Hakan Lans (Sweden)

Bringing Bull's Eye Precision to the Skies

Hakan Lans, a 60-year-old Swede with a bushy moustache and a brain full of ideas, can point to a long list of prominent inventions. Besides developing an early computer mouse and computer colour graphics, Lans revolutionised the maritime and aviation industries with his invention of the STDMA data link. A massive upgrade over radar, it introduces new levels of precision - and ultimately greater safety.

When you look up at the sky, you may see an open and infinite space. But the heavens over modern airports are often as congested as an urban freeway.

As an eager multi-engine plane pilot hobbyist, Hakan Lans knows the problem of air traffic control all too well. So when he first read about the U.S. Global Positioning System (GPS) in 1981, Lans' mind kicked into overdrive, and landed him at the belief that the information GPS is able to send to an airplane - its exact three-dimensional position - should be shared with other pilots in the sky.

If that transmission could be repeated every second and displayed on a monitor inside the cockpit, Lans concluded, pilots could learn not only the positions of their own planes and the planes around them, but also call signs, planned routes and speeds of other objects. Traffic control would naturally have the same display, meaning they could steer planes with bull's eye-accuracy through the busy skies of the world.

Lans realized that all that was needed was a device to distribute the information constantly between the different receivers, and so he immediately started work on what would eventually result in the STDMA data link - his landmark invention.

More accurate than radar

There is actually quite a prelude to the STDMA success story, and it comes in the form of hands-on experience, hard work, and a whole lot of money. Lans has nearly four decades worth of scientific research experience in positions at the Swedish Defense Institute and the University of Stockholm, and he spent some 15 years and roughly $25 million worth of venture capital to develop, test and demonstrate the STDMA data link before the patent was published in 1997.

Making use of the GPS system, STDMA today is integral to two world standards managing traffic security: The VDL Mode 4 for air traffic, globally standardised by the International Civil Aviation; and the AIS system, a mandatory world standard for maritime traffic. In terms of accuracy and reliability, those systems represent quantum leaps over radar, the traditional method used by ship and air traffic control.

Aside from being expensive to set up, radar has limited accuracy: When two planes get uncomfortably close to one another, their signals may collide. This means airports have to ensure a wide separation of air traffic, which naturally slows down planes and causes delays costing billions of euros each year. In Europe alone, these costs are estimated to fall between €4 to 6 billion per year.

By contrast, the STDMA data link offers great upside, the most important one being precision. Satellites provide positional accuracy of 0.5 to 10 meters, a figure radar simply cannot match.

But accuracy isn't the only advantage Lans' system has over radar. While radar shows the position a plane had 10 seconds earlier, the much cheaper satellite-based system can tell not only the aircraft's present position, but also where it intends to fly. Lans' STDMA data link is able to manage up to 9,000 movable objects in a traffic system, over five times more than any other system can handle. That also makes the STDMA data link fit for the future of air traffic - which is expected to become even busier.

And there's more: Because all pilots see where they are and also see other planes, they can react quickly and independently in case of an imminent midair collision. In other words, they are no longer flying blind or are having to rely on radio messages from traffic control.

A landmark invention for air and water

Experts view the data link as one of the most important inventions ever for the maritime and aviation industry, and it could be only a matter of time before it is implemented in all aircraft.

The European Commission has spent an estimated €200 million to push the system, and major companies and airlines - such as Lufthansa, Alitalia and SAS - have tested it for more than 150,000 flight hours. Russia, which has a rather outdated radar system, has decided to switch completely to the system based on Lans' data link.

When it comes to maritime traffic, the AIS system, which uses the STDMA data link, has already become a mandatory world standard. Because of terror threats, the U.S. Department of Homeland Security has required all larger ships entering its ports to transmit via AIS. This allows harbour officials to know at all times a ship's cargo, location, destination, and speed.
A tireless inventor, Lans is already working on a new project, though he's keeping a low profile when talking about the details of his plans - for now at least. The question is whether we should be turning to the skies for any clues that might reveal the nature of his next potential discovery.

HOW IT WORKS

The two major positioning systems employing the STDMA data link are based on the same principle: Because the position of GNSS satellites (GPS, GLONAAS, Galileo) in relation to the centre of the earth is known at any time, the exact three-dimensional position (latitude, longitude and altitude) of a moving object, such as an airplane, can be calculated with the help of four GPS satellites and simple trigonometry. This information is then transmitted to all players in the traffic system - mainly planes and air traffic control - using radio waves, GNSS receivers and Lans' STDMA patent.

Because the planes may be moving at incredibly high speeds, the messages have to be re-sent frequently using the same radio frequencies for the information exchange. The STDMA data link, a computer algorithm, solves this problem by allowing for very short transmissions (called bursts) from multiple stations to be timely organised so that at any particular moment only one of the objects is transmitting. The algorithm is self-organising, which means that controlling functions are not needed. In this way detailed information of the moving objects - such as the plane's call sign, its altitude, course and ground speed - are re-transmitted at regular intervals down to every split second.

Everyone in the system has real-time access to the same data via similar graphic displays, thus vastly improving situational awareness and increasing flexibility by enabling pilots to at all times actually see where they are in comparison to other planes and the ground.