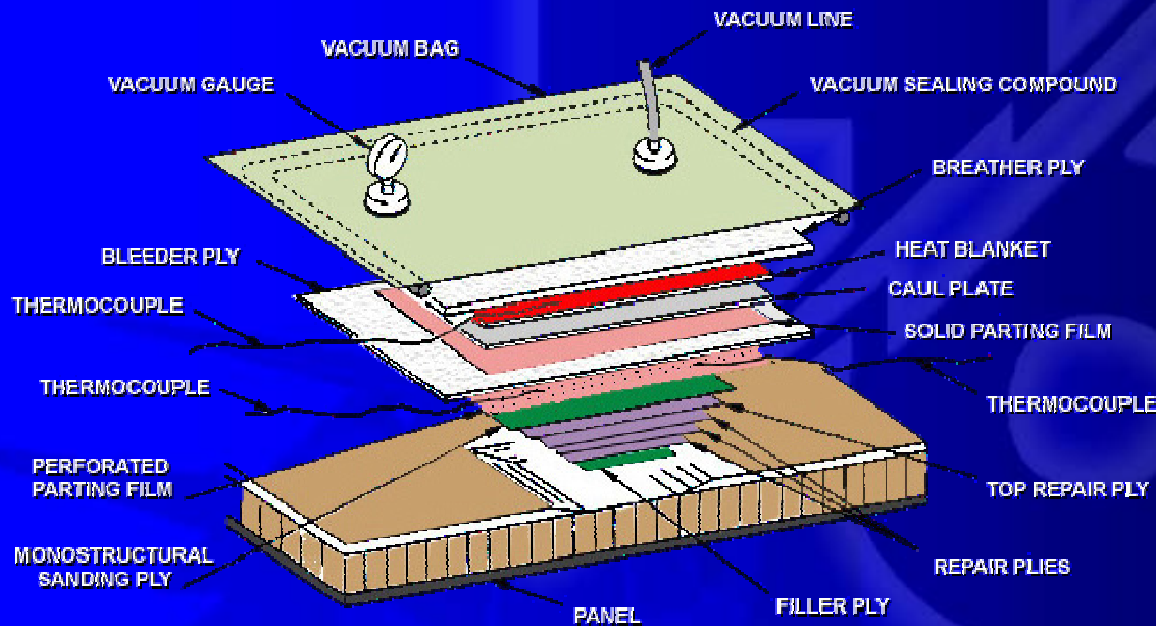




Composite Repair Heating Methods

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Typical Repair Method for Fiber Reinforced Aircraft Structures



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Typical Repair Method for Fiber Reinforced Aircraft Structures



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Understanding of heat transfer and repair methods is essential to success... otherwise



Laminate failure at high temperatures

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Repairing of complex structures presents further challenges.

- **3 Dimensional Heat Blankets**
- **Hot Air Systems**
- **Heat Lamps**



Custom Formed Blankets for 3-D Structures



**Radiant / Infrared
Heat Lamps**



**Hot Air
Systems**

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Heat Blankets: Leading technology



Radome



Standard & Shaded Blanket



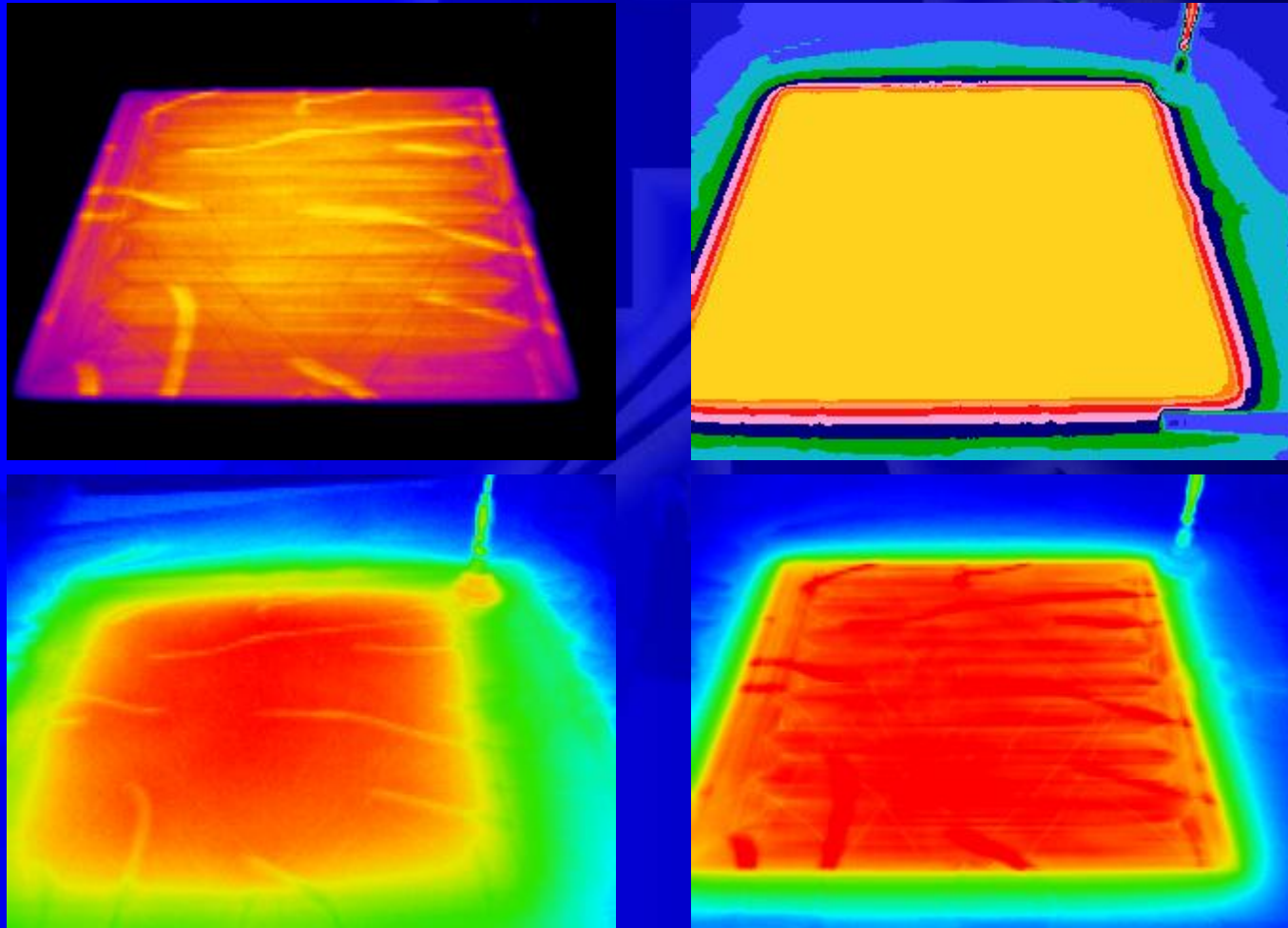
Stretchable



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Heat Blankets: Current research

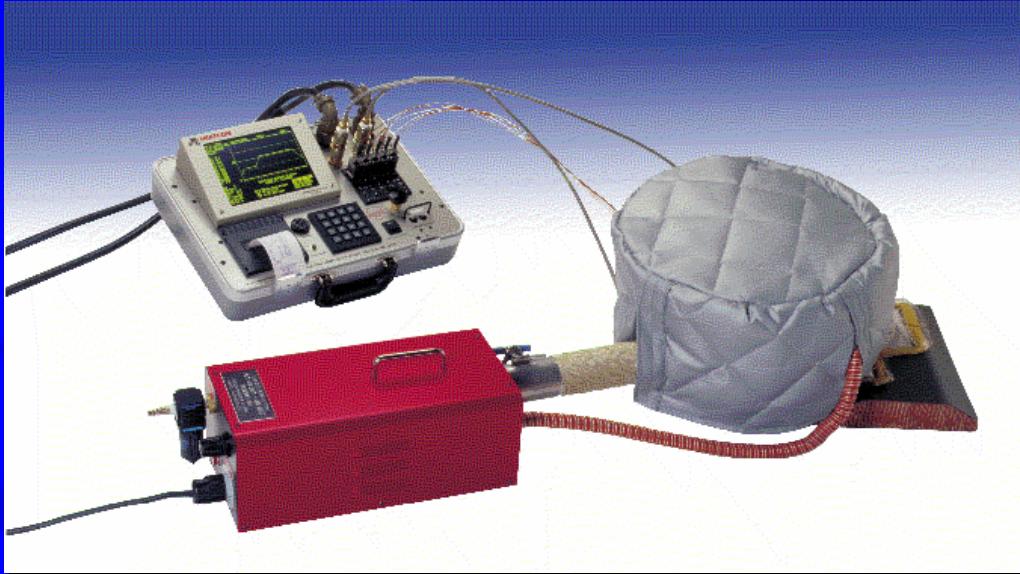
- **Thermal uniformity study for US Navy contract**



Thermal Imaging
Camera used during
heating process for
comprehensive heat
distribution mapping
analysis

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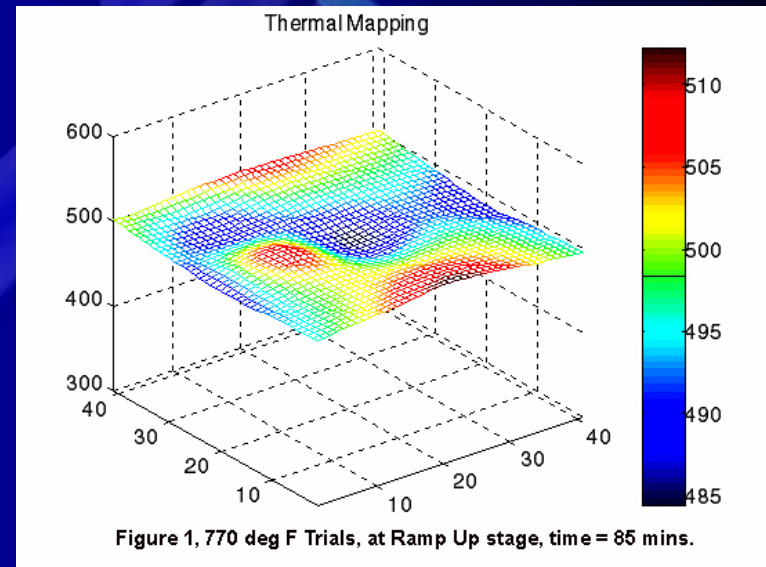
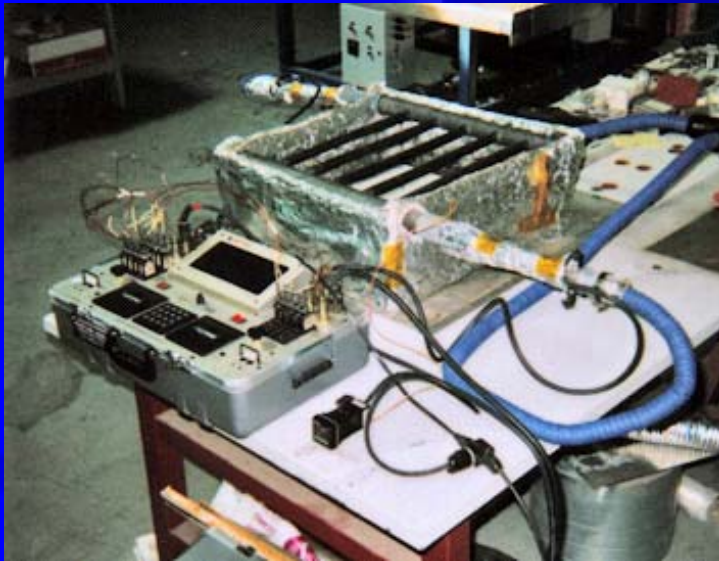
Hot Air Systems: Leading technology



Provides even heating of contoured surfaces where a heat blanket cannot be used

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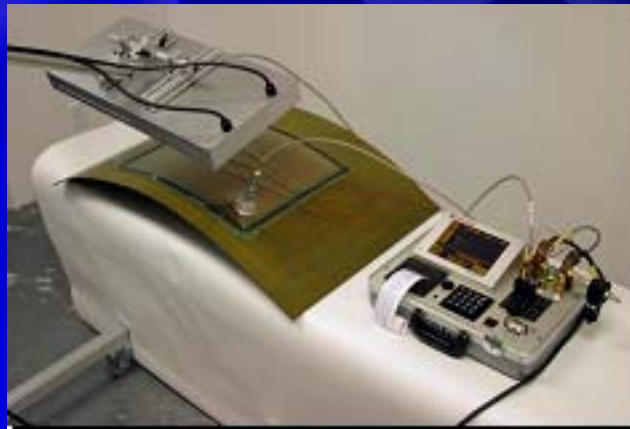
Hot Air Systems: Current research
US Navy SBIR project: completed in 2002



New research is being done on explosion proof systems

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Heat lamps: Leading Technology



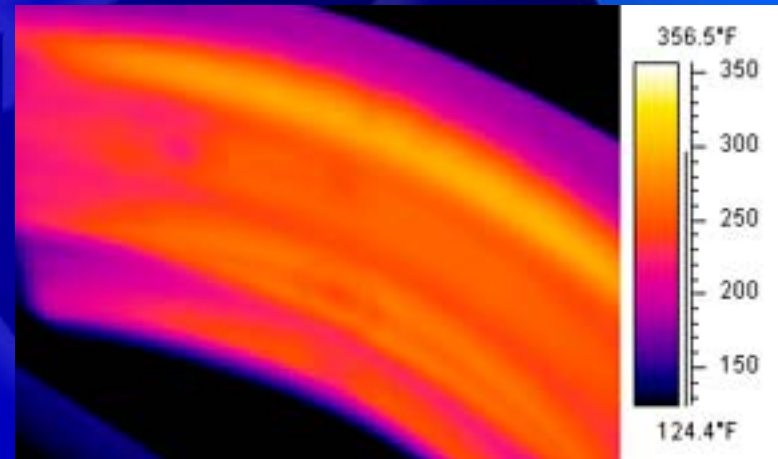
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Heat lamps: Current research

- Heating effects of infrared wavelengths on various composite structures



Thermal Image of
Infrared heat lamp
on composite structural
component



- Product development to produce heat lamps suited for shop use

Summary

- **Many different heating methods exist for composite repair**
- **All rely heavily on “real world” experience**
- **Limited training and documentation available**

Research needed to:

- **Better understand thermal effects of available heating methods**
- **Produce documentation that will aid repair in applying these methods**
- **Other?**