

## 14. Space Segment



The space segment of the Global Positioning System currently consists of approximately 30 active and spare NAVSTAR satellites (new satellites are launched periodically, and old ones are decommissioned). "NAVSTAR" stands for "NAVigation System with Timing And Ranging." Each satellite circles the Earth every 12 hours in **sidereal time** along one of six orbital "planes" at an altitude of 20,200 km (about 12,500 miles). The satellites broadcast signals used by GPS receivers on the ground to measure positions. The satellites are arrayed such that at least four are "in view" everywhere on or near the Earth's surface at all times, with typically up to eight and potentially 12 "in view" at any given time.



**Figure 5.15.1 The constellation of GPS satellites.**

*Credit: Illustration © Smithsonian Institution, 1988. Used by Permission.*

### Try This!

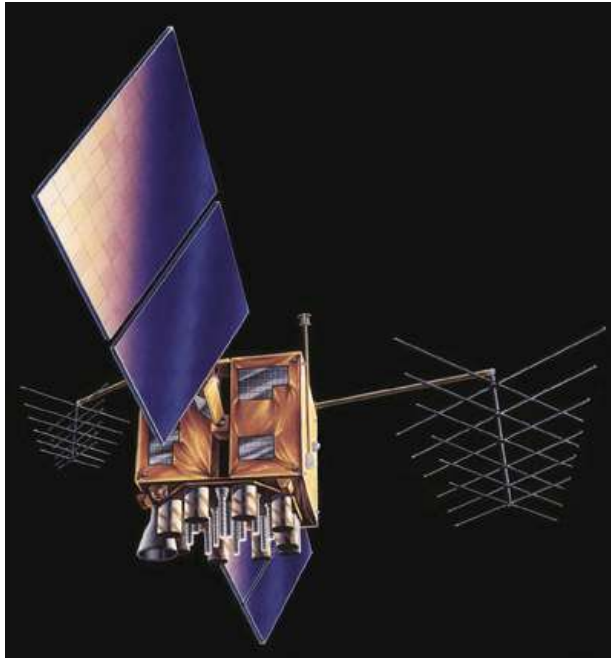
The U.S. Coast Guard's Navigation Center publishes status reports on the GPS satellite constellation. Its report of August 17, 2010, for example, listed 31 satellites, five to six in each of the six orbital planes (A-F), and one scheduled outage, on August 19, 2010. [You can look up the current status of the constellation here.](#)

### The Nature of Geographic Information

### Chapters

- ▶ [Chapter 1: Data and Information](#)
- ▶ Chapter 2: Scales and Transformations
- ▶ [Chapter 3: Census Data and Thematic Maps](#)
- ▶ [Chapter 4: TIGER, Topology and Geocoding](#)
- ▼ [Chapter 5: Land Surveying and GPS](#)
  - 1. Overview
  - 2. Geospatial Data Quality
  - 3. Error and Uncertainty
  - 4. Systematic vs. Random Errors
  - 5. Survey Control
  - 6. Measuring Angles
  - 7. Measuring Distances
  - 8. Horizontal Positions
  - 9. Traverse
  - 10. Triangulation
  - 11. Trilateration
  - 12. Vertical Positions
  - 13. Global Positioning System
  - **14. Space Segment**



**Figure 5.15.2 Artist's rendition of a NAVSTAR satellite**

*Credit: NAVSTAR GPS Joint Program Office, n.d.*



This textbook is used as a resource in Penn State's Online Geospatial Education online degree and certificate programs. If this topic is interesting to you and you want to learn more about online GIS and GEOINT education at Penn State, check out our [Geospatial Education Program Office](#).

◀ 13. Global Positioning System

up

15. Control Segment ▶

- 15. Control Segment
- 16. User Segment
- 17. Satellite Ranging
- 18. GPS Error Sources
- 19. User Equivalent Range Errors
- 20. Dilution of Precision
- 21. GPS Error Correction
- 22. Differential Correction
- 23. Real-Time Differential Correction
- 24. Post-Processed Differential Correction
- 25. Summary
- 26. Bibliography

▶ [Chapter 6: National Spatial Data Infrastructure I](#)

▶ [Chapter 7: National Spatial Data Infrastructure II](#)

▶ [Chapter 8: Remotely Sensed Image Data](#)

▶ [Chapter 9: Integrating Geographic Data](#)

## Navigation

- [login](#)
- [Search](#)

Author: David DiBiase, Senior Lecturer, John A. Dutton e-Education Institute, and Director of Education, Industry Solutions, Esri. Instructors and contributors: Jim Sloan, Senior Lecturer, John A. Dutton e-Education Institute; Ryan Baxter, Senior Research Assistant, John A. Dutton e-Education Institute, Beth King, Senior Lecturer, John A. Dutton e-Education Institute and Assistant Program Manager for Online Geospatial Education, and Adrienne Goldsberry, Senior Lecturer, John A. Dutton e-Education Institute; College of Earth and Mineral Sciences, The Pennsylvania State University.

Penn State Professional Masters Degree in GIS: Winner of the 2009 Sloan Consortium award for Most Outstanding Online Program

This courseware module is offered as part of the Repository of Open and Affordable Materials at Penn State.

Except where otherwise noted, content on this site is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

The College of Earth and Mineral Sciences is committed to making its websites accessible to all users, and welcomes comments or suggestions on access improvements. Please send comments or suggestions on accessibility to the site editor. The site editor may also be contacted with questions or comments about this Open Educational Resource.



The John A. Dutton Institute for Teaching and Learning Excellence is the learning design unit of the College of Earth and Mineral Sciences at The Pennsylvania State University.

#### Navigation

- [Home](#)
- [News](#)
- [About](#)
- [Contact Us](#)
- [People](#)
- [Resources](#)
- [Services](#)
- [Login](#)

#### EMS

- [College of Earth and Mineral Sciences](#)
- [Department of Energy and Mineral Engineering](#)
- [Department of Geography](#)
- [Department of Geosciences](#)
- [Department of Materials Science and Engineering](#)
- [Department of Meteorology and Atmospheric Science](#)
- [Earth and Environmental Systems Institute](#)
- [Earth and Mineral Sciences Energy Institute](#)

#### Programs

- [Online Geospatial Education Programs](#)
- [iMPS in Renewable Energy and Sustainability Policy Program Office](#)
- [BA in Energy and Sustainability Policy Program Office](#)

#### Related Links

- [Penn State Digital Learning Cooperative](#)
- [Penn State World Campus](#)
- [Web Learning @ Penn State](#)



2217 Earth and Engineering Sciences Building, University Park, Pennsylvania, 16802  
[Contact Us](#)

[Privacy & Legal Statements](#) | [Copyright Information](#)  
The Pennsylvania State University ©  
2023