

## AVIONICS FLIGHT CONTROL

### Application Challenge:

- Aircraft electronics are subjected to extreme environmental temperatures
- Eliminate existing liquid cooling systems
- Improve system performance with passive cooling solution
- Reduce overall payload weight
- Reduce power consumption of the cooling system



Photo 1: A Fighter's flight efficiency and combat readiness depend upon effective thermal management systems.

### Overview

Electronics in military aircraft are often subjected to operating environments well beyond their survival temperatures and with limited heat sinks to route the thermal load. The current approach is to use a liquid cooling system with either vehicle fuel or Polyalphaolephin (PAO) to cool the electronics. Advanced military platforms have found this approach limits their operational effectiveness, and in some cases, have been rendered inoperable due to overheated electronics.

### Solution:

Improve the thermal transport within the aviation electronics enclosure using the following approach:

1. Improving insulation to reduce ambient heat gains which must be removed by the liquid cooling system.
2. Using heat pipes to directly cool critical components.
3. Replacing the solid aluminum posts with heat pipe embedded posts.
4. Replacing the existing solid aluminum heat spreader with ACT HiK plates.

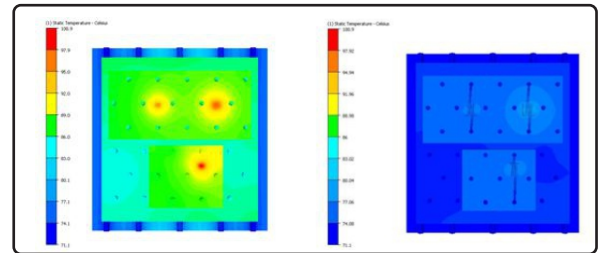


Figure 1: Thermal modeling results of a representative electronics assembly. Left view – thermal problem as defined by the customer. Right view – includes the ACT thermal management system. The test data agreed with these results.

### Optimized Results:

Model results of the first ACT electronic subsystem showed considerable improvements over the current approach, see Figure 1. The overall temperature gradient within a generic electronics box decreased by 25°C, increasing the allowable sink temperature by 25°C. The increase allows for more freedom in sink selection, which is typically limited aboard military platforms. The test data agreed with these results. Figure 2 is a profile representation of the electronics cooling assembly.

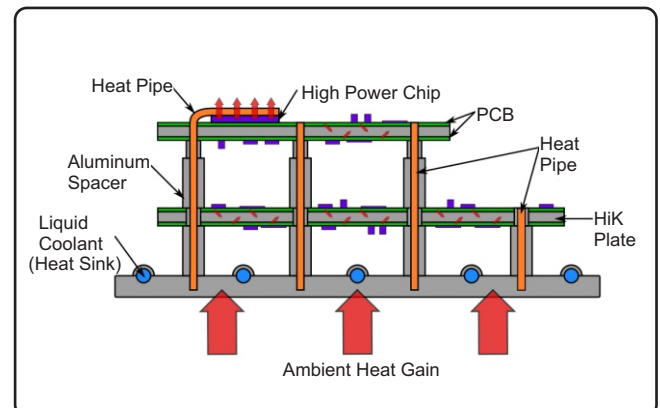


Figure 2: Representative Electronic Assembly