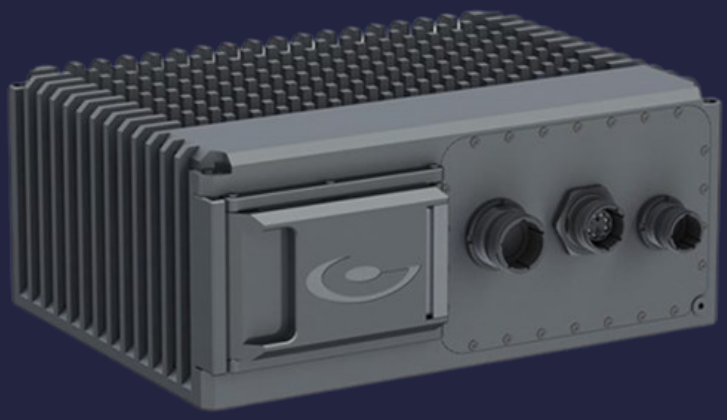
Rugged Small Form Factor Passive Computer



Configurable Intel COM Express

Passively Cooled Only

100W+ Total Power Draw

14%
operating temperature increase

6
Optimised for six different orientations

LOW
Mass with considerate materials

About Our Partner

Our customer is a world-class leader in the development of high-performance, high-quality storage solutions and small rugged data recorder systems.

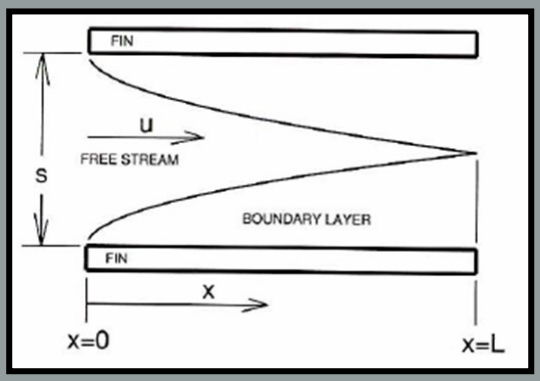
Our customer's offerings span from commercial-grade products for benign environments to ruggedized conduction-cooling products deployed in severe environments, with a focus on Size, Weight and Power optimisation.

Gaining a Competitive Edge

To compete in the Rugged Defence Market our customer must focus on improving the ruggedness of their chassis. Small Form Factor units are highly popular and the capability of operating their unit in a higher operating temperature scenario than their competitors stands the product out in a crowded room. The challenge was to improve the operating range of the ground vehicle computer unit under development which had no guaranteed access to conduction cooling through the baseplate. This unit was to be entirely self-contained, with internal Power Supplies and configurable Intel SoM options for functionality.

As a slightly smaller and more streamlined business than other OEMs in the industry, our customer cannot accommodate costly iterations or wasted contracted rates into their product model. They were looking to engage with a credentialed thermal design bureau whose results could be trusted to be true, and who could support and teach the existing thermal team as the project developed.

This level of trust was critical in the selection process for our customer to ensure that their quality delivery remained at a very high level. As part of our process to begin a working relationship, we **verified our simulation capability against a test piece independently controlled on site**. Our openness to challenge from our customers and clear communication of engineering principles suited what our customer were looking for in a partner.



An example of "boundary layer plugging", a phenomenon which should be carefully avoided where possible when designing fin spacing and geometry

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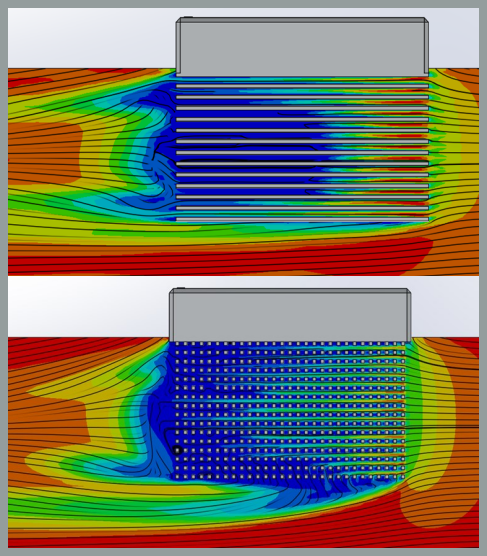
Optimising the Solution

With the positive feedback from the calibration verification study, Entropy were selected to help optimise this product's thermal solution. Entropy had shown we had the technical capability to produce reliable feedback to our customer which could inform future design decisions.

Utilising our expertise in creating fin optimisation studies for ambient cooling, we were able to quickly evaluate the relative merits of different fin geometries and advise our customer how to best test their product to represent likely customer scenarios.

Ambient cooled solutions are notoriously difficult to extract extra performance, as static air is a poor conductor of heat. To evaluate all possible solutions, Entropy identified five key aspects of an optimisation study:



A cut plot showing the passage of air through differing fin configurations. A pin array allows air inlet from multiply directions allowing for a more flexible unit.

- **Environment Review** – We take the time to review with the customer the true operating characteristics of their products, to ensure the units are built for purpose and not for generic standards. This can often change the solution drastically.
- **Effective Thermal Modelling** – convection cooling simulations can be highly computationally intense, which is prohibitive for a parametric optimisation. Poor thermal engineers will either sacrifice accuracy to resolve this, or delivery time. Entropy take the time needed upfront to create a robust model, to save time by the end.
- **Heat Spreading** – Distributing the heat from high power components into a more uniform area can improve the heat transfer out from the fins. High conductivity inserts or subtle geometry changes can help here.
- **Fin Geometries and Orientation** – the capability to install this product in multiple orientations changes the characteristics of the design. The unit may no longer have a single best operating point but may cover many, which could require differing fin shapes.
- **Fin Optimisation** – Maximising the heat transfer from the fins to the ambient air is critical in static cooling applications. We run specialised parametric studies to identify the best fin geometry for this solution.

A Cooler Box

Extracting performance gains from ambient air cooling is a difficult process. The potential for total heat transfer is low and all gains achieved are recognised for success. Entropy achieved a **14% improvement in the ambient air temperature** the unit may operate in evaluating the fin geometries alone. This is a notable figure which may be the difference between a rugged defence application or only an industrial deployment. Our customer were able to take this information and deliver an outstanding product with potential for even more range as more engineering is applied to the solution.

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