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NEWS

First Steps Taken in Quest To Prove Backpack Vtol Aircraft

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Developers report the start of tethered hover testing of a full-sized exoskeleton flying vehicle that could be used by soldiers or border agents as an unobtrusive look-down platform for patrolling, scouting or searching operations.

Called the SoloTrek XFV, the vehicle is a project of Millennium Jet Inc. Designed to make it easy for an operator to achieve vertical takeoff and landing (Vtol) flight, the XFV requires nothing more than strapping it on and taking off, said company founder and CEO Michael W. Moshier.

Millennium Jet's SoloTrek is not aimed for use by professional pilots, so it must be especially easy to fly, designer Michael Moshier acknowledges.

The idea is hardly new. Backpack concepts were tested as early as the 1950s, and some were even flown. Aside from concerns about stability, they commonly suffered from poor thrust-to-weight ratios. Substituting rocket propulsion overcame that problem, but there was no endurance. That's why Moshier is paying so much attention to the use of powerful but economical engines.

HIS GOAL IS TO BUILD vehicles that can achieve flight from tight quarters. Cruise speed is expected to be

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33% Aerospace Daily: DARPA's OAV To Provide Portable, 'Organic' Recon

The Defense Advanced Research Projects Agency (DARPA) is currently developing aerial vehicles no larger than one foot in any dimension that could eliminate the need for human scouts to locate and identify enemy troops. Organic Air Vehicles (OAVs) could carry a variety of sensors, including infrared or electro-optic devices, to detect vehicles or individual soldiers

40-60 kt. with a maximum speed of 70 kt. and a range of up to 130 naut. mi. Flight is controlled by a throttle in the left hand and joystick for directional changes in the right. A helmet-mounted display will provide the operator with flight information.

The vehicle has a rigid backbone that, for the present, contains a single, four-cylinder, two-cycle horizontally opposed piston engine that powers twin ducted fans above, behind and on both sides of the operator's head.

With a maximum gross weight of 700 lb., the vehicle measures 62 in. long and 104 in. wide. It carries a 10-gal. fuel supply and is to achieve a maximum hover altitude of 8,000 ft. MSL, although actual operations are more likely to be at 100 ft. AGL. The normal operating parameters are 65-75 hp. Liftoff is expected at 3,500 rpm., with cruise speeds maintained at 3,800-3,900 rpm.

Tethered liftoff tests have begun at the company's headquarters in Sunnyvale in California's Silicon Valley. Tests of a stability augmentation system also are underway, Moshier said. Manned flights are not expected until next year.

Millennium Jet was one of seven performers selected for development grants by the Defense Advanced Research Projects Agency's Exoskeletons for Human Performance Augmentation program. Darpa's $5-million, 36-month grant must be supplemented by $4 million in privately raised funds to complete the development cycle, Moshier said. He is seeking a joint-development partner and is not interested in his company undertaking manufacture.

In its exoskeleton program, Darpa is casting a wide net on behalf of Defense Dept. research. The general goal is to develop capabilities that increase human physical performance in combat environments. Darpa program manager Ephrahim Garcia has explained that this objective might be metin such areas as new materials, power sources, neuro-mechanical responses, human-like actuators and controls that take hierarchical approaches to task selection.

He declined to discuss specifics of the SoloTrek project, but a spokeswoman said, "The Millennium Jet concept would address the area of troop maneuverability, which has always been critical to military missions. The MJI aircraft would provide unparalleled

Troop maneuverability is one issue that attracted Darpa's attention about Millennium Jet's concepts. Shown is the DuoTrek design for a 1-2-person vehicle.

capability, especially in urban terrain."

Specifically, Darpa is interested in SoloTrek's ability to "demonstrate the ability to transition from hover to forward flight," she said. "We feel this to be a critical technical issue for any Vtol aircraft." She added that the U.S. Special Operations Command "is very interested in the capability promised by the MJI concept."

NASA Ames Research Center is following the company's research as well. The agency isn't an endorser or backer of SoloTrek, but it is interested in what the vehicle might reveal about ducted fans and vertical flight operations, particularly as they relate to hover, climb, transition, forward flight and descent, according to branch chief William G. Waimbrodt.

In its initial configuration, the XFV is being tested with a piston-powered Hirth F30 engine used to power ultralights. A switch to a small gas turbine engine is expected on production vehicles.

One candidate is the Williams International WTS-125 that powers the Canadair Peanut. The WTS-125 produces 125 shp., giving SoloTrek a margin of about 55 shp. above the nominal power needed for liftoff. Another is a small turbine developed for M-Dot Corp. for an unmanned aerial vehicle (UAV) that has since been canceled.

The validation tests involved full power and thrust needed to propel a full-sized XFV. Moshier said he is encouraged because the F30 engine is meeting or exceeding his initial predictions of thrust per horsepower necessary for SoloTrek to operate. That minimum is estimated at pounds of thrust per horsepower.

A MAJOR FOCUS of the Millennium Jet effort is the use of fixed-pitch fan blades for the transition from vertical to horizontal flight. Forward flight is to be achieved by the operator leaning forward 15-20 deg. There are a number of unknowns in the design, such as whether SoloTrek will require artificial stabilization. Moshier thinks controls can be maintained entirely with a mechanical system.

When Moshier considered 12 attributes that SoloTrek will need, most related to its powerplant. They include a useful percentage of excess power, quiet operation and low infrared signature, clean emissions, easy and safe operation, and no exposed fans, rotors or jets. Inattention to such basics is one reason other Vtol projects have failed.

The vehicle is designed with active noise cancellation technology. Moshier expects the engine and gearbox, not the fan, to generate most of SoloTrek's noise.

His goal is vehicle development rather than production--that he would license to a partner. While SoloTrek has a "Buck Rogers" element to its "backpack" type of flight unit, Moshier envisions other applications for Millennium Jet's ducted fan technology that would allow restricted-area operations.

One concept is the DuoTrek, which might come in either a 1-2-person manned version

or as a UAV. The 15.8-ft.-long concept aircraft has a 1,450-lb. maximum gross takeoff weight, could carry a 355-lb. payload 300 naut. mi., and have a hover/loiter endurance rate of more than 2 hr. It is enclosed, has a wingspan of 8 ft. and a T-tail. Four ducted fans are located fore and aft of its stubby wings.

The goal is similar to SoloTrek's--a vehicle with very low-noise, radar and infrared signatures. DuoTrek would have a 100% mechanical control system and be intuitively easy to fly. And if it does come under enemy fire, it would have an automatic, ballistic parachute recovery system.