DISABLE toggle switch.

14"T": pitch channel operation mode ENABLE/DISABLE toggle switch.

**Autopilot will fail to function if:**

- **Course system was not slaved;**
- **Gyroscopes were not caged (MGV).**

Additional panel switches:

15Spoilers extension in automatic mode switch; duplicates the switch on the throttle panel.

16Ailerons trim switch; duplicates the switch on the throttle panel.

17Autothrottle enable mode switch; duplicates the switch on the throttle panel.

18Rudder trim switch; duplicates the switch on the throttle panel.

## LIGHTS PANEL.



1. PITOT heat switch.
2. Units lights.
3. Cockpit light switch.
4. Fuselage lights extension switch.
5. Wings lights extension switch.
6. Taxi or landing light of fuselage lights switch.
7. Taxi or landing light of wings lights switch.
8. Taxi light of steerable landing gear.
9. Toggles aircraft lights.
10. Toggles navigation lights.
11. Navigation lights mode select (STRONG-WEAK).
12. Wings lights toggles.
13. Cargo compartment lights toggles.
14. "Close Panel" icon.

## IMPORTANT!

1. Stabilizer must be set to appropriate position before takeoff.
2. After takeoff retract gears and flaps, trim the aircraft by setting stabilizer until constant vertical speed is reached, then switch autopilot ON (otherwise, the aircraft will experience deflection by pitch).
3. Navigation mode in KLN-90B :
  - Turn KLN power ON;
  - Your flight plan must be entered in the FS flight planner and loaded into the KLN system prior to flight;
  - Select "CVM" mode on the PU-1P control panel;
  - Check that CVM-CHC switch is in CHC position;
  - Only after these steps are performed after takeoff, the NAV mode may be switched ON on the Autopilot control panel.
4. Navigation mode in GNS-530:
  - KLN-90B power must be turned OFF; if it earlier it was ON, reload the aircraft, because the STANDBY signal from KLN will not stop (we are in the process of correcting this glitch);
  - Turn ON GNS power;
  - Select "CVM" mode on the PU-1P control panel;
  - Check that CVM-CHC switch is in CHC position;
  - Only after these steps are taken after takeoff, turn on the NAV mode on the SAU-42 Autopilot control panel.
5. Prior to landing, appropriate ILS and VOR-DME frequencies must be set on the D-75 DME control panels. **DO NOT FORGET** to switch ON the KMP1 or KMP2 mode on the PU-1P control panel! Only after that switch ON approach mode on the Autopilot control panel.
6. SAU-42 Autopilot system failure or other systems failure is indicated by one or several "Central light" annunciator lights and upper annunciator lights on the KVS and 2P panels.
7. Parallel operation of the SAU and joystick has been rendered. While pressing the Backspace key on the keyboard, use the joystick to operate the aircraft when Autopilot is ON, but do not exceed maximum bank angle of 30° and maximum pitch angle of 16°.
8. Squawk SO-72 control panel is applicable only during on-line flights.

Questions and answers at [www.avsim.ru](http://www.avsim.ru) , forum at Yakovlev/Yak-42.

Happy flights!