Ishida TW-68 - Archived 10/95

Orientation

Description. Pressurized and unpressurized, 9-16 passenger regional/commuter/executive tilt-wing rotorcraft.

Sponsor. Ishida Group.

Contractors. Ishida Aerospace Research Group, Ft. Worth, TX. Ishida Aerospace is a unit of T. Ishida USA, Inc, San Francisco, CA, and its subsidiary company, TW-68 Industries Inc, also of San Francisco. Initial research and development was conducted by Dual Mode Air Vehicle Inc; Ft. Worth, Texas. Assembly, test, and certification was planned to be conducted at Ishida's Alliance Airport facility, Ft. Worth, Texas.

Status. Ishida ceased funding program, closed Ft. Worth facility in June 1993.

Total Produced. Not applicable.

Application. Short-medium range executive/business passenger transportation; short-range regional/commuter airline operations; small package/express cargo transportation.

Price Range. Manufacturer's estimate of $9 million in 1993 US dollars.

Technical Data

Design Features. Advanced technology tilt-wing rotorcraft utilizing a conventional semi-monococque fuselage with tricycle-type landing gear; main units retract into faired sponsons on the lower portion of the fuselage. Nose gear retracts directly into the forward fuselage section. The aircraft employs a roof-mounted wing with integral engine/nacelles mounted above the wing. Gearbox and propellers are mounted forward and below the wing leading edge. The entire wing/nacelle combination translates upward or downward, pivoting at the trailing edge above the fuselage. Collective controls are similar to those employed in the Bell/Boeing V-22 tilt-rotor. However, pitch control is augmented by a hydraulically-powered fan mounted vertically in the aircraft's T-tail section.

Dimensions (Exterior)	**Metric**	**US**
Overall length	12 m	39.4 ft
Overall height	4.08 m	13.4 ft
Wing span	10.97 m	36 ft
Wing area	3.7 sq m	255 sq ft
Fuselage diameter	1.78 m	5.83 ft
Dimensions (Interior)		
Cabin length	4.82 m	15.83 ft
Cabin height	1.6 m	5.25 ft
Weights		
MTOW, STOL (est)	8,158 kg	17,985 lb

MTOW, VTOL	6,320 kg	13,933 lb
Empty weight (est)	5,000 kg	11,023 lb
Maximum payload (est)	1,306 kg	2,880 lb

Seating/Accommodation. Executive configuration: nine passengers. Commuter configuration: 14-16 passengers, three or four abreast. All with pilot and copilot.

Performance

Maximum cruise speed	552 km	298 kt
Normal cruise speed	496 km	268 kt
Maximum range speed	345 km	187 kt
Range with max payload		
and IFR reserves	1,800 km	970 nm

Propulsion

TW-68	(4)	UTC Pratt & Whitney Canada PT6B-67R turboshaft engines flat-rated to approximately 745-1.120 kW (1,000-1,500 shp) each. Engines will be mounted side-by-side in wing-mounted nacelles and will drive six-bladed Dowty propellers through Lucas combining gearboxes.

Variants/Upgrades

TW-68 Stretch. Ishida was considering a 19-passenger stretch variant of the basic aircraft. It would have been powered by four uprated PT6As or two 3,500 shp class engines.

Program Review

Background. The Bell/Boeing V-22 is not the only tilt-technology aircraft in development or under consideration by industry. While it is the most famous and to date, the most advanced, the V-22 is not alone in its attempt to stimulate commercial and military operators' demand for the flexibility of tilt-technology.

The TW-68 is the product of a company established by former and late Toyota Motor Co CEO Taizo Ishida. He founded Ishida Corporation, a private Japanese foundation. Ishida brought two models of the TW-68 to the 1989 Paris Air Show and discussed construction of at least one prototype with US companies including Lockheed and Fairchild Aircraft. However, Ishida decided to establish both a research and production facility in the United States in order to deflect increasing criticism of technology transfer to Japan.

In mid-1989, Ishida contracted with a company known as DMAV. DMAV is an acronym for Dual Mode Air Vehicle. It is an entrepreneurial company headed by the aforementioned Mr. Cecil Haga and former LTV and Bell Textron engineers who participated in design and development of the LTV XCH-142 tilt-wing, General Dynamics/Canadair CL-84 tilt-wing, and Bell XV-15 and V-22 tilt-rotors. DMAV was responsible for all early design and development with that function transferred to the new facility in Ft. Worth, Texas, Alliance Airport in June 1991. DMAV is still associated with the project and moved from Arlington to Ft. Worth in 1990.

In late 1989, Ishida announced that it had agreed to acquire the Fairchild Aircraft Crestview Aerospace facility in Florida. Crestview is engaged in the production of fuselages for Fairchild commuter aircraft and may be the site for volume production of the TW-68 or major components thereof. All four flying prototypes will be built at Alliance.

In April 1990, Ishida signed the formal agreement to acquire Crestview and also announced that Toyota Tsusho Corp, a unit of the giant Japanese automotive manufacturer, would participate in marketing of the unique transport.

The FAA, a staunch supporter of tilt-technology during the V-22 budget fracas, said during the summer of 1990 that it hoped to launch a tilt-technology small parcel demonstration program in the mid-1990s to prove the concept to airlines

and civic leaders. FAA officials say that tilt-wing and/or tilt-rotor aircraft are economically viable on high density routes of between 100 and 300 nautical miles and would certainly meet FAA Stage III noise regulations. No formal timetable for the demonstration has been offered although the FAA has held discussions with "several parcel operators", most likely including Federal Express and UPS.

In October of 1990, DMAV announced that it was changing the TW-68 propulsion configuration from twin PW120-class to four PT6As. This was done so the aircraft could more easily meet existing and proposed FAA airworthiness certification requirements, in particular, the engine-out specification. DMAV studies proved that the two-engine aircraft could not meet FAA engine-out criteria at altitude. Gross weight of the aircraft has risen about nine percent with the overall airframe remaining nearly identical to the initial design. Fuel burn will suffer, although DMAV and Ishida say this performance degradation will be more than made up by the proven reliability and maintenance infrastructure of the less powerful but more numerous PT6A.

In January 1991, Ishida confirmed its commitment to the TW-68 by purchasing options on two additional land parcels totalling 17 acres at Alliance airport.

Why Tilt-wing? Ishida was firmly convinced of the marketability of tilt-technology aircraft. However, the company maintained that the complexity of the V-22 tilt-rotor, i.e., with the very complex tilt-rotor drive, is the major drawback of the design. It also adds inordinately to the weight of the aircraft. The tilt-wing, on the other hand, requires much less complexity in that only two large hydraulic actuators are required to tilt the wing/nacelle combination up or down. Additionally, the engines and rotors do not have the complex pitch change mechanisms employed on helicopters and tilt-rotors. However, because there is less rotor control through transition, an axial fan is located in the vertical stabilizer, which augments pitch control while in transition from vertical to forward flight. There are, of course, design similarities with the V-22. The most important is the use of cross-shafting to connect the two engine-driven rotor gearboxes.

North American Genesis. Although the TW-68 was to be solely funded by its Japanese sponsor, design of the aircraft was based strictly upon research and development activities conducted in the United States and Canada in the 1960s and early 1970s. DMAV president Cecil Haga was one of the principal design engineers for the General Dynamics/Canadair CL-84, a four-engined, tilt-wing technology demonstrator. Other DMAV and Ishida engineering staff had been culled from LTV and Bell, the former having produced its own tilt-wing demonstrator, the XCH-142 some two decades ago.

Program Schedule. Wind tunnel testing of a TW-68 scale model was conducted at LTV Aircraft Products Group facilities in Grand Prairie, Texas, during the summer of 1988. Additional testing was completed in 1989. Assembly of the first prototype was originally scheduled for 1993 with certification and initial delivery expected in 1996. In 1991, this date was adjusted to 1994 for first aircraft completion and 1997 for initial deliveries. In early 1993, Ishida announced that the planned first flight had been slipped into 1996, with certification and initial deliveries scheduled for 1998.

Program Halted. Ishida announced, in June 1993, that the Ft. Worth facility would be closed at the end of that month, and that no more funding would be forthcoming. While it remains to be sen whether Ishida will continue to seek a partner, the program is effectively terminated.

Funding

Ishida had estimated total development cost of the TW-68 at between $210 million and $275 million, not including production tooling. As of June 1993, approximately $20 million had been spent on development of the aircraft and on company facilities at Ft. Worth, TX.

Analysis. Ishida announced the cessation of funding for the TW-68 program in June 1993, adding that the company's US facility would be closed at the end of that same month. Toward the end of 1993 it was reported in the trade press that a group of former Ishida employees was seeking investors in an effort to resurrect the program. While this cadre, headed by the company's former VP of Engineering John Stowe, continues to seek financing arrangements, Ishida's facilities, land and offices have been put up for sale and the TW-68 mock-up remains in storage in the Dallas/Ft. Worth area.

At this time we are not forecasting a restart of the TW-68 program.

Timetable

Jun	1989	Ishida unveiled TW-68 at 38th Paris Air Show
Summer	1989	Ishida completed second set of wind tunnel tests
Late	1989	Company announced agreement to purchase Fairchild Crestview
Mid	1990	Ground broken for Alliance Airport R & D center
Jun	1993	Funding ceased, facility closed

Worldwide Distribution

Not applicable.

Forecast Rationale

We are not forecasting TW-68 production, nor are we anticipating the sale of this program to another company.

Ten-Year Outlook

No production forecast.