



We Need More Power Scotty!

*Getting the Heat Out:
Innovations for Cooling the Next Generation
of Embedded Computing Electronics*

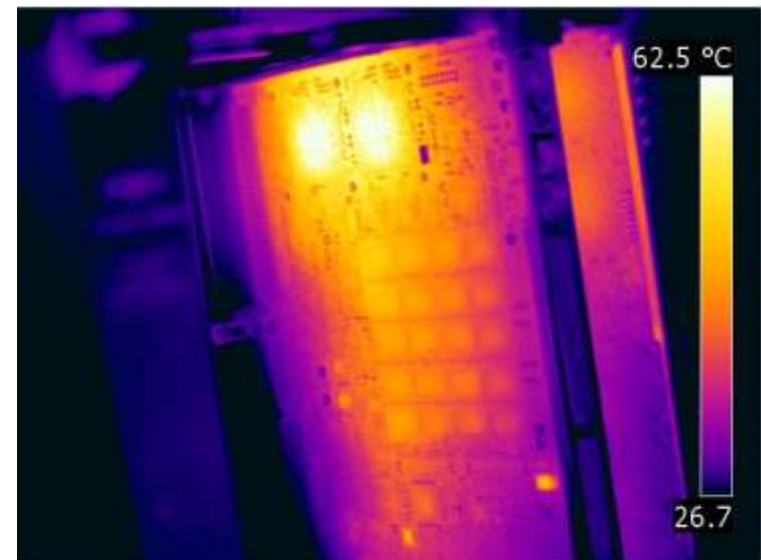
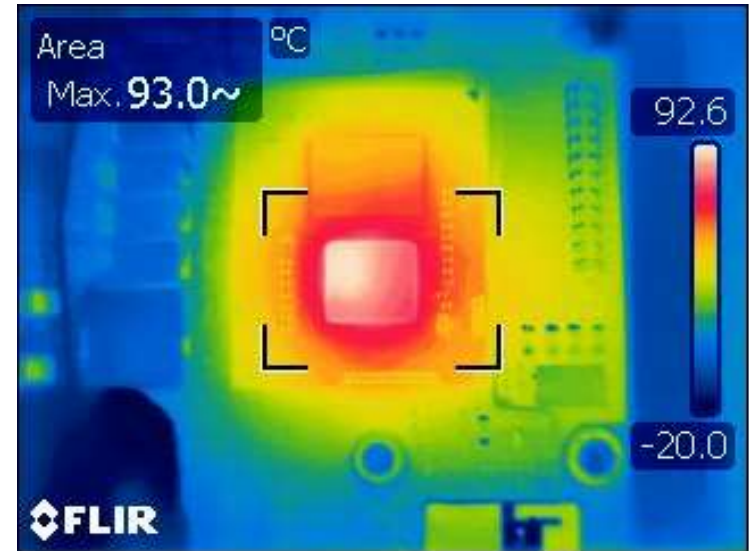
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Embedded Technology Trends
January 21, 2013

Thermal Challenges Overview

- Background – What's the problem?
- A brief history of power:
 - Module Power
 - Mezzanine Module Power
- Integrated Module Solutions
 - Air Cooled Vita 48.1
 - Conduction Cooled Vita 48.2
 - Air Flow-By™ VITA 48.7
- VITA 48 Sub-System Solutions
 - Quick reaction development platforms
 - Long term deployment solutions
- Summary



The Creation of SW&P Opportunities...

Size : 

“Captain.... I’m giving you all she’s got!!!”

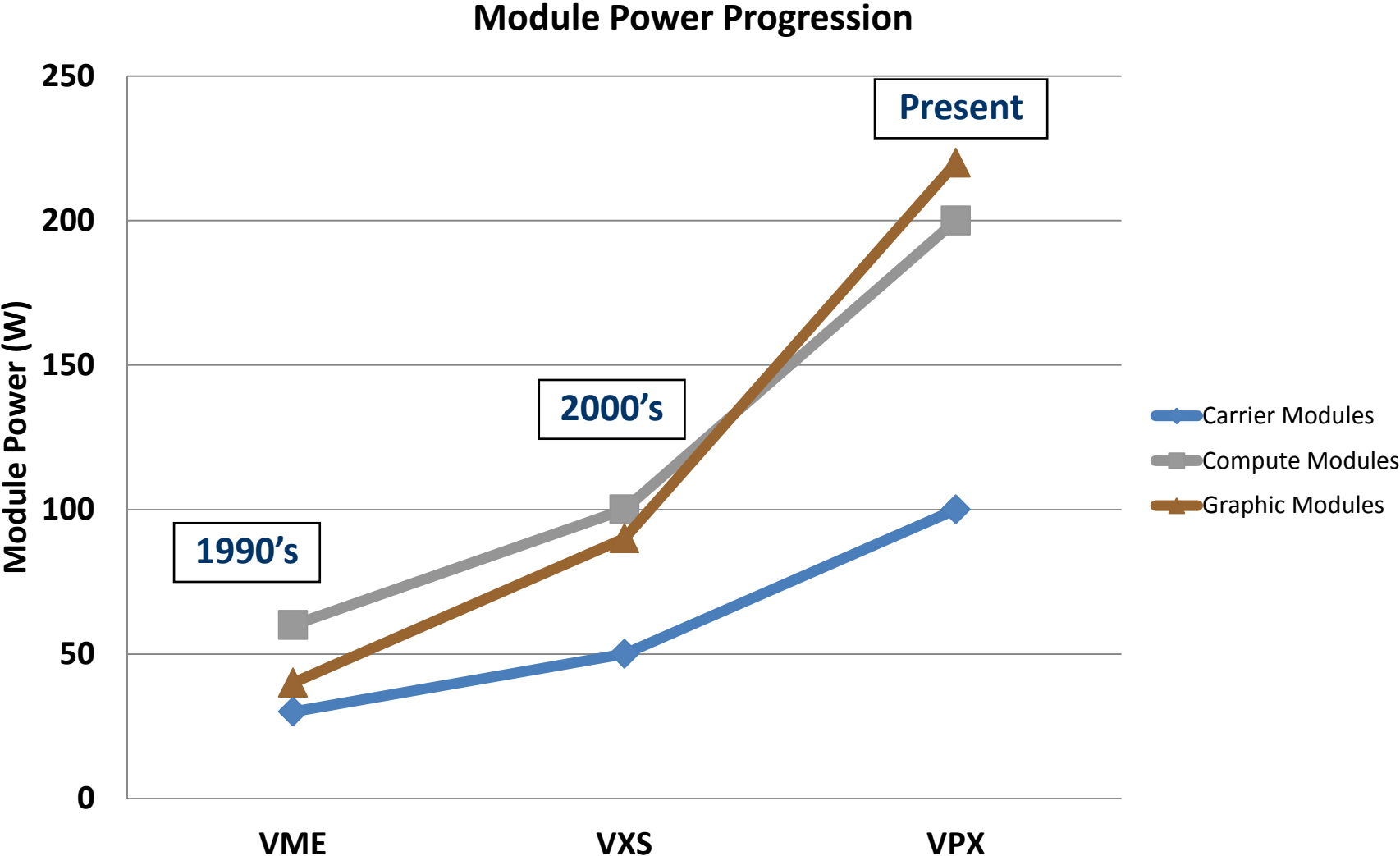
Weight : 



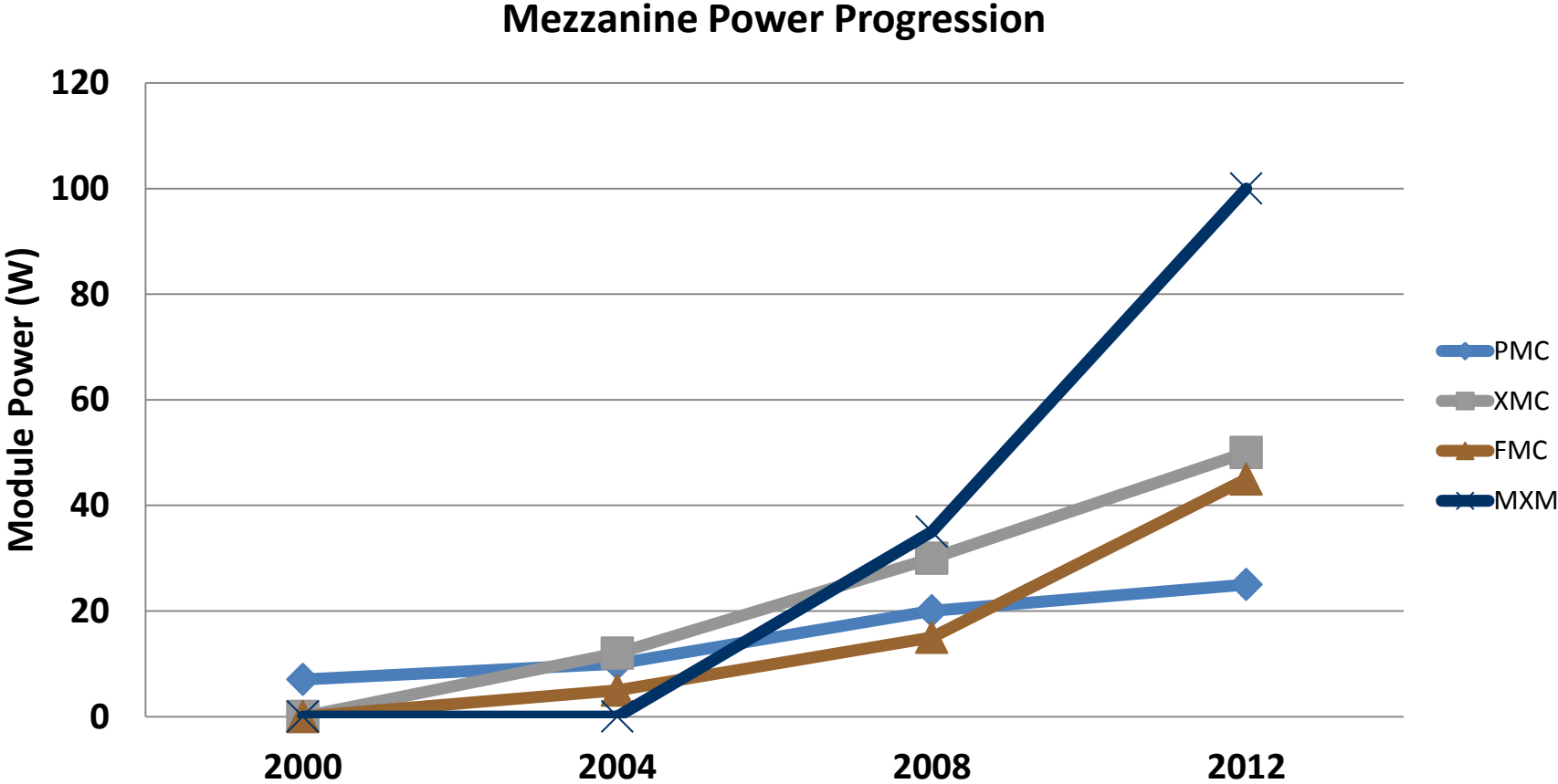
Power : 

How do we do more with less?

VME to VXS to VPX Module Power Progression



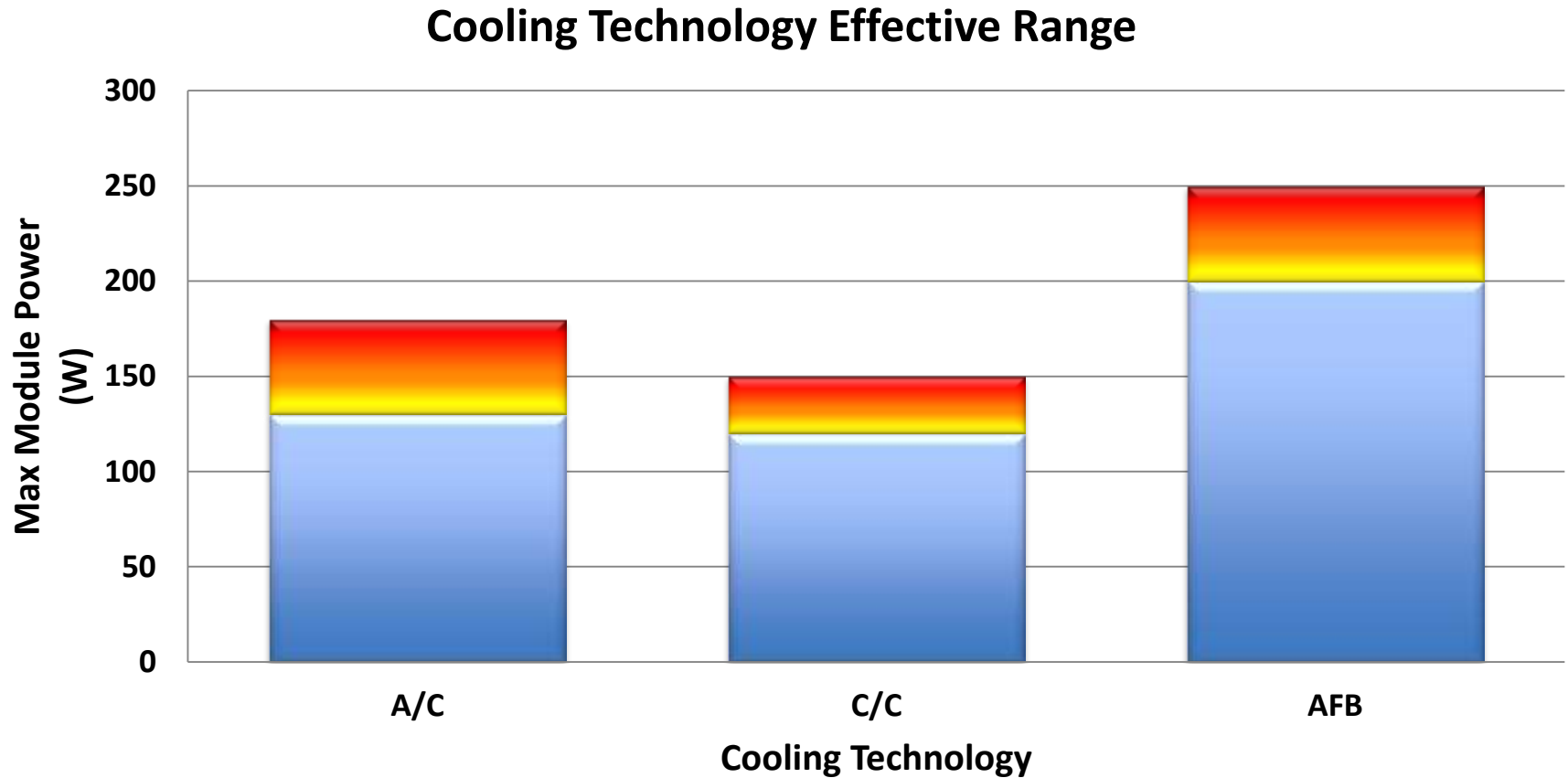
XMC Mezzanine Module Power



Mezzanine power has doubled every 4 years for the past 8 years!!!

Cooling Technology Effectiveness

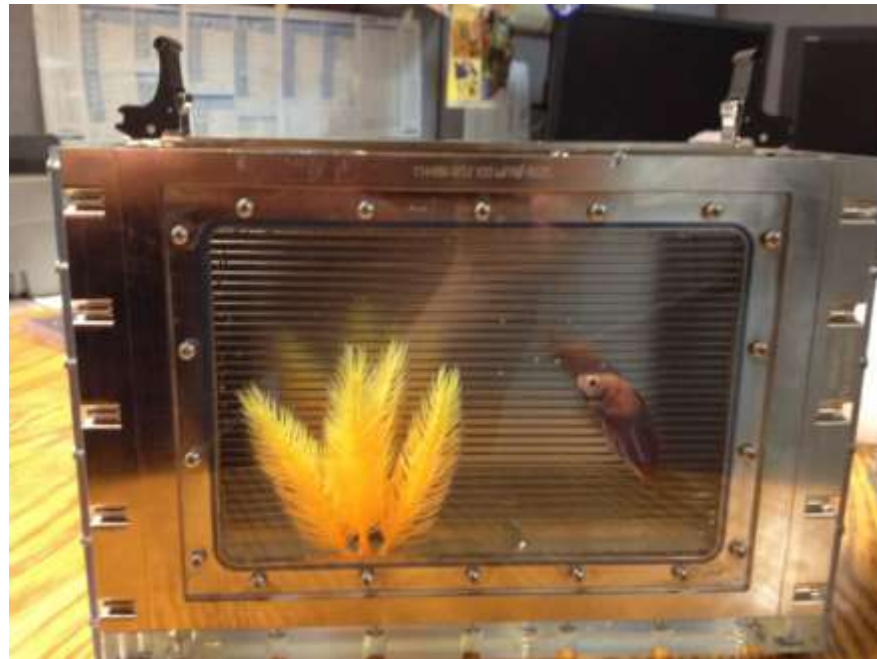
A/C vs. C/C vs. AFB



Many of today's high powered modules cannot be cooled using legacy cooling approaches.

Mercury Module Cooling Techniques

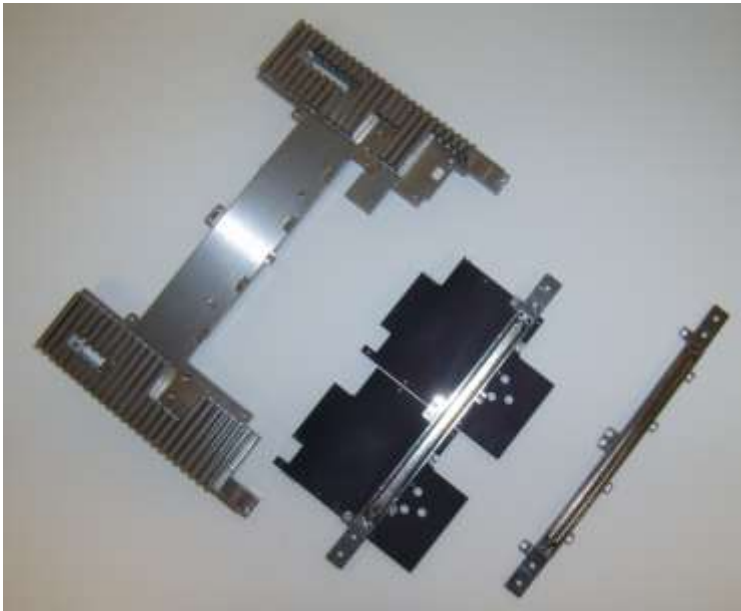
- Air-cooled VITA 48.1
 - Minimize air leakage and bypass areas by increasing effective heatsink area
 - Utilize 3-dimensional integrated heat-sinks
 - Increase air flow (CFM) across the heat-sinks
- Conduction Cooled VITA 48.2
 - Module to chassis interface thermal reduction
 - Improve Wedge-lock performance
 - Control the thermal path for heat dissipation



New Air Flow-By™ VITA 48.1 & 48.7

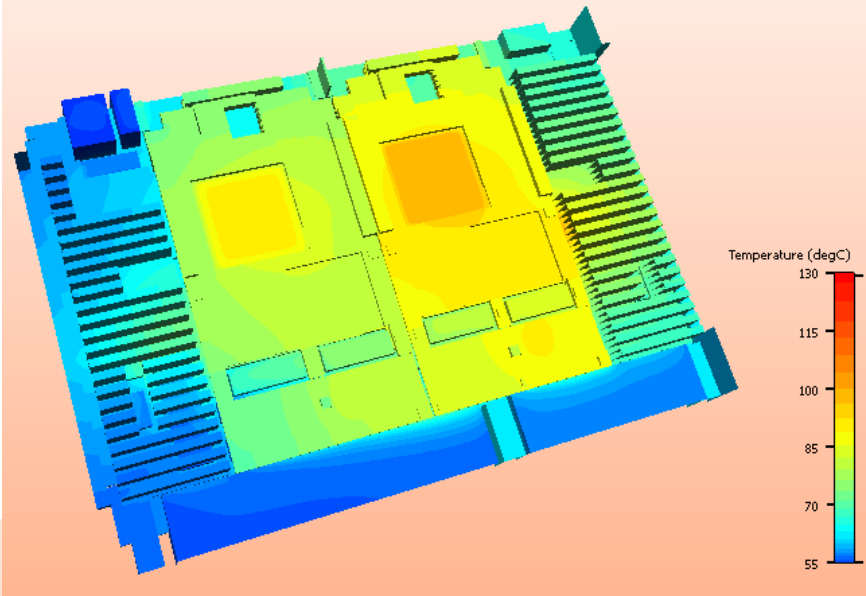
Integrated XMC Thermal Solutions – Air Cooled

- **Need:** Standards based approach to bring heat from the mezzanine modules to the carrier modules heatsink.
- **Solution:** Add “hooks” for a thermal bridge between the carrier module heatsink and the mezzanine module heatsink.
- **Result:** A thermal solution that is compliant to standards and allow for a wide range of mezzanine modules to be placed on a host while limiting any potential changes to a single component.

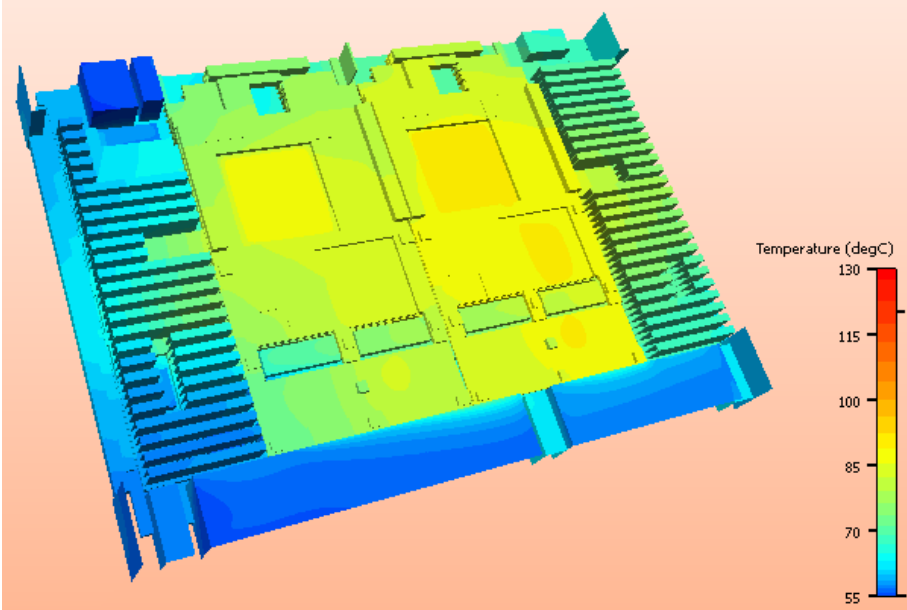


Air-Cooled Thermal Analysis Comparison

Without Integrated thermal bridge



With Integrated thermal bridge



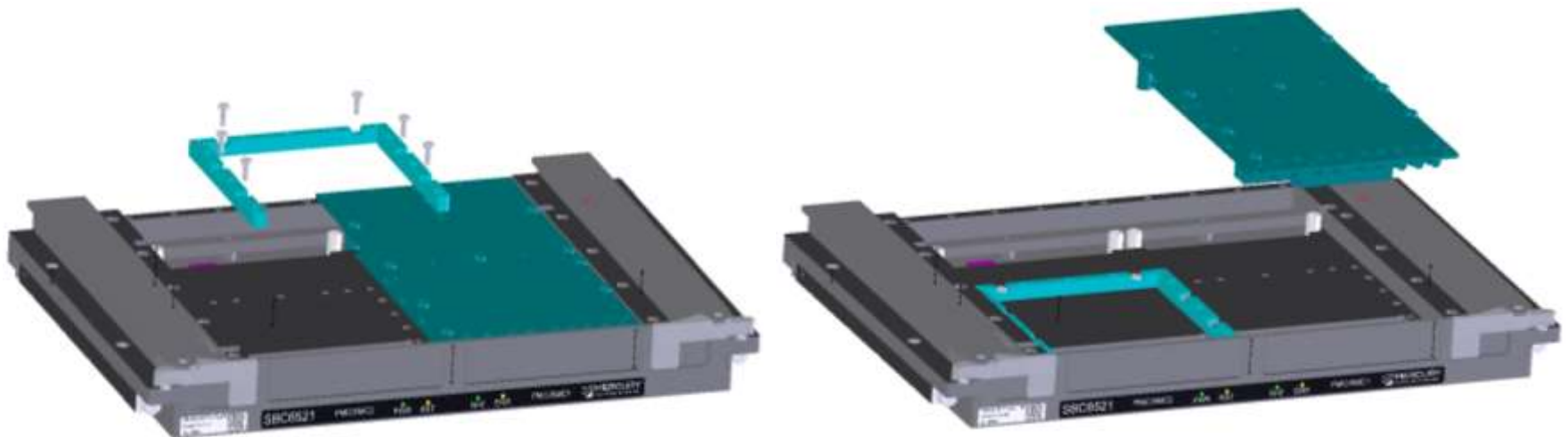
5°C Processor Thermal Reduction

½ Order of Magnitude

Impact on MTBF

Integrated Thermal Solutions – Conduction Cooled

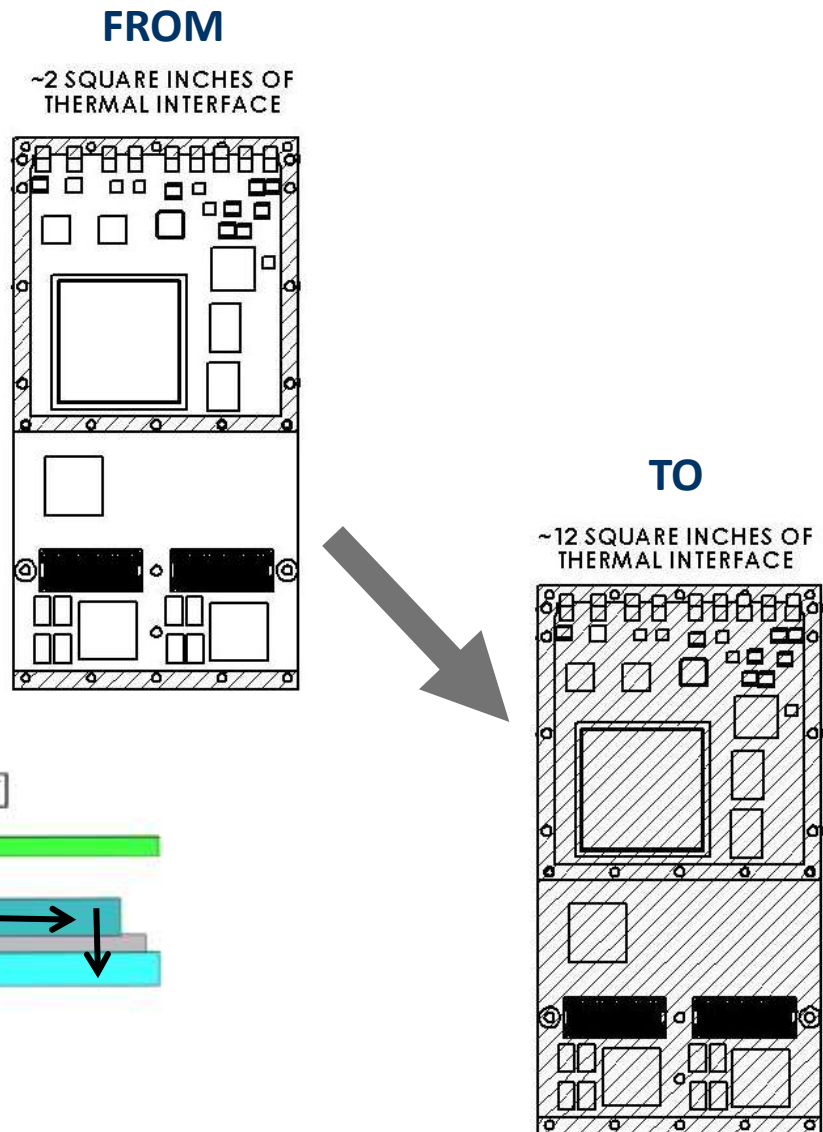
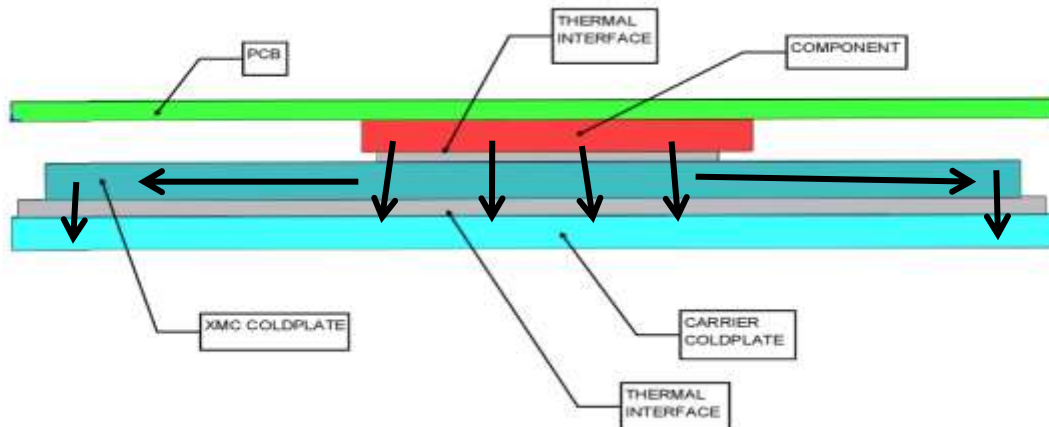
- Need: Standards based approach to bring heat from the mezzanine modules to the carrier module cold plate.
- Solution: Take advantage of allowances in ANSI/VITA 20 specification to allow for the thermal ribs to be removable. Add a mezzanine cold plate that is attached to the carrier module cold plate.
- Result: Staying compliant to standards allows for a wide range of mezzanine modules to be placed on a host while limiting any potential changes to a single component.



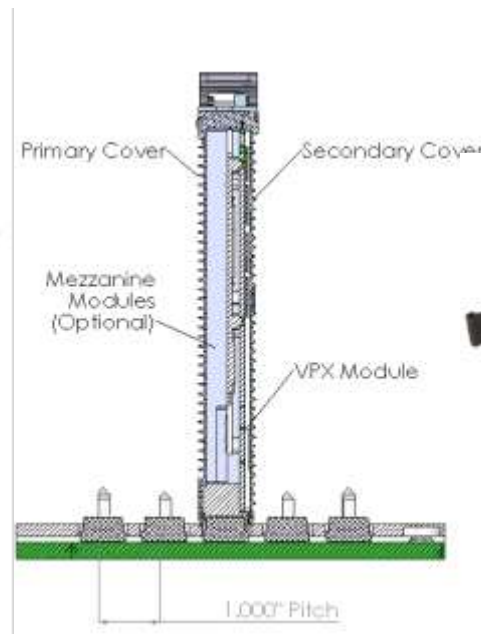
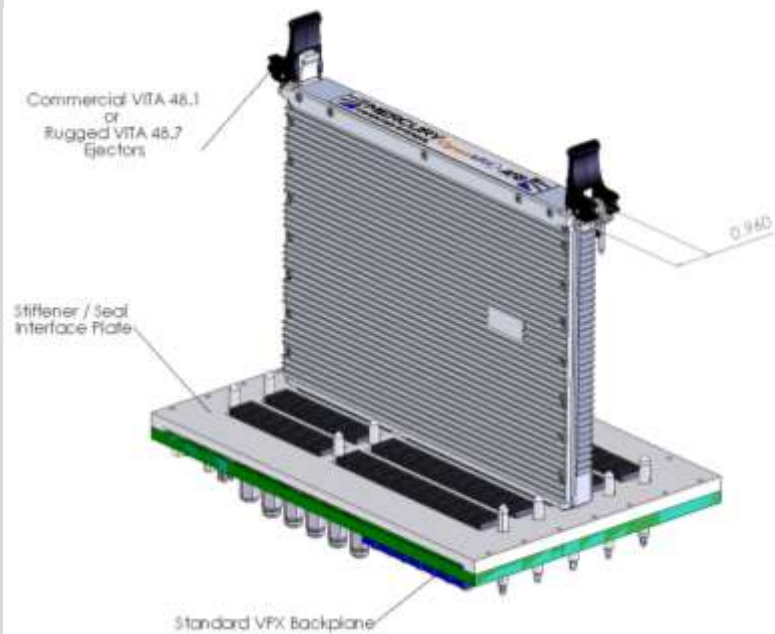
Integrated Thermal Solutions – Conduction Cooled

“New Solution”

- Max mezzanine module power:
 - **From:** 5-7 Watt Maximum
 - **To:** **30-50 Watt Maximum**
- Cooling method
 - **From:** Indirect path from a component to the PCB to the cold plate.
 - **To:** Direct path from the component to the integrated cold plates.
- Thermal interface area:
 - **From:** 2 square inches (legacy solution)
 - **To:** 12 square inches (new solution)



VITA 48.7 / VITA 48.1 Circuit Card Assembly



- Air is blown over the external covers for dual sided cooling.
- AFB covers wrap around existing modules to maximize re-use.
- 1" pitch modules.
- 200+ W per slot cooling capacity in rugged deployments.
- Designed for optimization of C-SWAP.

VPX Air Flow-By (AFB) QRC Versatility

- AFB modules can be used in commercial VITA 48.1 chassis or in rugged VITA 48.7 compliant chassis.
- AFB modules can be used side by side with standard A/C modules in a VITA 48.1 chassis.
- AFB chassis are capable of providing C/C slots for ease of transition from legacy technologies.

“Oh Captain, she’ll give us over 200 watts per slot!”



16-Slot AFB Chassis



6-Slot AFB Chassis

Mercury AFB Deployment Systems

(11-slot and 13-slot available)

AFB Deployed 13-Slot System Impacts:

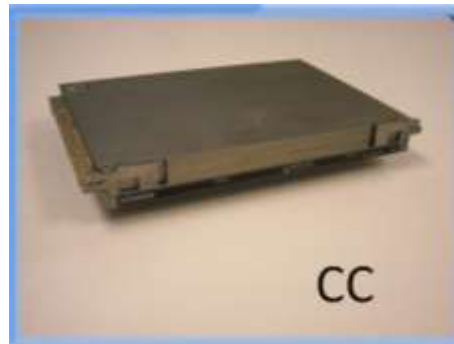
- Conduction Cooled to AFB modular upgradability.
- Weight reduction of over 20% (18.4 lbs.)
- Reduced system power by greater than 5%.
- MTBF increased by $\frac{1}{2}$ an order of magnitude.
- Equivalent system footprint to provide a drop-in upgrade.



AFB provides subsystem level flexibility to allow for higher max ambient OR increased heat load OR decreased fan power...

Thermal Challenges Summary

- By focusing on standard VITA based solutions for cooling today's high powered modules, Mercury is uniquely positioned to maximize 3rd party leverage and product velocity.
- Mercury is able to apply these solutions across a wide range of products (carriers, high compute devices, graphic modules...) across multiple use cases (air-cooled, conduction cooled, AFB....)
- These thermal solutions allow for VPX systems to be deployed in more extreme environments, operate more efficiently, and last longer than legacy solutions.



Learn more at <http://download.mrcy.com/thermal>



Q & A

Thank You