



## Gulfstream Makes Business-Aviation History

### *Makes First Flight Using Electrically Powered Flight-Control System*

**G**ulfstream Aerospace Corp. test pilots and flight-test engineers recently made business-aviation history when they flew the Gulfstream G650 flight-test aircraft for the first time using only an electrically powered, fly-by-wire backup flight-control actuation system.

On Dec. 21, 2010, Gulfstream's serial number 6001 flew for a total of 3 hours, 33 minutes. Test pilots, Jake Howard and Gary Freeman, along with flight-test engineers, Bill Os-

borne and Nathaniel Rutland, evaluated the fly-by-wire system in electric backup actuation mode for 2 hours, 20 minutes of the flight, performing five landings with the backup system engaged.

"The system performed flawlessly," said Pres Henne, Gulfstream's senior vice president, programs, engineering and test. "There was no difference in handling qualities between the electrically and hydraulically powered modes."

"It flew so well that unless pilots were told they were in backup actuation mode I don't think they would notice," Freeman said.

Typically, fly-by-wire uses a third hydraulic system to provide redundancy in the event of a dual hydraulic system failure. However, Gulfstream's fly-by-wire architecture uses electric backup hydraulic actuators: electrically controlled actuators that are primarily hydraulically powered but offer electric power as a backup.

A self-contained hydraulic reservoir and motor pump allow full operation should hydraulic loss occur.

The G650 has an EBHA at every primary control surface, (elevator, rudder and aileron), as well as the outboard spoiler. These provide enhanced safety and aircraft availability because of the two different power sources. The self-contained actuators also offer an advantage following extremely rare failure scenarios, such as a rotor burst.

The Dec. 21 G650 flight began with evaluating the electric backup-mode handling qualities in one axis, and then progressed to full evaluations in all axes (pitch, roll and yaw). The test conditions consisted of all flap settings at 10,000 feet for speeds ranging from 1.13 reference stall speed (VSR) to maximum flap extended speed (VFE). Cruise configurations were evaluated at FL280, FL350 and FL450, and the full speed spectrum. The pilots also initiated

an emergency descent profile from FL450 to FL250. Additionally, they evaluated handling qualities in the landing configuration by making multiple offset approaches at Brunswick Golden Isles Airport in Brunswick, Ga.

The EBHAs for the G650 are provided by Parker Hannifin.

For more information, contact Gulfstream Aerospace at 912-965-7279 or visit [www.gulfstream.com](http://www.gulfstream.com). □

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