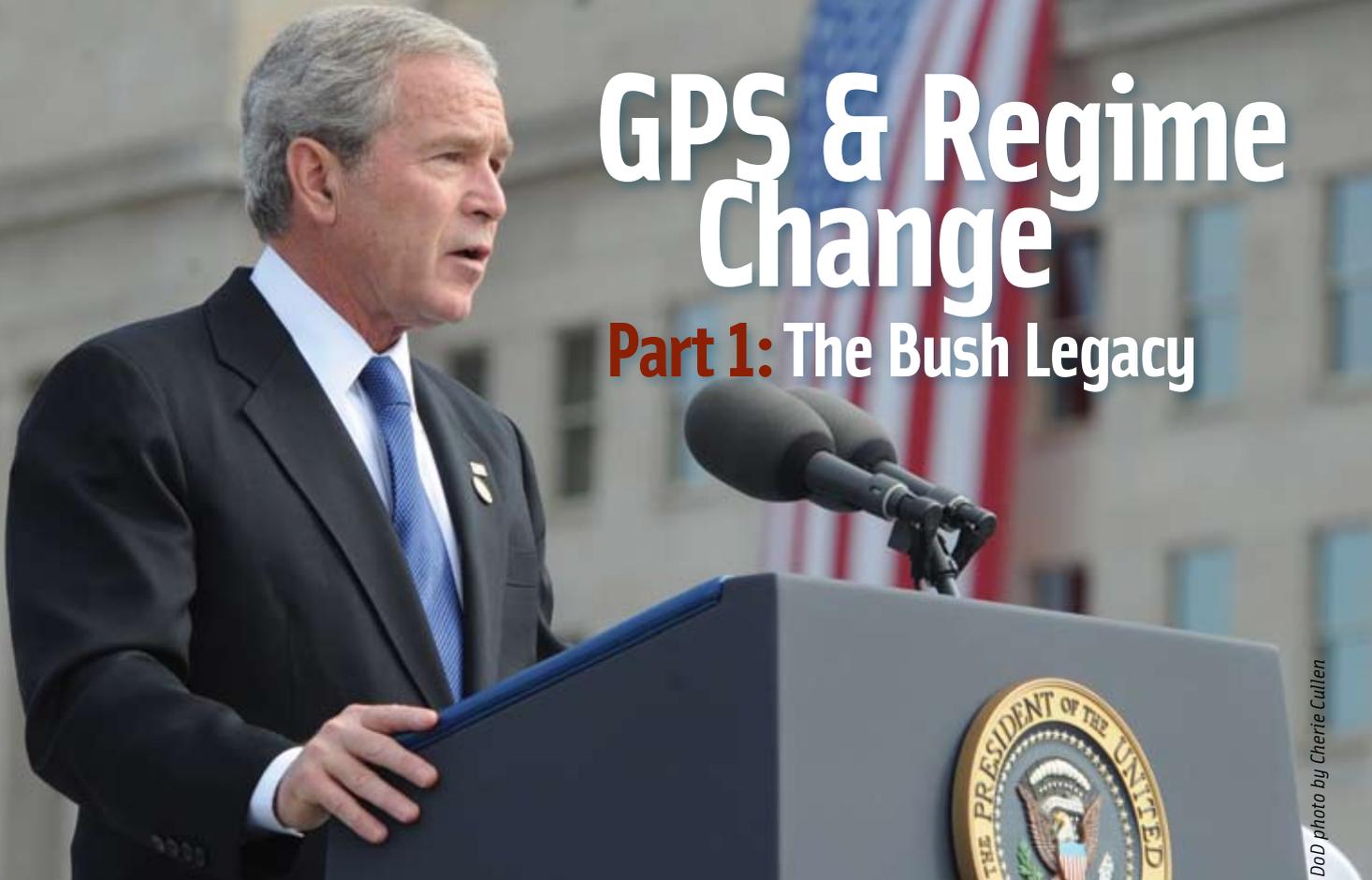


# GPS & Regime Change

## Part 1: The Bush Legacy



DoD photo by Cherie Cullen

GPS came a long way during the administration of President George W. Bush, although it could have gotten farther faster. And the incoming administration of Barack Obama still has a long way to go before GPS secures its place as not only the world's oldest GNSS system, but also the equal, if not the better of those GNSSes to come. But first, a look back at what the past eight years have wrought.

GLEN GIBBONS

Perhaps never has L. P. Hartley's opening line in *The Go-Between* — “The past is a foreign country: they do things differently there” — applied itself to such a short span of time.

The inauguration of George W. Bush as U.S. president on January 20, 2001, lies across a great divide from the present moment. The world that existed then — let alone the GNSS environment — now feels unfamiliar, even strangely innocent.

Soon a new division between past and future will occur: the passage from one national administration to another, from Republican George Bush to Democrat Barack Obama,

What will that mean for the Global Positioning System, its managers, users, competitors?

### The 21st Century, the 43rd President

When the Bush administration took the reins of government, it was before the towers toppled and the Pentagon itself bore the brunt of terrorism's new reach. It was a world with a 15-member European Union and a brand-new currency, the euro, with a value of 83 cents (US\$). A world with

an imploded Russia and a yet-to-be fully emboldened China.

In the GNSS realm, 2001 contained a failed GLONASS, an unrealized Galileo, an almost unimaginable Compass (although the first Beidou-1 launch had come a few months earlier). It was a world dominated by the Global Positioning System, which had succeeded beyond the wildest hopes of almost anyone who had seen its birth in late 1973.

And yet 23 years after its first satellite launch, GPS itself seemed under-realized as President Bush took office: a single civil signal — C/A-code — designed nearly 30 years earlier and dual-frequency military signals; 26 space vehicles (SVs) in orbit, mostly older Block II and IIA spacecraft; a global market of perhaps 16 million units with half of those sold in North America, no central coordination of federal policy and planning for GPS, little productive interaction with other would-be GNSS providers.

An Interagency GPS Executive Board (IGEB) established under the terms of President Bill Clinton's 1996 Presidential Decision Directive on GPS had failed to gain much traction in forging effective civil-military coordination. Funding for civil

improvements still came out of Department of Defense budgets dominated by DoD's operational requirements process.

Fast forward to late 2008: 31 GPS satellites in orbit, including six modernized Block IIR spacecraft (IIR-M) with a second civil signal (L2C) capability and a third civil signal (L5) to appear next year; the Next Generation GPS Control Segment (OCX) contract in hand and a billion-dollar program under way for Block IIIA satellites without selective availability. Meanwhile, GPS positioning accuracy has nearly doubled in terms of reduced signal-in-space user range error since 2001.

Today, GPS has the place of honor in a new National Security Policy Directive; a high-level Space-Based Positioning, Navigation, and Timing (PNT) Executive Committee

### **Despite its impressive accomplishments, GPS has lost its exclusive franchise and risks losing its leading position among the world's GNSSes**

with an international advisory board; a National Coordination Office facilitating consensus across executive agencies on GPS activities; and a national PNT architecture project, proposed by a 2005 Defense Science Board (DSB) task force on the Future of GPS, that is planning 20 years into the future.

The U.S. program now has a civil agency, the Department of Transportation, contributing funds for civil GPS modernization; participation in the International Committee on GNSS (ICG) and a series of bilateral agreements on GNSS cooperation.

The GPS worldwide user community is growing so rapidly that estimates are always lagging, but it almost certainly exceeds 500 million.

### **Yes, But . . .**

Despite the impressive list of cumulative accomplishments (see sidebar, "The Bush Legacy: GPS Milestones"), the GPS program's momentum has faltered over the past eight years, at times badly. Unreliable funding, schedule delays, lack of attention, over-confidence, under-appreciation, occasional program mismanagement, and absentee institutional governance. Take your pick of reasons: some, all, none.

The exclusive GNSS franchise of 2001 is gone, and GPS risks losing its leading position among the world's programs.

By 2013, GLONASS, Galileo, and Compass appear likely to boast robust, optimally configured, well-populated constellations with modernized satellites and signals — all before the United States can field its next round of GPS upgrades. The current GPS modernization schedule calls for the L2C signal to gain fully operational capability or FOC (transmitting on 24 satellites) by about 2016; L5 FOC, 2018; and L1C FOC, 2021.

Even the 31-satellite GPS constellation now in operation isn't the true three-plane, 30-slot configuration backed by the

## **The Bush Legacy GPS Milestones**

### **2001**

**December 1.** Deputy Secretary of Defense Paul Wolfowitz expresses resistance to Galileo in a letter to European defense ministers.

(**December 1.** Russia's system rebuilding project begins with the launch of a modernized GLONASS satellite prototype: GLONASS-M)

### **2002**

**November 25.** The U.S. Coast Guard moves from Transportation to the newly established Department of Homeland Security.

### **2004**

**June 26.** GPS-Galileo Cooperation agreement is signed by the United States and the European Union.

**December 8.** President George W. Bush signs National Security Policy Directive on U.S. Space-Based Positioning, Navigation, and Timing.

### **2005**

**August.** The Defense Science Board GPS Task Force releases report on the future of the Global Positioning System. Former Secretary of Defense and Energy James R. Schlesinger and Robert J. Hermann, Director of the DoD National Reconnaissance Office, are coauthors.

**September 26.** First modernized GPS Block IIR satellite (IIR-M) with second civil signal L2C is launched.

**December 1-2.** International Committee on Global Navigation Satellite Systems (ICG) founded with United States membership.

(**December 28.** First Galileo experimental satellite launched. Transmissions begin January 12, 2006.)

### **2006**

**January 24.** National Space-Based Positioning, Navigation, and Timing Executive Committee (PNT ExCom) chartered by Secretary of Defense Donald Rumsfeld and Secretary of Transportation Norman Mineta and cochaired by their deputies. National PNT Coordination Office up and running.

**December 16.** U.S. Air Force begins transmitting second civil GPS signal, a data-less L2C, following September launch of first IIR-M.

### **2007**

(**April 14.** China launches first middle Earth orbiting Compass/Beidou-2 satellite)

**July 26.** U.S. and E.U. agree on multiplex binary offset carrier design for common GPS-Galileo civil signal.

**September 4.** Second ICG meeting creates a Providers Forum. The United States, European Union, Russian Federation, People's Republic of China, Japan, and India are members.

**September 14.** New Block IIF satellites will be managed using new digital communications and a new message format for telemetry, tracking, and control (TT&C), the first steps in implementing the Architecture Evolution Plan (AEP) for the GPS Operational Control Segment

**September 18.** President eliminates selective availability (SA) from GPS Block III satellites and subsequent generations.

**November 21.** Next Generation GPS Control Segment (OCX) contracts awarded to two new vendors — Northrop Grumman Corporation and Raytheon.

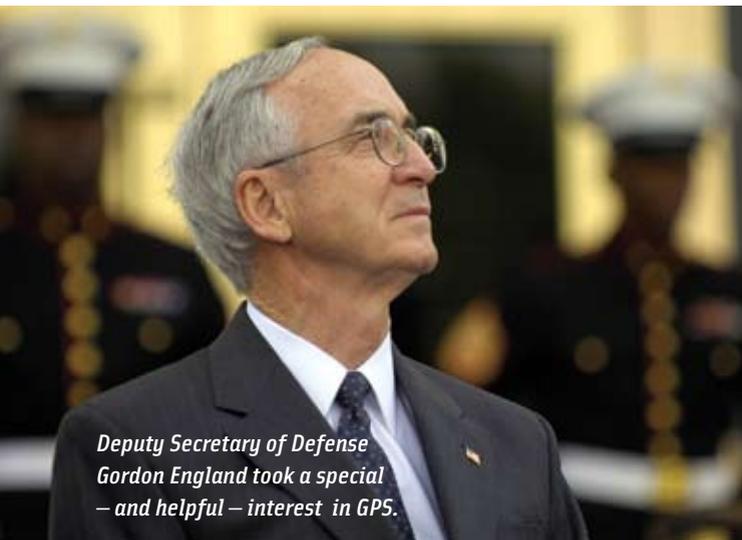
### **2008**

**March 20.** First civil U.S. Department of Transportation (DoT) sets aside \$7.2 million for GPS improvement in FY2008 as a down payment of a five-year civil contribution of more than \$200 million

**May 15.** GPS III contract signed with prime contractor Lockheed Martin.

**October 6.** Assistant Secretary of Defense John Grimes signs new GPS Standard Positioning Service (SPS) Performance Standard, the first update since 2001.

**October 31.** Federal Aviation Administration issues first performance standard for the GPS Wide Area Augmentation System (WAAS).



*Deputy Secretary of Defense Gordon England took a special — and helpful — interest in GPS.*

DOD photo, Tech. Sgt. Jerry Morrison

DSB task force and considered optimal for global coverage. It's actually 31 SVs clustered around 24 slots in a six-plane constellation.

And 12 of those 31 satellites are on the “watch list” of the 2d Space Operations Squadron at Schriever Air Force Base, which manages the system.

Meanwhile, component problems on the last two IIR-M satellites and delays in passing thermo-vac tests by the first Block IIF spacecraft has forced a yearlong break in satellite launches. In the near term, the GPS system faces a real possibility of declining capability, what some observers are calling the risk of “GPS brown-outs.”

So, the Bush legacy on GPS comprises a mixed result: solid improvement in international cooperation and a promising start at interagency coordination of PNT activities, but the robustness of the system infrastructure is in doubt — at a time when the nation's financial and economic straits will complicate federal budgets in general.

## Making Peace with the World

Unlike the general experience in foreign relations during the past eight years, international cooperation in GNSS affairs has become a hallmark of the Bush administration.

But it didn't come easy.

On December 1, 2001, U.S. Deputy Secretary of Defense Paul Wolfowitz sent a not-so-secret letter to defense ministers in NATO countries, charging that signals from Galileo satellites might interfere with the military GPS M-code signals and could be used for military purposes.

The real audience, however, was EU transport ministers who were scheduled to meet a few months later to decide the fate of Galileo.

A year and a half earlier, as momentum seemed to be gathering behind creation of a full-fledged European GNSS, Dan Goldin, then NASA director in the Clinton administration, announced at an Edinburgh, Scotland conference that selective availability (SA) — a time-dithering technique that degraded the civil GPS signal — was being turned off effective May 1, 2000.

Both efforts were thinly veiled attempts to convince European leaders that they didn't need to build their own system — that GPS was truly a dual-use system and would provide the higher accuracy demanded by civil user communities.

Ultimately, the effort backfired.

In a March 25–26, 2002, meeting EU transport ministers unanimously approved release of €450 million to finance the development phase of Galileo in addition to €100 million already committed from the EU budget and the €550 million approved by the European Space Agency.

The Bush administration was probably the last to recognize that Galileo — like GLONASS before it, and Compass after it — was not really about technological need or marketplace demand, but rather about political sovereignty and strategic infrastructure.

Within two years, U.S. policy had made a 180-degree turn — opening negotiations with the European Commission and signing a cooperation agreement on June 26, 2004, to try and create compatible and interoperable systems.

Two important factors drove the reversal of effort: Galileo was going to happen regardless of U.S. wishes and the persistence of State Department career diplomats, particularly in the Office of Space and Advanced Technology, who negotiated the EU agreement and other bilateral GNSS accords with Russia, Japan, India, and Australia.

Once the tide turned, even DoD officials — particularly in the GPS Wing — have shown increasing willingness to support U.S. cooperation with other GNSS systems — probably in part because the emergence of other systems can reduce the civil demands on GPS, which have a way of rolling over into the military requirements process . . . and budgets.

## GPS Modernization: Reforming “Reform”

The retrospective view, which compresses events and filters out details, conveys a sense of steady progress in GPS affairs under the Bush administration — warranted to a large degree. But it also obscures the fact that some things have not gone as well as they could have.

Modernization of the space and ground segments is three to five years behind the original plans. The contract for the Block IIF generation of spacecraft was awarded in April 1996 to Rockwell International (now Boeing Integrated Defense Systems).

At the time, the first satellite delivery was scheduled for April 2001, with the first launch expected by the end of that year. As 2008 is about to wear out its welcome and leave, the IIF program has yet to launch a satellite more than 12 years after the contract award.

Informed observers say that the GPS Block III, which has been in the works since the late 1990s, might have been able to launch by 2009 — rather than the 2014 date now targeted. And the same with OCX.

Defenders of the program lay a good deal of the blame off on so-called “acquisition reform” championed by Darleen Druyan, principal deputy assistant secretary of the Air Force in the mid-1990s. Also known as “total system performance

responsibility” (TSPR), acquisition reform was intended to take DoD out of the development process as much as possible and leave the prime contractor responsible for delivering a working system.

As one observer described the approach, acquisition reform assumed “you could throw a contract over the transom and four or five years later you’d have a satellite.”

Instead, in a dynamic technological and operational environment where capabilities and requirements changed rapidly, TSPR created a disconnect between the vendors and customer (DoD). Meanwhile, the Air Force on several occasions pulled funds away from GPS programs, particularly GPS III, to feed other program suffering cost overruns.

The fact that GPS appeared to be performing better than advertised actually worked against it in this situation. With the nation’s satellite navigation program seemingly trouble-free, other squeaky wheels got the GPS grease.

It took nearly a decade before Ron Sega, a newly installed the new undersecretary of the Air Force in charge of acquisition, came up with the theme, “back to the basics,” and reformed acquisition reform.

That meant, in the words of the current GPS Wing commander Col. David Madden, “We applied the lessons that industry has learned over the past decade and reinstated both technical and management standards in many areas. These provide the basis for verifying the quality of the technical work and ensuring issues are surfaced earlier in the program.”

## Governance: What Didn’t Work and What Did

Lack of effective governance and the money that builds programs and makes them manageable has hindered many public projects. But GPS has faced an additional complication that at first glance seems like a strength: its broad application and benefits.

In the context of the federal government, however, that has made it a peculiar kind of orphan, without a strong institutional patron or unified constituency in a single user community.

It was tough enough in the early days when GPS was essentially a military program. But once GPS became recognized as probably the first, true dual-use program — civil and military — a status enshrined in the 1996 presidential decision directive (PDD) — things really got tough.

Especially as civil users realized that a single, degradable, low-powered satellite signal designed around 1970s computer

processing capability and electronics — the L1 C/A-code — would not do all that they wanted it to do.

During an era when down-sizing government became a rote mantra, just getting officials to sit at a table where the GPS program was being discussed, especially in the context of financing modernization, was difficult

The 1996 PDD tried to address that situation by creating the Interagency GPS Executive Board (IGEB), an underfunded entity lacking a substantial staff or a distinct physical and institutional locus.

The situation improved somewhat when Bush’s 2004 NSPD replaced the IGEB with the PNT ExCom. Where the 1996 PDD had underlined the dual-use character of GPS and sought to draw in civil agencies to the program, the NSPD focused on the security and defense aspects of GPS and its primacy in the international sphere.

Leadership — still with DoT and DoD co-chairs — was elevated to the deputy secretary level, the number-two positions in the federal agencies. The PNT ExCom had another stroke of fortune: the DoD deputy, Gordon England, took a special interest in the work of the committee.

A prestigious advisory board was appointed, chaired by James Schlesinger (a former defense and CIA chief who had co-chaired the DSB task force on GPS) with Brad Parkinson, who organized and ran the GPS Joint Program Office in the 1970s, as vice-chair.



White House photo

Although the ExCom has no more power than the IGEB to direct GPS- or PNT-related activities of individual agencies, it has managed to keep ExCom members focused on accomplishing the self-selected tasks (or those mandated by the NSPD) that they’ve taken on. The emergence (and convergence) of England and Schlesinger as champions of GPS during the Bush administration added gravitas and momentum.

As the Bush administration turns into that of Barack Obama, the near-

and long-term prospects for GPS remain to be determined. The salient issues of infrastructure sustainment and modernization, program governance and funding, and international cooperation and competition will head the list in the new administration, too.

*Part 2 of this series will take up the question of “what lies ahead” in the January/February issue of Inside GNSS. [G]*