SOF ES Systems

A highly modular ES system suitable for multiple manned and unmanned platforms

Key Features

RF Capability:

- Wide RF instantaneous coverage via multiple 1GHz BW IF receivers

Direction Finding - 3 Options (or combos)

- **ADF** - Pulse amplitude differences from arrays of antennas, determines bearings
  - Per-pulse DF over entire RF range
- **Spinning DF** - High RPM spinning antenna determines bearings
  - Bearings limited to spinner beamwidth
- **External DF (e.g. interferometer)** can be cued
  - Precise bearings, but limited due to frequency range

Pulse Measurement Performance:

- Pulse Width: 50 ns min, no effective max
- PRF/PRI: > 1 M pulses per second per band

Timing/GPS:

- Built-in GPS with disciplined OCXO
- Can use external GPS/Reference clock

Data/Control Processing:

- Pulse Descriptor Words (PDWs) / messages built in hardware (SPR XMCs)
- "Finder" Software algorithms perform deinterleaving/ID/location/tracking on onboard single board computer (QCore i7)
- Linux OS (RedHat or Centos)
- Full suite of computer interfaces
  - DVI, USB, Serial, 3xGbE, SATA 3.0
- Internal or external storage

Other Capabilities:

- Dual band AIS Receiver
- COMINT or other SIGINT addons

Power:

- 500 W, 120VAC, 47-440Hz or 24-32VDC

Environmental:

- ATR w/ Convection/Conduction Cooling
  - ATR w/ full conduction option
  - Rackmount/Convection option
- Altitude:
  - -100 To 20,000 Feet (Receiver)
  - -100 to 65,000 Feet (Sensors/RFDs)
- Temp:
  - -40° To 55°C (Receiver)
  - -65° To 71°C (Sensors/RFDs)
- Vibe: Per MIL-STD 810G, Cat-13

SOF Receiver

SOF systems are modular ESM/ELINT systems for use in manned and unmanned airborne, ground, and shipborne monitoring systems. Their primary function is to detect, identify, locate and track pulsed RF signals. System modularity allows installation of multiple IF channels in a common hardware infrastructure. RF signals are collected at the sensor antennas and converted into multiple IF bands. Each IF band on an SOF system handles an instantaneous bandwidth of 1GHz and can provide all the classical ELINT data, including bearing on every detected pulse within its band.

The SOF system relies on proven Finder software operating on an embedded Linux-based single board computer. It includes support for a variety of interfaces (1553, A429, serial, GbE, etc.) for tying into existing platform infrastructure (GPS, INS, network). In also includes support for receiving and decoding AIS messages for monitoring shipping traffic.

SOF was developed by Aeronix, Inc. under contract with the US military. It is based on our earlier Finder and Copperfield systems, with significant functional, performance and cost improvements over these former systems.

The SOF system consists of a suite of sensors feeding an SOF Receiver housed in an ATR or rackmount chassis containing a sub-rack of 6U OpenVPX cards with VITA 62 AC or DC supplies.

Sensor antennas are selected based on end-user requirements and the desired DF option, of which there are three:

ADF - determines bearing from pulse amplitude difference from arrays of antennas. This provides accurate per-pulse bearings across the entire RF range.

Spinning DF - Uses a high-RPM spinning antenna to determine bearings. Bearings are reasonably accurate but limited by the spinner's beamwidth.

External - An external DF system such as an interferometer-based DF can be cued on a scan/signal basis. These typically have narrow frequency BW, thus the number of bearings will be limited, but can be used in conjunction with the ADF to provide superior results.

Probability of intercept (POI) for the primary RF path responsible for detecting everything but bearings is not affected by the DF selection.

Modularity is a key architectural aspect of the SOF systems. A primary building blocks which helps to achieve this modularity is the Signal Processing Receiver (SPR) Mezzanine, an XMC mezzanine designed to process IF or analog signals and provide results over an industry standard PCI Express (PCIe) interface to a single board computer (SBC) located in the SOF Receiver.

There are three different kinds of these SPR XMC cards in an SOF system:

Dual-IF SPRs (Multiple), which provide two full IF receivers - each taking in IF and producing a stream of Pulse Descriptor Words (PDWs). The quantity of these SPRs determines the amount of instantaneous frequency coverage in a system.

ADF SPR (1), which receives signal amplitudes from the DF Arrays and correlates with the IF SPRs' PDWs to provide bearings on each PDW.

AIS/IF SPR (1), which provides a dual-band AIS receiver paired with a single band IF Receiver.

Continuing the theme of modularity, the system supports multiple miniPCIe sites to add platform dependent interfaces such as A429, 1553, GPS serial/1PPS/10MHz, etc.

All data processing and control of the SOF system can be accomplished on its onboard single board computer using an improved version of the Finder software employed in our previous systems.

The SOF communicates with the outside world primarily via up to 3 GbE interfaces.

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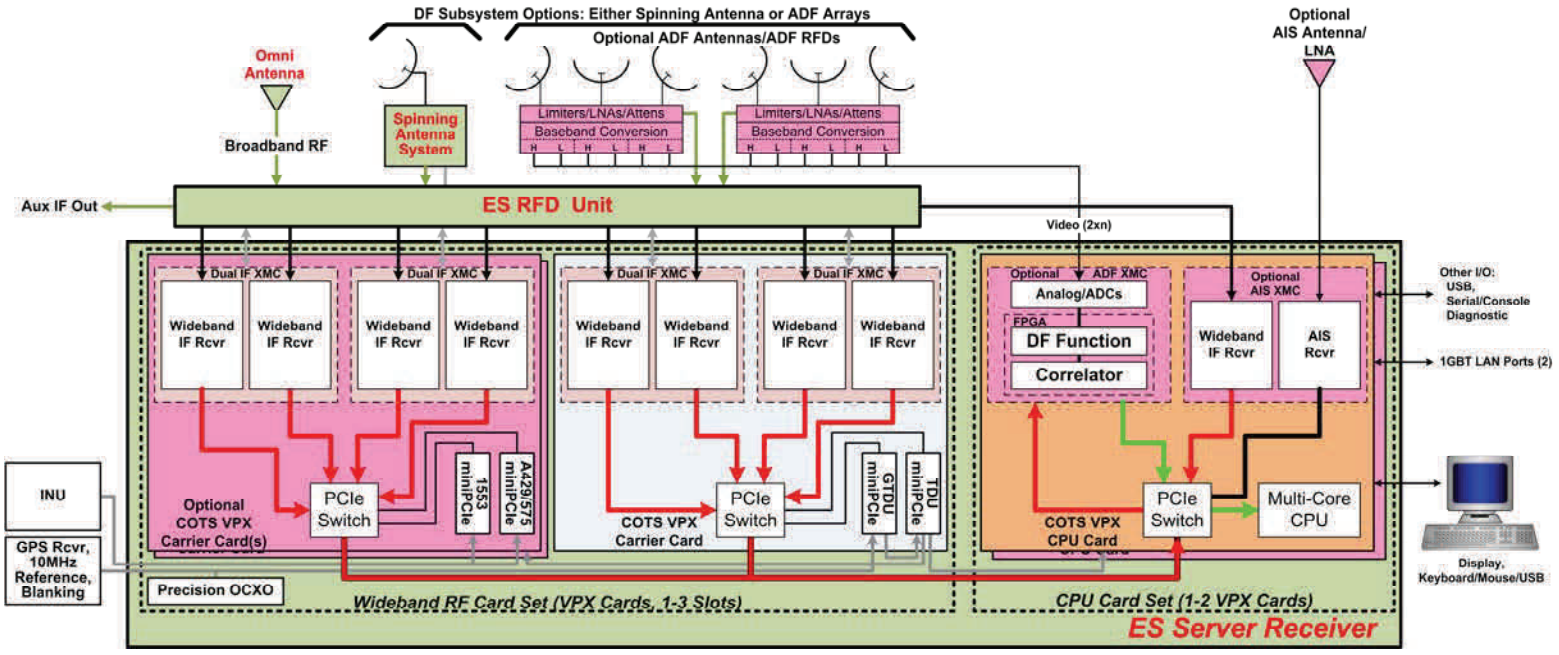

- Modular design using Signal Processor Receiver modules on industry standard XMC cards to provide key functionality
- System can be tailored to fit customer's needs
  - If more instantaneous frequency coverage needed, add more Dual IF XMCs on another Carrier Card.
- DF capability thru spinning antenna, Amplitude Direction Finding (ADF) array, and/or thru cued external DF subsystem:
  - Spinner will take more time to provide bearings (due to reduced POI because of spinner's beamwidth)
  - ADF provides per-pulse, high throughput bearings using differential amplitude from a flexible array of directional antennas
    - Uses a flexible array of 6-8 directional antennas, in various geometries, depending on platform needs
  - External DF can be used to augment or replace the Spinner or ADF capabilities.
    - Cued based on high POI of main FDF signal detection/identification, typically over GbE with predictive information on time/frequency
- ES RFD Unit
  - Conditions and splits omni broadband RF or ADF Array into up to multiple wide IF bands, aux IF
  - For Spinning Antenna, conditions RF, converts to baseband, provides to Dual IF XMCs with spinner bearings
- Dual Wide BW IF Receiver XMCs collect data from RFD, generate Pulse Descriptor Packets (PDPs)
- With Spinner, each IF XMC correlates data from Spinner to primary RF PDPs, sends to CPU card
- With ADF Array, ADF XMC computes bearings from ADF RFDs, correlates w/ IF XMC PDPs, sends enhanced PDPs to CPU card
- Data routed over x4 5 Gbps PCIe lanes on backplane to COTS CPU card (Quad core i7) which hosts Finder Application Suite (FAS) SW.
- Optional AIS XMC provides AIS data as well as an additional IF Band Receiver function
- A rich, flexible set of auxiliary interfaces to allow easy integration on a platform (GPS, INS, LAN, 1553, A429, AIS, Blanking, etc.)