Peraton

OSCAR

Operational Spectrum Comprehension, Analytics, and Response (OSCAR) Solution for Dynamic Spectrum Management
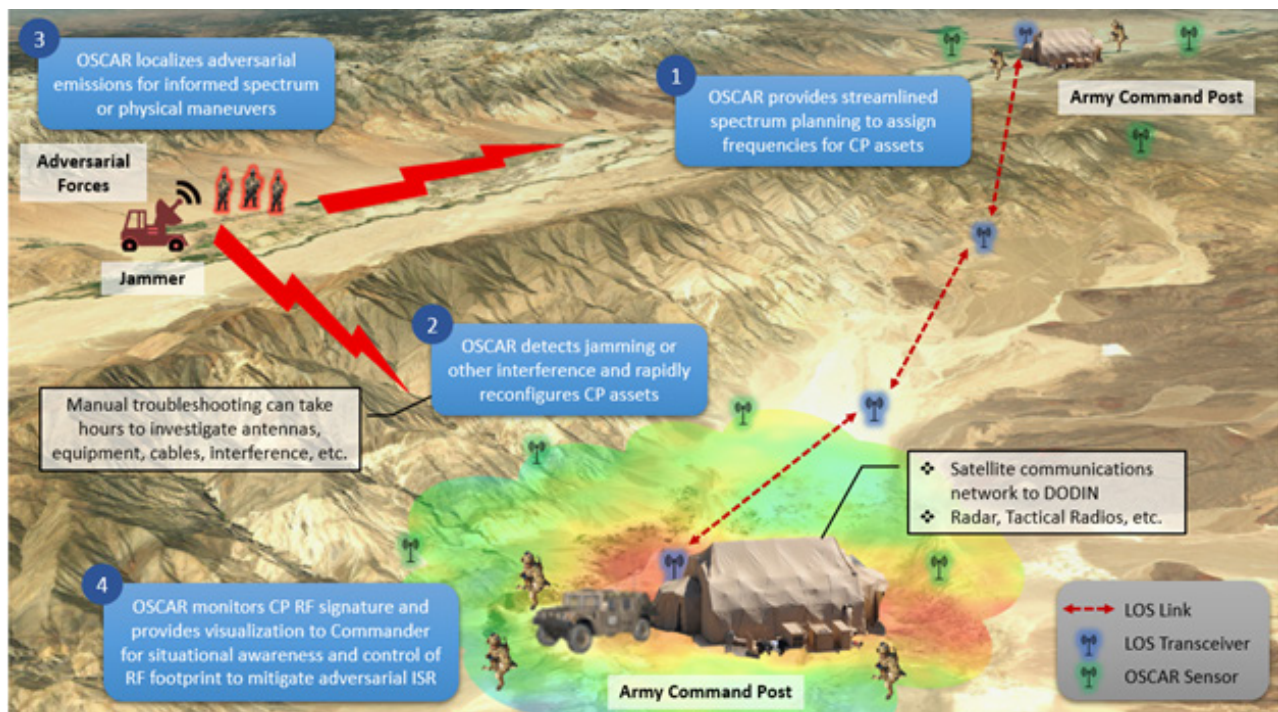
INTELLIGENT, DYNAMIC SPECTRUM MANAGEMENT IN CONGESTED AND CONTESTED ENVIRONMENTS

Efficient and intelligent spectrum management is increasingly required—on test and training ranges, as radio frequency (RF) bands are auctioned for commercial usage, reducing available spectrum—and during mission execution, as multi-domain operations (MDO) demand improved command and control (C2) and domination of the electromagnetic operating environment (EMOE) to support dynamic tactical operations.

Peraton Labs' OSCAR solution meets current and future needs for agile, dynamic spectrum management in congested and contested environments. OSCAR is a developing system which has been successfully tested and evaluated at high-profile events and continues to support important exercises (Vanguard, Cyber Quest, NetModX, etc.).

- Agile spectrum management and shared spectrum use cases from planning through mission execution and in test, training, and tactical environments

- Improved spectrum planning with automated workflows and intelligent deconfliction for greater efficiency

- Automated multi-mission RF conflict detection and resolution via sophisticated RF propagation models and efficient optimization algorithms

- A single, easy-to-use portal for spectrum managers with built-in integration to current tools and data sources

- Map-centric visualization of frequency requests and assignments during operations

- Delivery of spectrum data products to external applications via a flexible application programming interface (API)

- Closed-loop, automated spectrum monitoring and EMOE visualization during mission execution

- Real-time, in-mission RF signature analysis, detection of interference, adversarial anomalies, and unexpected EMOE conditions, and mitigation of detected issues

- Dynamic reconfiguration of radios and software defined systems (SDS) via real-time radio network C2 and dynamic spectrum access (DSA) policy management

- High-value spectrum situational awareness (SA), hot-wash debriefs, after-action reports, and post-mission analysis


Command Post (CP) Survivability: OSCAR CONOPS for Dynamic Spectrum Management in Contested Environments

OPERATIONAL SPECTRUM COMPREHENSION, ANALYTICS, AND RESPONSE

OSCAR provides an integrated portal for spectrum managers to streamline and simplify spectrum management and planning tasks. Featuring a flexible, microservice-centric architecture, OSCAR is compatible and interworks with current spectrum management and planning tools and databases.

- Standardized process for frequency requests and assignments across installations and sister services

- Visualizations that display "where is my request"

- Authorized spectrum managers in the loop for approvals

- Integration with SXXI records, installation RFAs, SPEED equipment database, UNO Planner SFAF outputs, EWPMT and SAM-PT tools, an CSE and IFDS files

- Input plans are retained in the plans and policies data subsystem for reference and retrieval

- Radio characteristics are input and stored in the radio reference data lake, within the radio reference data subsystem, and accessible to all OSCAR components

- OSCAR planner component provides a basic planning tool for users without access to other platforms
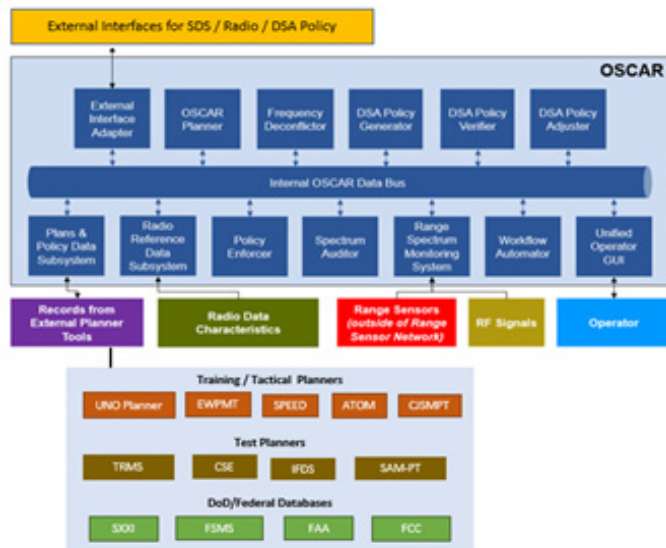

OSCAR's microservice-centric architecture enables seamless interworking and interfaces easily with spectrum management systems, planning tools, policy libraries, spectrum databases, and diverse radios and SDS.

OSCAR RANGE SENSOR NETWORK

OSCAR incorporates a range spectrum monitoring system with distributed, networked passive RF sensors. It also interfaces with heterogeneous external sensors, both within and beyond the area of interest, which may be a test range, command post, or other region. The monitoring system and external sensors support spectrum monitoring, spectrum auditing, data acquisition for spectrum utilization metrics, and detection of unexpected spectrum usage. OSCAR has been successfully demonstrated with a diverse, multi-vendor network of more than a dozen sensors at on- and off-range locations.

- Ruggedized network of distributed RF sensors enables persistent spectrum monitoring automated spectrum auditing across the area of interest

- Heterogeneous network with diverse sensors, including Peraton Labs SecureSense sensors and 3rd-party sensors (e.g., VMAX, Spectrum Guard Pro, CRFS)

- Digital signal processing (DSP) performed at the edge to reduce data backhaul requirements

- Signal detection, characterization, geolocation, and classification using DSP and machine learning (ML)

- Data backhaul is flexibly supported using heterogeneous services and hybrid networking (e.g., tactical radio network using TSM, LTE cellular coverage, etc.)

- Real-time alerting for anomalous / adversarial / unauthorized spectrum usage

- Spectrum data products and real-time situational awareness delivered to external applications via API
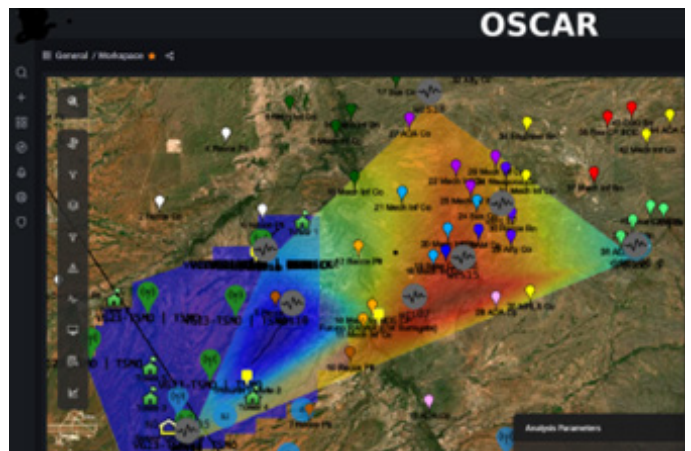
OSCAR's range sensor network display depicts the distributed range sensor network comprised of heterogeneous, ruggedized RF sensors.

SPECTRUM SITUATIONAL AWARENESS AND DATA

OSCAR provides high-value spectrum SA—during missions in the form of live spectrum auditing, active visualizations, and real-time alerts, as well as reports and data repositories to support post-mission analysis and lessons learned.

- Proven capability in range exercises to deliver live spectrum auditing, verify authorized emitters, and identify anomalous or unauthorized emissions

- Successful detection, characterization, and geolocation of signals from diverse systems, platforms, and manufacturers

- Real-time visibility of multi-sensor scan data, spectrum measurements, detected signals, composite spectrograms, and RF energy heatmaps

- Data measurement, collection, and archiving to support post-event analysis of RF signatures and assessment of spectrum utilization efficiency

- Data and reports for hot-wash debriefs, after-action reports, and post-mission analysis
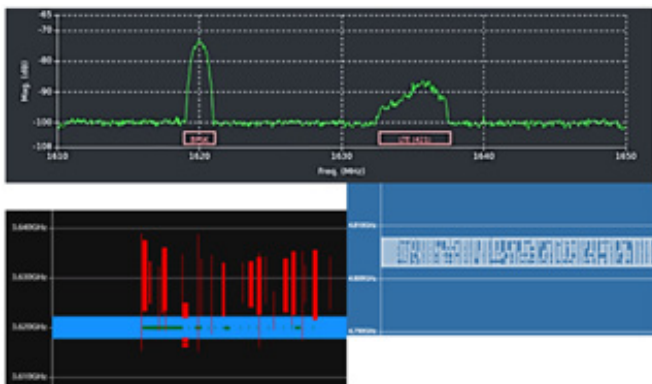

OSCAR's displays and visualizations provide high-value spectrum situational analysis both during missions and for post-mission analysis.

FREQUENCY DECONFLICTION FOR EFFICIENT SPECTRUM MANAGEMENT

Frequency deconfliction is key to improving the efficiency of spectrum management. OSCAR provides innovative frequency deconfliction capability for range planning and for dynamic, real-time deconfliction during mission execution.

Current spectrum management tools typically rely on conservative guard bands between radio frequency authorizations (RFAs). This approach, depicted as Status Quo in the following graphic, is inherently inefficient.

OSCAR harnesses the power of sophisticated pathloss or interference modeling and fast, constraint solving algorithms to deliver efficient and automated multi-mission spectrum conflict detection and optimal, real-time frequency deconfliction. OSCAR's in-mission solution operates in near-real-time solution and has proven performance with incomplete information on emitter characteristics and position.
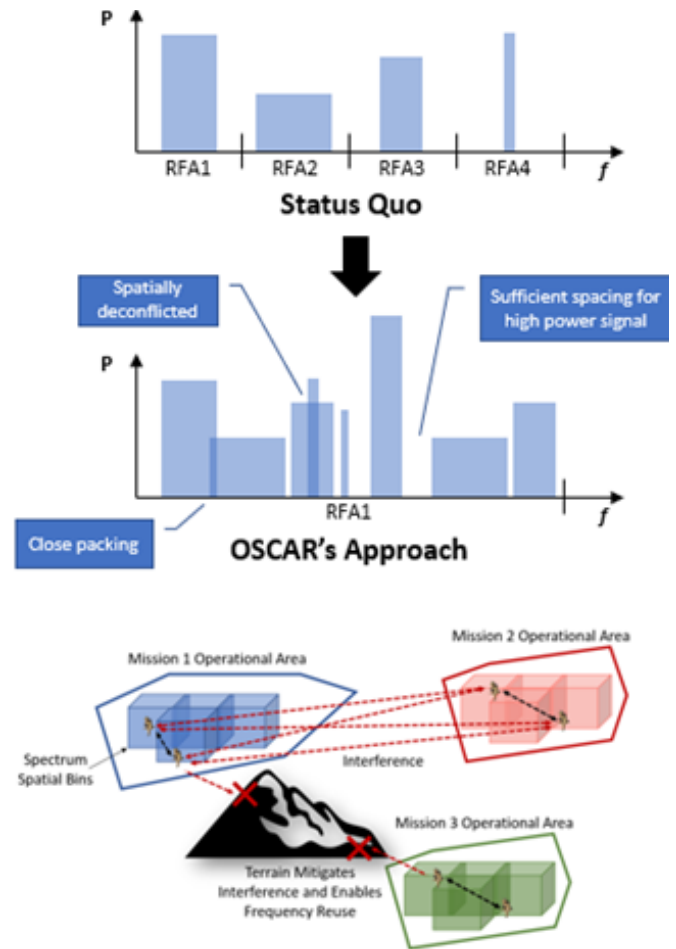
OSCAR optimizes spectrum management via efficient, model-based and spatially-aware RF deconfliction.

Efficient RF Deconfliction for Optimized Spectrum Management

- Incorporates interference modeling into both mission planning and mission execution workflows.

- Spatially-aware RF conflict detection accounts for signal propagation within the allowable operating range (AOR

- Automated multi-mission spectrum conflict detection performed as requests are entered, added, or updated

- Deconfliction approach scales based on time constraints for solution derivation in mission planning vs mission execution use cases

- Dynamic RF deconfliction leverages fast, algorithmic optimization to maximize multi-mission RF utilization within the detected EMOE and environmental constraints

- In-mission RF deconfliction enables real-time reaction to the EMOE in response to unexpected, interfering, and adversarial behavior

DYNAMIC RECONFIGURATION OF RADIOS AND SOFTWARE DEFINED SYSTEMS (SDS)

Dynamic deconfliction is critical for mission execution in congested and contested environments with chaotic and fast-changing EMOEs. Rapidly determining a deconfliction solution is just the first step—the solution must then be rapidly implemented, which requires fast frequency re-assignment and reconfiguration of radios. OSCAR provides proven real-time radio network C2 and dynamic spectrum access (DSA) policy management to quickly adapt to interference, adversarial behavior, or unexpected EMS conditions

The OSCAR architecture includes components for (DSA) policy generation, DSA policy verification, and DSA policy adjustment. OSCAR uses these components in a streamlined DSA policy generation process streamlined to facilitate generation and validation of complex and compliant policies.

- Approach is consistent with IEEE 1900.5 policy-based DSA radio standards
- Supports diverse IEEE 1900.5 policy types, such as geo-spatial, temporal, and device-capability-specific
- Risk-based policy generation via interface with RISA if available
- Restricts Frequency Set of selected equipment based on bandwidth specs

- Cross-references policy type being created with the associated equipment's DD1494 parameters
- Interference modeling is used to inform policy generation to avoid interference with legacy radios
- Dynamic radio configuration is used to push deconflicted assignments to DSA radios to resolve issues immediately

Importantly, OSCAR also provides capability to enforce policies for legacy over the air managed (OTAM) radios. OTAM legacy radios are not policy-based; nonetheless, OSCAR's policy reasoner enables a centralized DSA behavior for such devices. This feature is of significant value as it enables missions to reap the benefits of DSA with existing non-DSA radio hardware.

- For legacy radios, OSCAR issues instructions for manual configuration
- For frequency agile radios, OSCAR issues API commands to automatically adjust configuration parameters such as frequency or output power
- For DSA-enabled radios and software defined systems (SDS), OSCR provides policy generation and enforcement via dynamic reconfiguration

For more information about OSCAR and other spectrum solutions from Peraton Labs, contact info@peratonlabs.com or see Products - Peraton Labs.
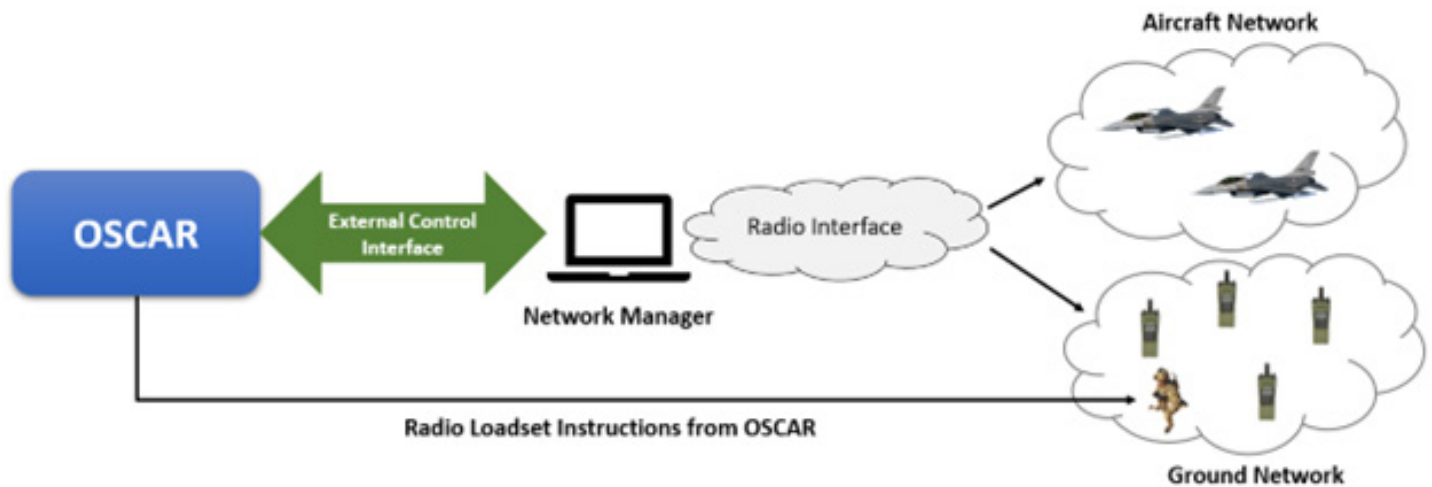
Dynamic Reconfiguration of Radios and SDS: OSCAR provides real-time radio network C2 and DSA policy management, including capability to automatically generate and enforce policies in DSA-enabled radios and SDS via dynamic reconfiguration.