# MOSA, SOSA, and NO-SA: A Comparison of Chassis Platforms for MIL/Rugged Applications

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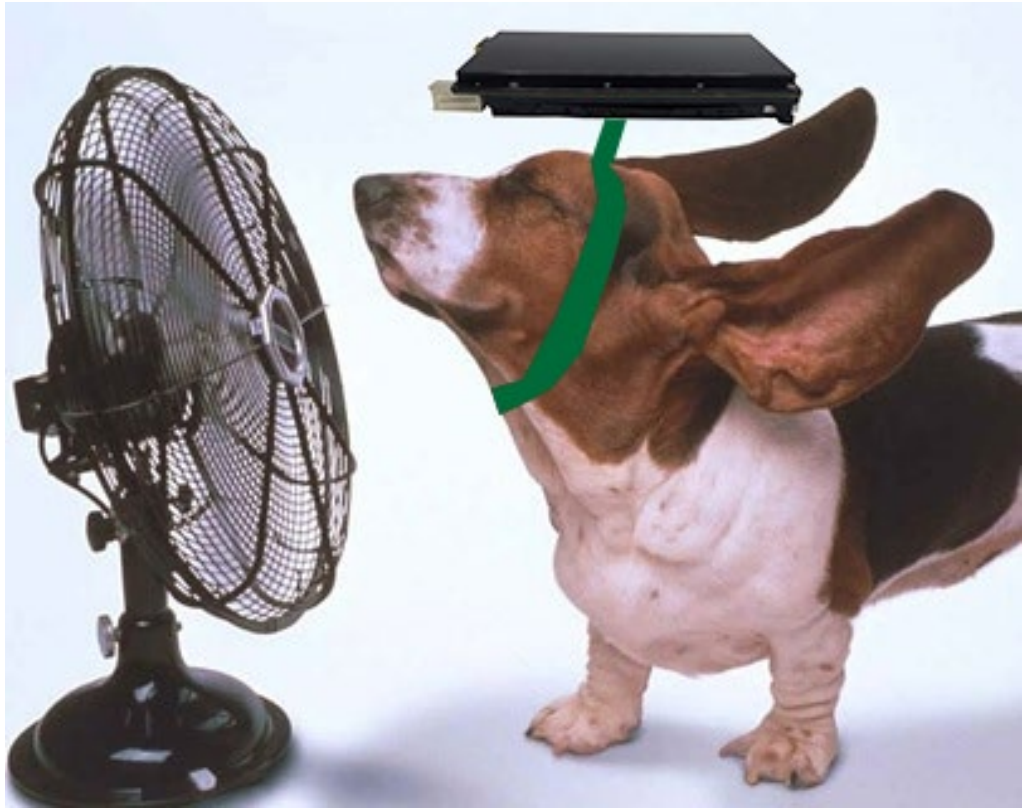
# Common Design Challenges Across High-End MOSA, SOSA, and NO-SA Systems

- Higher wattage boards bringing thermal challenges:
  - Air cooled designs sometimes over 2300W
  - Conduction cooled designs often over 100W/slot, some cases more extreme
- Maximize RF/optical out to the panel
- SWaP requirements

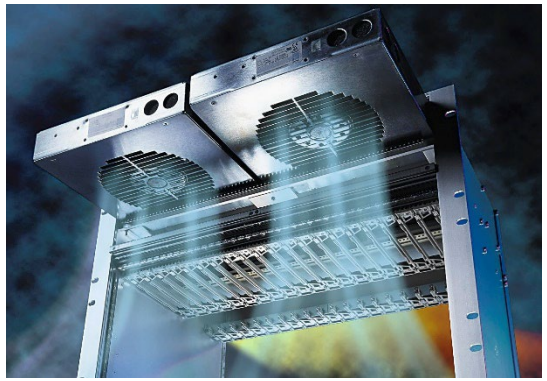
# How Do We Cool These High Power Systems?

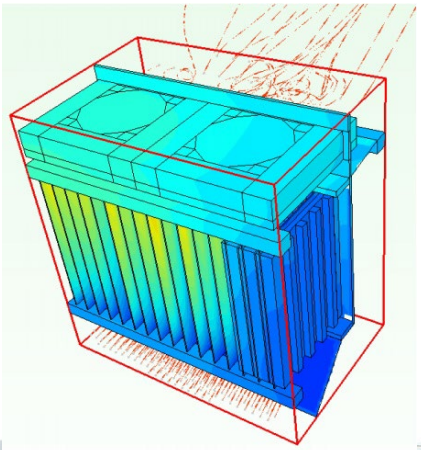


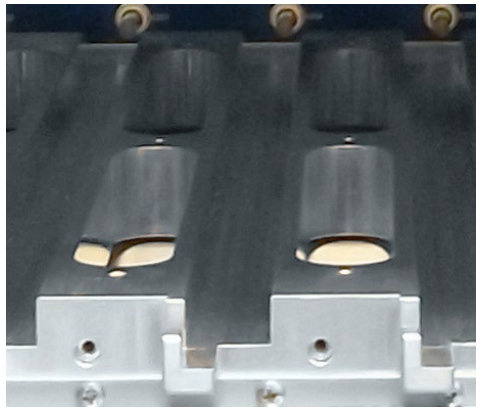
Original photo from Dodog

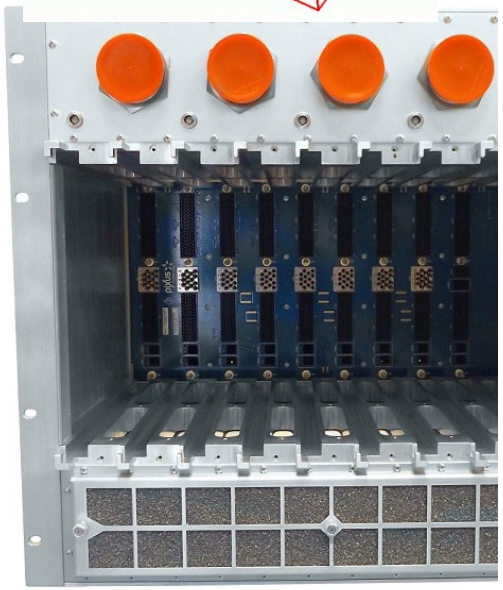
# Cooling Solutions

- Optimized fan selection: balancing back-pressure, airflow, ruggedization, environment
- Thermal simulation to cool each slot properly, utilize baffling, spacing, etc.
- New Air Flow Through (VITA 48.8) or Air Flow By (VITA 48.7) techniques
- Liquid cooled (VITA 48.4).  Often the last resort









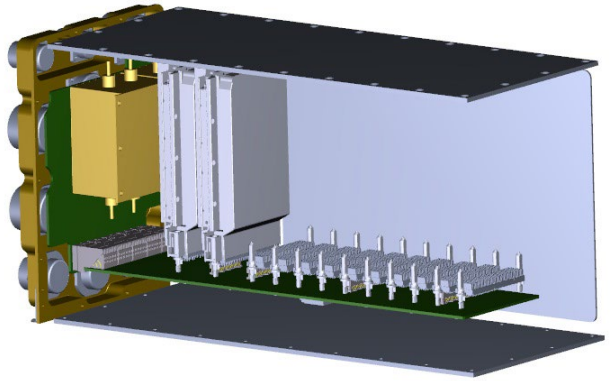
# SOSA: Sensor Open Standard Architecture



# SOSA: Key Backplane/Enclosure Parameters

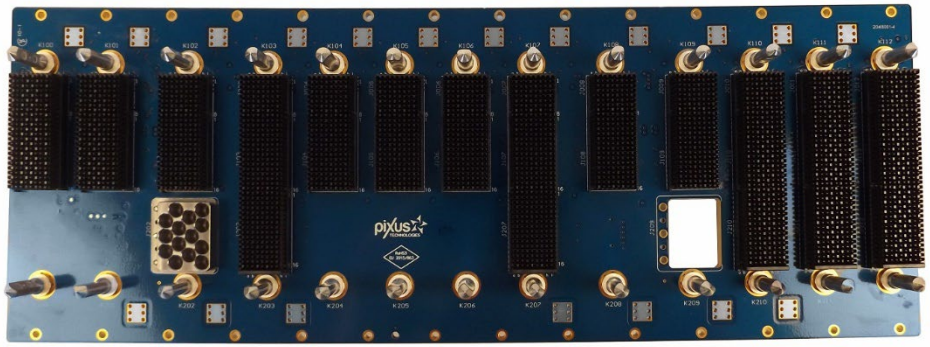
Key Elements of SOSA:

- SOSA Aligned profiles based on 3U/6U OpenVPX, often with fiber or optical interfaces
- Encapsulates CMOSS, FACE, HOST elements in one
- Often pushing performance barriers
- Speeds to PCIe Gen4 and 100GbE
- System management requirement



Challenges:

- Challenging thermal management, often higher than 100W/slot
- Backplane signal integrity at higher speeds and fiber/optical cutouts

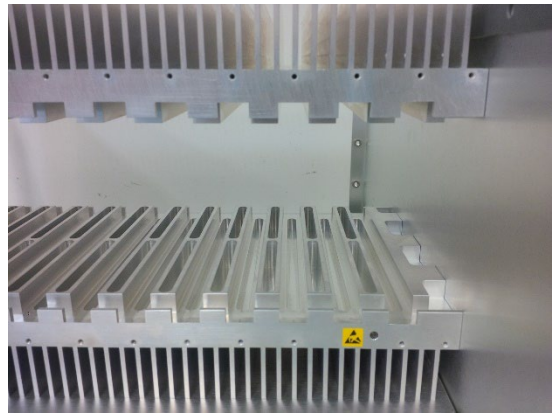


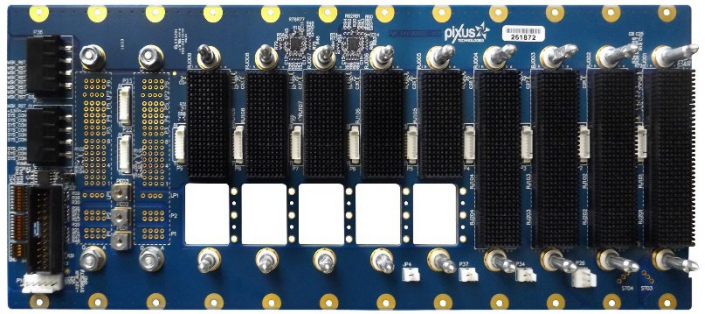
# Application Example: 19” MIL Rugged Rackmount

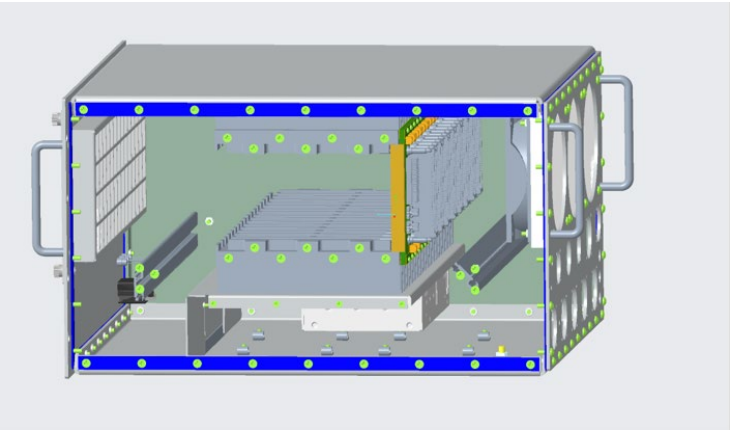
6U Tall 19” MIL Rugged Rackmount, 3U OpenVPX/SOSA Aligned Chassis

Addressing challenges:

- 100GbE (and PCIe Gen4) backplane with multiple P2 cutouts for RF/optical, backplane simulation
- Cooling of over 100W/slot, thermal simulation
- Advanced I/O implementation with multiple RF/optical interfaces, management of 38999 connectors spacing
- SOSA aligned shelf manager, often mezzanine type that does not consume any slots







# MOSA: Modular Open Standard Architectures



# MOSA: Key Backplane/Chassis Parameters

Key Elements of MOSA and MOSA-like:

- Open standard, but not a firm SOSA related requirement (Other OpenVPX, SpaceVPX, VME64x, CompactPCI/cPCI Serial, other)
- Sometimes very high performance, but others very basic levels (don't need SOSA performance)
- SOSA elements are often a plus, but not a requirement
- "Just make it work" vs a specific SOSA profile (ability to break the rules to achieve an objection)
- Broader range of applications typically

Challenges:

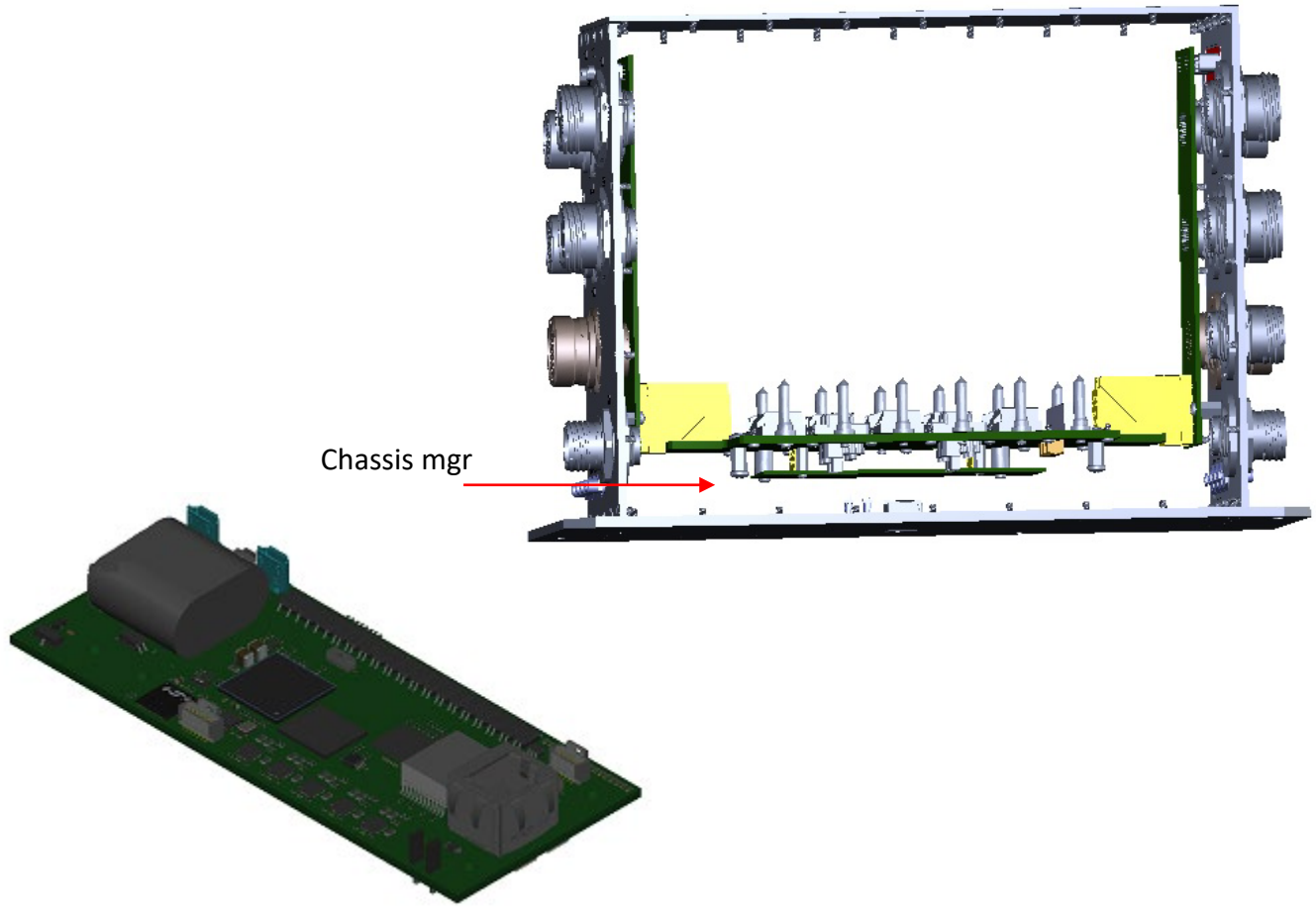
- Cooling and I/O management can be extreme
- Some cases with very high performance

# Application Example #1: SOSA Performance Not Key Driver, I/O Requirement

½ ATR 3U OpenVPX Chassis, Maximizing I/O Space

Addressing Challenges:

- Dual I/O boards double the panel space available (when allowed by application), some mirror-image, some not
- Saving space with SOSA Aligned SlotSaver Mezzanine-based Chassis & Hardware Manager below the backplane
- Fiber or RF through the backplane to panels, choosing optimal RF/fiber 38999 connectors
- All elements maximize space and reduce SWaP

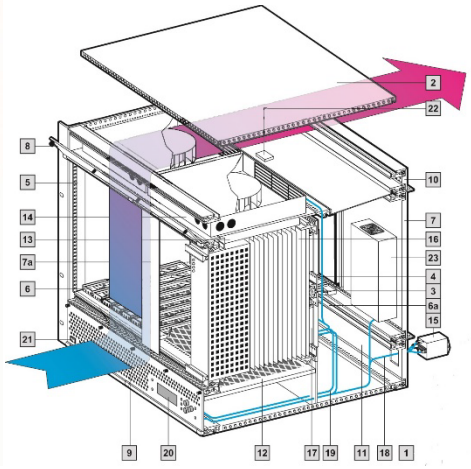


# Application #2: SOSA-like, Less Requirements to Reduce Costs

10U RiCool Chassis:  Redundant Pluggable Power & Ultra-high Wattage

Addressing Challenges:

- Very similar to SOSA, but limited budget and scaled back functionality (PSUs, chassis mgmt)
- Data center type of application (not MIL rugged)
- Multiple boards over 200W, powerful dual 191 CFM hot swappable blowers
- Dual redundant pluggable power in rear, including 5V option
- Chassis management (more related to thermal/power, not individual boards), lower cost pluggable module

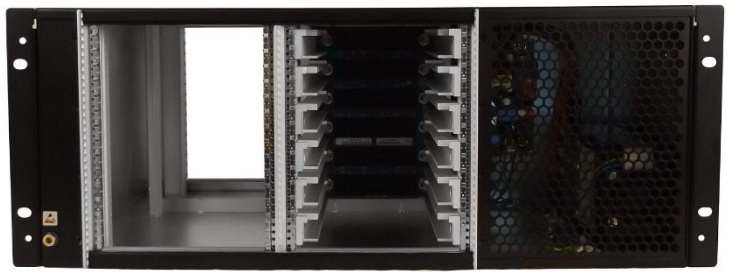


| Board Power | Board Airflow | Loss coefficient | No of Slots |
|---|---|---|---|
| 70W+ | 10 CFM | 166.65 | 3 |
| 100W+ | 13.5 CFM | 90.97 | 1 |
| 175W+ | 15 CFM | 73.22 | 4 |
| 195-225W | 25 CFM | 26.6 | 5 |

# Other Application Examples

Other Styles:

- 3U/6U hybrid OpenVPX
- VME/VME64x implementations
- OpenVPX ATR, but no SOSA needs
- Multi-bay 3U implementations
- Red/black implementation
- SpaceVPX



# NO-SA: Specialty Architectures & Designs

Image courtesy of NI

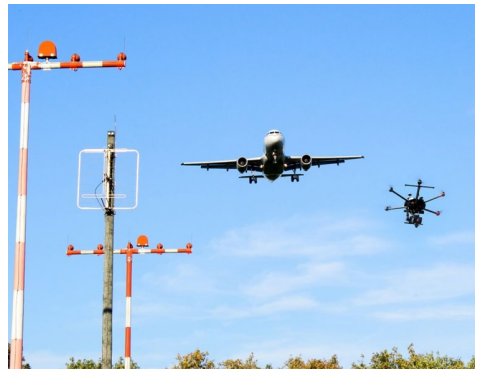
# NO-SA: Key Board/Chassis Parameters

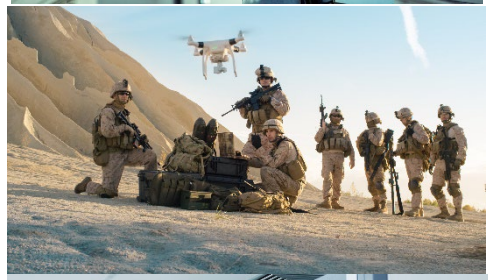
Key Elements of NO-SA:

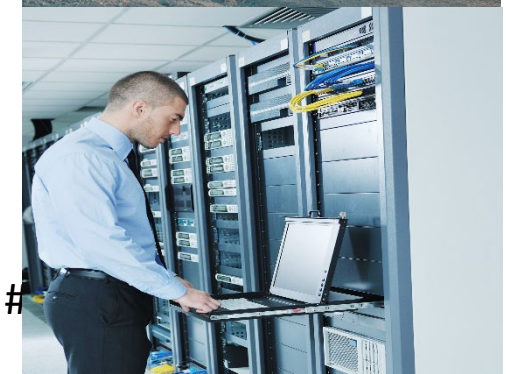
- Application where modularity and standardization is not required
- Key driver such as only certain functional parameters (ie, small rugged enclosure) or cost
- Occasionally may have opposite requirement of extreme performance requirements (ability to break the “rules”)
- Wide range of application flexibility (communication systems, signal jamming/control, drone detection/deterrence, pole-mount & more)

Challenges:

- Extreme backplane performance
- Reducing SWaP
- Meeting MIL environmental (shock/vibration, -40C +71C, weather resistant





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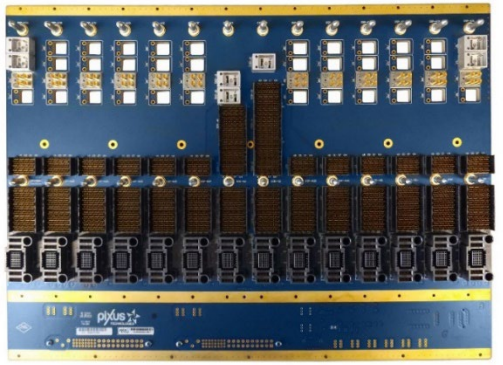
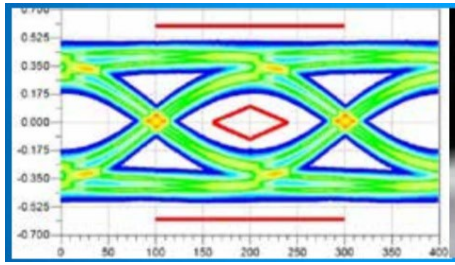
# Application Example #1: Leverage OpenVPX, but Custom for Maximum Performance

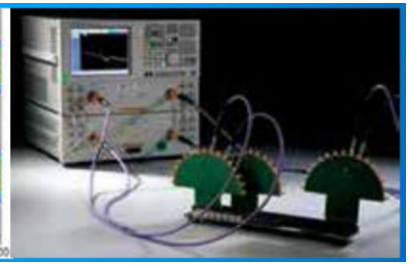
Ultra High-speed Custom Chassis Design &
Advanced Cooling

Addressing Challenges:

- Speeds beyond 100GbE (28+G across backplane, high speed connector), backplane simulation
- OpenVPX electrically, but custom connectors to achieve speed levels
- 9U RiCool chassis w/dual powerful 191 CFM each hot swappable blowers for ~2200W of cooling
- Front-to-rear airflow
- Open area for RTM access and fiber/RF cabling







# The Crowded Digital Battlefield

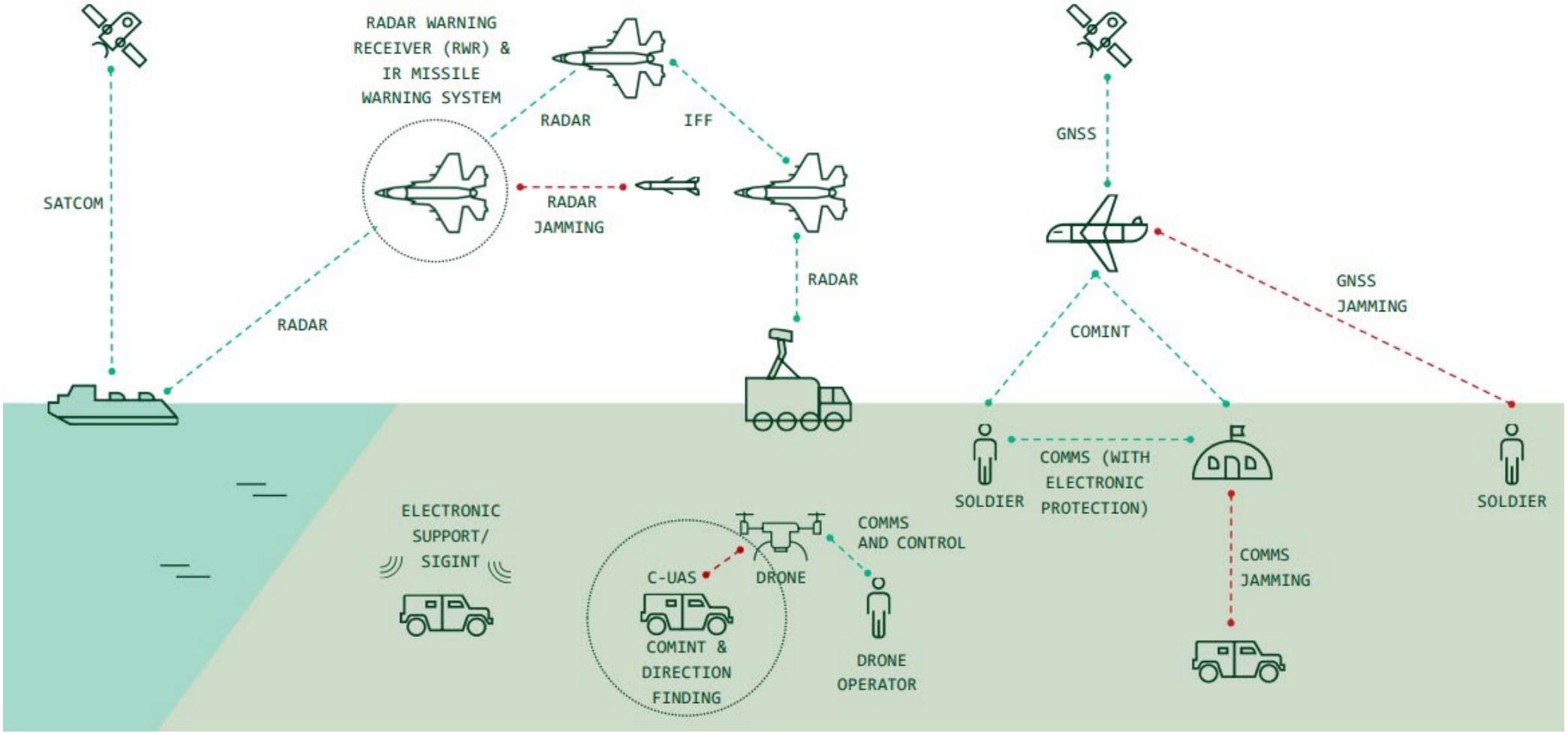


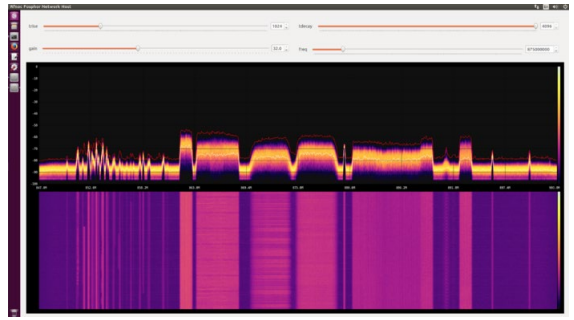

Image courtesy of NI

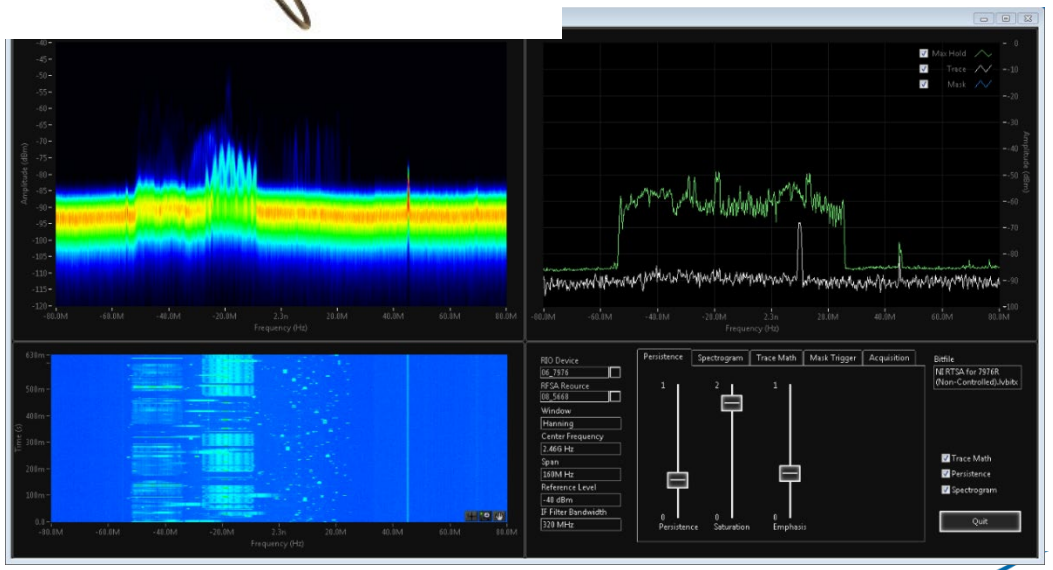
# Application #2 Solution: Control the Wideband Spectrum Through Ruggedized Commercial SDRs

Ruggedized NI and custom SDRs

Addressing challenges:

- IP67 weatherproof or MIL rugged with 38999 interfaces
- Special heat-sink design to cool, options with heat/fan to meet extended temps
- Dual channel transceiver speeds to 100GbE
- Processors ranging from Zynq UltraScale+ to Spartan 6
- Often a PCIe Gen3 x8 interface
- Compact versions (lower performance for man-wearable applications), semi-rugged air cooled versions for Transport grade apps





# Comparison of Chassis Classes

| | SOSA | MOSA | NO-SA |
|---|---|---|---|
| **High Performance** | High | Medium to High | Low to High |
| **Restrictions on Design Specification** | High | Medium | Low |
| **Configuration versatility** | Medium | High | Low to Medium |
| **Interoperability/Ease of integration** | High | Medium | Low |
| **Scalability/Future re-use** | High | Medium | Low |

# Questions?

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