DASSAULT DESIGN PHILOSOPHY EVIDENT IN 5X, 8X

News / Manufacturer

Dassault has never been one to follow the pack when it comes to business jets: it has been at the forefront of innovation when it comes to the use of three-engine **designs**, 3-D design software, metal bonding blended with composites to lighten weight, advanced wing geometry, fly-by-wire flight controls, sidesticks, the EASy II intuitive all-glass cockpit and more; the list is a long one.

All this seemingly contrarian thinking is ingrained in the company's culture, one that takes young engineers and molds them in the Dassault way of thinking, according to Olivier Villa, Dassault senior vice president for civil aviation. "Usually engineers like me join the company right after school and stay until retirement. This is very little turnover and that has two important consequences. First, the people who design our aircraft have a lot of experience and have worked on several different projects. Second, we keep our convictions. The 5X [twinjet] is designed with the same philosophy used on the Falcon 900 and Falcon 2000, to create an aircraft that achieves the best balance between range, good short field performance, low cost of operations and the best possible comfort," he said.

"The fact that Dassault is largely privately owned means the company can pursue longer range, and in some cases, more elegant solutions. Villa said. "It makes a big difference. The Dassault family is not interested in short-term results. It gives us a different perspective. If we are convinced that a large investment is required for long-term success, I've never seen our main shareholder rejecting such a solution. It is quite a difference [from a publicly owned company]."

It also helps that the company has a strong background in building jet fighters. "We use the right technology to make an aircraft different and achieve different performance," Villa said. "Our company began designing jet fighters [in the 1950s]. Obviously performance is key for fighters. You have to use all available technology to reach your performance point. That means that at least in two key areas, aerodynamics and structural design, you need to find the best possible solution. You need to go to the edge of technology. So we developed the tools that supported these technologies. We were the first to use finite element computation software for these early planes in order to save weight everywhere possible and to make sure the structural [strength] margins were met. It is amazing what you can achieve using sophisticated computing tools to ensure that the structure is robust, but that there is no extra material or [strength] margin where it is not needed. With aerodynamics it is the same thing. We always have designed our Falcons by making sure that the shape is optimum. We were the first ones to design an aircraft fuselage, in this case on the Falcon 900 [in the 1980s], with area ruling [pinching of the aft fuselage inward near the engines similar to the top of soda bottle]. We use very sophisticated shapes in order to ensure that the drag is minimal."

Dassault readily adapts and applies what it learns on the military side of the house to its civil designs, Villa said. "The EASy cockpit was designed using our test pilots' experience in fighters. Look at what happens in the cockpit during a dogfight, the amount of information and the speed at which it is presented. It is really, really challenging. So when you design the fighter cockpit you need to ensure that the pilot is presented only with the information that is critical at a specific, precise time. It will display only during a certain phase of flight. Then in another phase other information that is critical is displayed. You have to merge all the sensors and determine what to display and when. That led to the EASy design philosophy. All our [test] pilots fly fighters and Falcons. They determined what to display and when, and determined which information is shared between pilot and copilot. We are constantly improving EASy. Now we are including our combined vision system. It merges infrared [camera images] and synthetic [vision] on a head-up display with a wide field of view. Combined vision is a good example of taking the latest technology and making sure you get the most benefit when it comes to performance and safety."

Back to the Drawing Board

But coming up with the best design solution, wherever it originates in the company, sometimes means going back to the drawing board, even at the expense of program schedules. "When we first developed the Falcon 50 we developed a prototype and it was flying well and meeting the performance points. But [company founder] Marcel Dassault wasn't happy and said, 'We can do better.' He pushed the company to scrap the wing and design a new one. This was the first supercritical wing that was later derived for the Falcon 900. We have never hesitated to fit our Falcons with sophisticated devices such as full leading edge slats and sophisticated air brakes. On the Falcon 5X we have introduced the flaperon, which up until now we just used on our Rafale fighter. It is a [multipurpose] control surface that can be used as flaps, ailerons and an air brake. These are just a few examples of the technology we use to enhance performance. It requires investment, but in the end you get a superior aircraft," Villa said.

That investment means having the willingness, resources and patience to find the right solution to any particular design challenge as opposed to what could be an easy, quick fix, Villa said, using the example of when deciding where on an aircraft to use composites and where to use aluminum and other metals. He illustrates the problem with the Falcon 900.

"The aluminum wings have quite a different structure as well. The structures are machined from large aluminum billets. Some parts are made of Kevlar composites, some titanium. We look at each and every part and make sure we have the best solution for that part. It takes a lot of engineering and mastering different technologies. Once you know what you can achieve with carbon fiber and other materials then you are in a position to look at the tradeoffs for each component. On the Falcon 900 today the empennage is made of carbon because we found that carbon was the best solution–robust and light. But the wing is aluminum. We know how to design a carbon wing. We were the first to certify a carbon wing on the Falcon 10 in the 1970s. But putting a carbon wing on a Falcon 900 would not have been optimum compared to aluminum. Unlike the empennage the wing is a fuel tank. We need the wing not only to be a lightweight structure, but also to provide the maximum volume inside for the [fuel] tanks. The carbon solution would have lowered the fuel quantity at the time. So you see, each part of the airplane requires a different solution."

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