# HONDA GOES AIRBORNE?

HondaJet heralds an approaching juggernaut. by Dave Higdon




Can you remember the last time you took a drive without encountering some device powered by an internal-combustion engine adorned with the name "Honda"?

Concentrating hard to remember auto traffic from about 1960 only serves to make the concept become clear to me; but only in an abstract sense. In reality, Honda became a part of my memory bank in a world simultaneously becoming familiar with a British rock group called "The Beatles," color television and compact import cars.

Yet, the auto wasn't even where Honda first shook up the world here in the States. No, Honda rode into the American world on two wheels, not four. Competing products bore strong names hard as steel – Harley-Davidson, Indian, Triumph, BSA, Ducati and Bultaco.

"Honda," for whatever meaning it might hold in Japanese, imparted no emotional reaction amongst us youngsters. Ditto for the other names that invaded across the Pacific – Bridgestone, Kawasaki, Suzuki, Yamaha.

However, disdain born of unfamiliarity greeted Honda and the other newcomers. That position lasted only a few years, however, the years it took for motorcycles from Japan to expand the market beyond the traditional segment held by the American and European bike makers.

Smaller, lighter, and higher quality than the established machines, these new bikes also sold for far less – so little, in some cases, that even 'geeky' kids could afford to deliver their paper routes on a low-end single-piston Honda. It was Honda's pioneering automated manufacturing techniques that made possible the value equation.

A few years later Honda applied the same market savvy and manufacturing expertise to ease into the automobile market. As Honda had become with the motorcycle set, its cars became market winners. Sure, the first Civic was a tiny little two-seat skate-with-an-engine – a large motorcycle engine, in reality. So small and different was the original Civic that it gave an on-steroids appearance to the classic Mini Cooper of the same era.

Gradually the "foreign car" stopped serving as the butt of jokes and became the worry of domestic carmakers. Initially, the domestic carmakers only lost market share (which they never expected to lose) in the small car segment. But the domestic carmakers had to face larger and nicer Hondas – and, eventually, the advent of the noun "Acura."

Honda's upscale car line foretold similar upscale expansions from Nissan and Toyota, luxurious drives with names "Lexus" and "Infiniti."

Honda enjoyed equally strong success with its boat engines, with off-road, all-terrain vehicles, lawn-care equipment, emergency generators, even pumps. With every new market, Honda applied its own strong market research with industry-leading R&D and ultra-efficient automated manufacturing systems to succeed at each and every step.

**AND THEN...**

Back in 1989, during Honda's unstoppable global growth in tapping every possible internal-combustion engine market, the company turned its focus toward aviation.

Rumors and rumblings of Honda's efforts have been part of the subterranean grapevine for years now, so it was to little surprise that the story picked up credibility back in December 2003, on December 16, to be exact.

That date, one away from the Centennial of Flight, marks the day when Honda announced the first flight of its developmental HondaJet – behind the power of its own all-new HF 118 fan-jet engines.

Thinking back to the market changes that followed all of Honda's prior moves into consumer transportation, are there any predictions on how business and personal aviation might appear 15 years from now?

Some staggering potential – particularly if you consider that this time Honda's not even at the front of the pack. But Honda does bring resources unmatched by most of the players in this new pack – and it's those resources that could, in a decade or so, make the name "Honda" as common a name in aviation as it is in autos and motorcycles – maybe even as recognized as today's largest business jet maker, Cessna.

Mid-February's announcement of Honda's alliance with GE to certificate and market the new HF 118 engine served only to heighten expectations that a HondaJet is part of aviation's short-term future.

Between the two companies' marketing goals, plus the anticipated outcome of talks about sharing manufacturing, it appears there someday soon could well be Honda airframes flying on Honda engines and Honda engines flying on other planemakers' airframes.

**MARKET POTENTIAL:**

The HondaJet takes up a slot in the emerging field of very light or micro-jets – in fact, Honda's arrival comes so far after the emergence of this category that the grouping has grown into double digits.

That means should Honda decide to proceed with commercial development – so far, no hints other than a flying prototype and masses of certification-like testing already done – that some formidable competitors will already be delivering airplanes. At least, that is the conventional wisdom of some.

Given Honda's 18 years of development work already in the can, the string of engines designed, built and run, prior to the HF 118, and the company's legendary prowess in marketing, sales and support, conventional wisdom may not fly here. No, Honda's new plane fits nicely in a pre-defined group, not necessarily to fit into the group – but absolutely to meet a defined market target.

Honda could be closer to certification and delivery than some of the other planemakers playing in this class. And no contender – not even Cessna – brings quite the name, global recognition and favorable reaction as Honda. If a large segment of the target market is new to aviation, far more people have traveled in or on a Honda than in any make airplane.


Aircraft Index see Page 2

Contrary to some views of Honda's work, it is conceivable that follow-on models could push down the threshold for owning a personal jet – and not exclusively track a "bigger-is-better" product line. That would help set up a growth track that taps into the widest possible base – particularly with the new technologies emerging in instrument panels and avionics. Changes in technology and how flying is taught will likely also change how quickly small jets will come within reach of pilots today limited by their budgets to flying new airplanes from Beech, Cirrus, Cessna, Lancair and others.

The approaches employed so far by Honda support development of just such products for years to come.

**THE HONDAJET:**

Carbon-fiber fuselage, aluminum wing, all-digital flight instruments and radio controls. You might think of Raytheon Aircraft's Beech Premier I or Hawker Horizon – and you'd be right. However, in this case the product description applies to the HondaJet, as much a cutting-edge design as either of the Wichita jets.

First, up front in the panel, we need only to say one thing for the moment: Garmin G1000. Certified and coming in the Cessna 182 and 206 piston singles, in the Citation Mustang, and in a host of other light aircraft, the G1000 is arguably the cutting edge solid-state EFIS/PFD/FMS package available today for light aircraft.

Addressing the rest of the airframe, you'll find more unconventional than conventional – and all for good, proven reasons.

For example, Honda's engineers designed the wing with stand-above struts to hold the engine nacelles, freeing the fuselage from the structural and space burdens of carrying the engine weight and the thrust loads. In this case, the fuselage is made of a honeycomb structure wrapped in carbon fiber and hardened into a shell with epoxy resins – it's composite.

The wing employs a proprietary laminar-flow airfoil Honda developed for both aerodynamic efficiency and ease of manufacturing. The all-metal structure employs skins machined on the inside to enhance their strength while providing a smooth surface that aides in the retention of laminar air flow.

Since the wing center structure already must be built to carry the full weight of the airplane impacting a runway at relatively high speed, reinforcing the structure to carry the engine weight and thrust loads was a manageable issue.

More of an issue was dealing with the subtle differences in airflow, drag and interface issues of keeping air moving smoothly past wing-top-mounted engines at all angles of attack. Honda's extensive computer modeling and wind-tunnel tests allowed the engineers to refine the mounts, the nacelles and their position and angles relative to both the wing and the fuselage.

The result not only resolves the airflow issues, it also keeps the engines close enough to the airframe centerline to prevent asymmetrical thrust from becoming an issue.

The biggest beneficiary of this approach is the back-cabin occupant. Freed from the need to carry the weight and thrust loads of the engine, the aft fuselage is freed from the need for the significant structurel imposed by fuselage-mounted powerplants.

The cabin benefits greatly from this departure from light-jet convention. Not only does this approach simplify the fuselage design, it also provides a space bonus equal to a gain of more than 30 percent in the volume compared to the same diameter, length and taper in a fuselage designed to carry the engine struts and support plumbing.

Honda even went so far as to work out a laminar-flow nosecone to reduce drag to an absolute minimum.

The total result, according to Honda, is an airframe with 40 percent superiority in fuel efficiency compared to more-conventional designs. Additionally, Honda claims the largest cabin in its class thanks to the combination of the composite fuselage structure and the absence of the engine-mount hardware.

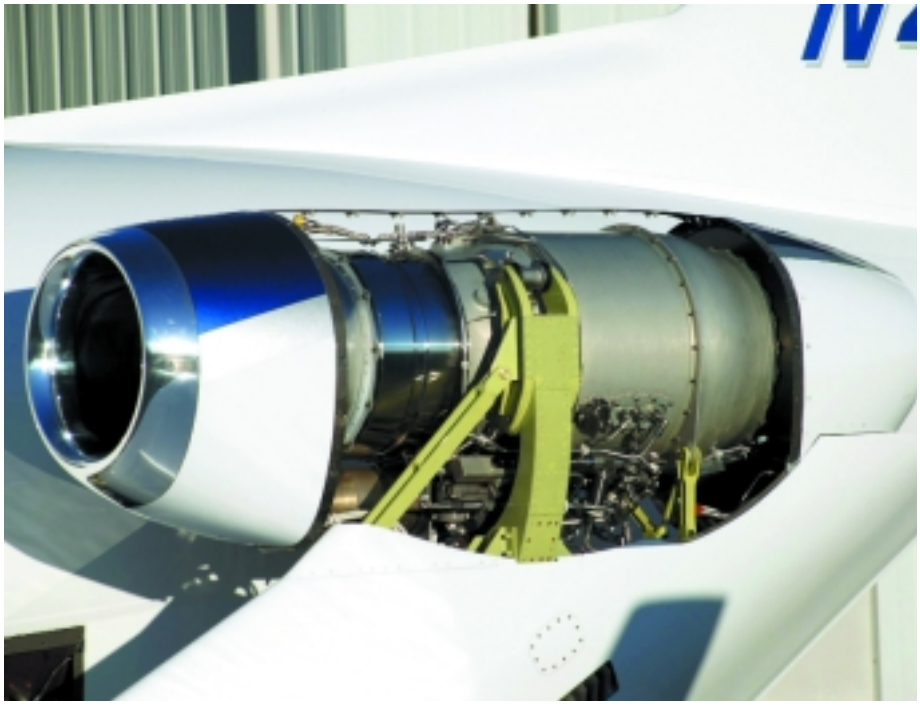
Then, of course, there is the engine itself…

**NOT THE FIRST, ONLY THE LATEST**

As you might expect – from Honda's approach to aircraft development as well as its entire history – the engine powering the HondaJet also departs from the conventional.

Development of the HF 118 started in 1999 as the latest in a string of gas-turbine engines Honda had designed, built and run, dating back more than a decade. Yet, none of those engines ever powered an aircraft. The HondaJet represents the first Honda airframe flown on the power of a Honda engine. Prior Honda-designed airframes flew on the power of other manufacturers' powerplants.


Aircraft Index see Page 2



improve on the use of individual vehicles for the benefit of an entire population. Honda also uses its Technology section to address its work on hydrogen fuel cells, solar-powered hydrogen-generating home-fueling stations and fuel-cell-powered vehicles.

As this technology advances, Honda plans to be well past the starting gate with the power cells, the cars that run on them and the stations needed to refuel hydrogen fuel-cell-powered cars.

To many, Honda's long history of approaching product development with such depth and creativity means that the now-visible segments of Honda's new jet program truly represent only the tip of the iceberg.

Below the surface, these observers believe, Honda is already well prepared to handle the manufacturing, assembly, testing and distribution of a new aircraft line. "Expect", these folks say, "a great deal more automation in the airframe production than seen to date in aviation."

## "MAYBE WE'LL SEE A MOVE INTO AVIATION PARALLEL WITH WHAT HAPPENED IN MOTORCYCLES IN THE 1960s"

Making 757 pounds of thrust, the HF 118 falls into the same power range as the Williams International EJ22 initially chosen to power Eclipse Aviation's Eclipse 500.

Honda developed this light, compact, simple powerplant through the use of its own proprietary computational fluid dynamics software. The goal is a familiar one to engine and airframe designers alike: optimize airflow – in this case through the engine – toward the end of gaining the maximum possible efficiency.

The engine employs a two-spool design with a single-stage, 17.4-inch fan, a two-stage compressor and a two-stage power turbine. The engine measures 54.5 inches long and weighs 392 pounds dry.

The bypass ratio is a modest 2.9:1. Honda engineers designed a simple, high-performance combustion chamber with an eye toward keeping engine-emission levels low enough to meet the anticipated standards for compact jets.

The company borrowed some from its own automotive engine technology to develop what the company calls "the first ultra-compact" Full Authority Digital Electronic Control (FADEC) system for this class of engine. This FADEC offers superior engine operation and reliability without variable mechanisms.

The combination seems frugal where fuel consumption is concerned. According to Honda data, HF 118s consume about 370 pounds an hour at take-off power; at cruise (420 pounds of thrust) the engines consume only about 315 pounds an hour.

Among the testing conducted on this engine since development started almost five years ago is the FAA-standard 150-hour endurance run through which all aircraft powerplants pass before receiving certification. Honda's R&D team also mounted the HF 118 on other airframes and flew more than 110 hours of in-flight tests prior to December's first flight of the engine on the HondaJet.

Honda, it appears, again developed technology that goes places.

### WHERE NEXT?

With no firm announcement of a full-blown product program, Honda continues to play its cards close to its corporate chest. However, if you explore Honda's website you find information on the HondaJet and the HF 118 under the "Technology" banner. It's at this part of the company's extensive Internet presence that you see how devoted the company appears to be where staying ahead of the power curve is concerned.

Within the Technology pages Honda promotes ICVS – or Intelligent Community Vehicle System – a way to

The company's vast experience in distributing parts for cars, motorcycles and boats puts the company in a great position to set up marketing, sales and, most importantly, support for any new aircraft.

With the market niche already identified and targeted, expect the company to be well positioned to launch its marketing effort before words of a product launch stop echoing inside a meeting room.

Indeed, with a heavyweight like Cessna developing its Mustang for a similar market, with well-financed efforts such as Eclipse and Adam well along with their efforts, the prospect of a HondaJet in the mix serves only to add legitimacy and momentum to the mix. Now it is mainly a matter of watching and waiting to see what next happens with the HondaJet.

After more than 40 years of watching this powerhouse player conquer the world of internal-combustion engines, I'd feel pretty foolish betting against Honda's prospects as an aviation player.

Maybe we'll see a move into aviation parallel with what happened in motorcycles in the 1960s. Who knows, to paraphrase the 1960s ad slogan, maybe you'd even meet the nicest people in a Honda.

■ More information from Honda; Website: http://world.honda.com


Aircraft Index see Page 2