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Maxwell Propulsion Systems Evolution
by
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As a good number of you know, the NSI product, though it showed promise, had experienced major production delays, reliability issues, and given its rampant customization, was cost prohibitive to produce and still remain in business. You can't ship a $5,000 bill with each engine and be around long. With this turn of events, Maxwell Propulsion Systems, Inc. (MPS) acquired the inventory from NSI, LLC, and in doing so, has made a commitment to do everything feasible to support the operating NSI product line, while expanding the firewall forward offering. The MPS goal is to bring an alternative power plant in the 150 to 200 HP range to experimental aviation. We took a look at the available systems in the marketplace and found a good opportunity. Thus, MPS began what turned into a two year journey to design a propulsion system that was safe, reliable, cost-effective, and reproducible.

As with other companies, the MPS story began with choosing a name. As a bit of background, John Maxwell and I (formerly Gwen Glaefke) had a relationship that extended back to the 1970s. Discussions between John and his brother, Bill regarding a name proposed: *Maxwell Propulsion Systems*. My counter-suggestion was: *How about Maxwell-Glaefke Propulsion Systems*?" After a bit of sputtering(on John's part), I, wisely listened to his counterview: *That will never work! Nobody will remember it or even be able to spell it!* My ever logical (to say nothing of equitable, understandable, and reasonable ☺) response was: *You know, Honey, I totally agree with you. I think Maxwell Propulsion Systems really would be a much better name and I would be fully supportive…if I were a Maxwell!* And so it came to be, that the birth of Maxwell Propulsion Systems put an end to John's bachelorhood *twice!:* on January 5 and January 6, 2006. One might ask why twice; well having waited 31 years, I was not about to let him get away easily. It so happened that on the evening of January 4th, I was sitting next to the Captain of our cruise ship at dinner discussing our impending marriage when he offered to perform a shipboard ceremony. John and I both thought this sounded romantic and on the following afternoon we were married by the Captain (a handsome Italian) with the blue waters of the Caribbean as a background and cruising just North of the island of Hispaniola. The second (much less impromptu), exchange of vows took place the next day on the beach at the La Romana Viva Resort in the beautiful Dominican Republic.

The next (and admittedly a quite enjoyable) design process was development of a company crest. Several of our customers have inquired about the origin of the company's crest. By way of explanation (and hoping we don't get sued for plagiarism) read on. The centerpiece and most prominent component, the double headed eagle, is taken from the Maxwell Family crest. The shield and vertical bars are adapted from the radiator badge of the Maxwell Motor Car, produced in the US from 1904 to 1925 when it was bought by Walter Chrysler. The crown and Latin motto are taken from the crest of

St. Peter's School, York, UK. The school motto, *Super Antiqua Vias* (*Over Ancient Ways*) while fitting for the Old World and one of the oldest boarding schools in England (founded AD 627) it is hardly so for the New World. *Super Novo Vias* (*Over New Ways*) seemed much more appropriate for an up and coming 21st century engine manufacturing company. *Let's hope MPS lasts longer than the motor car!*

For the first year, LeGrande and Marlene Harris volunteered their management expertise and for this we are truly grateful. In addition, their GlaStar was the platform used to develop the prototype MPS system. In January 2007, following a six month sabbatical, Gwen officially retired after a 31 year career at the Fred Hutchinson Cancer Research Center. To *celebrate* ☺ her retirement, she assumed day-to-day management of MPS as Chief Operating Officer. Currently, she and three staff members, Lawrence Kerr, Design Engineer, Craig Woolman, Production Manager, and Colin Gillespie, Electrical Technician, comprise the staff.

As one might expect, beyond the fun things, like selecting a name and designing our crest, there were business issues that clearly needed to be addressed if MPS were to succeed where others had failed. First and foremost, the cost effectiveness issue was partially resolved by developing a system that used as many stock and off-the-shelf components as possible. To address the reproducibility concerns, meet production requirements, and increase profitability, MPS production systems are being designed to use Lean Manufacturing principles.[1] Our first step along the Lean pathway was to begin implementing the principles of 5S on the company facility. While we have made some excellent first steps in separating, sorting and cleaning, we continue to work on standardizing and sustaining those changes.

Two parts of the NSI system that were admirable are the Subaru EJ25 engine and the Whirlwind blade configuration. That said, in the early going, MPS is using some of the NSI components, for example, the engine mounting and cooling systems, and the A40 PSRU. Our goal is to phase these out as improved support systems are designed and developed.

The heart of the MPS story really is all about our product, so we thought it might be useful and of interest to readers of the GlaStar News to provide an overview of key features incorporated into the MPS firewall-forward system.

Engine: The power plant is based on the EJ25 single over-head cam Subaru. We start with a new, completely bone-stock engine purchased directly from our local Subaru dealer. We believe that the minimal horsepower gain accomplished by marrying the EJ20 heads to the EJ25 short block increases the chance for a mismatch and potential for cooling and compression problems. In addition, it is not cost-effective to modify the pistons, cylinder heads, gaskets, rocker arms, and manifold. What's more, these custom parts are not available at your friendly local auto supply shop.

Fuel Supply System: Gone is the heavy, custom-designed and manufactured fuel header tank. It is replaced by a commercially available returnless fuel system with an air-fuel separator.

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[1] Lean Manufacturing: An approach to manufacturing that finds and eliminate efforts that do not add value to the finished product.

MX1 Ignition and Engine Management System: MPS designed a dual switchable ignition. Each is a primary system with only one activated at any time. The fuel map is matched to the engine to ensure reliable starting and the Engine Management System is designed to control all functions of the engine and propeller.

Exhaust: On evaluation, the NSI muffler was over-engineered, over-weight, and over-budget. It sat happily under the oil pan serving a dual purpose: reducing noise and heating the oil pan and oil cooler, thus creating an *Artic Package* whether you wanted one or not. In contrast, the MPS exhaust consists of two straight pipes with resonator tips; the results are less weight and a *thankful* oil-pan.

Air Flow and Cooling: The air filter is now larger and no longer sits in the air duct. This simple modification significantly improves the air flow through the plenum chamber.

CAP 220 In-Flight Adjustable Propeller: MPS's first major design effort was focused on enhancing the safety features of the CAP200. We now have what we view s a reliable and very safe propeller that should stand the test of time.

PSRU: The most recent major design project is a new propeller speed reduction unit. The PSRU is, in many ways, the heart of the alternative engine system, setting it apart from direct drive. Less than a year ago, MPS decided to design a new PSRU with a TBO of 2000 hours. By the time this newsletter goes to press we expect ground testing to be complete and flight testing to have begun. The unit will be offered in two configurations: clutch activated and elastomeric coupler. The first 50 hours of ground testing demonstrated that the clutch, which is engaged and disengaged using a switch, worked flawlessly with no slipping or measurable clutch disc wear. We believe that the ability to start the engine without turning the propeller will appeal to many, particularly the float-plane crowd and those in cold climates. The elastomeric version should be in production early-mid 4th Quarter 2007 and the clutch-activated version in early 2008.

So, finally, after two years of development, the MX1 - Firewall-Forward system is complete. True to our *lean principles* and the commitment to build to order, delivery of a complete system is estimated at 6-8 weeks from receipt of a purchase order. Nevertheless, while we are ready to deliver product, our pursuit of excellence is ongoing and we will continue to develop and introduce system improvements and refinements.

For product information see www.maxwellpropulsion.com or for further information contact gsmaxwell@maxwellpropulsion.com