

ECE Distinguished Seminar Series

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Impact of GPS Modernization and Galileo on Aviation

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Abstract: Today, the Global Positioning System (GPS) includes 28 satellites that provide position, velocity and time (PVT) information to over 40 million users worldwide. This capability is available 24 hours per day in all weather. The position accuracy ranges from 10 meters for stand-alone receivers to ten centimeters for users that are connected to a nearby reference receiver. These PVT capabilities serve a breath-taking variety of applications. Consider two far flung examples. GPS is included on every new Boeing or Airbus jet for enroute guidance. In the near future, GPS will be included in most new cell phones and smart phones so that the position of emergency callers is automatically reported to the public safety officials. Remarkably, the strength of this capability will multiply in the next decade. GPS will triple the number of signals available to civilians. This frequency diversity will enable greater accuracy and more robust operation indoors and downtown. The Europeans are about to launch a similar system called Galileo. With GPS and Galileo, users of satellite navigation would have 60 three-frequency satellites on orbit. This talk will introduce the basic workings of GPS and Galileo. It will then describe the new signals and the benefits they will bring to aviation. It will close with a cautionary note on the vulnerability of all satellite signals, and the techniques available to mitigate this vulnerability.

Biography: Per Enge is a Professor of Aeronautics and Astronautics at Stanford University, where he is the Kleiner-Perkins, Mayfield, Sequoia Capital Professor in the School of Engineering. He is also the Director of the GPS Research Laboratory, which works with the Federal Aviation Administration, U.S. Navy and U.S. Air Force to pioneer systems that augment the Global Positioning System (GPS). Of these, the Wide Area Augmentation System (WAAS) supports smaller airplanes at all airports across the conterminous United States. It became operational in July of 2003. The Local Area Augmentation System (LAAS) supports larger airplanes at high-traffic hub airports. In time, it will enable automatic landings. Earlier in his career, Per worked with the US Coast Guard to design a medium frequency (MF) radio system to broadcast differential GPS corrections to maritime users. Today, this system covers much of the world's coastline and provides differential GPS data to 1.5 million users. Per has received the Kepler, Thurlow and Burka Awards from the Institute of Navigation for his work. He is also a Member of the National Academy of Engineers (NAE), Fellow of the ION and a Fellow of the IEEE.