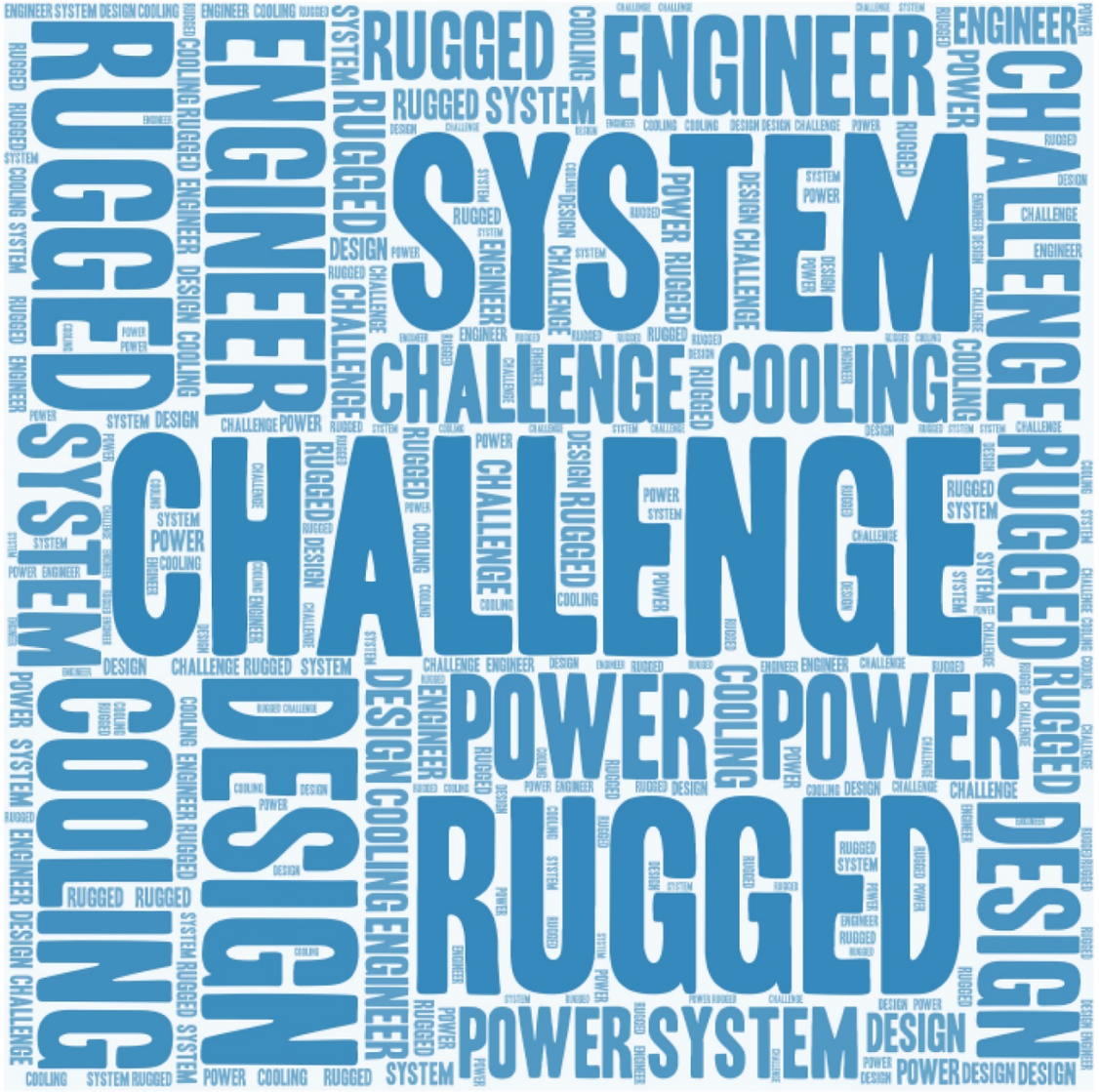
Enclosure Systems: Tackling Tomorrow's Thermal and Ruggedization Challenges Today

Common System Design Challenges



1. Minimize Space in Rugged Design
2. High Power Cooling Chassis To Rugged
3. Minimize Rack Height for VPX, Mixed Sizes
4. Ruggedize a Commercial SDR

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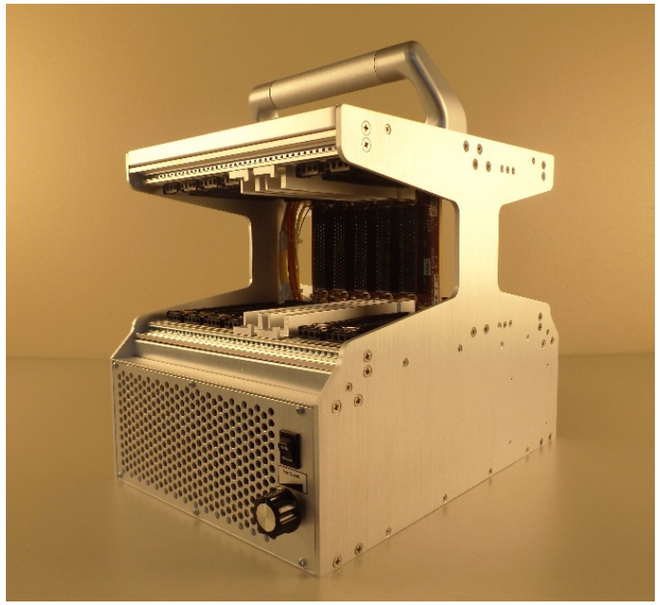
Challenge #1: Minimize Space in Rugged Design

Started with a 3U OpenVPX, open frame, 3-slot for development



Requirements:

- Need to minimize size, weight for airborne application
- High reliability, MTBF, secure cabling approach
- Price competitive
- Cool at least 125W

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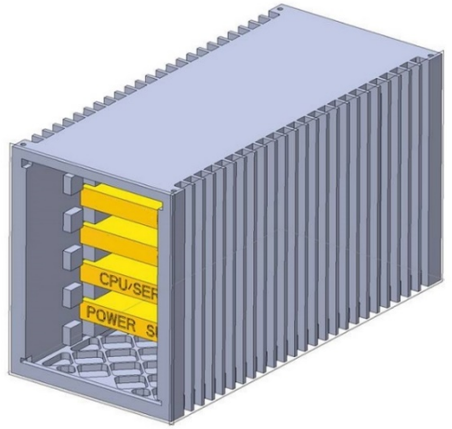
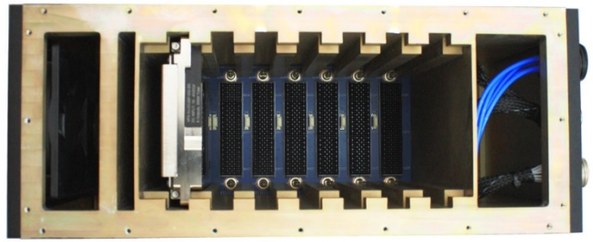
Decision Points: What format for spacing space and reliability?

Choices/Challenges:

- Top-loaded or other (space, cabling)
- Dedicated board for I/O panel or cabled (security, cost)
- Natural convection or other (space, reliability, cost)





Solution: Compact ATR – Rear Loaded

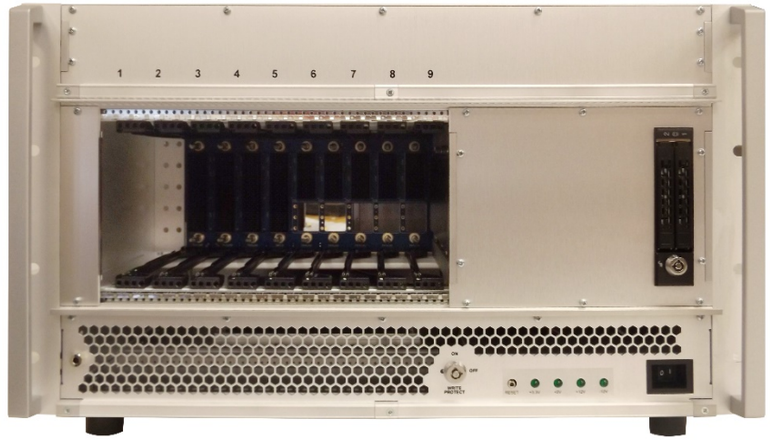
Solution:

- Rear loaded approach
- Natural convection with thermal simulation
- Secure cabling, space efficient

- Passed flight testing and design approved

Challenge #2: High Power Cooling Chassis To Rugged

Started with a 3U OpenVPX, RiCool with advanced cooling, 9-slot, with 4 RTMs



Requirements:

- Take chassis with high heat and apply to rugged applications
- VITA 67 for RF connections
- Meet MIL specifications for shock/vibration/environmental and EMI

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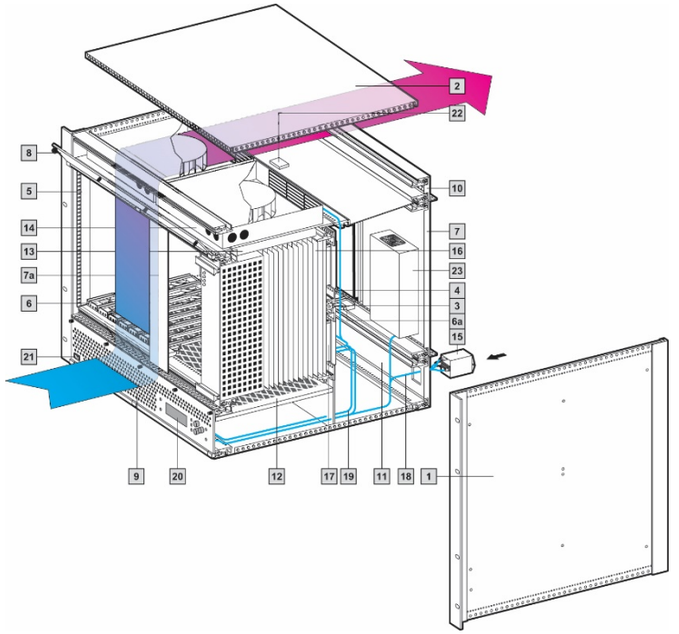
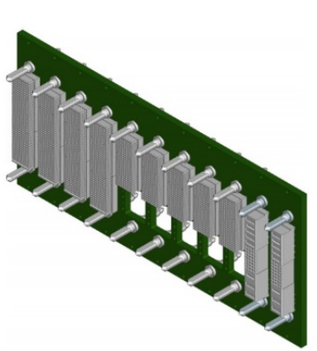
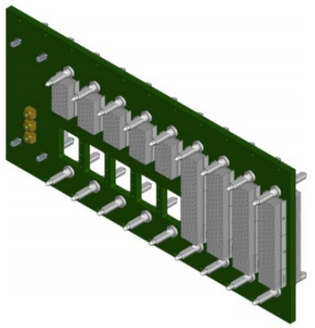
Decision Points: What Format and Levels of Ruggedization?

Choices/Challenges:

- Rackmount or ATR
- Ruggedize RiCool or typical MIL fan approach
- Keep RTMs or cabling
- Pick one ruggedization level or multiple



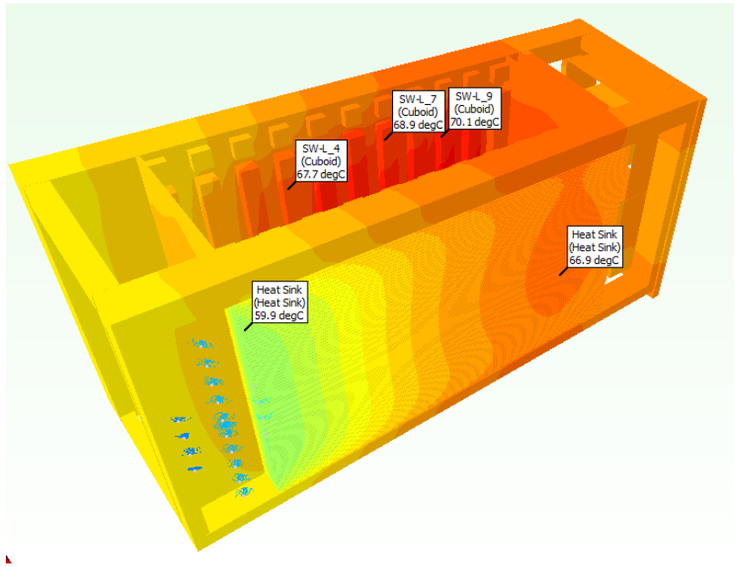




Solution Option A: High Wattage ATR

ATR Solution for conduction-cooled:

- ½+ ATR with heat exchange, thermal simulation to cool 800W
- Inner shelf for sealed MIL requirements, outer shell for airflow over fins
- Stand off for radius of VITA 67 cabling
- Customized front panel I/O

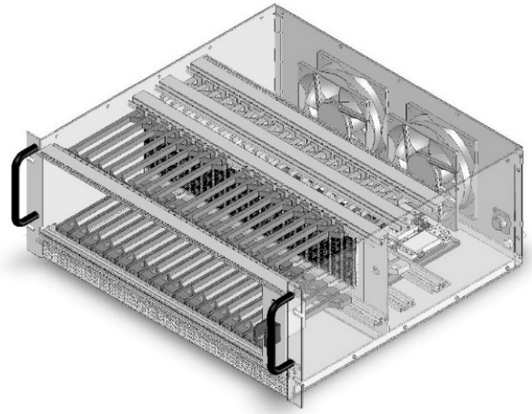


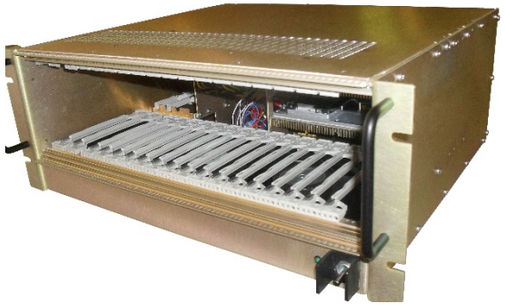
- Approved for ATR, conduction-cooled designs

Solution Option B: Rugged Rackmount

Rugged Rackmount solution for air-cooled:

- Light-rugged version with hardened RiCool, with RTMs
- MIL rugged version with rear fans
- Rear cabling for I/O
- Thicker metal, dampeners for shock/vibe, double rails





- Approved for rackmount, air-cooled designs

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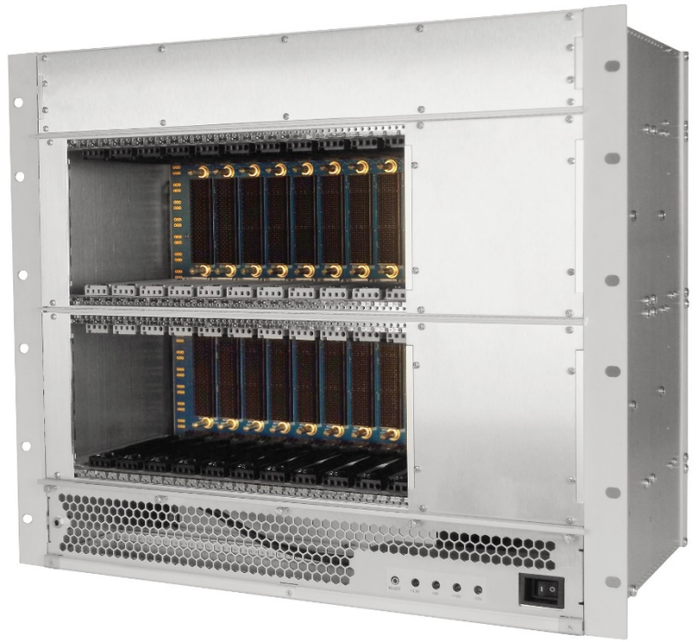
Challenge #3: Minimize Rack Height for VPX, Mixed Sizes

Requirements

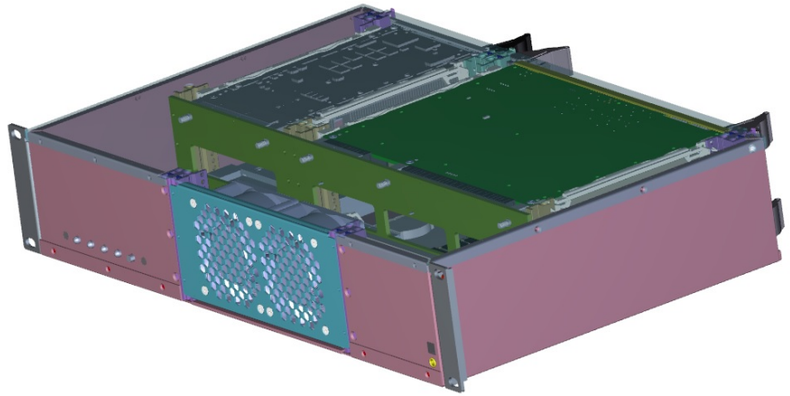
- 2 VPX 6U slots and 1 VPX 3U slot
- 19” rackmount enclosure in minimal rack height
- Semi-rugged, long MTBF
- Front-to-rear cooling



Decision Points: Trade-offs for Space & Cooling

Choices/Challenges:

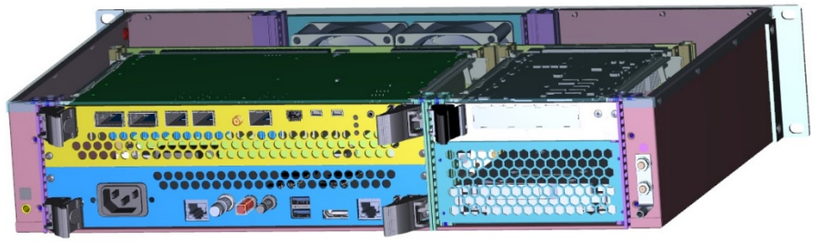
- Front load or rear
- 1U or 2U height (0.8” vs 1.0”)
- How to mix/match 3U and 6U
- Effectively pulling air across boards



Solution: SlimBox™ Rackmount OpenVPX

Solution:

- Rear-loaded approach, all cabling in back of chassis
- VPX components – rails, card guides, threaded inserts, etc.
- Modular extrusions for 3U and 6U segments
- Thermal simulation for airflow paths
- 2U chosen for extra airflow, more panel space



- Approved compact rackmount design

Challenge #4: Ruggedize a Commercial SDR

Requirements

- Need SDR to meet rugged applications
- Weatherproof options, IP67
- MIL/Rugged options
- Conduction-cooled options
- Various mounting options

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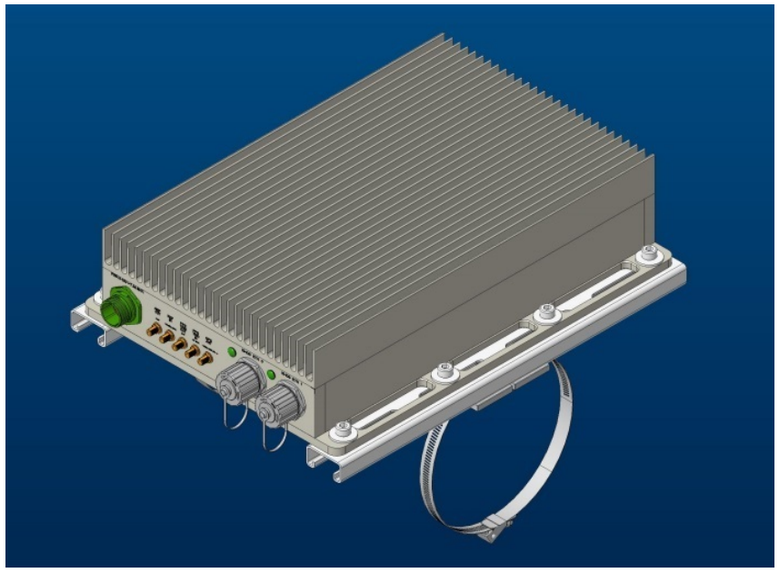
Decision Points: How rugged Do We Go?

Choices/Challenges:

- Meet MIL specs or semi-rugged
- Add IP67 capability for weatherproof?
- Cooling FPGA, multiple types
- I/O differentiation



Solution: Start with Most Rugged

- Start with MIL rugged, conduction-cooled, weatherproof
- Can use non IP67 components in slightly modified version
- Use aluminum case with fan filtering for semi-rugged

- Multiple options and configurations for various environmental conditions

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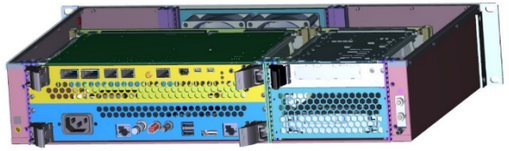
Questions?

The “Mini Me”

The “Cool Hottie”

The “Skinny Kid”



The “Tough Guy”

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