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SUN3125

FAA Migration from TDM (Serial) to IP Interfaces

Radar Focus, Part 2

Introduction

Sunhillo has a long history of interfacing radars systems within the FAA and DoD, but it is Sunhillo's portfolio of serial-to-IP products (RICI, Ventnor and Longport) that provide the bridge between dissimilar systems such as radars and Air Traffic Management (ATM) Automation systems. These products allow a large variety of data formats to be converted, processed, and displayed for a common air picture.

Historically, radars have used multi-channel serial connections to ingest this data and distribute it to required consumers. Serial connections have survived decades as a fundamental communication path for radar data and other FAA protocols. Using TDM, or Time Division Multiplexing, provides multiple channels of data across a single T1 line. T1 lines have been leased by the FAA for many years to accommodate this conveyance of the data necessary to sustain operations of our national airspace, however, this technology has reached life cycle

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maturity and has become more costly to maintain. The FAA Fiscal Year 2025 Budget submission has an allocation of funds requested for the Time-Division Multiplexing (TDM)-to-Internet Protocol (IP) migration to move away from the aging, and now costly, TDM infrastructure with modern broadband IP-based technology for long haul connections (building to building).

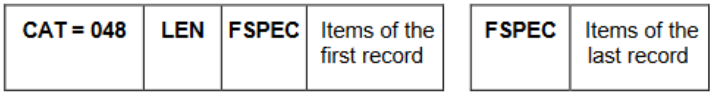
Radar Data Migration – Moving External T1 Connections to IP

The transition away from serial lines has also been joined with the initiative to convert to a common data format defined by the All-Purpose Structured Eurocontrol Radar Information Exchange (ASTERIX) standards. The transition away from TDM and moving to the ASTERIX data format has been part of the FAA Surveillance Interface Modernization program or simply "SIM". SIM helps facilitate the transition to the Next Generation (NextGen) environment moving away from legacy communication infrastructure. Sunhillo products provide the fundamental building blocks for this transition by translating between communication mediums to provide the TDM-to-IP bridge and converting legacy data formats to ASTERIX.

Replacing legacy serial communications requires a careful strategy. The starting point of this strategy considers the sources of air traffic surveillance which includes the radar surveillance assets. Since it is cost prohibitive to replace these assets, the SIM initiative considers the TDM-to-IP transition and the subsequent transmission of the native radar data ASTERIX standard. The resultant ASTERIX data is encapsulated in a data frame defined by the SIM standard and then transmitted out as a UDP/IP message onto a modern infrastructure such as the FAA Telecommunications Infrastructure (FTI) network or other network infrastructure.

SIM ASTERIX

What is SIM ASTERIX? To answer that question, it is desirable to first define ASTERIX. ASTERIX is a binary surveillance data format that was developed and is maintained by the European organization Eurocontrol. An ASTERIX message follows a defined structure shown below where the first octet holds the ASTERIX Category (CAT) identifier (e.g., CAT048) and the second octet holds the total length in octets of the ASTERIX Category message including the Category and Length fields.



The next field is the Field Specification, or FSPEC, which is an index that details which fields are present and which fields are not within a single ASTERIX data record and the remaining data that will complete a single ASTERIX message. Each ASTERIX Category has an ICD defining the details of all the fields in the FSPEC; many of which can be found on https://www.eurocontrol.int/asterix.

SIM ASTERIX describes an encapsulation of a Eurocontrol ASTERIX message format inside an FAA specific frame. The appropriate ASTERIX Category (CAT) aligns with the type of radar data being transmitted and falls into three groupings: weather radar, surveillance radar and surveillance service messages.

Weather Radar

Weather radar data is defined by Eurocontrol ASTERIX CAT008. This data is often presented as one serial channel in the native communication path. For example, ASR9 radar data has a weather channel component.

Surveillance Radar

Depending on the surveillance radar source and existing infrastructure, this type of radar data may be presented on one to three serial channels. Surveillance radar data is defined by Eurocontrol ASTERIX CAT048. ASTERIX CAT048 data can convey the necessary information, regardless of the source channel count, for transmitting Uncorrelated/Correlated Primary Surveillance Radar (PSR) and Secondary Surveillance Radar (SSR) Beacons.

Surveillance Service Messages

Surveillance Service Messages are defined by Eurocontrol as ASTERIX CAT034. CAT034 provides information about the operation of the radar including radar azimuth messages (North Mark, sector marks), Strobes and Status.

Other Data Types in SIM

The SIM migration includes other data types beyond the ASTERIX formats described. Some FAA groups also require additional formats to be output from their system domain. In addition to the SIM ASTERIX formats, En Route Communication Gateway Protocol (ECGP) is also a required output. The ECGP protocol, originally developed for the ECG program, can also convey various radar information, and depending on the application, may provide similar outputs as the ASTERIX data for ECGP formatted feeds of PSR, SSR and weather. A fully implemented SIM ASTERIX system may have as many as 10 UDP outputs containing both ASTERIX and ECGP data.

SIM ASTERIX Conversions Underway

Sunhillo's footprint in NextGen provides multiple solutions for FAA surveillance groups tasked with updating infrastructure in support of eliminating costly TDM lines. Figure 1 illustrates, at a high-level, a diagram of a radar communication path transitioned to SIM ASTERIX.

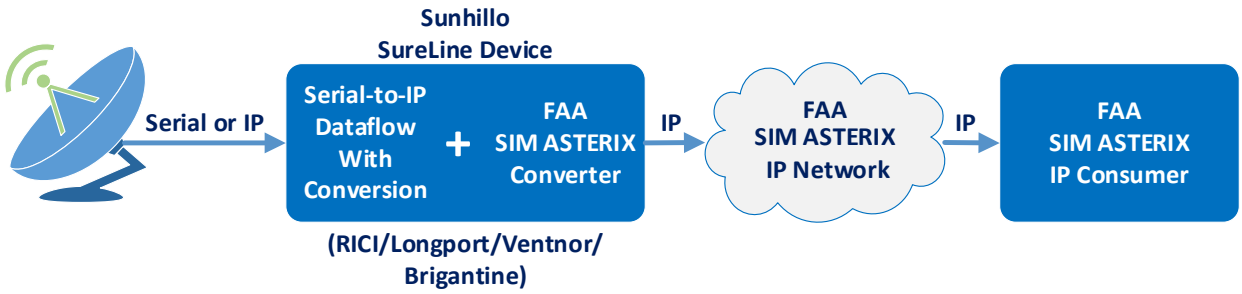


Figure 1: SIM ASTERIX Pieces in Place

The surveillance service messages from legacy radar sources remain the primary item that requires further definition to convert to SIM ASTERIX. Unfortunately, this data has no specific standardization of what service message information coming from the radar source data map to in the CAT034 data format. These specific mapping requirements are obtained with a close interaction with the respective FAA program group. Sunhillo has worked, and is working currently, with multiple FAA teams to define these mappings. Nothing can be 100% SIM compliant without these mapping requirements from the FAA for each interface type. However, once defined, the mapping can be included as part of the Sunhillo radar conversion products such as RICI, Longport, Ventnor and Brigantine as part of the common software present on each called SureLine®.

Sunhillo has supported multiple efforts within the FAA to fast-track the transition to SIM ASTERIX. The following FAA teams have already started, or completed, this work:

- **ASR11** – UDP IP FAA ASTERIX ASR11 Cat 1/2/8 to SIM ASTERIX 34/48/8 & ECGP (Efforts in progress with Oklahoma City for status mapping)
- **ATCBI-6** – UDP IP FAA ASTERIX Cat34/48/8 to SIM ASTERIX 34/48/8 & ECGP (FAA led effort utilizing Sunhillo Brigantines)
- **ASR-8/ASR-9 (via CTD)** – UDP IP CTD ASTERIX 34/48/8 to SIM ASTERIX 34/48/8 & ECGP (FAA going to Key Site testing soon)
- **Mode-S** – Serial CD2 to SIM ASTERIX 34/48/8 & ECGP (Effort in progress for status mapping)

Conclusion

FAA surveillance radar migration to SIM ASTERIX is on an aggressive track to eliminate the monthly costs associated with traditional TDM leased lines. Leased TDM line costs are rapidly increasing due to telco providers seeing decreased need. Some FAA groups have already begun the migration to SIM ASTERIX by doing the advanced work of mapping the traditional radar status to CAT034. With these efforts, the gap between TDM and the migration to an IP-centric backbone is well within reach using proven Sunhillo.

For more information, please email Sunhillo at Sales@Sunhillo.com or visit www.Sunhillo.com