Novel analysis helped narrow Malaysian jet search (Update)

March 25 2014, by Justin Pritchard

In this Monday, March 24, 2014 photo, crewmen on board an RAAF AP-3C Orion aircraft look at their radar screens whilst searching for missing Malaysia Airlines Flight MH370 over the Indian Ocean. After 17 days of desperation and doubt over the missing Malaysia Airlines jet, Malaysian officials on Monday said an analysis of satellite data points to a "heartbreaking" conclusion: Flight 370 met its end in the southern reaches of the Indian Ocean, and none of those aboard survived. (AP Photo/Richard Wainwright, Pool)

Investigators are closer to solving an international aviation mystery

thanks to a British communications satellite and classroom physics.

An analysis of faint signals sent from Malaysia Airlines Flight 370 to an Inmarsat satellite led officials to conclude the plane crashed in a remote area of the southern Indian Ocean. More precise information about the plane's position when it sent the last signals is helping authorities refine the search being undertaken by planes and ships in seas 2,500 kilometers (1,550 miles) southwest of Perth, Australia. Investigators had little to examine otherwise because other communications were lost early in the flight March 8.

THE TIMING

Even with other communications shut down, the plane sent an automatic signal—a "ping" or a "handshake"—every hour to an Inmarsat satellite. Flight 370 completed six pings, and the time each took to be sent by the plane and received by the satellite showed the plane's range from the satellite, according to the U.K. Air Accidents Investigation Branch. This initial analysis showed the last ping came from a position along one of two vast arcs north and south from the Malaysian Peninsula.

DOPPLER EFFECT

Think of a horn being honked in a passing car. To an observer, the sound is high pitched as the car approaches and is lower after the car passes. On approach, each successive sound wave is sent from a slightly closer position to the observer. The sound waves get compressed, resulting in a higher frequency. The opposite happens as the car moves away. It's called the Doppler effect for Austrian physicist Christian Doppler, who put forward the theory in 1842.

The same effect applies to the pings, which would arrive to the satellite at a higher frequency if the plane was moving toward the satellite and

decrease in frequency when moving away.

For the analysis that led to Monday's conclusion the plane had crashed, Inmarsat studied the satellite communications made while the plane was on the ground at Kuala Lumpur airport and early in its flight.

In this Monday, March 24, 2014 photo, a crewman of an RAAF AP-3C Orion aircraft loads a sonar buoy that will mark the location of any wreckage found whilst searching for missing Malaysia Airlines Flight MH370 over the Indian Ocean. After 17 days of desperation and doubt over the missing Malaysia Airlines jet, Malaysian officials on Monday said an analysis of satellite data points to a "heartbreaking" conclusion: Flight 370 met its end in the southern reaches of the Indian Ocean, and none of those aboard survived. (AP Photo/Richard Wainwright, Pool)

It considered aircraft performance, the satellite's fixed location and other

known factors. By knowing how the Doppler effect would apply to the satellite communications, Inmarsat could calculate the possible positions, direction of travel and speed of the plane.

The company then compared its predictions to six other Boeing 777 aircraft that flew the same day, and found good agreement, according to Malaysian Defense Minister Hishammuddin Hussein. Inmarsat did not respond to repeated requests for comment from The Associated Press.

"By analyzing that you can determine speed and direction," said Joseph Bermudez Jr., chief analytics officer and co-founder of AllSource Analysis, a commercial satellite intelligence firm. And by determining the area from which the last signal was sent, then estimating fuel left, it "could give you an approximate area of where the aircraft impacted."

MORE ANALYSIS

Inmarsat sent its data to investigators days after the plane went missing. But it continued to run its own analysis to see if it could wring out any more clues.

The company's engineers were dealing with a "totally new area," Chris McLaughlin, senior vice president of external affairs at Inmarsat, told the BBC. "This really was a bit of a shot in the dark." However, the latest information could only go so far in pinpointing the jet's location.

"We can't help you with any closer data," he said.

Gregory D. Durgin, a professor who teaches satellite communications at the Georgia Institute of Technology, said that because Inmarsat was using a different kind of satellite in a novel way, he expects it would locate the last ping from the Malaysia Airlines lane within "around 100 miles (161 kilometers) of precision."

THE COMPANY

Inmarsat Plc started out in 1979 as an intergovernmental organization with the aim of helping ships communicate while at sea. It became a private company in 1999 and listed its shares in London in 2005. Customers now include governments, airlines, broadcast media, oil and gas companies, aid agencies as well as merchant shipping. They use hand-held satellite phones, laptop size Internet devices and antennas linked to the company's 10 satellites to communicate.