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The Human Factors in SATCOM (RF) Interference:

Creating More Effective Mitigation Teams

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The Human Factors in SATCOM (RF) Interference:

Creating More Effective Mitigation Teams

Bob Potter, President, SAT Corporation

It's convenient to think of problems like RF interference by reducing it to its technical form. But in the operator's world view its far more than phenomenon of physics; it's a human-centered challenge to be solved as quickly and inexpensively as possible, with the least amount of disruption to customers and service. But until we have fully self-healing networks, and magic push button technology, we'll continue to rely on (the often unheralded) human who lies at the center of the equation. People can be brilliant problem solvers, so how can we unleash the full potential of operators to take on more of today's complex interference scenarios and get further along the detect-locate-resolve problem resolution path– without relying on more specialized, costly, and scarcer expertise?

Rather than a wish list of blue sky hypotheticals, we look at three of the most practical and impactful areas for improving the human performance when it comes to RF interference, particularly to help Level 1 operators do more before escalating problems to Level 2 or higher. These include,

1) on the job training to better prepare operators for today's wide variety of RF interference scenarios,
2) workflows that bridge discrete parts of the problem into a unified whole to take on more of the 'monitoring to mitigation" problem set, and
3) intuitive tools designed to match how operators think and accelerate complex problem-solving.

Together, strengthening these three areas enables Level 1 operators to tackle more interference challenges more efficiently – for better talent utilization internally, and customer service externally.

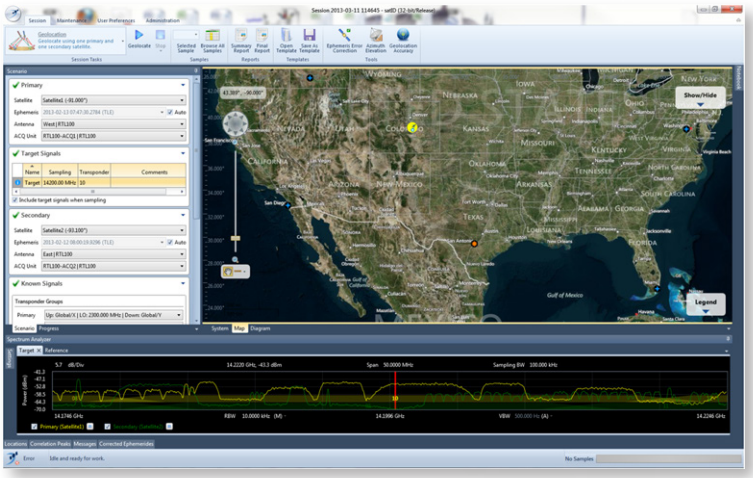
Reducing Cost and Improving RF Interference Mitigation Training

If you ever wondered why special ops teams perform so well in varied situations or an athlete in a high-pressure moment, it can be distilled down to practice: consistent practice that's rooted in realistic scenarios that prepare them for those moments.

Unfortunately, the majority of today's interference preparation is relegated to infrequent, expensive and inconvenient offsite training, so it's understandable why interference events are sometimes so disruptive and require escalation. Satellite congestion, an explosion of VSATs, configuration errors from added services, not to mention hostile jamming, all make identifying, locating and resolving interference harder for today's less experienced operators, and why repeatable on the job training is critical.

By practicing against a wide spectrum of signal misbehaviors rooted in realistic situations, operators can be better prepared for whatever they might encounter.

Consider this typical occasional use scenario, where a conflicting signal is detected shortly before a live news broadcast. In an ideal world, the Level 1 operator detects and determines the originating source, calls the conflicting carrier, and resolves the issue quickly. In reality, however, determining whether the disruption is, for example, from broadcaster XYZ or the test transmission from a mobile truck may take longer so it is passed to a Level 2 operator who's required to build a geolocation scenario. The difference between the ideal and the actual response hinges on the Level 1 operator's limited exposure to and preparation for these scenarios.



Integration of RF tools enables a seamless process for operators to detect, characterize, identify and locate interference.

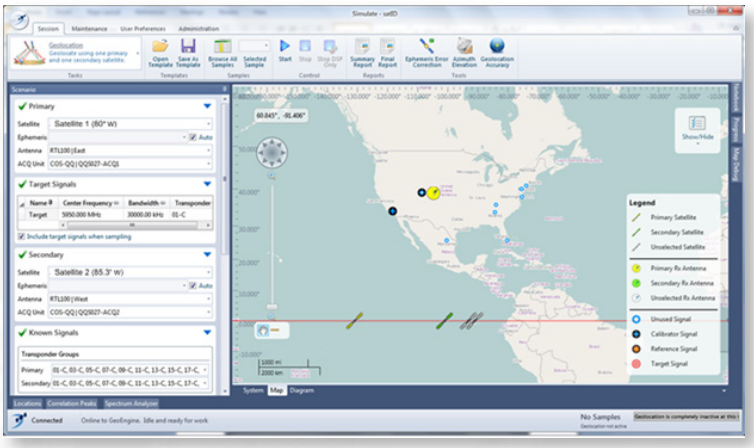
One highly effective, low cost approach to gaining those on-the-job repetitions is to use monitoring and geolocation systems (tools) that have capabilities that enable them to be used to simulate a wide variety of interference events. For example, a monitoring tool, when combined with a signal generator, allows a system administrator to create and insert a modulated waveform into any of the downlink monitoring paths without disturbing the traffic on the satellite. The occurrence looks and feels like real interference for all intents and purposes, creating an alarm for operators to respond and work through necessary protocols and procedures.

Another way for operators to prepare and train for a wide spectrum of interference events is with a geolocation simulator. By injecting signals through the ground station (within the geolocation system itself) the operator can practice against interference that might occur due to equipment failure, operator error, intentional jamming, or unauthorized use. The geolocation simulator eliminates the issues associated with

relying on a live satellite for training, as is the typical case today,, thereby eliminating traffic disruption, increasing training time, enabling onsite training, and dramatically reducing training costs.

The simulator can also be used as a geolocation self-test solution, for assuring peak performance of vital link protection systems, and as a pre-mission simulator to anticipate, plan and design against interference scenarios. The operator can select ground locations for transmission and reception sites, choose satellites, enter antenna pattern information, and generate protected, interference and reference signals.

These approaches dramatically sharpen the operator's geolocation techniques and knowledge, resulting in faster and more accurate detection, diagnosis, location, and resolution. Operators can now train consistently on the job anywhere, anytime, obtaining the necessary reps and varied scenario exposure they need, rather than relying on the limited and intermittent training that comes from live-fire events.



Geolocation using the map-driven interface of satID 3.0 allows quicker identification and location of interference, whether from equipment failure, operator error, intentional jamming or even unauthorized users.

Tools That Support Improved Workflow and Efficiency

With better training Level 1 operators can now address more of the full 'monitoring to mitigation' cycle, rather than parsing and passing along the problem (in stove-piped manner). This problem-solving depends on tools that are integrated and that can bridge the workflow between monitoring and geolocation. By pulling important data from monitoring, such as detailed signal-under-signal characterizations, into a graphically-oriented geolocation interface, more complete scenario analysis can be performed at lower levels in the organization, with greater geolocation confidence.

By integrating the toolsets, the detection-to-geolocation process becomes more seamless, making the Level 1 operator far more productive. This boosts the bench strength of front line talent, and increases the potential of faster, less costly interference resolution. Considering that Level 1 operators are the 24x7 staff who are most plentiful, this is critical when more specialized expertise or Level 2 operators are scarce, off-shift or unavailable when interference strikes.

When "Murphy's Law" types of scenarios do arise, don't overlook the importance of contingency planning. When Level 1 or Level 2 expertise is needed, but unavailable, globally managed RF services with 24x7 operations center staffed by experts are available to perform interference detection and geolocation in a matter of minutes. These outside resources are also an economical option for cases where a small team can't support the need for a Level 2 operator, the amount of geolocation scenarios encountered are too few to warrant a full-time Level 2 operator, or third party validation of results is needed.

Now that Level 1 operators are more thoroughly trained and prepared, it makes sense to extend geolocation capabilities to other monitoring sites to protect more beams and spectrum. By adding/upgrading geolocation software to distributed sites where (PC-based) hardware is already used for monitoring, you gain dual-use, dual benefits from invested equipment for not much more expense.

Better Decision Making by Supporting How Humans Think

Today's satellites scenarios are more complex, involving more beams, switching, and transponders. It's much easier to pictorially understand these satellite states and configurations through a map visualization, rather than text or tables. The text-based data in most tools today present operators with unnecessary complexity from and restrict how they can interpret and interact with the information. It's the difference between the earliest DOS-based computers and the revolution in business productivity that resulted from the graphically rich and intuitive displays we use today.

Geographic context is central to understanding and optimizing the geolocation process. Starting with a visually detailed map at the center of the interface (rendered directly from Bing, Open Street Maps, Google Maps, or a private map server), an operator can overlay satellite and signal information, spectrum analyzer displays and other elements to perform geolocation within the map. This scenario visualization allows the tool to suit the user, not the other way around, providing a more efficient way of generating geolocation results and expediting mitigation.

An example of the cumulative power of combined training, integrated tools, and graphical displays is demonstrated when trying to resolve intermittent interference – the type that appears for a short time, goes away, and returns again. Level 1 operators can now be made aware of the interference, replicating the event in the training tools to practice against the event. When the interference event does re-occur, the Level 1 operator is notified immediately via the monitoring tool, and within the same environment activates the geolocation scenario to more quickly locate the source and expedite the interference resolution.

A Future of Promise

With 50% more satellites being built for launch from 2011-2020 than the previous decade, the satellite industry is positioned for exceptional growth. And more capacity, users and services will present more interference challenges. But satellite companies now have a roadmap to very efficiently and

cost effectively prepare and equip their human talent for the road ahead. By empowering its front line operators to do more and solve more, the organization's return on their human investment dramatically increases, as will customer service, profitability and satisfaction.

End-to-End RF Interference Mitigation Solutions

SAT, a Kratos company, provides a comprehensive suite of solutions that address RF interference challenges, including products and services used by 80% of major satellite operators to help quickly identify and mitigate costly RF interference events.

Improving Workflow and Efficiency in RF Interference Mitigation

SAT enables operators to be more effective with its integrated RF interference tools Monics® and satID® that improve their ability to monitor and geolocate RF interference. SAT's products provide RF signal monitoring as well as an accurate, fast, all-in-one solution for locating and identifying sources of interference due to equipment failure, operator error, intentional jamming, or unauthorized users.

Using the map-driven user interface in satID, SAT's powerful geolocation product, provides operators with the ability to perform geolocation scenarios more efficiently and effectively. Integration with Monics®, the industry's leading carrier monitoring solution, provides an advanced spectrum measurement and interference analysis. Important data from Monics, such as detailed signal-under-signal characterizations, is pulled into satID's graphical interface to provide an even more complete scenario analysis and greater geolocation confidence. With satID and Monics integrated together, the full spectrum of detection, characterization, identification and location of RFI becomes a seamless process for operators.

Cost Conscious Gelocation Testing and Training Solutions

Executing RF interference mitigation training can become expensive and time consuming when you have to use live satellite bandwidth. satID GeoSim, the industry's first geolocation simulator from RT Logic, also a Kratos company, can increase effectiveness of satID users by creating exact, real-world, complex RF signal conditions that will exist when a geosynchronous satellite encounters interference. satID GeoSim, allows for simulation of a wide range of nominal and worst case RF signal scenarios to increase the readiness of operators to help ensure high data and communication system uptime.

RF Interference Expertise Available 24/7

In some cases an organization is not prepared to take on a full-time interference monitoring model. SAT is the only global provider of 24/7 managed SATCOM Network Operations Services. SAT's global network of dual antenna sites equipped with Monics and satID provide the best in class network for monitoring, locating and mitigating costly RF interference. SAT's state of the art Network Operation Center is staffed by full time Satellite Network Analysts with a combined 25+ years of experience in resolving RF interference.

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