

August 29, 2001
A RED LETTER DAY FOR GNSS
POSITIONING AND TIMING

A Statement to
DOT Hearing on
The Volpe Center Report

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I. INTRODUCTION

The Volpe Center Report on GPS navigation and timing dated 29 August 2001 is a seminal document. The findings and recommendations of the report will forever alter the design and use of GNSS systems-GPS, GLONASS, and GALILEO- for the better. Fully implemented, the reports findings will remove the doubts about the risks associated with satellite positioning and timing and will permit the fullest possible use of this remarkable technology by civilian users worldwide.

Special praise is due to Transportation Secretary Norm Mineta who read the report, immediately understood its technical soundness and beneficial potential, ordered its release, and directed several DOT operating units to come into compliance. The Secretary's example will be copied worldwide.

Much work lies ahead, as the report points out. But a journey of a thousand miles begins with a single step, and the Volpe Center Report is a giant step.

II. THE SIXTY DAY RESPONSE

Secretary Mineta directed the various DOT agencies-FAA, Coast Guard, FRA, FHWA- to report in 60 days on how to comply with the reports findings. Given the short time available, these responses will be a plan rather than a list of conclusions.

The preliminary nature of today's hearing precludes a detailed discussion of all the issues. The following items, therefore, constitute only a partial list of matters of concern.

III. DEFINING THE BACKUP REQUIREMENT

There has been a tendency to diminish the threat to GPS both in respect to the size of the outage and to the length of time. This is a mistake.

Specifically, it has been assumed that a backup system need only get the aircraft safely on the ground. Wrong.

The reality is that a loss of GPS could last for days or months. So the backup system must permit continued service for every phase of flight with an undiminished ability to provide full service.

Terrestrial nav systems would meet this requirement. But it is not so certain that inertial systems would meet the need for continuing high accuracy in complex domestic airspace.

An attack on the satellites could last a long time, as the Rumsfeld Commission has pointed out. And we would most likely be at war. Who today could say that we will never be engaged in a space war?

IV. TIMING

The Volpe Center Report correctly points out the vulnerability of the US telecommunication system's growing dependence on GPS timing. Unlike aviation and marine systems, however, there are no Federal safety standards in telecom. The truth is that no one has any idea of the scope of the risk here. The NTIA and the FCC should assign the highest priority to this task. As I said in my Dublin speech to ATCA, I now believe that GPS timing constitutes the greatest GPS risk to America.

V. THE DME DILEMMA

Astonishingly few people realize that all modern FMS-equipped aircraft rely for all navigation (except precision approach) on reception of multiple DMEs as the primary positioning system. The more DMEs in sight, the more accurate the fix. Some FMS's can scan as many as 18 DMEs at once. DMEs, however, are terrestrial line of sight transmitters and are lost over the horizon or behind hills. So we have 1,000 DMEs in the NAS.

EUROCONTROL, which has never contemplated GPS sole means, has recognized the importance of DMEs as a primary nav system and is planning to increase DME coverage.

FAA is headed in the opposite direction. FAA has published a plan to eliminate $\frac{3}{4}$ of the DMEs in the NAS. A map of the coverage of the remaining 250 DMEs has been released and it shows wide coverage of the US. But there's a catch-it only shows coverage at 6,000' AGL! Aircraft fly below 6,000' at least twice per flight, and this skeleton system will be useless to carrier and heavy biz jet aircraft. FAA refuses to release the list of 250 DMEs to be retained. This list should be made public and a discussion initiated about the number of DMEs (and VORs) needed as a primary nav system backup.

VI. THE ILS DILEMMA

A similar problem exists with the ILS array. Some 700 airports in the US are equipped with a total of 1000 ILSs. The ILS constitutes virtually the only non-GPS-dependent precision approach aid in the NAS. In my opinion the number that can safely be turned off is: none.

VII. INTERDEPENDENCE

In my Dublin paper I pointed out that GPS positioning and/or timing had crept into all three elements of the NAS system-communications, navigation and surveillance. Now we have a common failure mode that could bring down the entire ATC system.

FAA has no idea of the scope of this problem and should assign a high priority to solving it.

This problem may also exist in the marine field as well. It is likely that marine comm. and surveillance, in addition to DGPS navigation, have become GPS-dependent.

VIII. ESTABLISH FAA SAFETY STANDARDS FOR ATC

Secretary Mineta, in another farsighted decision, ordered FAA to establish a safety

oversight process for ATC.

Work on this directive is proceeding at a snail's pace. The single thread nature of GPS, as well as its vulnerability, has created significant safety problems in ATC. In addition, the economic rationale of ATC modernization has been undercut.

None of this would have happened if FAA had applied traditional aviation safety principles of fail-safe redundancy to ATC.

IX. BEEF UP THE IGEB

The 1996 PDD designated the Secretary of Transportation as the US coordinator for all civil uses of GPS. The mechanism for this oversight is the interagency GPS Executive Board.

This item, to quote David Hume, fell stillborn from the press. For a long time the IGEB didn't meet at all. Lately there was a breakthrough: a director, Greg Finley, was hired, and Becky Casswell comes over several days a week from the Coast Guard's Nav Center.

The IGEB needs more staff and, above all, Secretarial attention.

X. ENDORSE LORAN

The LORAN system in the US is being re-capitalized and the Tech Center in Atlantic City is doing solid work in proving that LORAN is an excellent nav system for aircraft. It works well with GPS and the stunning data gathered this summer clearly indicate that LORAN can provide an NPA.

LORAN also provides a powerful jam-resistant timing source, thus solving the GPS timing dilemma.

The bad news is that the long-term status of LORAN is still unresolved because the project is continued in the short term pending a long-term decision.

It is now time to end the suspense. The Secretary should state that LORAN is a permanent element of the navigation and timing infrastructure and will be continued until at least 2015.