

RADIONAVIGATION AND LORAN
IN THE UNITED STATES

OCTOBER 2004

A Paper Delivered To The
International Loran Association
Tokyo, Japan
25 October 2004

By:

Langhorne Bond
Pittsboro, NC, USA
(919) 542-6614

Let me begin by referencing the U.S. Federal Radio navigation Plan of 2001, the latest version of the FRP. I know that the world community reads this with great interest, and it is certainly accurate enough. But it is not very informative because radio navigation in the US, like radio navigation worldwide, is in a state of constant evolution as technology, government decisions, and users choices develop. For the record, a new FRP is due and is held up until the US formally approves the long-term continuation of LORAN.

So I will touch on a few high points of this constantly changing landscape.

Insofar as GNSS is concerned, the arrival of GALILEO in 2008 is good news to civil users. The Dublin agreement this summer seems to have cleared out the major obstacles to an interoperable system for civil users, the NATO folks having succeeded in protecting the M code. My colleague David Last says a number of technical issues remain, but I hope and expect they will be worked out.

In the US the arrival of Galileo in 2008 presents some aviation issues that have not yet been publicly acknowledged. An aircraft receiver with GPS and Galileo will have both accuracy and integrity sufficient for a CAT I precision approach without augmentation such as WAAS (SBAS) OR LAAS (GBAS).

The WAAS system in the US is a reality and a large number of GPS WAAS receivers are in use in non-aviation applications, principally agriculture. But the aviation market has not yet developed. The air carriers, who perform 75% of the Instrument Meteorological Conditions (IMC) flight in the US will not equip with WAAS, so WAAS in aviation is a service to business and general aviation aircraft. The WAAS signal in space was approved for approaches to a decision height of 250 feet in July 2003 but so far only 1500 receivers have been sold. Furthermore, in October and November of 2003 a solar storm killed the WAAS approaches across the entire US. At the recent ION conference at Long Beach, CA, a prominent DOT advisor said that if this had occurred before July 2003 the signal would not have been approved. The WAAS picture is further clouded by the ongoing region-wide jamming of GPS by the US DOD. And in 2008, Galileo, when teamed with GPS, will provide a CAT I approach like WAAS.

The situation with LAAS (GBAS), is better known. The FAA has shelved LAAS until (much) more research indicates it can meet safety standards. In the US, LAAS is basically a CAT II and III system: only a few airlines are expressing interest in LAAS, perhaps because there are so few operation landings below CAT I weather conditions. In the US there are 1100 ILS's, 140 of which are CAT II & III on runways with the most traffic and bad weather. New technology does not always create new demand.

This leads me to the most significant recent issue for GNSS navigation: vulnerability. We all know the many instances of GPS failure caused by natural and man-made forces. The Volpe Center report is on everyone's desk, and the memory of the World Trade Center is fresh in our minds. Those of us who predicted this, I regret to say, have been proven right.

Secretary Mineta, bless his heart, recognized the gravity of the situation and endorsed the findings of the Volpe Center report. But the response of the navigation bureaucracies, FAA and Coast Guard, has been slow. While recognizing GNSS vulnerability in principle, the adoption of specific radio navigation redundancy strategies has not proceeded speedily. The government agencies, so deeply invested in GNSS projects, have been reluctant to recognize a new reality. As Sir John Keegan, the great military historian wrote, "The only thing harder than getting a new idea in a soldier's mind is getting the old idea out." Thus are wars lost. To quote the famous 9/11 Commission Report, "We suffered from a lack of imagination".

Which brings us to LORAN. The Volpe Center Report described LORAN as "theoretically the best back up to GPS". Since the full future potential of LORAN was unproven, an exhaustive program of studies and engineering tests of LORAN was undertaken. These studies and tests are now complete and the final reports were submitted to Secretary Mineta on April 1, 2004. Secretary Mineta wrote the Congress that the cost benefit studies and the engineering tests were all positive. LORAN meets FAA requirements for non-precision approach (RNP 0.3), The Coast Guard's harbor entrance and approach standards (8-20 meters), and provides precise time well below stratum I (100 nano-seconds) for telecom systems. LORAN's status is no longer "theoretical".

The US government is now in the final stages of approving LORAN for the long run by extending the 2008 service guarantee to the foreseeable future. In case there is doubt in anyone's mind, let me now assure you: it will happen.

The process, however, has taken longer than some, not including me, had expected.

When the final reports were printed in April (they are not yet public in their entirety), they were sent over to the brand new Department of Homeland Security. DHS, overwhelmed with traditional security tasks, was unexpected and unprepared. Radio navigation and timing infrastructure security were not on DHS's agenda. It is now. DHS is working to get up to speed on our favorite subject. I am learning that not everyone knows about sky waves, scintillation, and cesium fountains.

In addition to unfamiliarity at DHS, another temporary delay has popped up. Neither the Coast Guard nor FAA wants to pay all the costs of LORAN forever. Since the timing and positioning benefits of LORAN extend far beyond aviation and marine navigation, other agencies and users should share the cost. This Cartesian argument has the benefit of logic but not consistency. As far as I am concerned FAA and Coast Guard are getting GPS for free courtesy of the Defense budget and it is graceless to object to the tiny, and mostly temporary, cost of LORAN operation and modernization. The exact outcome of this unattractive argument is unknown, but I expect it will be resolved. After all, it is America's security that is on the line.

- Here is what I predict will happen:
- I. LORAN will be extended for the long run.
 - II. The argument about the allocation of LORAN costs will go forward separately.
 - III. The operation of the LORAN stations will be handed over to a national contractor, thus cutting the costs in half (to \$15 million) and freeing up nearly 200 Coast Guard billets for useful service elsewhere.
 - IV. The Congress will continue to provide \$20 million per year for continued recapitalization/modernization, which is 75% funded already and more than half complete.
 - V. The private sector will immediately produce secure integrated GNSS/LORAN nav and timing receivers.
 - VI. LORAN service will spread worldwide.
 - VII. The world will be a safer place.

Thank you.