

B/CA Update: IAI Astra SP

New avionics, interior and performance schedules give the Astra a new "SP" designation while an enthusiastic sales-support-service team lights the competitive fires.

By B/CA STAFF REPORT

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Sometimes there's more to an airplane than meets the eye or gets into the performance pages of an aircraft flight manual. Such is the case, apparently, with the Astra 1125, the Israeli-made, long-range, medium-cabin business jet.

Indeed, several modifications—minor and not so minor—have come together at serial number 30 to produce an airplane different enough from its predecessors to deserve the new designation "Astra SP." Major airframe improvements include a modification to the nose gear and nosewheel steering mechanism; addition of a windshield fairing that houses repositioned windshield wipers; improved avionics bay cooling; redesigned door frame stiffening and improved maintenance access to the aft equipment bay.

The Astra 778/SP also boasts a new digital avionics suite. The Collins' Advanced Pro Line 2 system includes EFIS 86-C displays and controllers, an APS 85 autopilot and optional Doppler radar.

The SP interior has been reworked entirely by the human factors designers at Henry Dreyfuss Associates to provide a cabin that's comfortable over the long duration flights that define the SP's competitive mission profiles.

And for that "hidden performance," Astra SP engineers have certified a new zero-flap takeoff for high/hot situations, and worked out new climb and descent profiles that can improve range or increase uplift capability.

Perhaps, most important, is the fact that Astra Jet Corporation, the Israel Aircraft Industries (IAI)-owned, U.S.-based worldwide sales and support organization, has bloomed rapidly since its start-up about two years ago and is bringing a new credibility to the Astra program.

DEFINING THE SP

Recently, B/CA editors spent two days with the Astra Jet team at their headquarters in Princeton, New Jersey and at its support and delivery center in the Atlantic Aviation complex at Wilmington, Delaware. We also spent some time with the IAI engineers working on extracting new performance from the Astra. Finally, we toured the first Astra demonstrator equipped with a Dreyfuss-designed interior and flew the first SP outfitted with the advanced Collins avionics package. We'll share our observations here and in the sidebar titled "Flying the Astra SP."

Roy Bergstrom, Astra Jet's president and CEO, tells us "SP" stands for "Special Performance" improvements, "Special Pilot" refinements, and "Special Passenger" comfort. We're willing to concede at the outset that IAI and Astra Jet seem to have delivered on most of the SP promises.

The "special performance" improvements involve the optimization of performance that was, for the most part, already built into the Astra. The new climb and descent schedule simply optimizes performance for faster speed on short trips or range for the long reach.

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The accompanying figure shows the important issues in the changes to the climb and descent profiles. This chart compares the Astra SP schedules with those available for earlier Model 1125s. Note first that the new climb is a "shallower" 273 knots to Mach 0.71 compared with 240 knots to Mach 0.66.

While this seems a relatively modest change, you can see in the figure that the aircraft ends up 32 nm farther down range to begin its Mach 0.71 cruise.

Next, take a look at the end stage where the airplane stays at altitude 72 nm deeper into the trip and then descends at 3,000 feet per minute.

Taken together these climb and descent schedule changes increase range (four passengers, NBAA IFR reserves) from 2,755 nm to 2,815 nm. Trip time is reduced by some 28 minutes. This range increase means more comfortable margins for overwater operations and greater dispatchability in a wide range of adverse wind situations.

The other "special performance" improvement has to do with the Astra's hot-day, high-altitude takeoff performance.

We can only give you approximate numbers here because IAI engineers were still crunching data for certification at press time, but the theory, nevertheless, is interesting.

Until the SP, Astra pilots were required to use 12 or 20 degrees of flaps for takeoff. Zero-flap takeoffs simply were not in the book. In hot-day, high-elevation situations—Denver at 25 degrees C, for example—the airplane is second-segment climb-limited to 21,495 pounds. Sea-level, standard-day MGTOW is 23,500 pounds.

IAI engineers knew they could get some improvement in that second-segment limit if they ran the takeoff maneuver at zero flaps, but there was another challenge—cleaning up drag created by the inboard main-gear doors. These mechanically actuated doors hang down when the airplane is on the ground. Allowing the doors to hang on airplanes prior to serial number 30 provided excellent maintenance and inspection access and kept the mechanical linkages simple.

Drag from these drooping doors was negligible during takeoff as long as the flaps were extended. However, the doors do generate significant drag at the relatively high speeds involved in a zero-flap takeoff. Therefore, if the zero-flap takeoff schedule for reduced second-segment climb limits was to work, the gear door drag had to be reduced. The change has been accomplished entirely by reworking the mechanical linkages. IAI engineers also told us they expect their zero-flap, takeoff certification program will generate a 400-pound improvement in the hot/high climb limit.

Other mechanical improvements on the SP include

new top hinging (and therefore, improved maintenance access) for the aft equipment bay hatch and the addition of a new fairing just forward of the windshield. The windshield fairing provides a parking spot for the windshield wipers (producing improved crew visibility) and an adjustment to airflow over the top of the cabin (for a quieter cockpit).

Finally, the IAI engineers have cleaned up the fuselage a bit by moving an under-door strap to the inside.

PILOT REFINEMENTS

High on Astra pilots' wish lists has been the desire for kinder, gentler nosewheel steering. Astra engineers have castered the nosewheel and changed the gearing ratio of the pilot's hand tiller mechanism in hopes of improving things. (See "Flying the Astra SP.")

The major "special pilot refinement" is the installation and certification of a new digital avionics package—Collins' Advanced Pro Line 2. The heart of this system is the APS 85 digital autopilot, a device that provides considerably greater autopilot authority for the agile Astra SP.

The system also includes a new, five-tube EFIS 86C display system and optional Doppler radar. This advanced Collins system provides lower maintenance costs and higher reliability than earlier versions. Astra Jet marketers told us a significant factor in its choice of the Collins system was its ARINC 429 capability that allows easy interface with several popular FMS systems. The demonstrator aircraft we flew was equipped with dual Global-Wulfberg GNSX units. Universal and Honeywell systems are available also as factory options.

The Astra SP also sports a major redesign of avionics bay cooling and humidity control. High volume fans keep air distributed among the components in the nose-bay racks and the temperature is limited to 105 degrees F. This change is being retrofitted into the entire Astra fleet.

Avionics options include a second air data system and HF comm from Collins or Bendix/King.

PASSENGER COMFORT

Keeping people comfortable on a five-to-seven-hour trip can be quite a challenge. Astra turned to the interior designers at Henry Dreyfuss Associates, a New York industrial design firm, for help. This company is largely responsible for the wide-body look of recent vintage Dassault Falcons. The accompanying pictures tell much of the story.

Astra and Dreyfuss paid special attention to the seats and galley, the two keys to keeping passengers happy. The ERDA-made seats have ultra-wide pans and arms that can move with the back or can be stowed.

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Headrests and lumbar support areas move to fit the individual passenger and the entire seat can be berthed to provide full-length sleeping accommodations. An optional video center is available. It includes Air Show and VHS capability.

A new, long-haul galley features central water and extra large holding hot and cold storage areas for food, beverages and (perhaps most important) trash. An optional, extended-range, quick-change galley annex can be swapped for one seat to provide additional cold storage.

This interior, in our opinion, is an order-of-magnitude improvement over the last demonstrator interior we flew and a significant improvement over many of the late serial number Astras.

Even the lavatory compartment has been redesigned with central water, a larger wash basin and storage for overwater gear and optional toilet servicing.

PRICE AND WARRANTY

Most Astra SP's with typical equipment will go out the door with price tags approaching \$6.55 million.

The production rate is running about 1.5 airplanes per month and the company hopes to push the rates higher into 1992. Delivery positions were running six to eight months behind orders at this writing.

Astra Jet Corporation supports the Model 1125SP with a new warranty, one that is, they assert, the best in the business. The airframe primary structure is fully warranted for five years or 5,000 hours, and then on a prorated basis out to 10 years or 10,000 hours.

Proprietary parts—those manufactured by IAI—are covered for five years or 5,000 hours. Labor is included for two years or 2,000 hours. The Collins avionics

package carries a two-year/1,000-hour warranty; other vendor parts are covered for 18 months and the interior accessories and exterior paint are covered for one year or 1,000 hours.

ASTRA JET CORPORATION

One of the more important things to happen to the Astra program has been the establishment of the Astra Jet Corporation.

Business aviation is, by definition, a synergy of commerce and engineering, of people and machines. Nowhere is that synergy more apparent than in the initial success (or lack) of a new airplane design entering the community of business aircraft operators.

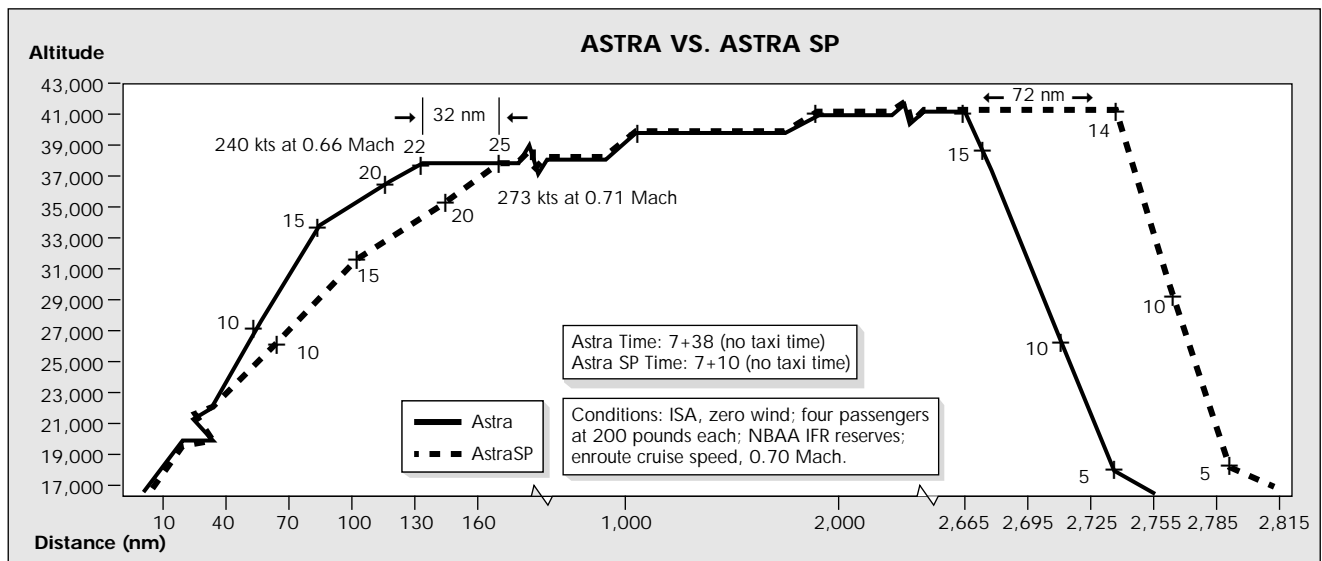
The world's best marketing team will have little success if the engineers and fabrication teams haven't done their jobs.

Conversely, a fine new airplane design will not do well if potential customers have cause to fret over the ability of the marketing, service and engineering support people to carry out long-term commitments.

The Astra, we think, has been a case in point.

The Astra is a beautifully designed, third-generation business jet and surely has the right combination of cabin, range and price to match the transportation needs of many companies around the world. (See "B/CA Analysis: IAI's Astra," August 1987, page 40.) Yet Astra worldwide sales have been less than impressive at least until this year.

Potential users simply were not convinced that the airplane would be supported as well as the competition. Some potential buyers would even settle for less performance in order to assure themselves the benefits of a strong sales/support organization.



Flying The Astra SP

While CEOs and their boards may pay for business aircraft, chief pilots and their flight crews fly them. Thus, pilot opinions of flying qualities and operational characteristics will always be important in the selection process, which is good news for Israel Aircraft Industries, manufacturers of the Astra SP.

Pilots familiar with IAI's Westwind I and II series will be pleased with the improved handling of the Astra SP both on the ground and in flight. Directional control and tracking while taxiing, taking off and landing requires less compensation than Westwinds and has been enhanced since the first Astras were introduced following the 1985 Paris Air Show ("Inflight Report: IAI Astra," B/CA, September 1985, page 67). All models departing IAI's assembly facilities near Tel Aviv now have castored nosegears and less sensitive nosewheel steering, as well as refined rigging that improves ground handling. The aircraft we flew, serial number 30, seemed to have a slight "dead zone" as we moved the nosewheel steering wheel—more so than the late-model Astra we flew for an earlier evaluation in 1987. It also was possibly in want of some adjustments, but the level of pilot attention and workload was minimal and, we suspect, easy to learn. Basically, we felt comfortable with the aircraft's ground handling.

Rotation forces are reasonable, and the aircraft has very comfortable pitch characteristics as it transitions from the takeoff roll to its initial climb. We found the Astra held its trimmed airspeed nicely in the climb, and over-the-nose visibility is improved by the higher climb speed used by the Astra SP.

Speaking of visibility, the windshield wipers on the SP are recessed behind a fairing located along the fuselage nose just ahead of the windshield; they no longer are parked vertically next to the windshield center-post. Without their presence, the pilot's over-the-nose view is noticeably improved.

Through the entire flight regime, pitch control is authoritative and pitch stability is nicely damped. The aircraft's initial response to an elevator input is a comfortable increase in pitch rate with no tendency to overshoot the desired change in pitch attitude (our center of gravity was in the midrange). The phugoid, or long-term dynamic response to an elevator input, was damped and of sufficient period to control easily, thereby attributing to the aircraft's attractive speed stability.

In the lateral/direction modes—bank and yaw—the Astra also behaves nicely. Ailerons are fairly light and responsive, and the aircraft exhibits excellent spiral stability (no tendency to spiral off to either side when left unattended) and minimal adverse yaw to an aileron-only control input even with the yaw damper disengaged. (The yaw damper is not a required item for dispatch). When we excited the Dutch roll at FL 410 with the yaw damper disengaged, we observed a mild banking/rolling oscillation that was neutrally damped but easy to stop with minimal application of controls. Westwind pilots will be impressed.

The Astra's pitch and lateral/directional handling qualities are particularly impressive at slow speeds and at the stall. The aircraft exhibits ample stall warning solely from its aerodynamics, and roll control is maintainable via the ailerons in the stall. The aircraft employs neither a stick shaker nor a pusher, nor does it give any indication that either device is even remotely required.

Flying the SP's steeper descent, which is profiled at 3,000 fpm, results in a very comfortable deck angle and no increase in workload for either the pilot or the Collins APS 85 digital autopilot. The aircraft also handles very nicely at lower altitudes and in the traffic pattern. Airspeed stability is sufficiently solid so that tracking the Astra's typical VREF speeds of around 120 knots requires minimal workload and was achieved quite easily even with our limited experience in the aircraft. The landing flare also is easily achieved, and ground tracking after touchdown and the application of thrust reversers (standard equipment) is not demanding.

Pilots will find hand-flying the Astra SP pleasant and not fatiguing, in part because of the aircraft's good handling qualities and in part because of the excellent instrument presentations of its Collins Advanced Pro Line 2 EFIS. Airspeed is presented as a vertical tape alongside the electronic attitude deviation indicator, and it provides both a moving arrow and a digital readout of velocity. Although the Astra's instrument panel also houses conventional airspeed indicators located in their regular positions left of the captain's ADI and right of the copilot's, we found the EFIS's airspeed a more useful presentation and one that was very easy to use for tracking our reference speed closely.

We were also pleased with the performance of the Collins APS 85 digital autopilot. Its operation was smooth, even when we commanded it to capture altitude following a rapid descent or intercept an ILS at an acute angle.

Needless to say, we found the Astra SP a very comfortable aircraft to fly and one that appeared to live up to its performance claims. **J.W.O.**

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In the last year, however, the situation has changed. Sales are up. Deliveries are up. Companies that looked at the Astra five years ago and dismissed it are taking another look. Most of this has happened because IAI turned to a group of experienced marketing and support professionals to generate a vital and stable synergy of hardware and people.

IAI's board gave its nod to the Astra Jet Corporation start-up in January 1988. Roy Bergstrom was hired away from Falcon Jet to serve the new company as its president and CEO. Astra Jet Corporation had one employee (Bergstrom) and nothing else.

As B/CA went to press Astra Jet had 52 employees, 18 offices worldwide and a functioning support network for some 1,100 existing Jet Commanders, Westwinds and Astras.

Astra Jet has fielded 11 technical representatives who deal directly with customers and service centers.

The company also handles all technical publications, vendor parts quality assurance, parts sales/support and purchasing/warranty support.

The people who work at Astra Jet Corporation have a contagious enthusiasm. They're betting that, coupled with the backing of IAI in Israel, they will be able to convince the potential Astra SP customer that the airplane and its support team are ready and able to provide reliable long-range corporate transport well into the 1990s. **B/CA**