DELTA VIRTUAL CONNECTION

AEROSPATIALE ATR-72
OPERATING MANUAL

FIRST EDITION

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AIRCRAFT HISTORY

The ATR (Aviones de Transport Regional) consortium was launched in October 1981 in response to a newly posted industry request for a 64 to 72 seat, mid-ranged, regional aircraft. Prominent among the specific requirements sought after by the carriers was exceptional operational flexibility in severe or restricted environments; fuel and maintenance efficiency and passenger comfort. When the various manufactures looked at the requirements, France's Aerospatiale and Italy's Aeritalia/Alenia companies decided that it made more economic sense to cooperate than compete in a tight market. They therefore entered into an equal partnership agreement for the project.

Using existing engineering work done prior to their merger, ATR employed much of the research and development efforts that had already gone into the Aeritalia AIT-230 and the Aerospatiale AS.35 to produce a new aircraft. In addition to being resourceful, a key component to their upcoming success lay in the adoption of a family concept of development, just like Boeing had done so well with its 707, 727 and 737 airliners. Thus, identical internal systems would be used as much as possible to allay maintenance and supply issues. The fuselage diameter would also remain constant for future modification purposes.

The results of their activities became the ATR-42 and the stretched version ATR-72, the names derived from the normal seating capacities for the first variants. It wasn't long before ATR recognized they had struck upon a winning combination.

The ATR family of aircraft would soon provide feeder service to major airlines throughout the USA, as well point to point service worldwide. By the end of March 2001, 616 aircraft have been delivered of the 652 ordered. Of those, 256 are ATR-72 variants, while the remaining 360 are ATR-42 series ships. This represents 67% of the world market share of turboprops in the 40 to 70 seat category. Currently, there are 102 operators worldwide in 65 different countries, including American Eagle, British Airways City Flyer, Team Lufthansa, Alitalia Express, CAS Czech Airlines, Thai International Airways, Sabena, Continental Express, Iberia/Air Nostrum, ASA/Delta Connection, Air France, Air New Zealand Link, EuroWings, and KLM Excel.

Plans for the additional stretching of both variants into the ATR-52 and -82 series were dropped in 1992 when the Franco-Italian partnership joined the Deutsche Aerospace Group (DASA) and the British Aerospace (BAe). In January 1996, the alliance changed with the company now calling itself AI[R] Aero International (Regional). This venture did not include the Germans, but did bring in two BAe subsidiaries, Avro International Aerospance and Jetstream Aircraft. In mid-1988, the AI[R] group disbanded and ATR regained its independence. Corportate headquarters has remained in Toulouse, France where the parent companies have merged the marketing sales, customer support, and product research and development for the ATR program.

The most current data available places the average fleet age of the ATR-42 at approximately 15 years and for the ATR-72 approximately 12 years. Four years after the ATR-42 entered service, the first ATR 72-200 prototype, F-WWEY, took to the air on October 27th, 1988. It was soon followed by the second aircraft on December 20th, 1988.

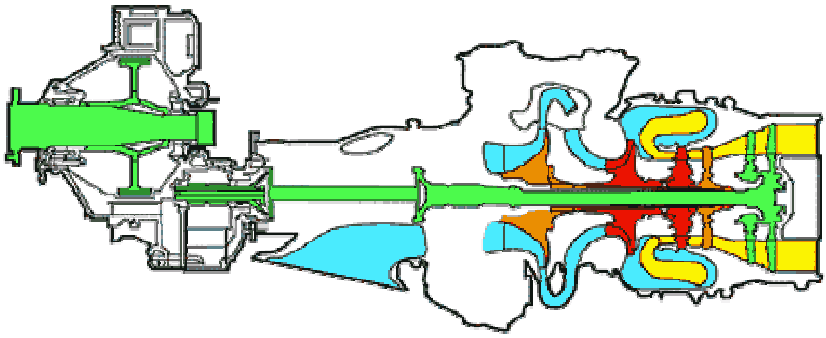
ATR's first order for the ATR-72 was placed by Finnair for five aircraft. Certification followed and ATR-72-200 serial OH-KRA became the first production aircraft delivered.

Kar Air (a subsidiary of Finnar) took possession on October 30th, 1989. The awarding of certification for the ATR-72 to the French and then the US was in late 1989.

The largest difference between the ATR-72 and the smaller and older ATR-42 include a 4.50m (14ft 9in) fuselage stretch and reworked wings. The ATR-72's wings are new outboard of the engine nacelles, with 30% made up of composite materials, comprising composite spars and skin panels, and a carbon fibre wing box. Aside from the baseline ATR-72-200, two developments have been offered, the ATR 72-210 and the ATR-72-500 (previously ATR-72-210A, renamed ATR-72-500 on May 18, 1998). The ATR-72-210 is optimized for operations in hot and high conditions, and is equipped with more powerful P&W-127 engines for better takeoff performance. Both the ATR-42 and -72 designs incorporate numerous internal systems to facilitate quick change operations. A standard front cargo door allows the aircraft to be rapidly converted from a passenger layout into a freighter. The maximum payload a -72 series aircraft can accommodate in a freighter configuration is 15,875lbs (7200kg), in thirteen containers.

POWERPLANT

Despite its appearance, a turboprop engine is much closer to a jet engine than the piston engines of the past that one may associate with the term "propeller engine". The engines used by the propeller-driven airliners of the 1930s and 1940s were piston engines; very similar to the ones used in an automobile.



A turboprop engine, on the other hand, is essentially a jet turbine. Instead of driving a fan like a turbofan engine, the turbine spins the propeller shaft, propelling large amounts of air outside the engine altogether. In many ways, a turboprop is just a turbofan engine where the fan has fewer blades and is not contained within the engine nacelle.

PRATT & WHITNEY PW127F

The PW100 series is a family of turboprop engines from Pratt & Whitney Canada designed to power 30 to 70 seat regional transport aircraft. The family concept of power plant and gearbox allows a continuum of engines to meet a range of performance requirements. With over 4,800 engines delivered to date, the PW100 series powers three-quarters of all modern regional turboprop aircraft.

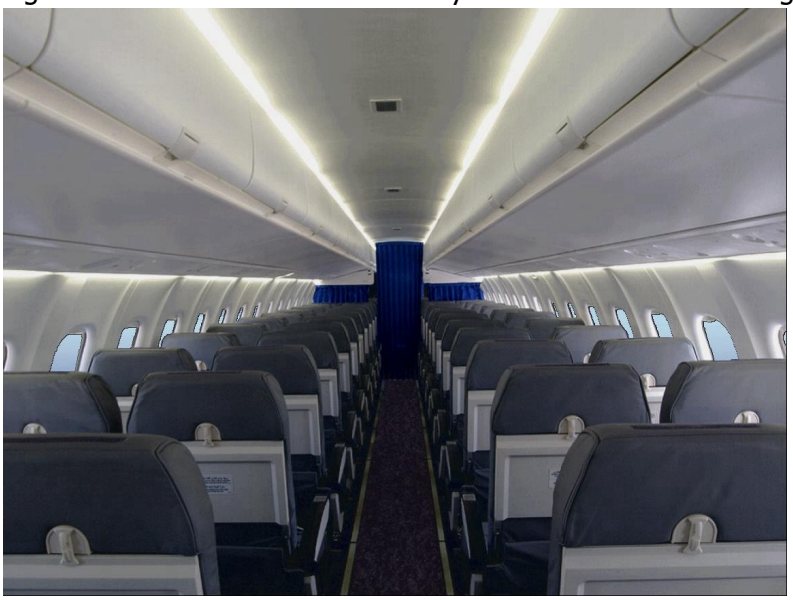
The ATR 72-200 utilizes two 1610kW (2160shp) Pratt & Whitney PW-124B turboprop engines; the ATR 72-210 utilizes two 1950kW (2480shp) Pratt & Whitney PW-127 turboprop engines; and the ATR 72-500 utilizes two 2051 (2750shp) Pratt & Whitney PW-127F turboprop engines. In its fifteen years of evolution, the PW100 family has been developed in a number of different models, generating 1,800 shaft horse power (shp), to over 5,000 horsepower in the PW150.

AIRCRAFT SPECIFICATIONS

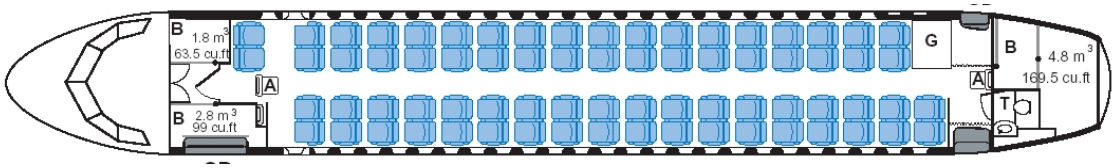
Basic Dimensions		
Aircraft Length	89 ft 1.5 in	27.166 m
Aircraft Height	10 ft 8 in	3.27 m
Wingspan	88 ft 9 in	27.05 m
Wing Height	12 ft 2 in	3.71 m
Tail Span	23 ft 11.8 in	7.31 m
Tail Height	24 ft 8 in	7.52 m
Wheel Track	13 ft 5.4 in	4.10 m
Engine Separation	26 ft 6.8 in	8.10 m
Cabin Width	75.21 in	1.91 m
Cabin Height	102in	2.57 m
Weights and Loading		
Maximum Taxi Weight	49,978 lbs	22,670 kg
Maximum Takeoff Weight	49,603 lbs	22,500 kg
Maximum Landing Weight	49,273 lbs	22,350 kg
Maximum Zero Fuel Weight	45,194 lbs	20,500 kg
Maximum Payload	15,542 lbs	7,050 kg
Maximum Fuel Load	11,023 lbs	5,000 kg
Maximum Range @ 240 kts	2160 nm	4000 km
Operational Limitations		
Service Ceiling	25,000 feet	
Maximum Operating Speed	250 knots / Mach 0.55	
Maximum Manoeuvre Speed	175 knots	
Maximum Rough Air Speed	180 knots	
Maximum Wiper Operation	160 knots	
Maximum Flap Extension	V_{fe} 15 = 185KT / V_{fe} 30 = 150KT	
Maximum Landing Speed	165 knots **ground** speed	
Maximum Gear Extension	V_{le} = 185KT / V_{lo} RET = 160KT	
Performance Data		
Economy Cruise Speed	248 knots	
Maximum Cruise Speed	284 knots	
Stall (Clean) Vs_1 @ MGW	102 knots	
Stall (Flaps & Gear)	84 knots	

ATR-72-500 CABIN

The ATR cabin cross-section was designed from the start for passenger comfort with the 17.3-inch width of seats being wider than a standard economy class seat on the Boeing 737. The completely new cabin interior used on the ATR 42-500 has also been applied to the ATR-72-500, using increased-volume overhead bins and acoustically absorbent materials.



These features give the ATR 72-500 the highest carry-on volume per passenger in its class. The new smooth, soft lines of the ceiling and cabin side panels, reshaped and re-designed to offer passengers more space and light, turn the cabin into an harmonious and balanced space where traveling is a pleasure.



FUEL LOADING

Delta Virtual Connection's ATR-72 has two wing-mounted fuel tanks, left and right. Each tank has a capacity of 5,540 lbs, (2500kg), for a total of 11,020lbs (5,000kg) of Jet A fuel. With a full load of fuel the ATR-72 is capable of flying over 2100 nautical miles. To load fuel into your aircraft, select ***Aircraft***, then ***Fuel*** and place the correct fuel amounts in the wing tanks.

Captains ordering fuel for Delta Virtual Connection flights should remember that more fuel equates into more drag, requiring more power. An unnecessary overabundance of fuel will only cost the company money. Fuel should be kept as close to the trip fuel required as possible. With that said, **it is always the pilot's responsibility to ensure that there is enough legal fuel for the flight**. Any incident that was the result of miscalculating the fuel load will always be the fault and sole responsibility of that flights captain and crew. When in doubt, take more.

Any trip estimations that you see in this manual are for calm winds and standard temperatures, any deviation from standard, winds or temperature will result in different actual performance for your aircraft.

Delta Virtual Connection aircraft should always carry a minimum fuel load for the trip to one's destination and a 45-minute reserve for cruise at low altitude. Pilots are to make sure that the aircraft is always operated within all design limitations.

RECOMMENDED EQUIPMENT

Delta Virtual Connection provides 32-bit Windows aircraft fleet installer utilities for its aircraft, as part of its Fleet Library. The ATR-72 Fleet Installer contains Francisco Sanchez-Castner's Aerospatiale ATR 72-500 in Delta Connection, Air France and Alitalia liveries, along with an ATR-72 panel. There are also now available ATR 72-500 payware add-ons on the market with excellent levels of detail, flight modeling and realism in graphics.

These aircraft models and panels are available from the Delta Virtual Connection Fleet Library, as well as the popular flight simulation web sites **http://www.flightsim.com** and **http://www.avsim.com/**. If you find a model or panel that you believe is superior to the ones listed here, please contact us and send us a copy.

DELTA VIRTUAL AIRLINES STANDARD OPERATING PROCEDURES

These procedures are designed so that today's crews can work together effectively and safely as well as allowing some standardization of procedures for the company. By standardizing procedures the company can budget flights better financially as flights will always be the same or at least somewhat similar.

For the crews, this means that the company can schedule pilots together that have never flown together before and still maintain a safe operation. For Delta Virtual Airlines, these procedures are for the benefit of the pilots using this manual. By flying using these standard procedures, pilots will be able to make better use of the manual and also operate the aircraft in a similar fashion company wide.

NOTE: In any circumstance where company procedure conflicts with manufacturer's recommended operation, company procedure will take precedence unless a safety factor is involved. Discretion is the responsibility of the Captain.

PRE-FLIGHT

- Calculate your proper fuel load for the trip. Don't forget reserves, as well as a 1,250 lb allowance for taxiing.
- Ensure that you have proper approach charts for both takeoff and approach airports. When there is the possibility of poor weather at your destination you should also obtain charts for alternate airports. These charts should be available at the Delta Virtual Airlines web site.
- Ensure that the local airport VOR frequency has been dialed into the DME2 radio. Always assume that you will need to abort the flight *after* V_1 – that means getting the aircraft off the ground and returning to the original airport. You don't need to be fumbling through charts and the radio stack in such a situation!
- If you are flying online, ensure your flight plan has been filed and approved by the clearance delivery controller for your departure airport.
- Obtain tower clearance for engine startup, pushback and taxi.

ENGINE STARTUP

- Battery ON.
- Close doors 5 minutes prior to scheduled departure time.
- Parking Brake SET, Propeller Controls FULL FORWARD.
- Navigation Lights ON. Beacon ON. Anti-Ice ON.
- Fuel Flow ON. Right Engine Start switch DEPRESSED until engine started.
- Check that Right Engine LOW OIL/FUEL PRESSURE lights extinguished. Monitor N1 speed and ITT (Inter-Turbine Temperature). Right Generator ON.
- Repeat sequence for Left Engine.
- Master Avionics Switch ON.

GATE DEPARTURE

- Make departure announcement: "Ladies and gentlemen, on behalf of the flight crew, this is your (*captain or first officer*) (*insert name*), welcoming you aboard Delta Virtual Connection flight number (*flight*) with service to (*destination*). Or flight time today will be approximately (*time en route*) to (*destination*). At this time, I'd like to direct your attention to your to the monitors in the aisles for an important safety announcement. Once again, thank you for flying Delta Virtual Connection."
- Contact the ramp controller, obtain pushback clearance and push back. Receive taxi clearance.
- Check flight controls for binding. (Rudder, Elevator and Ailerons)
- Auto-Feather ARMED.

TAKEOFF

- Confirm takeoff speeds (V_1, V_r and V_2). Set auto-brake to RTO.
- Advance throttles to stabilize the engines. Set N_1 to 100% thrust and monitor ITT – use lower thrust settings if temperature too high.
- Release Brakes and accelerate to V_1. (Captain's hand must remain on the throttle until V_2.)
- At V_r, smoothly rotate the nose of the aircraft to 10° nose up. ***Rotation in excess of 10^0 may result in a tail strike.***
- When a positive rate of climb has been established and above 100' AGL, Landing Gear UP.
- Accelerate to V_2, raising the flaps on schedule (blue line – minimum 125 KIAS).

CLIMB

- Set power to 90 %N_1 and climb out.
- Propellers 1600 RPM or as desired. Propeller Synchrophaser ON.
- At 3,000 feet AGL, select autopilot CMD.
- Accelerate to 250 KIAS until 10,000 feet MSL where you are allowed to accelerate to enroute speed.
- AT 10,000 feet MSL, inform cabin crew that use of approved electronic devices is authorized. Landing Lights OFF.
- At 18,000 feet MSL, reset altimeters to standard pressure of 29.92.

CRUISE

- Make cabin announcement: "Ladies and gentlemen, this is the (*Captain or First Officer*) speaking. We've reached our cruising altitude of (altitude). We should be approximately (*time*) enroute and expect to have you at the gate on time. I've turned off the fasten seatbelt sign, however, we ask that while in your seat you keep your seatbelt loosely fastened as turbulence is often unpredicted. Please let us know if there is anything we can do to make your flight more comfortable, so sit back and enjoy your flight."
- Auto-Feather OFF.
- Monitor flight progress, fuel consumption and engine performance.
- Review meteorological data for your destination and alternate.

DESCENT

- Review the STAR/Runway charts and brief the crew on the approach.
- Auto-Feather ARMED.
- At FL180, set altimeters for the destination.
- Throttle back to 250 KIAS below 15,000 feet MSL, 240 below 12,000 feet MSL.
- Below 10,000 feet MSL landing lights ON, seat belt signs ON.
- Review IAP/ILS charts.

APPROACH

- Auto-Feather VERIFY ARMED. V_{ref} CONFIRMED.
- Flaps SET TO APPROACH. Auto-Spoilers ARMED. Auto-Brake ARMED.
- Once passed the last navigation aid, set ILS frequency into NAV1.
- Intercept the glide slope at 200 KIAS; slow the aircraft to 160 KIAS on the glide slope.
- Once established on the localizer, enter missed approach altitude and heading into the autopilot.
- When glide slope is one dot above, select landing gear DOWN.
- Once airport is acquired visually, slow the aircraft to 124 KIAS selecting full flaps.

LANDING

- Condition Levers HIGH IDLE. Propeller Levers FULL FORWARD.
- After touchdown, select reverse thrust and brakes as required to slow the aircraft.
- At 60 KIAS or when sure of stopping distance, disengage thrust reverse, lower spoilers and taxi clear of the runway. **Reverse thrust is ineffective below 60 KIAS.**
- Power Levers GROUND FINE.
- Make announcement: "On behalf of Delta Virtual Connection and your entire flight crew we'd like to welcome you to (*destination*) where the local time is (*time*). We hope you've enjoyed your flight with us today and hope that the next time your plans call for air travel, you'll choose us again. Once again, thank you for flying Delta Virtual Connection."

TAXI TO TERMINAL

- Once the runway has been vacated, landing lights OFF, taxi lights ON.
- Auto-Ice OFF. Auto-Ignition OFF.
- Set Transponder to STANDBY.
- Retract flaps.
- Autopilot OFF.
- Obtain taxi clearance and gate assignment.

SECURING THE AIRCRAFT

- Parking brake SET.
- Taxi lights OFF. Avionics Master OFF.
- Auto-Feather OFF.
- When ITT has stabilized at lowest temperature for 1 minute, select engine fuel flow CUTOFF.
- Propellers FEATHERED. Generators OFF.
- Seat belt signs OFF.
- Once engines have spooled down, all navigation and strobe lights OFF.
- Battery OFF.

PRINTABLE ATR-72 CHECKLIST

FINAL COCKPIT PREPARATION	
Memo Panel	CHECK
Gear Pins & Covers	ON BOARD
Fuel Quantity	CHECKED
T/O Data-Bugs	SET
Trims	SET
Altimeters	SET
Landing Elevation	SET
COM/NAV	SET
ENG Test	PERFORMED
Parking Brake	SET

BEFORE TAXI	
Tail PROP	CONFIRMED REMOVED
Doors	CLOSED
Beacon	ON
Engine 2 Start	ON
PROP Brake	OFF
CL 2	AS REQUIRED
Anti-Ice	AS REQUIRED
Flaps	SET
Anti-Skid	TEST

TAXI	
Brakes	CHECKED
Engine 1 Start	ON
CL 1	AS REQUIRED
Cockpit COM Hatch	CLOSED
AFCS	SET
Takeoff Configuration	TEST
Takeoff Briefing	COMPLETED

BEFORE TAKEOFF	
Gust Lock	RELEASED
Flight Controls	CHECKED
Bleed Valves	AS REQUIRED
Airflow	NORMAL
CCAS	TO INHI
EXT Lights	SET
Transponder	ALT SET
TCAS	AUTOMATIC
CL 1 & 2	AS REQUIRED
Rudder CAM	CENTERED
Lateral Flight Director Bar	CENTERED

AFTER TAKEOFF	
Landing Gear	UP
Taxi & Takeoff Lights	OFF
PWR MGT/CL	CLB MODE SET
Flaps	0 SET
Bleed Valves	ON
Altimeters	SET
Memo Panel	CHECKED

CRUISE	
PWR MGT	CRZ MODE SET
Seat Belt Sign	AS REQUIRED
Flight Conditions	OBSERVED

DESCENT	
STAR/IAP/ILS Chart Briefing	COMPLETED
Anti-Ice	PREFORMED
CCAS	AS REQ
Landing Data	SET
Seat Belt Sign	ON

APPROACH	
Altimeters	SET
Cabin Altitude	CHECKED
Speed v. Icing AOA LT	CHECKED

BEFORE LANDING	
Landing Gear	3 GREEN SET
TLU Green Light	CHECKED ILLUMINATED
Flaps	SET
PWR MGMT	SET
CL 1 & 2	AS REQUIRED
Exterior Lights	SET
Auto-Pilot	DISENGAGED

AFTER LANDING	
Transponder	STANDBY
TCAS	STANDBY
Flaps	0 SET
Gust Lock	ENGAGED
Pitch and Roll Controls	CHECKED LOCKED
Trims	RESET
Engine Start	OFF/START ABORT
Engine Cooling Time	1 MINUTE OBSERVED
CL 1	FUEL SHUTOFF

PARKING	
Parking Brake	SET
CL 2	FEATHERED
PROP Brake	ON/LOCKED
Tail PROP	AS REQUIRED

SHUT DOWN	
Oxygen Main Supply	OFF
Ice and Rain Protection	OFF
EXT Lights	OFF
EFIS	OFF
COMM	OFF
CL 2	FUEL SHUTOFF
Fuel Pumps	OFF
Emergency Exit Lights	DISARM
Battery	OFF

WORDS FROM THE CHIEF PILOT

The unique nature of the ATR-72 makes flying it a pure joy. Delta Virtual Airlines maintains a significant fleet within its Delta Virtual Connection program, with the ATR-72 as the flagship of the DVC turboprop program.

The ATR-72 is most forgiving and handles well in flight, but at low speeds, primarily during the landing sequence, the ATR requires extra pilot attention. The ATR taxies with ease but remember taxi speed limits as you are essentially driving 3.5 tons on a narrow wheel base. A vertical speed of 800-1,000fpm (V_2 +5KT) will allow airspeed to continue to increase during the climb, to climb altitude, 170 KIAS. 5^0 to 9^0 of pitch is recommended until cruise attitude, which will allow the aircraft to maintain a continued acceleration climb out speed. At cruise, pitch will vary with weather and load considerations. While the autopilot function will assist reduction of pilot workload, keep in mind that when switching from NAV to VNAV on final, the autopilot is going to want to look around for the ILS and glide slope. Keep in mind VNAV is for vertical navigation in the glide slope and as such your intercept angle (10^0 to 20^0 to the glide slope) will have a lot to do with the ATR accurately capturing the glide slope.

Data collected from numerous ATR flights have provided the following flight energy management and performance example profiles:

CLB FL 5,900' TQE 97.3 NP 82.2 ITT 658c NH 97.8 ENG Oil PRES 66psi ENG TEMP 71c FF 1057lb/hr IAS 230KT GS 235KT TAS 244KT TAT 11 VSI 1.0 AVG. WND Aloft 326/24

CRZ FL 18,000' TQE 73.0 NP 82.0 ITT 574c NH 90.3 ENG Oil PRES 64psi ENG TEMP 71c FF 775lb/hr IAS 209KT GS 291KT TAS 270KT TAT -9 AVG WND Aloft 318/30

Keep in mind that your data will vary based on load configurations, weather conditions, throttle setting, and pitch values in climb. You should continually scan instruments for performance levels. Cross checks of MCT/CLB/CRZ maximum TQE values as computed in FDAU as a function of propeller speed, and altitude pressure should be conducted throughout the flight profile.

Other consideration of ATR operations include; takeoff, use of nose wheel steering guidance is only recommended for the very first portion of the takeoff run as rudder becomes very rapid in efficiency when airspeed increases (around 40KT). In order to not increase takeoff distances, power must be set quickly during the last phase of the line up turn. Don't waste time and distance aligning the ATR on the runway. The deceleration capabilities of the ATR 72-500 provide a good operational advantage which should be used extensively; decelerated approaches reduce noise (noise abatement zones), minimize time and fuel burn and allow for better integration in larger sized airports. The ATR enjoys low speed approach handling characteristics, but keep in mind, once in the pattern, you're sharing approach airspace with larger sized jets. As such, power management should be monitored and an expeditious approach and final should be conducted. Always follow ATC instructions carefully. The ATR 72-500 Initial approach speed may be maintained on a typical 3^0 glide slope down to IAS x 10ft NP 82% above the runway. Maintain a standard final approach slope (3^0) and final V_{APP} until 20' is called on the radioalitimeter. At 20' reduce to F1 and flare visually as required. Use caution in pitching nose up too much on flare as it could result in a tail strike. Let the ATR settle into the landing as airspeed bleeds off from the flare. Sink-rate should not exceed 5ft/sec at touchdown.

There are a variety of ATR add-ons available for use in the Delta Virtual Connection fleet. What you fly is up to you. Regardless of add-on type, the quality of time in the hours you fly is up to you. Enjoy!

ACKNOWLEDGEMENTS AND LEGAL STUFF

- Delta Virtual Airlines and Delta Virtual Connection are not in any way affiliated with Delta Air Lines or any of its subsidiaries. We are a non-profit, non-commercial organization catering to the Flight Simulation community. The real Delta Air Lines web site is located at **http://www.delta.com/**.
- Revisions of this manual may have been made since its original publishing. Please check Delta Virtual Airlines' web site at **http://www.deltava.org/** for the most up to date version.
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- This manual is designed for use by Delta Virtual Airlines as reference material for flight simulator pilots operating the Aerospatiale ATR-72-500 aircraft. There is no guarantee of the accuracy of this information. This is a reference for the virtual flying world and is not to be used for real world aviation.
- The information in this manual has been gathered from Internet resources and from test flying the aircraft in Microsoft Flight Simulator 2004 on Microsoft Windows XP Professional. This manual makes no claim to represent Aerospatiale, Pratt & Whitney Canada, Hamilton Sundstrand, Microsoft, or any other party involved.
- This manual is freeware and is not to be included with any 'for sale' product.