

ATR 42-500

# Manuel de vol

Flight manual



&  
**ROTW**

French Developers Team

pour  
for **FLY! II**

# ATR42-500

## Introduction

Once more, we use this unique feature, in consumer simulation, created by TRI for Fly !: a complete and "scrollable" instruments panel, a cockpit where everything works whatever the displayed window.

As usually it will be still possible to start in pressing the key "E" which will show you, if you validated the option, all the steps well decomposed. This is practical for learning with the manual. But we shall never repeat it enough; nothing is worth a manual starting up step by step. It is a pleasure to hear every turbine puts itself into operation and to see propellers starting as soon as we activate the throttle levers.

The ATR is the first twin turboprop aircraft realized by the ROTW. It's also our first "commercial" aircraft and passenger management was not forgotten (cabin pressurization, belts, cigarettes). It benefits from numerous novelties; the main ones are a GPWS and a failure manager which is the object of a particular panel, as in professional simulators.

As you know it, this aircraft was in process for several years. The departure towards other horizons of its initial designers put it aside and it is Jean Sabatier (ROTW) who took up the torch. This plane is his work.

We are sure that you will find a very big pleasure to use this very splendid Franco-Italian bird manufactured by ATR consortium (EADS ATR (formerly Aérospatiale) plus Alenia Aeronautica).

This manual, **usable exclusively for flight simulation**, has for only purpose to allow the "in simulation" ATR42-500 user to dive into the real manipulations of the check list enumeration before starting up. It also supplies all parameters which will allow a management of simulated flights with a maximum of realism

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## 1. DESCRIPTION

This aircraft includes a host of new features, among them:

### A. Real battery life

Batteries will discharge when used and will reload during flight provide the correct procedure is applied.  
When discharged, no battery current is available.

### B. Hydraulic power

Hydraulic power is simulated from 2 circuits. Hydraulic power is needed to operate ground steering, flaps and landing gear.  
Hydraulic failure will affect those components.

### C. Pneumatic system

Pneumatic system is emulated through engine air bleed valves.  
Pneumatic system is providing air power to Anti-Icing subsystem, Air-Conditioning and pressurization.

### D. Anti-Icing

Icing detectors are implemented for airframe and both engines.  
Failure to operate the anti-icing system will lead to serious engine troubles in icing conditions.

### E. GPWS

A Ground Proximity Warning System is implemented. The GPWS supports aural alerts for the following modes:

- Excessive descent rate: a DON'T SINK and PULL UP alerts are given,
- Collision detection: in flight configuration, excessive lower altitude leads to a PULL UP alert,
- Landing configuration: various aural alerts are given depending on the altitude, speed, flaps and gears positions,
- Aural warnings are also given for rotation speed and autopilot disconnect.

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## 2. CHARACTERISTICS

<b>External dimensions</b>	
Wing span	24,57 m
Length overall	22,67 m
Fuselage maximum width	2,865 m
Height overall	7,59 m
<b>Powered</b>	
Motor	PW127E
Propeller	Hamilton
Blades	6/568F
<b>Weights and Loadings</b>	
Operating weight empty	11 250 kg
Maximum fuel weight	4 500 kg
Maximum payload	5 450 kg
Maximum Take-off weight	18 600 kg
Maximum landing weight	18 300 kg
Max zero-fuel weight	16 700 kg
Max wing loading	341,3 kg/m <sup>2</sup>
<b>Performance</b>	
Max cruising speed	556 km/h (300 KTS)
Time to climb to 17,000 ft	9.2 min
Service ceiling	25000 feet
OEI, ISA +10°C, 97% max T-O weight	5 485 m (18,000 ft)
<b>Take-off distance</b>	
ISA, sea level	1 165 m
ISA +10°C at 3,000 ft	1 415 m
ISA, sea level for 300 nm (556 km) stage with 48 passengers	960 m
<b>Landing field length</b>	
Sea level at landing weight with max passengers	1 040 m
Sea level at max landing weight	1 126 m
Range with max fuel	1 852 km (1 000 mm)
Max range with 48 passengers	1 555 km (840 mm)



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## 3. PANELS LAYOUT

### A. Upper panel



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Ident.	Description	Ident.	Description
<b>FUEL control</b>		<b>DE-ICING</b>	
1-2	Left and right fuel valves	22	Air isolation valve
X1	Fuel cross-feed between left and right tanks	23	Frame de-icer
P1-P2	Boost pump for take-off and landing	24-25	Left and right engine de-icers
<b>DC control</b>		26	Fast de-icing
0	Battery switch Override= DC bus are fed by batteries even if generators are on	27-28	Left and right prop de-icers
3	Starter mode (Off- Both Engines- Continuous Relight)	29-30	Elevator and Aileron horn de-icing
4-5	Left and right igniters	31	Side window heater
6-7	Left and right generator contactors	32-33	Windshield heaters
8-9	Emergency and main battery charge contactor	<b>PITOTS</b>	
BL	AMP battery	19-20-21	Pitot probe heaters
Bs	Battery selector for AMP	<b>FIRE Control</b>	
X2	DC1-DC2 bus cross-feed	F1-F2	Fire handles for left and right engines
P1	External DC power	T1-T2	Fire testers
<b>AC Control</b>		A1-A2	Agent extinguishers (they are cross-fed to operate on any A engine)gent extinguishers (they are cross-fed to operate on any engine)
10-11	Left and right alternator contactors	T3-T4	Agent testers
X3	AC1-AC2 bus cross-feed	Fa-Fb	Fire detector Loop A and B inhibit
P2	External AC power	<b>OXYGEN</b>	
<b>HYDRAULIC</b>		Ox	Oxygen valve
12-13	Blue and Green hydraulic pumps	<b>LIGHTS</b>	
Ap	Auxiliary hydraulic pump Provides 30 second hydraulic power when Blue pressure is down	L1	Master light for all panel (Off-Bright-Dim)
X6	Hydraulic cross-feed	L2	Master overhead warning lights (Test-Bright-Dim)
<b>PNEUMATIC</b>		LIGHT	Aircraft lights as indicated
14-15	Left and right Air Bleed valves. Provide air power for air conditioning, de-icing and pressurization. Cross-feed X4 is automatic while on ground. In flight both circuits are isolated	<b>Hotel Mode</b>	
<b>AIR CONDITIONING</b>		Hotel mode replaces usual APU. On ground, when engine 2 is running, a proper breaker may be activated to conserve energy. Then engine 2 can provide DC and AC power.	
16-17	Cockpit and cabin isolation Air valve	Hm	Prop brake switch
R1-R2	Temperature selectors (left=cockpit, right=cabin)	H1	Unlink warning when Prop brake is miss engaged
R3-R4	Temperature mode (automatic-manual)	H3	Ready signal. Prop brake is allowed
34-35	Recycle Fans switches	<b>Miscellaneous</b>	
36	Temperature gauge	M1	Door test switch
37	Selector (cockpit-cabin) for temp gauge	M2	Spoiler light (when unlocked)
38	Accelerator	M3	Landing gear indicators

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### B. Main panel





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Ident.	Description
N1-N2	Navigation radios
ApDIM	Autopilot dimmer
AP	Autopilot engage
YD	Yawn damper engage
C1	Course on Pilot HSI
C2	Course on copilot HSI
Hd	Heading on pilot HSI (no heading on copilot)
A1	Altitude preselect
Vr	Speed type and adjust on ADI
Gpw/Gs	GPWS warning and Glide-slope indicator
MW1-2	Master warning and master caution switches
Stick	Stick shaker warning
Apw	Auto pilot status
Hyd	Hydraulic pressures (blue, green and brake)
Pwmg	Power manager and Sync switches
Flap	Flap gauge
Trim	Elevator trim position
Pz	Pressurization control
EFISdim	EFIS dimmer (pilot and copilot separated)
PanelDim	Panel light dimmer
Gpws	GPWS on/off switch
Icw	Ice indicator
CCAS	Red and amber warnings
Tq	Torque gauges
N1	N1(prop rpm) gauges
ITT	Interturbine temperature
N2	N2 gauges
FF	Fuel flow
OP/T	Oil pressure and temperature
Ft	Fuel temperature
Rm	Reminder panel

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### C. Mid panel



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Ident.	Description
<b>Honeywell panel</b>	
Am	HSI display format (normal and approach mode)
Bm	Bearing mode
Cm	Course mode
ADI	On/off switch
HSI	On/off switch
DH	Decision height selector
uFMS	Universal Flight Management System

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## 4. START-UP

### A. Floor panel

- Set both throttles to GI (idle) position
- Set both conditioner levers to Cut-Off position
- Set both conditioner levers to FTR (feather) position. This will open fuel valves.
- Set the parking brake

### B. Upper panel

Apply the following procedure on the upper panel and watch all warning lights:

- Set the battery switch to ON (0)
- Check left tank valve is open (1)
- Check right tank valve is open (2)
- Set Starter mode to START-AB (3)
- Engage left igniters (4)
- Wait for engine running
- Engage right igniters (5)
- Wait for engine running
- Engage left DC generator (6)
- Engage right DC generator (7)
- Engage DC cross-feed X2
- Engage left and right pumps P1-P2



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### -----Electrical power -----

- Set battery switch to OFF (0)
- Engage left battery charge switch (8)
- Engage right battery charge switch (9)
- Engage left alternator (10)
- Engage right alternator (11)
- Engage AC cross-feed X3
- Set both conditioners to 45% to get enough RPM for alternators

### -----Hydraulic power -----

- Engage left hydraulic pump (12)
- Engage right hydraulic pump (13)
- Engage hydraulic cross-feed X6

### -----Pneumatic power -----

- Open left air-bleed valve (14)
- Open right air-bleed valve (15)

### -----Air conditioning -----

- Open left Air-Cond (16)
- Open right Air-Cond (17)
- Set automatic mode R3-R4
- Adjust temperature R1-R2

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### -----Pitot heater -----

- Open left pitot heater (19)
- Open centre pitot heater (20)
- Open right pitot heater (21)

### -----Fire detectors-----

- Open detector Loop A (Fa)
- Open detector Loop B (Fb)

### -----Lights -----

- Switch on panel light L1
- Adjust warning lights L2

### C. Main panel

Go to the main panel and follow this procedure

- Wait for hydraulic power (Hyd) to build up. When power reaches 1500 psi on both sides, the CCAS warning signal is extinguished.
- Check that all warnings (except parking) are off on the CCAS panel.
- Check that all warnings are off on the upper panel.
- To floor panel, engage both conditioner levers to Max position.

**NOTE:** Keyboard keys may be assigned to those levers through the option menu, avoiding to change panel view (for instance \* and \$ keys)

- Now slowly engage the throttle levers to 50% up. Engine power is building up.
- For ground taxiing, power must be set around 40-45%.

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## 5. TAKE-OFF

### A. Main panel

When throttles are about 50%, a safety system checks the following components for take-off:

- Power Manager (Pwmg) on TO position,
- Flap position not UP (flap),
- Elevator trim (trim) in the range  $[-1.5^\circ > \text{etrm} > 5^\circ]$ .

Any discrepancy activates the configuration (CFG) signal on the CCAS.

Problem must be corrected before take-off.

### B. Take-off

When configuration is OK,

- Pre-select a climb rate on autopilot if it is used during first stage.  
Rate must be between 1,700 and 2,000 fpm. Autopilot must be engaged for the selection to be memorized.
- Pre-select the final altitude.
- Disengage autopilot
- Pre-select decision level. Aural message MINIMUM is given when landing and passing this level at landing.
- Activate the auto pressurization mode (PZ switch).
- Release the parking brake.
- Apply 90% power on both throttles. In normal conditions the aircraft will take-off at 90% power.  
100% power is considered for emergency procedures: Lost of engine during Take-Off or Go-around (GA) at landing.
- Let the aircraft roll.
- At 80 KTS, an aural signal is given.
- At 103 KTS, the ROTATE signal is given.
- Rotate at 105 KTS and set a 12% climb attitude (from 1,700 to 2,000 fpm VSI).
- Retract the landing gear at 300 feet.

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### 6. CLIMBING TO 1,500 FEET

Autopilot may be used at this point.

- Climb at 90% power up to 1,500 feet.
- Retract flaps when speed reaches 145 KTS.
- Wait for 1,500 feet.

### 7. CLIMBING TO FINAL LEVEL

At 1,500 feet, adjust the climb rate around 1,500 fpm (manual or auto-pilot), and reduce power to achieve 160KTS.

**NOTE:** Those are the recommended VS and speed for the climbing leg.

- Reduce progressively power conditioners during climbing leg.
- Conversely augment the power (not exceeding 90%) when speed bleed-off.

**NOTE:** Maximum altitude for ATR42 is 25,000 feet. Set a Flight level accordingly.

At the final altitude,

- Set power to 90% to reach the cruise speed around 250KTS.
- Set power manager (Pwmg) to cruise position.
- Set the SYNC switch on Pwmg.

#### **IMPORTANT**

During climbing, when AIR Conditioning is in manual mode, you must monitor the cockpit and cabin temperatures on the upper panel. Augment both temperatures with the related buttons (R1, R2) as the altitude increases. **EFIS instruments are protected** against extreme temperatures and stop when  $[-4^{\circ} < \text{cockpit Temp} < 40^{\circ}]$ . Temperature warning is given on the CCAS by the AIR warning signal.

When reaching altitude about 10,000 feet, ice is forming on airframe and engine inlets. Ice warning is given on the main panel (Icw). Anti-Icing must be activated on upper panel by opening the isolation valve (22) and activation of De-Icing frame valve (23) and De-Icing engine valves (24-25). Failure to de-ice engines leads to **engine flameout** after 2 or 3 minutes.



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## 8. DESCENT

Normal descent is made between 500 fpm and 1,500 fpm, depending on initial point and speed not exceeding 240 KTS.

Auto pilot may be used for this phase.

- Progressively reduce speed.
- Set descent rate (1,500 fpm-500 fpm).
- Augment slowly the conditioner level.
- Whit AIR Conditioning in manual mode, monitor cockpit and cabin temperatures while descending (adjust the temp buttons (R1 and R2)).
- De-icing is automatically disconnected to conserve energy when external temperature is around 0°.
- Stop descending at recommended altitude (around 5,000 feet AGL).

## 9. LANDING

Prepare the aircraft for approach.

- Reduce speed to 140 KTS. Conditioner at 100% up. Deploy 15° flaps at 150KTS. Adjust power.
- Final descent must be made at 500 fpm (VSI) maximum.
- Align the aircraft or intercept the glide-slope when ILS is present. Aural message GLIDE SLOPE is given when autopilot is catching the GS.
- Slowly reduce the speed to 120 KTS.
- Deploy landing gear at 2,000 feet AGL. Adjust power.
- Deploy 30° flaps at 113 KTS Adjust power.
- At Decision Height, the aural message MINIMUM is given.
- Touch down will be made around 115 KTS. Never reduce power below 35% N1.
- Touch down at 115 KTS.
- Roll on and activate brakes to stop.
- Retract flaps and taxi to the parking.

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## 10. STOPPING

- Retract flaps to 0°.
- Parking brake on.
- Stop air conditioning.
- Stop all de-icers and heaters (pitot, windows, etc).
- Close air bleed valves.
- Stop hydraulic pumps.
- Stop alternators.
- Open battery switch.
- Stop battery charge switches.
- Stop generators.
- Stop both fuel pumps.
- Cut fuel with both conditioners to 0%. This stop engines.
- Close all lights.
- Close battery.

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## 11. [GPWS](#)

GPWS monitors the following modes.

### A. Excessive descent rate.

In all configurations, an excessive descent rate gives aural alerts below 2,500 feet AGL:

- DON'T SINK when entering the excessive descent rate,
- PULL UP when exceeding this limit rate.

### B. Terrain collision

When in flight (flaps and gear up), a minimum altitude above AGL is controlled in function of the IAS speed. The following aural alerts are given when below 2,500 feet AGL:

- TERRAIN-TERRAIN when crossing the limit,
- PULL-UP when exceeding the limit.

Alerts are given until VSI is above 1,600 fpm.

### C. Landing altitude

When in landing configuration (power  $N1 > 49^\circ$ ), the following alerts are given when below 2,500 feet AGL:

- Gear up: TOO LOW TERRAIN when IAS is above 130 KTS. TOO LOW GEAR when IAS is below 130 KTS,
- Flaps up: TOO LOW TERRAIN when IAS is above 130 KTS. TOO LOW FLAPS when IAS is below 130 KTS.

**NOTE:** GPWS may be switched off on the main panel, left side. During the first training periods you may experiment several warnings during take-off if you don't follow the proper Vertical speed and the proper air speed. You may prefer to disconnect the GPWS until aircraft reaches 5,000 feet, and then reengage it for the main flight.  
Sometime, the GPWS may be confused when very bad conditions occur at the same time and several messages may be triggered simultaneously.

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## 12. [FIRE SYSTEM](#)

If an engine is On Fire, apply the following procedure:

- Pull the corresponding Fire Handle (upper panel). This cut the engine fuel flow and several other components related to the engine. Extinguisher Agents come alight (under the fire Handle). There are 2 fire extinguishers (A and B), either of them may be accessed from any side.
- Push either AGENT until the fire is extinguished. The corresponding AGENT will be exhausted (DISC warning) and cannot be used again until repaired.
- The corresponding engine cannot be restarted until repaired.

## 13. [FAILURE MANAGER](#)

Failure manager can trigger failure on a random fashion. Use it like this:

- Adjust the reliability level. This controls the failure frequency,
- Activate one or more failures,
- Activate the OK button.

Selected failure(s) will occur later on anytime.

To prevent a failure before it occurs, just reset the OK button.

If you manage to bring back the aircraft on ground, you may repair it with the REPAIR switch. Both engines must be off for repair to be effective.

## 14. [EXTERNAL POWER](#)

You have access to external power when the aircraft is on ground. This power may be used to start the engines as an alternate source from the batteries.

- Go to the failure Manager panel.
- Activate the corresponding contact (DC, AC).
- The AVAILABLE indicators are green on the upper panel for the corresponding power.
- Push the related switches.
- Start the engines.
- Set power switches off.
- Disconnect the power lines from the Failure Manager panel when start-up is completed.

**NOTE:** Failure to disconnect external line when the aircraft is moving will damage the engine number 2.



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## 15. [HOTEL MODE](#)

Hotel mode acts as the classical APU. To enter this mode, aircraft must be on ground, and then follow this procedure:

- Activate the parking brake.
- Activate the DC ground power unit.
- Set the right conditioner level on FTR position (< 33%).
- Activate the hydraulics pumps (HYD A on lower panel).
- READY green signal comes alight in few seconds on upper panel (PROP BRAKE area).
- Uncover the brake (PROP BRAKE) and then engage the brake.
- Actuate the right FUEL pump.
- Set the ENG START selector on “start A&B”, and activate the “start 2” button.
- You are in HOTEL mode with engine 2 running and supplying DC power.
- You are ready to start engine 1.

The only thing that cannot be simulated is the stopping of the propeller while the engine is running.

**NOTE 1:** Do not forget to disengage the prop brake before going back to normal operation. If the prop brake is engaged, an UNLINK warning is activated.

**NOTE 2:** Some airports have only external DC power and no AC power, so no hydraulic power is available in first step. In such situation, the hotel mode is needed.

**NOTE 3:** In order to have AC power on any engine, the propeller must be running and the conditioner level must be set above 45%.

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## Credits

Project initiators	Sébastien Mayzaud and Jean Baruch
3D model	Jean Sabatier (ROTW)
Panel and instruments	Sébastien Mayzaud and Jean Sabatier (ROTW)
Internal views	Sébastien Mayzaud and TJ (ROTW)
Flight model	Jean Sabatier (ROTW)
Electrical circuit	Jean Sabatier (ROTW)
External paintwork	Leen « Flybike » de Jager (ROTW)
Flight tests	Azzurro, Gilles Guesnel, Frédéric Mouflin (all ROTW)
General validation	Vincent Carret, ATR and CRJ captain, ATR and CRJ instructor at Britair
Flight manual	Jean Sabatier, Jean-Marie Reuter, René Birot (all ROTW)
Manual cover	Ema Trésarrieu