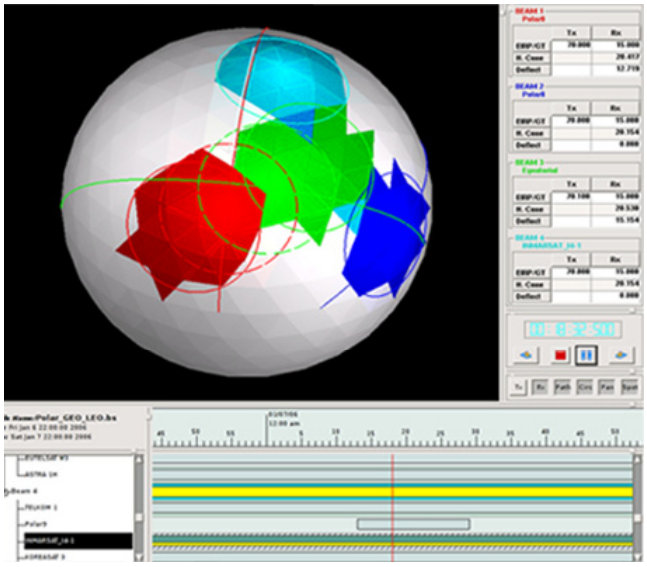
Antenna Control Computer



Beam Arbitration Module

Description

Large-scale Tracking, Telemetry, and Command (TT&C) phased arrays provide significant operational improvements including increasing capacity and throughput.

The Antenna Control Computer (ACC) for the TT&C Phased Array Antenna was originally developed under a Phase I and II SBIR project for Air Force Research Laboratory Sensor Directorate (AFRL/SN). The ACC provides beamsteering control, contact scheduling, beam walking and panel resources management, satellite aquisition, and tracking for a new generation of multi beam, multi-band phased array antenna designs. Now a Phase III follow-on development project, the ACC has been developed for integration with a new Geodesic Dome Phased Array Antenna (GPAA), a hemispherical SGLS USB TT&C phased array being developed under an Air Force Advanced Technology Development (ATD) project.

Under a new project in collaboration with the AFRL/SN, Space Battle Lab, 22nd Satellite Operations Squadron, and Space and Missile Systems Center (SMC), CME is developing new software capabilities and algorithms for the GPAA program including; intelligent scheduling of satellite contacts, automated resource allocation, and arbitration of the antenna array elements. The ACC enables local and remote scheduling that will ultimately support networking and global resources scheduling of GPAA network and ground segment, remote tracking stations. CME is also developing innovative, passive tracking algorithms that minimize sensitivity to fluctuations in received signal attenuation.

Applications

With the rapidly increasing use of satellite technology in both military and commercial applications, the Air Force Satellite Control Network (AFSCN) is currently in the process of modernizing its capabilities to meet the growing demand for contact resources. As part of this modernization, the AFRL is developing a GDPAA that consists of thousands of phased array elements on a multi-planar dome structure. The GDPAA would support all of the functions of the existing system including satellite TT&C. Its phased array dome structure would allow the formation of multiple active beams to enable multiple contacts simultaneously with substantially reduced turnaround time between passes, thereby providing more funtionality than multiple dish antennas. The first full-sized GDPAA is planned for fielding in 2013. The ACC can also be leveraged for other emerging satellite program ground segments. The ACC has been demonstrated in field testing with a six-panel phased array antenna.

Key features & benefits

- Frequency independent, antenna controller
- Phased array steering and beam walking
- Multiple satellite acquisition and coverage
- Arbitration of conflicting beams
- Passive satellite tracking
- Algorithmic control for multi-beam resources
- Ephemeris computations of satellite tracks
- Seamless integration with AFSCN architecture
- Optimal beam allocation and contact scheduling
- Technologies under development:
  - Tx and Rx power scalable to satellite requirements
  - Multifaceted beam forming and control simulation
  - Advanced passive tracking and searching
  - Full system simulation
  - Redundancy and hot swap capabilities
  - Optimized sequence and currency
  - Gain-on-demand

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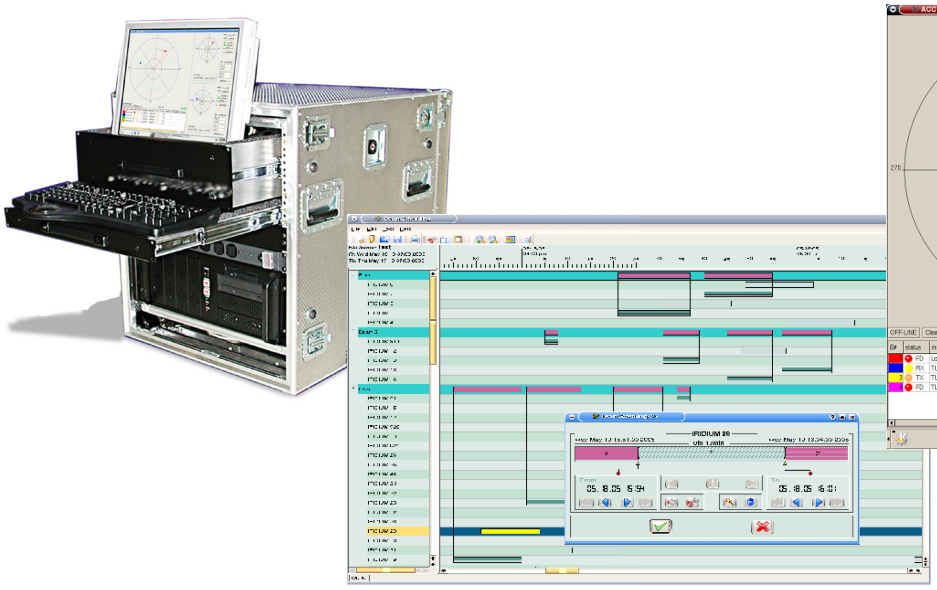
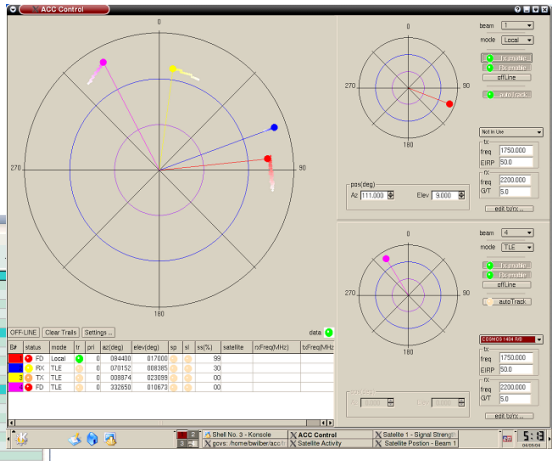
ACC Performance Objectives

- Able to support legacy and current AFSCN architecture
- Supports 4 to 8 contacts simultaneously
- Tx and Rx beam of a contact can be allocated to separate aperture areas; determines active area assignment
- Resolves beam conflicts
- Minimizes fragmentation of aperture area for large reserve capacity
- LEO satellites have the highest priority
- Manages single antenna array resources and provides robust, local scheduling
- Provides dynamic, near real-time satellite contact services based on hemispheric availability
- Supports graceful degradation features intrinsic with multi-array phased antennas
- Supports on-demand contact requests
- Decomposes complex algorithms and computational tasks or functions into manageable tasks via an easy-to-use, intuitive graphical user interface

ACC Integration for 6-panel Demonstration at NASA Wallops Island



ACC Scheduling Module



ACC Beam Steering Module