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Issue 9: From the Guest Editors

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Successful navigation requires an understanding of location, course and distance. Early travelers depended on the position of the sun and the stars as well crude compasses and sextants to aid them in their journeys. Early in the 20th century, application of technology created two significant advancements: the internal combustion engine and the airplane. These technologies complicated the problem of navigation by introducing altitude as a variable while at the same time they expanded our range and the speeds at which we began to propel ourselves. Demand for more precise position information, altitude and range has multiplied as we continue to challenge the limits of our technologies.

Out of the need and demand for such precise positioning and navigation requirements came advances in navigation technologies enabled by, and flown on, satellites. It is a simple concept. Like stars, satellites can form constellations providing properly equipped users with precise location, direction and velocity in three-dimensional space. Moreover, when fixed with known locations, or waypoints, distance can be determined.

In the beginning, complex and difficult issues had to be overcome. Issues such as:

1. The immature development of existing technologies. Future development would exact substantial overhead in power, speed, size, weight, and cost that, at that time, made such a system impractical. Existing technologies required excessively complex systems.
2. Fundamental management decisions that would allocate resources between satellite and user equipment development.
3. The then existing navigation systems called into question the need for developing a new and unproven design.
4. To what degree should or would the globe be covered?
5. Should the system be "passive" or "active?"
6. Should this new system be for military use only, or should it be made available to all users?
7. What would be the type and what would be the level of benefits for having almost instantaneous access to precise location for both civilian and military uses?

Those charged with making these decisions will do so in a constantly changing technological, economic and political environment. Like many, I take for granted the precise navigation we all enjoy.

This was not always the case.

In the latter part of the 1970's, space-based navigation was only an untried concept in the process of validation. My introduction to space-based navigation began in 1977 when I was assigned as a member of the Department of Defense's NAVSTAR Global Positioning System (GPS) Joint Program Office (JPO). The U.S. Air Force was the lead service in this joint-service development at Space Division in Los Angeles, and during that time, I served in program control and engineering. With the combined resources of the Air Force, Army, Navy, Marine Corps, Defense Mapping Agency, Coast Guard and several of the (original) NATO countries, the JPO launched test satellites, fielded a variety of user equipment and operated a satellite control station that eventually validated the system.

By the early 1980's, full-scale engineering development for the three Global Positioning System segments (space, user, and control) was in full swing. Since then, the development, growth and deployment of GPS worldwide has greatly exceeded the expectations of those of us involved in its initial development.

GPS is now a mature system with new challenges, issues, applications and almost endless opportunities and potential. It also requires a continued focus on not only GPS, but what role and how it interfaces with all the existing and future constellations that constitute the Global Navigation Satellite System (GNSS).

Welcome to Issue 9 of the Online Journal of Space Communication as we discuss the Global Navigation Satellite System, its past, present and the direction its taking us.

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