Winning an Asymmetric War with Skycar

Please allow me to demonstrate how an allocation of 5 million dollars will not only achieve a win in Afghanistan, but additionally score a “Stimulus Homerun” while achieving a major victory in cleaning up the environment, and simultaneously reduce our dependence on foreign oil. I define “winning” as the accomplishment of the United States of America’s strategic objectives while minimizing the tactical loss of soldiers and equipment. Throughout history we’ve nearly always armed our soldiers with the equipment we used to win in the last war. We seem to be committing the same error regarding Afghanistan and Iraq. Afghanistan is not Iraq. How often have you heard this phase repeated by both military and civilian analysts? Having served as an Electronic Warfare Officer (EWO) and logistics officer on both battlefields, I would emphasize these differences require extraordinary measures be taken to protect our troops in Afghanistan. We must take warfare to the next level to meet our objectives and offer our troops protection they deserve. The MRAP (Mine Resistant Ambush Protected) vehicle that turned the tide of battle in Iraq will have much less impact in Afghanistan. Poor and unimproved roads and rugged terrain severely limit the use of the MRAP. The Moller Skycar provides a more cost effective, high speed, agile, flexible, highly maneuverable, lethal, and safe platform for the 21st century soldier to dominate and win in an **Asymmetric Warfare Environment**. The Skycar will become the MRAP vehicle of Afghanistan. The ability to safely and rapidly employ soldiers on the battlefield enables us to exercise economy of force on the battlefield, doing more with fewer soldiers.

The word “Green”, in front of just about anything, has come to mean products and processes that reduce pollution and help the environment. Moller and its affiliates already have letters of intent for the purchase of almost one million small rotary engines; with a large percentage to be used for generating electricity to add power or extend the operating range of PHEVs. These engines have met California’s ultra low emission standards without the use of a catalytic converter. Their simplicity, (only 2 major moving parts), low cost, light weight, quiet and smooth operation, with improved fuel efficiency over 2 cycles, will also make them the engine of choice for generators, gas powered yard appliances, and recreational vehicles. The engine production plant is due to begin production sometime in 2010, providing a boost to the economy in construction, factory jobs, and exporting engines to our trading partners. **Demonstrating Cost Effective Performance,** the Skycar minimizes both direct and indirect costs. The Skycar uses engines that can burn almost any fuel from diesel to natural gas, including JP8. Successful tests were performed using ¾ ethanol and ¼ water without degradation in performance. Using gasoline, the M400 can be expected to achieve over 20 mpg, reaching a range of over 750 miles. Each of the eight 150 HP Rotapower engines have only two major moving parts, weigh less than 80 pounds, occupy less than one cubic

foot, and collectively yield 1200 HP. The bulk of the remaining technology consists of replaceable electronic modules monitored by the onboard systems to identify failed or failing components. Initially introduced as the M400, four-seat model, the Skycar technology has the ability to be both scaled up to a six passenger, M600, or scaled down to a one passenger, M100. This allows a cost efficient vehicle size to accommodate a variety of military, paramilitary, and commercial transport missions. A mix of 4 and 6 passenger models might be most suitable for deployment to both Afghanistan and Iraq.

The “X” Prize for 100 MPG cars marks the beginning of an automobile revolution of series electric cars, like the Chevy Volt, greatly increasing the demand for smaller and more efficient small electric generating units. For every PHEV replacing a far less efficient, and dirty, piston automobile around the globe, the environment stands to gain substantial ground. Likewise, dust blowers, lawnmowers, chainsaws, snowmobiles, (the list is endless), will all dramatically reduce pollutants and noise in our environment. Enabling many of the “X” Prize participants, winners or not, to purchase these low-cost, light-weight, low-maintenance, and efficient stand-alone engines, (running independent of the PHEV’s electric drive system) will afford the world consumers many desirable alternatives to the piston driven polluters they now purchase. Servicing the rotary engine requires a quick stop at your local mechanic. He releases a few fasteners, unplugs a cable and a hose, and easily lifts the engine and generator out of the car. If the engine has 10,000 or more hours on it, he will tell you he must overhaul the engine, so instead of picking up in 30 minutes, he will ask you to give him an hour. You drive off in your still operable electric car to do some shopping, and then return to pay the $200 bill for an overhaul that now extends the life of the engine for another 10,000 hours of use. It’s not hard to see how this will catch on with the average American. If you’re still feeling guilty about having to pay so little for the overhaul, you can pay a visit to a local body shop that, for a modest cost, will swap out the body of the car for an updated version.

How can the production of the Skycar enable a light-weight vehicle, with little or no armor, to provide a safe environment for our fighting soldiers? The greatest danger to our soldiers in Afghanistan continues to be IEDs (on the roadways) and hand grenades (while traveling through populated areas). Skycars handily defeat both of these threats. While small arms fire has the potential to penetrate the skin of a Skycar, Operators, and the troops accompanying the operator, should wear full armor protection. personal armor and the easily defeat this threat. Belly shielding, consisting of thin aluminum, coated with Dragon Shield, as tested by the Marines, greatly slows and prevents penetration by most small arms fire and shrapnel, mitigating most ground fire at very low altitudes. The capability to rapidly move around the battlefield in almost any weather condition, combined with crash-avoidance radar and extreme maneuverability

capabilities, elevates the Skycar to an idyllic platform to take the fight to the enemy. The Moller Skycar's small size, speed, low heat signature, and quiet operation provide a stealthy target for the enemy to engage. 4 engine pods, containing 2 low maintenance rotary engines each, provide power redundancy to each pod. Should some other malfunction disable flying functionality, twin parachutes deploy to deliver the craft and occupants safely to earth. A "Compound Rotary" engine, currently in testing at Moller, more than doubles the fuel efficiency and reduces the heat output from about 1,000 degrees F to around 500 degrees F. While this engine will not be part of the demonstration Skycar, they could possibly end up as part or all of the delivered 1,000 initial Skycars.

At first glance, it seems a bit unrealistic to predict the Skycar will be commonplace on the battlefield within 2 years, but that's exactly what must happen. Military use often precedes civilian application when ushering in dramatic paradigm shifts, and that's what must occur with the Skycar. Attaining non-rotor VTOL safely, simplistically, and efficiently now appears to be an attainable short-term goal. Besides parachutes and redundant engines for vehicle safety, a redundant navigation and artificial stability system for flight control, greatly enhances the drivers to control the vehicles. With the Skycar's enhanced maneuverability, automated collision avoidance can also be included as part of the artificial stability system. Strain gauges on wheels ensure maximum weight and proper weight distribution are achieved prior to takeoff. Simplicity in operation means soldiers, (not pilots), requiring a minimum of instruction, can easily operate the Skycars.

Attaining VTOL safely, simplistically, and efficiently for $450,000 a copy appears to be an attainable goal. The top Speed of Blackhawk is around 230 MPH, as compared to a top speed of Moller Skycar @ 375 MPH while carrying 3 combat loaded soldiers. Blackhawks cost over $10 million (1992 dollars) a copy. That's 20 times the unit cost of a Skycar. The Blackhawk also requires 2 pilots and a gunner. MRAPs, costing $600K-1,000K, pit a combination of brute force and advanced electronics against these insidious devices. Skycars could be purchased for half the price of an MRAP.

Improvised Explosive Devices (IEDs), in both Afghanistan and Iraq, provide the majority of threat to the lives of our soldiers. Strong evidence points to the increased use of these tactics by terrorist groups worldwide. By examining some of the missions MRAPs and Blackhawks perform on a daily basis, we can easily identify some missions where Skycars would be more suitable. Blackhawks rapidly MEDEVAC Wounded Soldiers to the nearest treatment facility. Blackhawks also transport critical parts and small numbers of troops and civilian contractors from base to base. Skycars, as contrasted with rotor lift VTOL, utilize enclosed ducted fan lift technology making them more accommodating to landing within close proximity to infrastructure, pedestrians, and rugged terrain. The Skycar's combined VTOL and fast speed enables extremely rapid

response. Search and Rescue, Emergency MEDEVAC, Drug Interdiction, Surveillance Operations, Escort Services, Routine Small Troop Relocations, or Critical Personnel Transport all represent but a few suitable applications. MEDEVAC and Search and Rescue illustrate examples where minutes saved can literally mean the difference between life and death. Search and Rescue in the rough northern seas of Alaska will benefit greatly from the use of Skycars. 6 passenger Skycars, modified with a basket lowering apparatus, could easily follow the roll of a fishing vessel without the worry of wrapping a rotor in the rigging, and saving more lives with greatly improved range capabilities. While Skycars could pluck soldiers from the sides of sheer cliffs, a like civilian mission would be to rescue personnel from upper stories of burning skyscrapers … a task with no solution to this day. The Skycar nibble to gently break the window of skyscraper, pushing the glass inside the building to allow for the escape of trapped workers. It is ideally suited to perform a Tactical Deployment and Extraction of Police or Soldiers while in very close proximity to structures, narrow streets, and confined spaces. Other military missions include: Scouting for Route Clearance Teams, Quick Reaction Forces, and Transporting Critical Parts to locations around the battlefield. Enemy UAVs have already posed themselves as a threat on the battlefield. The Skycar, performing the task of UAV Hunter/Killer, provides a low cost platform to counter this emerging threat. These missions all lend themselves to the Skycar being a suitable low-cost replacement for both MRAPs and helicopters.

Helicopters have traditionally offered the flexibility necessary in the above applications, allowing for ingress and egress into a limited space where fixed wing aircraft do not have access. The low maximum cruise speed, a limited range, and a restricted operational ceiling illustrate just a few of the performance penalties for using helicopters as compared to fixed wing aircraft. A M400 Skycar, by utilizing its non-rotor VTOL capability, maintains the flexible access of the helicopter, while increasing speed to 375 mph, extending range to 750 miles, and reaching the 36,000 foot ceiling of a high performance aircraft. The M400 can also climb at more than a vertical mile per minute. The directly driven fans reduce the installed power required to deal with an engine failure. In addition the drive train is eliminated. The drive train adds a substantial cost to the helicopter, resulting in severe energy conversion loss, and also accounting for 40% of all helicopter accidents.

Examining the MEDEVAC mission more closely will illustrate why we will save money by spending the money to acquire the Skycar:

Scenario 1, solution Blackhawk: A convoy of 10 MRAPs and 40 truck and trailer rigs strikes a command initiated IED. With all the confusion on the ground, no one sees the triggerman, over a 100 yards away scurry off into a village. The driver of MRAP 1 is severely wounded, the gunner moderately wounded. Both require immediate MEDEVAC. The driver has less than an hour to live without professional treatment.

The nearest treatment facility is 100 miles away with MEDEVAC Blackhawks on call. After 10 minutes of communication, the choppers are on their way. The trip takes approximately 40 minutes. They land 50 yards from the injured soldiers. Battle buddies carry them to choppers and load them aboard. 55 minutes of life have ticked away for the driver. His chances of survival are dim at best. The 40 minute return flight makes the total 95 minutes from injury to treatment. The doctors do all they can, but the driver dies and the gunner survives. After waiting 90 minutes EOD (Ordinance Disposal Team) arrives. EOD takes 30 minutes to clear the site and the convoy resumes mission.

AAR Blackhawk: Fuel to support 44,000 lbs of combined payload capacity was expended to deliver 500 lbs of soldiers 200 miles with a 50% survival rate. 85 minutes of wear and tear on all components were experienced.

Scenario 2, solution Skycar: A convoy of 4 Skycars, 3 MRAPs, and 50 truck and trailer rigs strikes a command initiated IED. The driver is severely wounded, the gunner moderately wounded. Both require immediate MEDEVAC. The driver has less than an hour to live without professional treatment. The nearest treatment facility is 100 miles away. The truck commander immediately signals the patrolling Skycars with 2 red smoke canisters, placing each on the road where they should land 20 feet from the injured soldiers. Within 120 seconds the Skycars land and load the injured soldiers. The trip to the hospital takes less than 20 minutes. The doctors stabilize both soldiers. Simultaneously, the other 2 Skycars patrolling the convoy spot the triggerman fleeing the scene. The triggerman realizes he's been spotted and fires on the lead Skycar. Several rounds impact the Dragon Shield backed aluminum plate on the bottom of the Skycar, but do not penetrate. The rear gunner engages and kills the triggerman. EOD, equipped solely with Skycars arrives on the scene 20 minutes later; takes 30 minutes to clear the site, releasing the convoy in less than an hour. The 2 Skycars performing the MEDEVAC mission rejoin their convoy while EOD is still clearing.

AAR Skycar: Fuel to support 500 lbs of combined payload capacity was expended to deliver 500 lbs of soldiers 100 miles with a 100% survival rate. The triggerman did not live to kill another day. After dropping off the wounded, the Skycars returned to their convoy.

The M400 Skycar carries a payload of 750 lbs, not including fuel, requiring a driver and an assistant driver. 1 or 2 passengers, acting as gunners armed with small machine guns and grenade launchers, occupy the back seats. The assistant driver may also perform duties of a gunner. The gunners can fire out of holes on the side of the canopy, closed when not in use. The M600, about 20% larger, carries a payload of 1,500 lbs. The military will likely want a mix of these 2 Skycars. One engine can provide electricity to wheel motors for ground travel or sufficient thrust as a backup to the electric motors.

Flying consists of the manipulation of 2 sticks. There are no pedals, flaps, or rudder to complicate flight. Drivers quickly learn on simulators to effectively control the Skycar. Qualifying for a driver's license in a Skycar will be on every soldier's wish list.

Every utilization of a Skycar in lieu of a Blackhawk results in huge savings from a number of sources. Fuel represents a substantial savings but the real saving comes with reduction of flight hours for the Blackhawk. Including the $34,500 maintenance check at 1,500 hours, the total overall cost every 3,000 hours, for the for the PT6A-41 turbines alone, exceeds $800,000. Every 3,000 hours of Skycars performing Blackhawk missions buys nearly 2 Skycars. This calculation disregards other associated expenses with the transmission and remainder of the craft. The age factor combined with the sustained high operational tempo of Army is wearing out the H-60 fleet much faster than planned. By only utilizing Blackhawks for missions Skycars cannot perform, we extend the life of the Blackhawk fleet well beyond current estimates, saving countless millions in replacement cost of the aging fleet.

Since the Skycar engines are protected with redundant backup, overhauls can wait until failure occurs. Even catastrophic failure is mitigated by the deployment of the Skycar's emergency parachutes. Skycars require less engine maintenance than their automotive counterparts. The Skycar engines do not have oil pans and radiators. The only friction wearing, caused from apertures scraping the combustion walls, takes 30 minutes to change every 10,000 hours of operation. Lubrication and cooling occur simultaneously by spraying a fuel/air charge on the rotor during the intake cycle.

In summary, the Moller Skycar would immediately save lives both on the battlefield and at home. Fast-tracking this technology by spending the 5 million to purchase the demonstrator will substantially advance the United States Armed Services capabilities on the battlefield. Amortizing the cost of the first one over the next 1,000 will only increase the base cost to $455,000 per copy. The introduction of the Moller Skycar into the Asymmetric Warfare environment will represent a defining moment in the history of the world.

Thanks for your time,

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