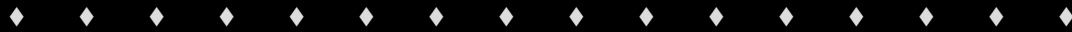


# DOT Vulnerability Study

**Navigation Architecture**

**Industry Day**

**7 May 2002**



**Michael Shaw**

**U.S. Department of Transportation**





# Overview

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- **Background**
- **Action Plan**
- **Radionavigation Systems Task Force**
- **Summary**



# Background

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- **PDD-63** tasked **GPS Vulnerability Study**
  - Analyze civil **aviation, maritime, and surface** use
    - Assess the ways each is impacted by GPS outage
  - Recommend steps to **minimize impacts** of GPS outages
    - Safety, operational, environmental, and economic
- **Overall Finding**
  - GPS is **vulnerable to interference/disruption**
  - Independent **backup systems/procedures** needed in critical applications



# Background (cont'd)

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- Report had **16 specific recommendations** to mitigate the impact on transportation systems
  - Continue **GPS Modernization** to include GPS III
    - More civil signals/higher broadcast power
  - Implement **appropriate mitigation** strategies
    - For each individual mode, maintain appropriate backup systems or procedures
    - Reflect impact of interference in application designs
    - Monitor/report/locate sources of interference
    - Applicability of military anti-jam technology
  - DOT develop **Navigation Infrastructure Roadmap** for the future



# Background (cont'd)

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- **December 01** – Briefed review of Volpe GPS Vulnerability Study to Deputy Secretary
  - Operating Administrations concurred
  - **January 02** - Forwarded action plan to Secretary for approval
- **March 02** - Secretary approved action plan
  - Department is currently **implementing plan**
  - DOT Positioning and Navigation **Executive Committee** overseeing implementation
  - Task Force will perform a **Capabilities Assessment**



# Overview

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# Action Plan Goals

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- Ensure that **GPS** fulfills its potential as a **key element** of the nation's transportation infrastructure
- Ensure that the vulnerabilities identified in the report **do not affect the safety and security** of our transportation system
- **12 elements**



# Action Plan Elements

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- Continue **modernizing GPS** with DoD
- Improve **interference detection**
- Facilitate civil use of appropriate military **anti-jam technology**
- Continue **spectrum protection**
- **Certify** safety-critical GPS receivers
- Develop **receiver standards** with industry
- **Public awareness** about GPS risks
  - Cooperation with industry and local DOTs
  - Outreach and education programs



# Action Plan Elements

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- Maintain adequate **backup systems**
- Complete a **radionavigation capabilities assessment** across all modes of transportation
- Identify **appropriate mix** of radionavigation systems
  - Including a decision on future of **Loran-C**
- Decisions to be reflected in **2003 Federal Radionavigation Plan (FRP)**



# Overview

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- **Background**
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- **Summary**



# Radionavigation Systems Task Force

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- Chartered by DOT POS/NAV Exec Committee to conduct a **multi-modal capability assessment** of radionavigation systems
- Complete **assessment of the future mix** of systems to meet all requirements of the U.S. Transportation Infrastructure
  - From both a **capability and cost perspective**
  - Consider requirements of **non-transportation users** of Federal Radionavigation Systems
- Provide **recommendation to Secretary** by end of CY02



# Technical Approach

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- **Develop alternatives** for system of systems mixes
  - Based on technical assessment versus cost
  - Requirement for backups to GPS
- Other **additional factors**
  - Impact on other U.S. Gov't systems and operations
  - User equipage
  - Interagency agreements and international commitments
  - Political considerations
- Provide recommendation on mix of systems to satisfy **national need for radionavigation, positioning, and timing services** for at least the next 10 years



# Timelines

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- **May 02:** Complete capability assessment vs cost and develop alternatives for mixes
- **Aug 02:** Complete assessment of additional factors early Aug 02
- **Aug 02:** Prepare draft recommendation for most appropriate mix of systems
- **Oct 02:** Complete POS/NAV EC clearance
- **Nov 02:** Submit recommendation to SECDOT
- **Dec 02:** SECDOT approval and press release

**Conduct User Outreach Throughout**



# Outreach

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- **DOT OPS Administrations and other Agencies**
  - Participating on Task Force
  - Interacting with constituency
- **Early May 2002** – Conduct FAA Navigation Architecture Industry Day
- **Early Jun 2002** – Publish a Federal Registry Notice announcement on public meeting and solicit comments on selected alternatives



# Outreach (Cont)

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- **Early Jun 2002** – Notice on CGSIC Website to announce public meeting and solicit comments on selected alternatives
- **Late Jun 2002** – General Public Outreach Meeting to discuss and solicit feedback on selected alternatives
- **Early Sep 2002** - 2<sup>nd</sup> General Public Outreach Meeting to solicit feedback on recommended mix of systems

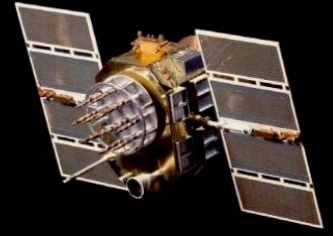


# Summary

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- Department **concurs with all recommendations** of the Volpe report
- Safety-critical transportation applications that use GPS **currently have adequate backups** in case of GPS disruptions
- Department is implementing **Action Plan**
  - Completing Assessment of future radionavigation mix to maintain adequate backups in the future

**Infrastructure Protection Will Be A Continuing Issue**

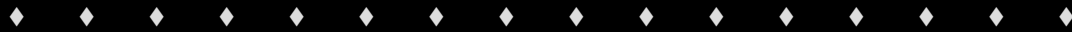


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# Backups



# Modal Assessment Summary

Recommendation	Security	Rail	Highway	Maritime	Aviation
1. Safety-Critical Backups	A	A	A	A	A
2. Acceptable Risk Levels	A	A	A	A	A
3. GPS Modernization	A	A	A	A	A
4. Spectrum Protection	A	A	A	A	A
5. Receiver Certification	A	A w/c	A w/c	A w/c	A
6. User Training	A	A	A w/c	A	A
7. Report Interference	A	A	A w/c	A	A
8. Anti-Jam Technology	A	A	A	A	A

**A = Agree**  
**D = Disagree**

**w/c = With Comment**  
**n/a = Not Applicable**



# Modal Assessment Summary

Recommendation	Security	Rail	Highway	Maritime	Aviation
9. Anti-Spoof Technology	A	A	A	A	A
10. User Notification	A	A	A	A	A
11. User Awareness	A	A	A w/c	A	A
12. Integrity	A	A	A	A	A
13. Receiver Features	A	A	A	A	A
14. Cost Analysis	A	n/a	A	A	A
15. Modernize Loran-C	A	n/a	n/a	A w/c	A
16. DOT Roadmap	A	A	A	A	A

**A = Agree**  
**D = Disagree**

**w/c = With Comment**  
**n/a = Not Applicable**