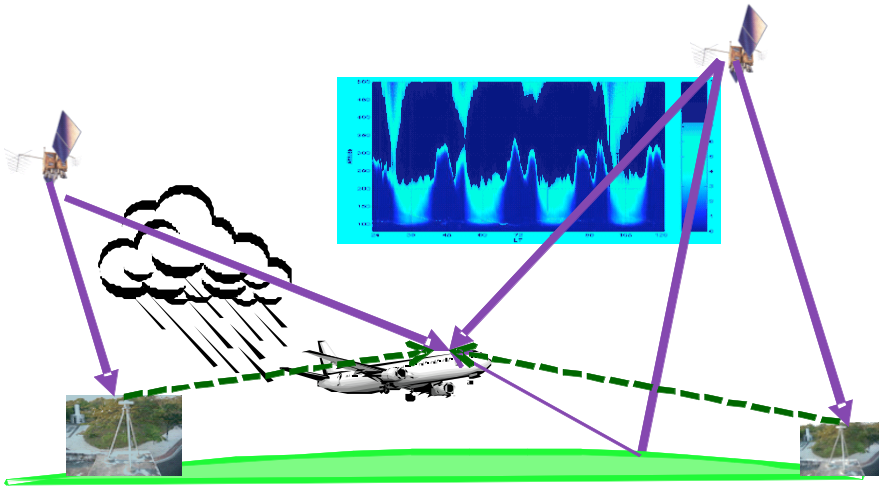
Three-Frequency Based High Precision GPS Receiver Development for Navigation Applications

PI: Jade Morton, Miami University, Frank van Graas, Ohio University
Sponsor: Air Force Office of Scientific Research (AFOSR)



This objective of this project is to use a systems engineering approach to design and develop high precision three-frequency GPS receivers for local and regional areas as well as global operation using both carrier phase and code phase measurements. Both differential and single receiver architecture will be developed. Multi-lane geometry-free based approaches will be used to resolve carrier phase integer ambiguities. Ionosphere-free combinations of the three frequency carrier phase measurements will be used to reduce the ionosphereic error, while troposphere models and local measurements will be incorporated as the main tool to characterize troposphere delay. To ensure receiver performance integrity, multiple innovative cycle slip detection methods will be implemented. Special effort will be made toward the handling of signal degradation and drop outs during operation, multipath mitigation, and optimal receiver tracking loop design. WAAS augmentation system and real time precision orbit and satellite clock correction will also be incorporated into the receiver for wide area differential system and precision point position purposes. We will also investigate higher order ionosphere error under both quiet and disturbed conditions using the three-frequency receiver platform. Vigorous validation procedures will be applied to the algorithms and techniques developed in the study. Our goal is to achieve 1~ 2cm position precision for local area differential systems and 10~20cm precision for wide area and single receiver systems under normal operating conditions.