A MULTI-MISSION AIR MULE

Building an Unmanned Cargo Vehicle: The Case of the AirMule

An Interview With Rafi Yoeli

12/22/2010 – **In a recent visit to Urban Aeronautics, a small Israeli company with significant experience in unmanned vehicles, Rafi Yoeli, CEO of the company outlined their basic cargo UAV offerings, built around variants of what they call the AirMule.**

The AirMule is a small UAV, which can carry (dependent on the variant), 1,400 pounds or 2,500 pounds or more either for CasEvac or cargo missions. It can also be used for special force missions carrying 4-6 people. It is small enough to land on a truck, operate off of ships like the Littoral Combat Ship, amphibs, or can be carried by CH-53Es and CH-53Ks. It can operate with either jet or truck fuel, which makes is a key element for operating in expeditionary conditions.

It might also be mentioned that the company is working on air jeeps. As Rafi Yoeli commented: "*We need that where we're operating. Manned, unmanned, it doesn't matter. We need a small vehicle that can fly in the streets and can land on any roof and that can operate from a small ship.*"

Rafi Yoeli underscored their engagement with a number of interested parties on shaping the cargo UAV offering.

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He underscored working with many other authorities as well.

> *There is a NATO working group (RTG-184), which was set up to explore and define safe ride standards for casevac via UAVs. They've visited our facility and are well acquainted with what we're doing. Although Israel is not a NATO member, the IDF trauma branch has a lot of experience and know-how to contribute to the discussion. Dr. Elon Glassberg, head of the IDF trauma branch has been a major proponent of casevac via UAV and we've been working very closely with him.We're also in involved in ongoing discussions with a number of entities within the US DOD and armed forces. The Marines, the Army and the Air Force are all involved in developing requirements for casevac and/or cargo UAVs.*

The design of the AirMule is relatively simple and maintainable.

According to Rafi Yoeli:

> *The design is very straightforward, there is nothing to move, nothing to rotate, nothing to articulate–nothing. This is almost solid state. The rotors run at a constant RPM powered by a turbo shaft engine. We're able to lift a very hefty load, up to 1,400 pounds easily. If we have room for a short running takeoff with the wheeled landing gear, then we can work in STOVL mode. And in STOVL mode, our load is 2,950 pounds, this includes fuel – but fuel burn is on average no more than 350 pounds per hour. If we fill this vehicle with fuel, we have four hours at 100 knots, easily. All this is possible due to the unique aerodynamics that we've spent so many years to develop.*

And Yoeli then talked about the impact of carrying the AirMule on a Helo in shaping deep penetration raids or support.

> *"In the STOVL mode, we can actually operate forward off of helo transport. And because this vehicle gets into a CH-53 — a normal CH-53 or a CH-47– we can start counting our 300 nautical miles from some point in the desert. So this is a very useful vehicle for everyone.*

The company is developing a larger AirMule, AirMule 3. "It's 2.6 meters wide, by 8 meters long. You can pack a lot of those on a small vessel. With this compact footprint this vehicle can do 3,000 pounds for 100 nautical miles. Which exceeds what presently the US Marine Corps wants."

Rafi Yoeli then underscored the relevance of the vehicle to the evolving threat environment.

> *If you look at published data (such as the RAND Institute publication) the situation in Lebanon is extremely difficult. The threats are, much more challenging than what the U.S. Army has seen in Afghanistan or Iraq. It's getting to the point where helicopters can't fly.*
>
> *With AirMule you can fly low and fast. You don't need to be above the terrain at all. You can be under the tree level with the AirMule, under the power lines. You have enough sensors to avoid colliding with obstacles. But that's possible, because you don't have an exposed rotor and your width is around six feet and you fly fast.*
>
> *You're under the threat. Flying at any significant altitude you're a sitting duck. Your exposure to missiles, radar missiles, canons, and so on is enormous. AirMule, flying low and fast can significantly reduce that exposure. Plus, of course, you can then land at any spot.*
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> *In addition to the above-mentioned RAND Institute publication, there have been a number of published reports detailing the challenges the IAF encountered in the last Lebanon war and in Gaza. Air support and CasEvac were seriously challenged and sometimes impossible. And of course, trucks weren't an option.*
>
> *So we see our solution is to come at the speed, anywhere between zero and 100 knots, or 120 knots. Depending on the terrain, depending on what you want to do. And we can really fly quite low.*

Finally, Rafi Yoeli underscored how the AirMule could move together with the combat force even in the threat environment he described above. The team on the ground at the objective can put down a transmitter determining where the AirMule should land; so human-machine interaction determines the landing spot.

> *Put the transmitter on the landing point and AirMule can land on that path, that's all you, need. Now, if there's a tree there that got overlooked, there are sensors that are in the loop as well.*
>
> *I think we tend to underestimate the efficiency of having a human in the loop who has a small transponder or even passive laser reflector, looks around, and in a second and half, does what no computer can do. He looks around and understands what he sees. He sees a building there, a power line there. There are maybe two landing options but the one here is less exposed so that's where he puts the transmitter. This is the kind of decision that UAVs cannot yet do. Eventually maybe—and AirMule is designed to accommodate that technology when it's available—but for now a commander's on-the-spot judgment is the best option.*
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> *Of course, in the case of cargo delivery and CasEvac there's always a call requesting the service and a location attached to the call. The vehicle flies autonomously to the vicinity using GPS or INS. The officer on the ground then defines the LZ or can turn off the transponder if conditions have changed. If the vehicle doesn't sense the transponder, it's programmed to return autonomously back to its base.*
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> *The dispatch base is like a taxi station. Our assumption is that at the brigade level or a higher level, there are a few AirMules, and they're on standby. They're on standby to deliver directly to any outpost whatever they need–that's a no brainer–and to get the wounded back. There are criteria being developed for that,*
>
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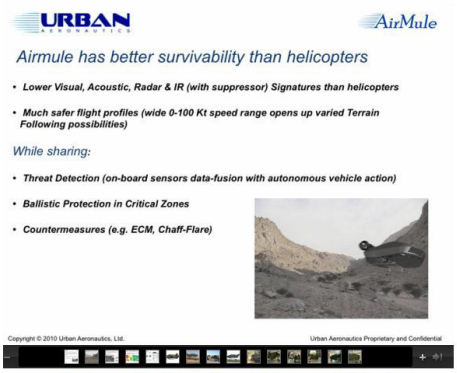
Yoeli underscored another aspect of the flexibility of the AirMule.

> *Another nice thing with this design is that you can land on 20-25 degree slopes, which opens up entirely new options where a helicopter has no chance of landing because of the big rotor coming in contact with the slope and so on. We can articulate the landing gear very easily land on significantly sloped terrain.*
>
> *Now because this vehicle is not a big aircraft and is transportable by truck, it moves together with the brigade. That way you can set up a depot 50 miles or 80 miles away from the front with a small unit that will receive the calls and service a vast amount of area continuously.*

Finally, Yoeli underscored the scalability of their solution sets.

> *The design is scalable. For now the small (1,400 lb. payload) size is our vehicle of choice but we can size up to 3,000 lbs. It will be more expensive, but it will carry more. We can do it.*



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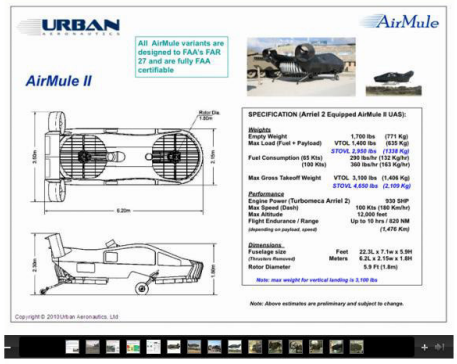

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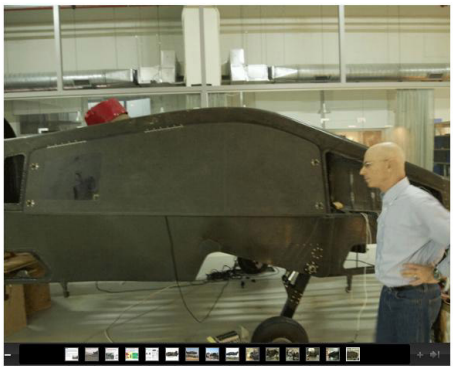

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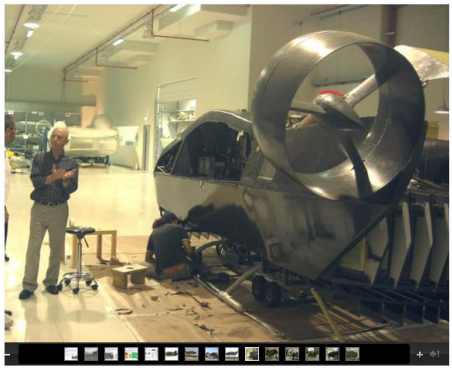

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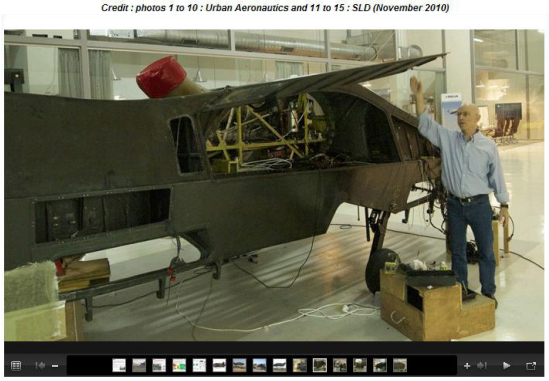

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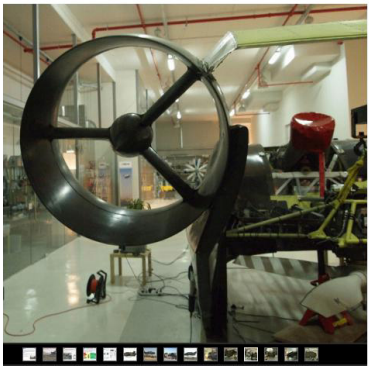

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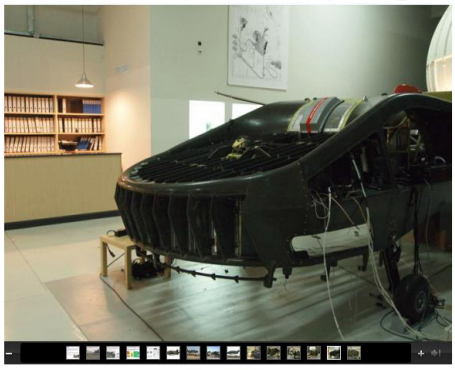

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