★ AMERICA'S 250TH ANNIVERSARY EDITION ★

Working the Birds: Field Day 2026

An Engineering Overview of KD4UWU's Portable Satellite Station

DAVIE COOPER CITY AMATEUR RADIO CLUB (DCARC) • EL96

Station Architecture

Unveiling Tony's (KD4UWU) state-of-the-art portable amateur radio satellite ground station components and integration.

Ground Control Core Hardware

Icom IC-9700 Radio

The definitive all-mode VHF/UHF transceiver. Natively optimized for dual-VFO satellite operations, providing full-duplex operation for real-time downlink monitoring.

CSN S.A.T. Controller

A self-contained computer system interfacing with our rig and rotators. Eliminates traditional PC port mapping by delivering a web dashboard for tracking.

Yaesu G-5500 Rotor

A dual-axis azimuth & elevation heavy-duty rotator. Precision controlled to dynamically steer directional antennas across 3D sky trajectories.

Directional Antennas & Prediction

SPATIAL AWARENESS

2m & 70cm Yagi Array

Multi-element directional Yagi antennas mounted on a robust horizontal non-conductive boom. By focusing radio frequency energy, they supply the high-gain paths required to capture faint satellite transponder signals from space.

Integrated Tracking & Apps

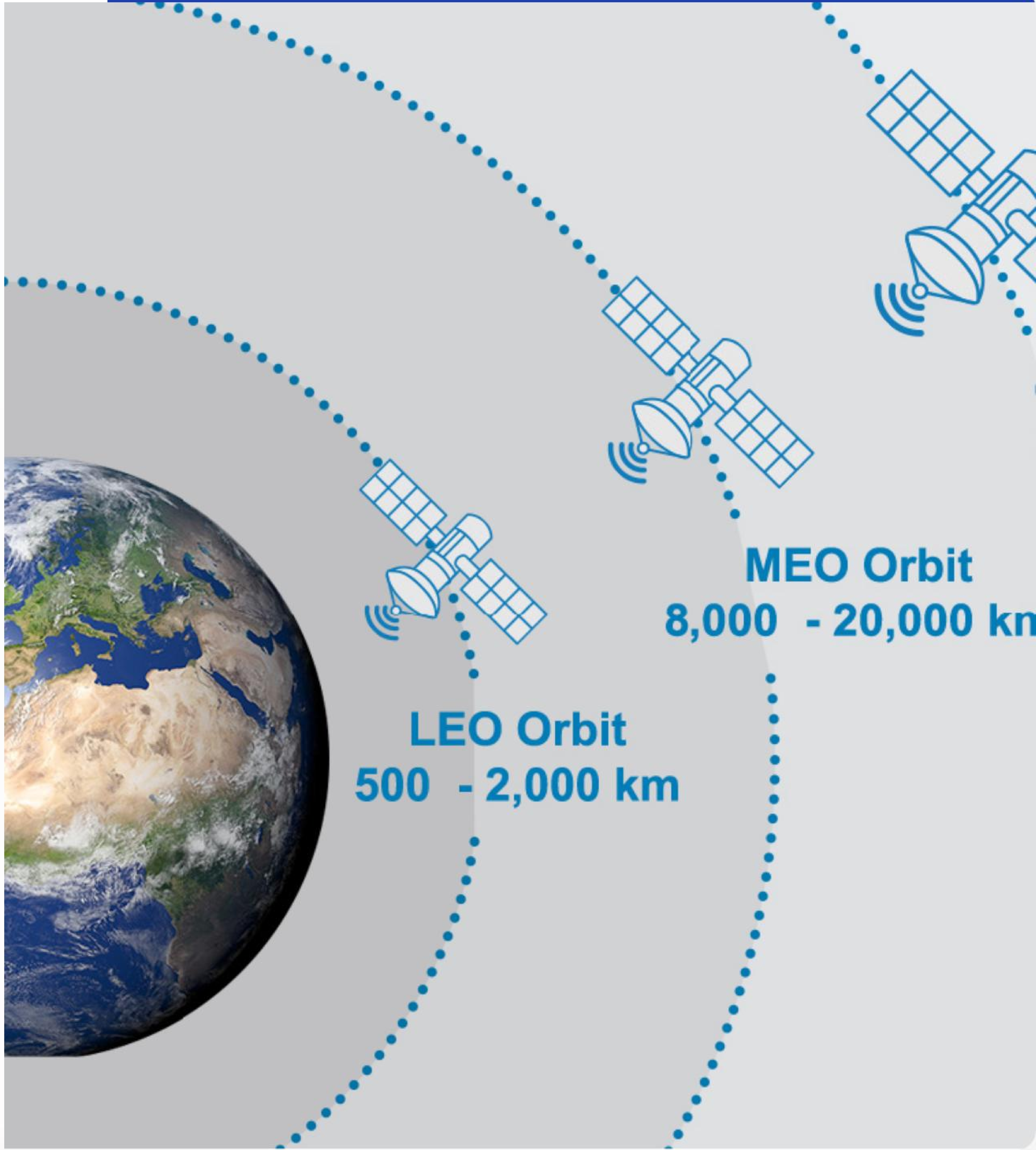
We leverage a dedicated laptop linked directly to the CSN S.A.T. system to process tracking equations. Meanwhile, the ISS Predictor software runs on mobile devices as our secondary safety alarm for pass prediction schedules.

Power Setup

Powering the Field Station

Ground stations running in the field require absolute, ripple-free power isolation. We employ dual Lithium Iron Phosphate (LiFePO4) systems for peak performance.

The primary battery drives the 13.8V DC rail directly to the Icom 9700 and laptop. A secondary high-capacity LiFePO4 battery feeds a clean sine-wave inverter, providing stable 120V AC specifically to drive the Yaesu G-5500 rotator controller.



Orbital Mechanics

Understanding Low Earth Orbit boundaries, spatial signal polar fluctuations, and footprint math.

Low Earth Orbiting Satellites

90

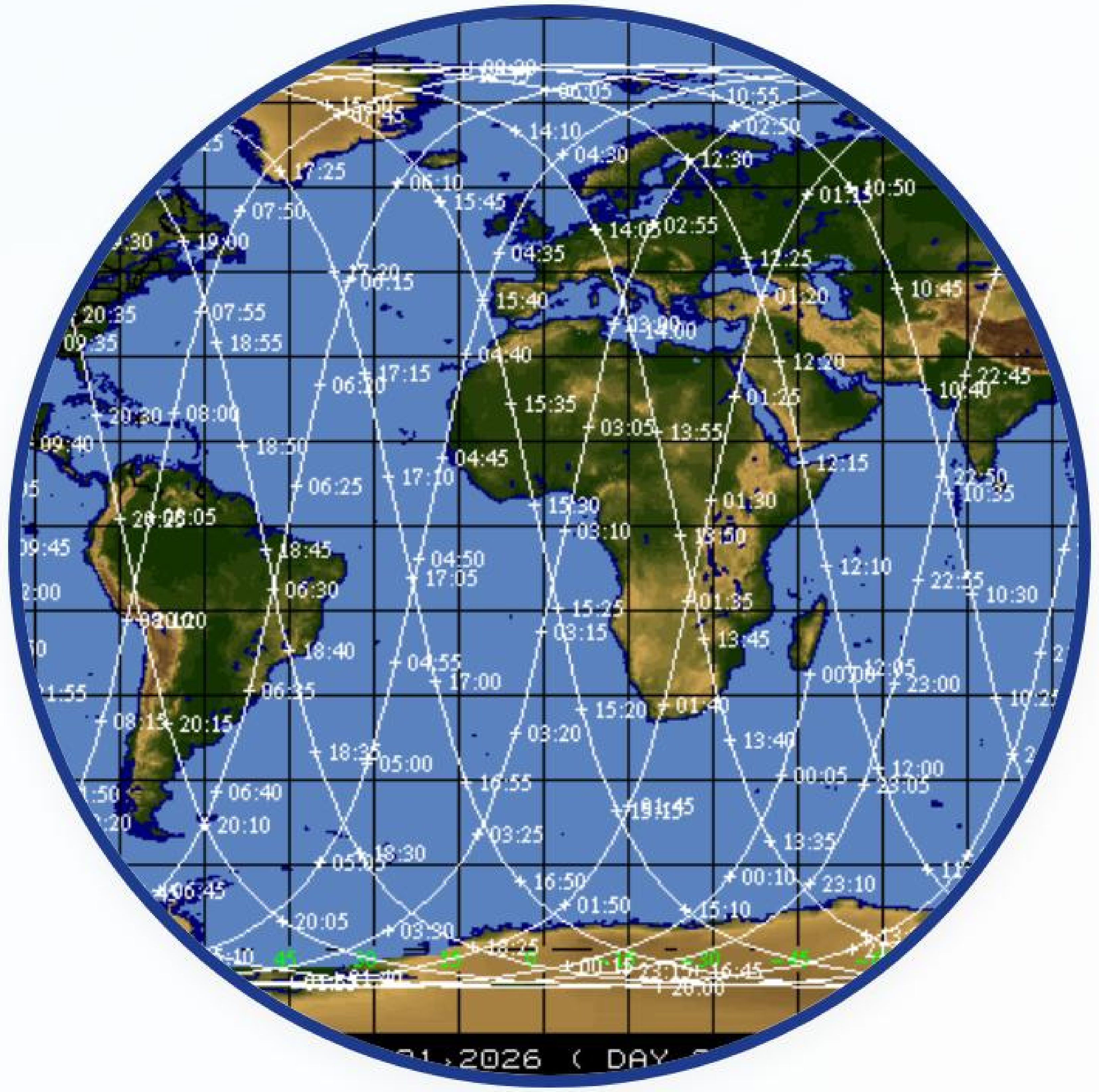
Minute Average Orbit Period

Understanding LEO Velocities

Low Earth Orbit (LEO) satellites circle Earth at altitudes between 400 and 1,200 km, traveling at a staggering speed of roughly 27,000 km/h (17,000 mph).

Because they are in close proximity and moving incredibly fast, they do not remain static. A typical pass from horizon to horizon lasts a mere **10 to 15 minutes**, demanding fast tracking and operating coordination.

Signal Polarization & Tumbling



LHCP, RHCP & Doppler Math

As satellites drift through space, they naturally tumble. This random orientation causes linear radio signals to twist. We bypass severe "polarization fade" by using circular polarization (Right-Hand and Left-Hand Circular Polarization).

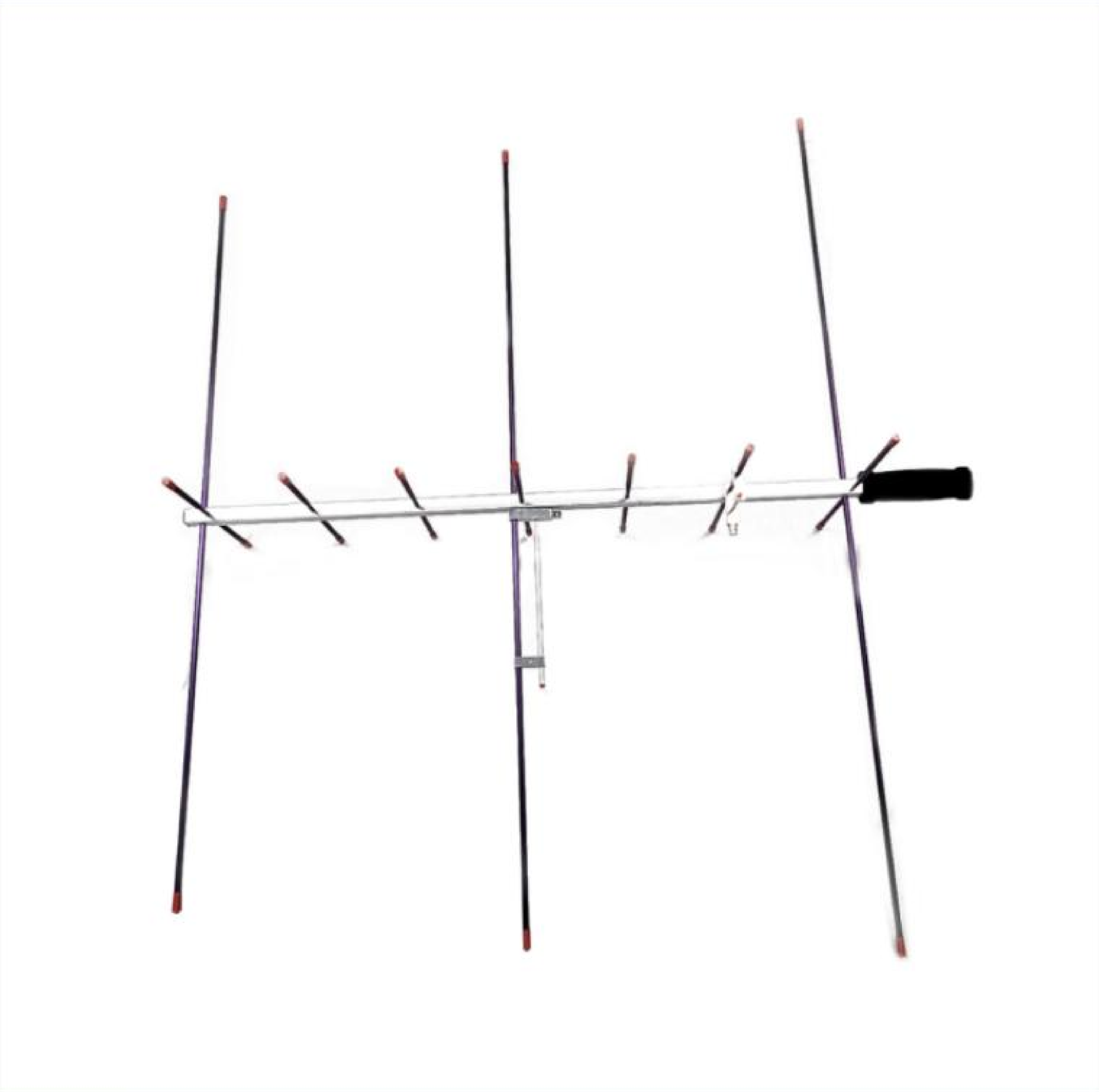
Furthermore, rapid satellite motion compresses and stretches radio waves, creating Doppler frequency shifts that we calculate mathematically:

$$\Delta f = \frac{v}{c} \cdot f_0$$

Navigating via Maidenhead Grid

GRID SQUARE EL96

- **Global Mapping Coordinates:** The Maidenhead Locator System splits the entire globe into 18,660 unique geographic sectors.
- **Our QTH - EL96:** The Davie/Cooper City Field Day operation sits in Grid Square **EL96**. We must exchange this precise code during contacts.
- **The Ultimate Amateur Sport:** Accumulating unique grid squares is the bedrock of satellite achievements, presenting a rare and exciting challenge on Field Day.



QSO Range & Footprint Geometry

COMMUNICATIONS COVERAGE

Satellite Classification	Typical Orbit Altitude	Coverage Footprint Dia.	Maximum QSO Range
Space Station (ISS FM)	~420 km	~4,500 km	~2,200 km
Low Earth Orbit (LEO FM/SSB)	600 – 800 km	~5,500 – 6,500 km	~4,000 km
Medium Earth Orbit (MEO Digipeaters)	~5,800 km	~14,000 km	~8,500 km

Note: Our physical reach is mathematically defined by the intersection of both stations' horizons within the satellite's active footprint.

The Magic of Satellite Comm

"There is nothing quite like hearing your own voice echo back from space, knowing that a low-power signal from your hand-built station traversed 500 miles of vacuum to connect you with another ham on the horizon."

— TONY, KD4UWU • DCARC EL96 STATION ENGINEER

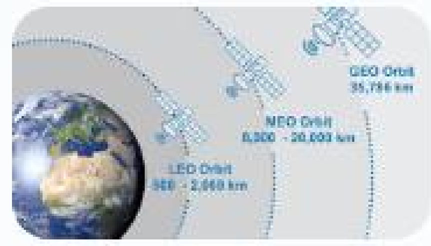
🎏 CELEBRATING 250 YEARS OF AMERICAN INNOVATION 🎏

Join Us on the Air!

Step up to the mic, point the Yagis, and log your first contact through space.

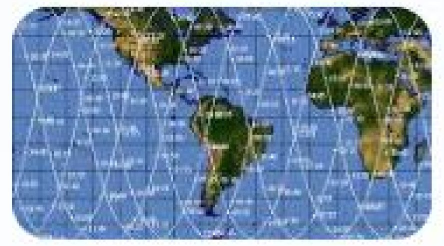
contact@dcarc.club | www.dcarc.club

Image Sources



https://csiac.dtic.mil/wp-content/uploads/2025/07/saliby-figure-1.jpg

Source: csiac.dtic.mil



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