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Stan Shire

A 5m³ Solar Refrigerator

THE UNIVERSITY OF WARWICK

Project funded by the U.S. Army:
to design and build a refrigerated food storage container for use in the desert

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ATMI

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Background

- The U.S. Army soldier's daily fuel use has risen from **1→16** gallons since WW2
- July 25 2006, Maj. Gen. Richard Zilmer sent the Pentagon a "Priority 1" request... for "***a self-sustainable energy solution***" including "***solar panels and wind turbines***"
- **60,000** US army personnel to transport fuel

Project initiation

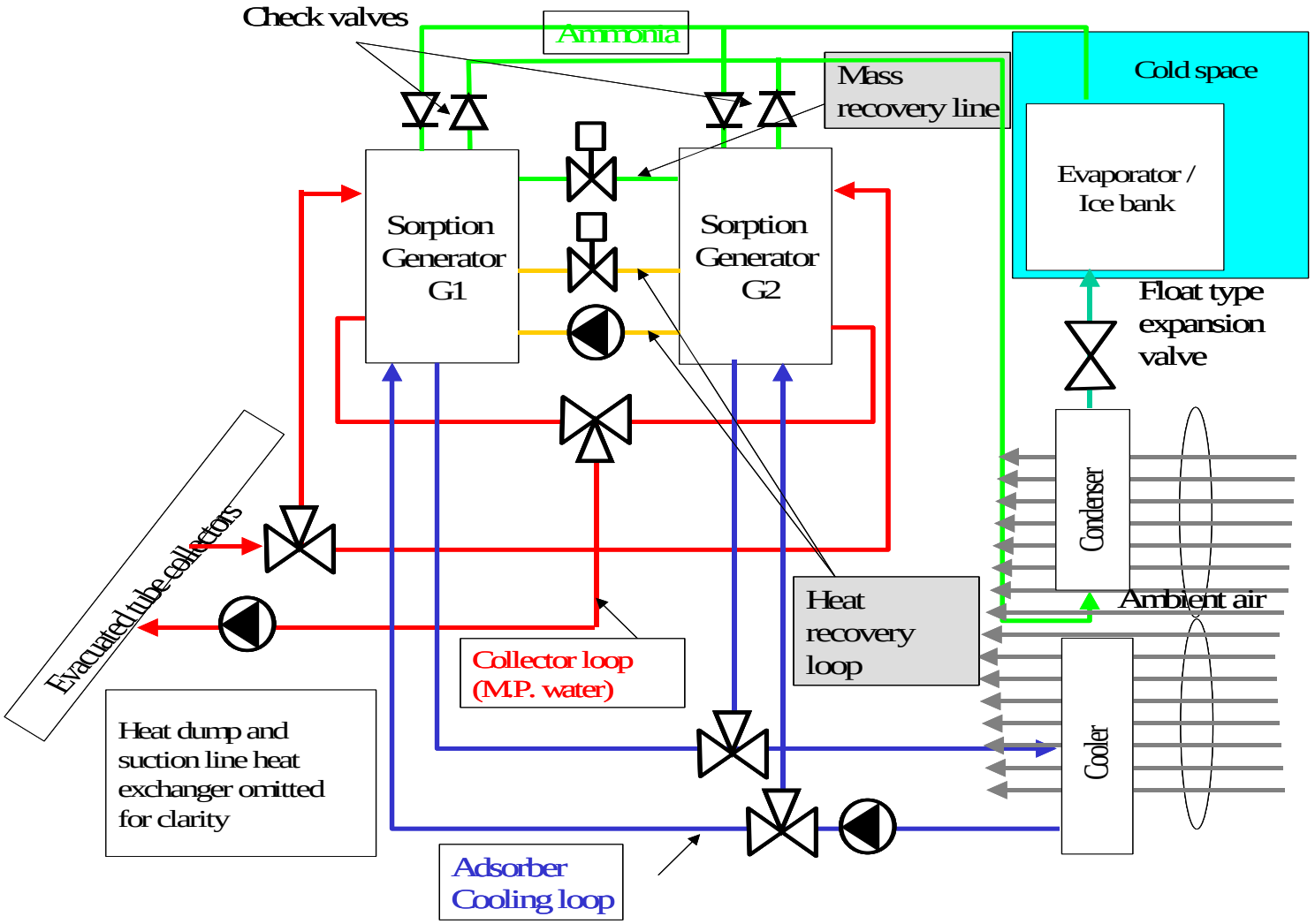
- Funding was available for ATMI to develop a solar thermal powered refrigerated container using their carbon
- The carbon is produced in monolithic plates, has high conductivity and porosity but low permeability
- ATMI selected Warwick to partner them in this project

Project brief

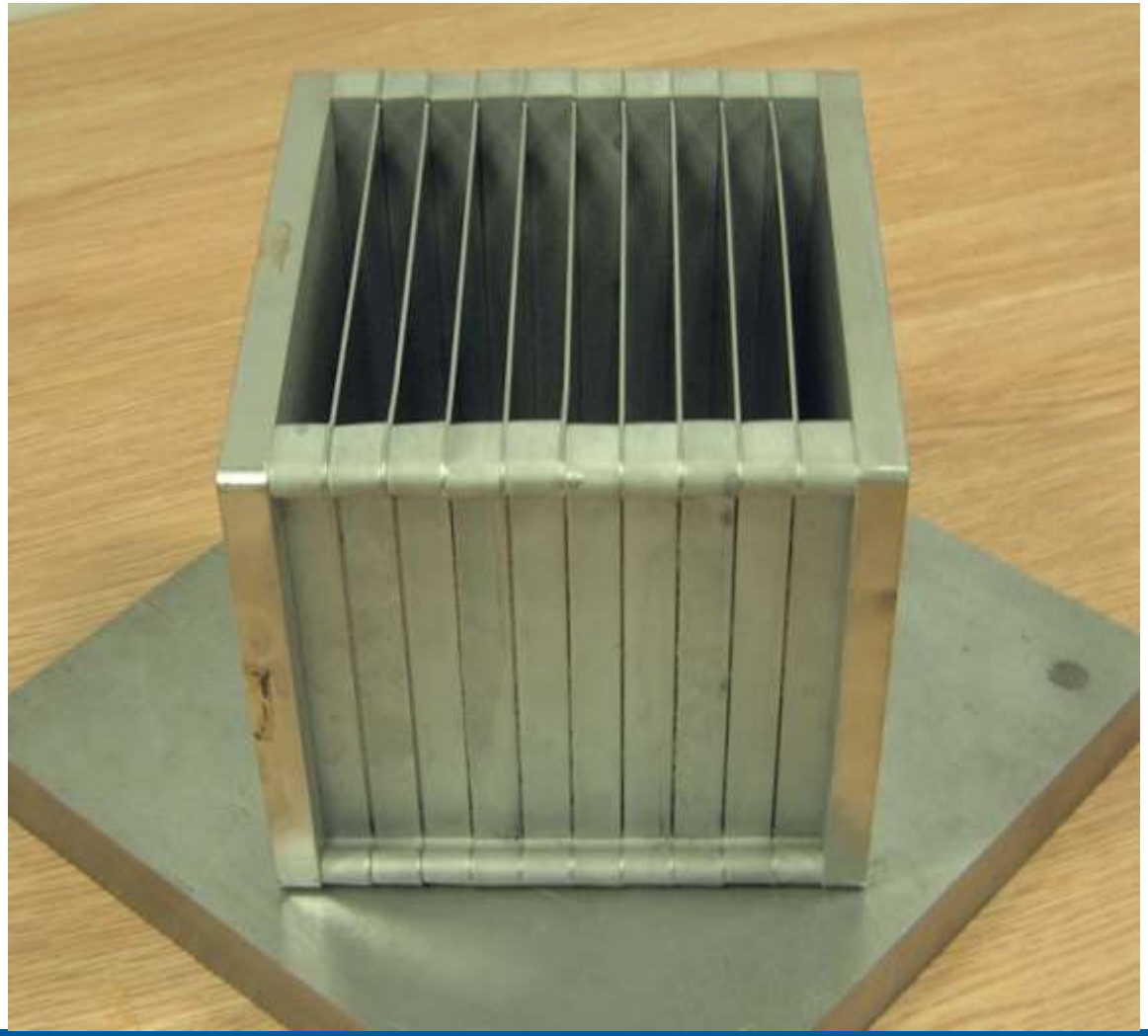
- Product is a stand-alone chilled (5°C) container, 5m^3
- 2 beds with heat and mass recovery
- Evacuated tube collectors 10m^2
- Ice storage for cold
- One year from concept to test!

Standard container

Design -system schematic



Generator (adsorbent bed)

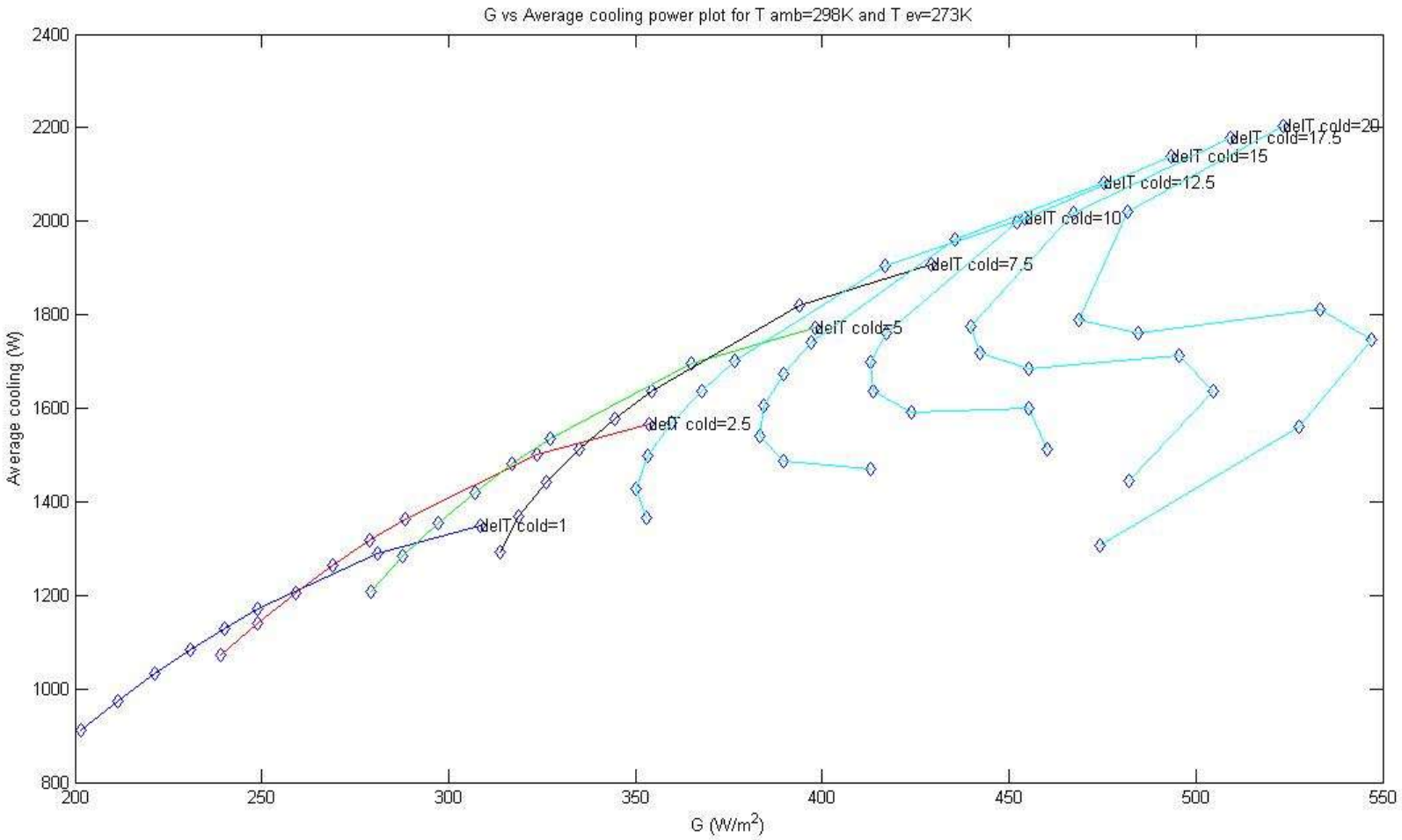


Pressure testing generators

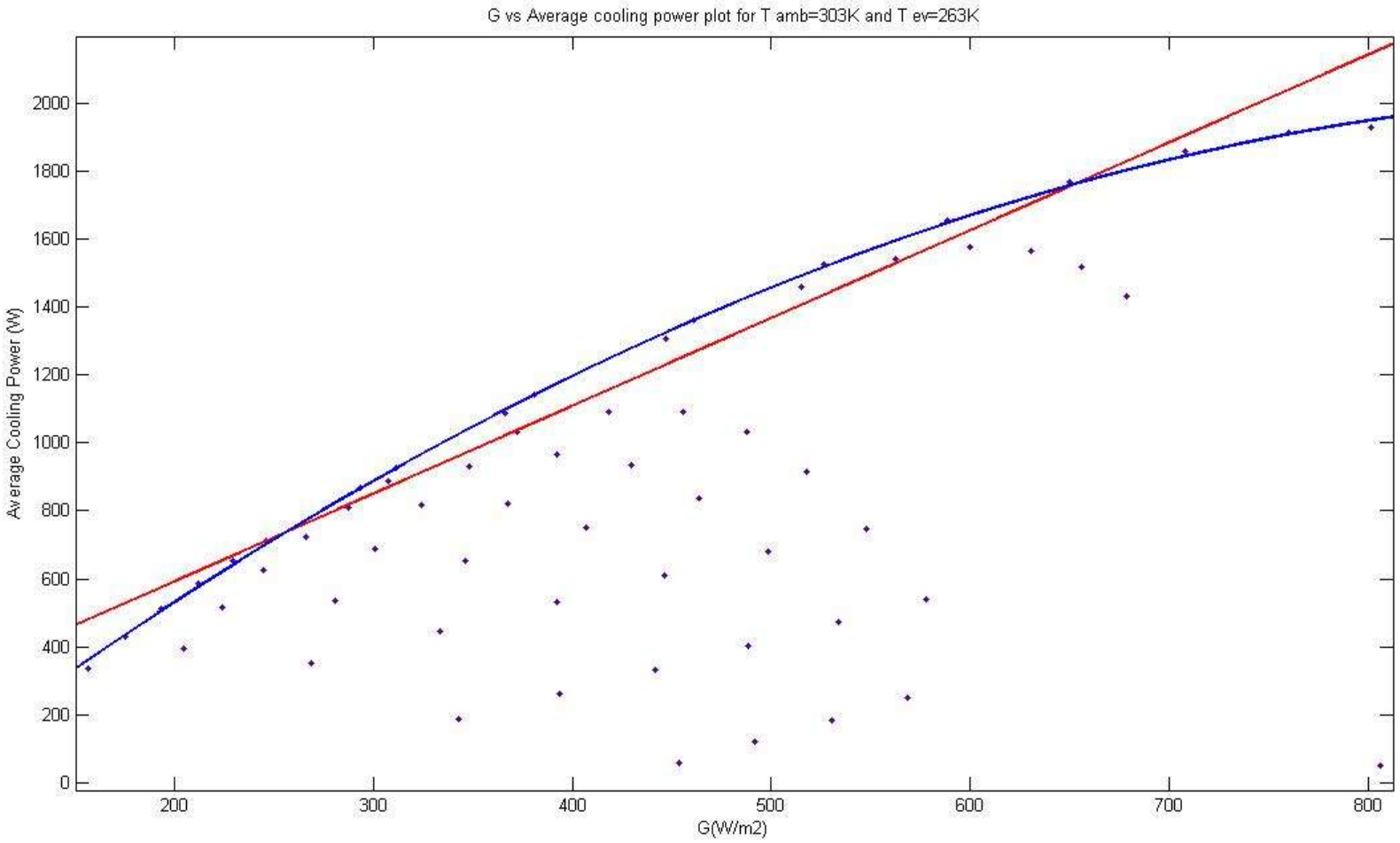
Packed generator

Carbon plates

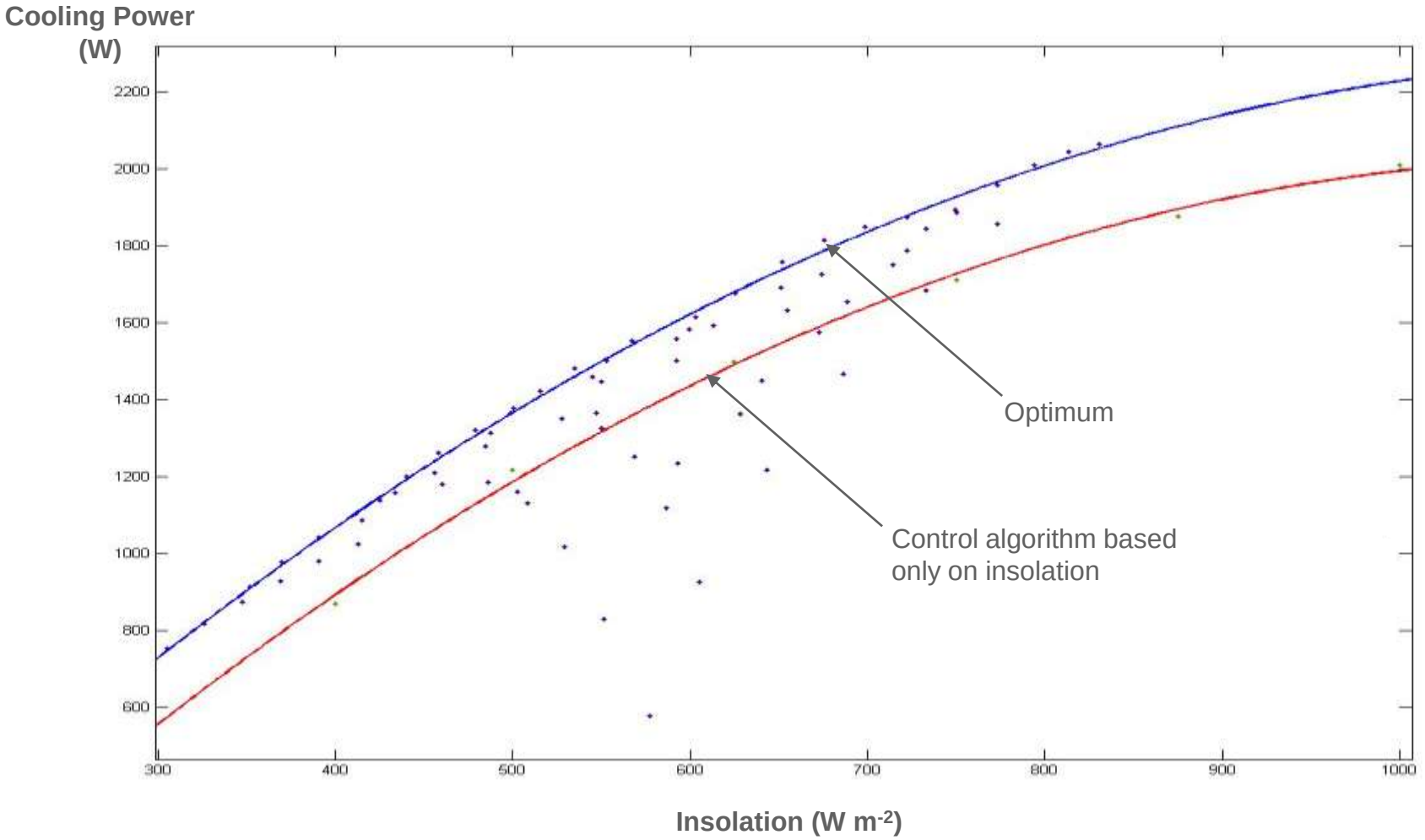
Modelling


G vs Average cooling power plot for T amb=298K and T ev=273K
Average cooling (W)
G (W/m2)
2400
2200
2000
1800
1600
1400
1200
1000
800
200
250
300
350
400
450
500
550
delT cold=20
delT cold=17.5
delT cold=15
delT cold=12.5
delT cold=10
delT cold=7.5
delT cold=5
delT cold=2.5
delT cold=1

Optimizing performance

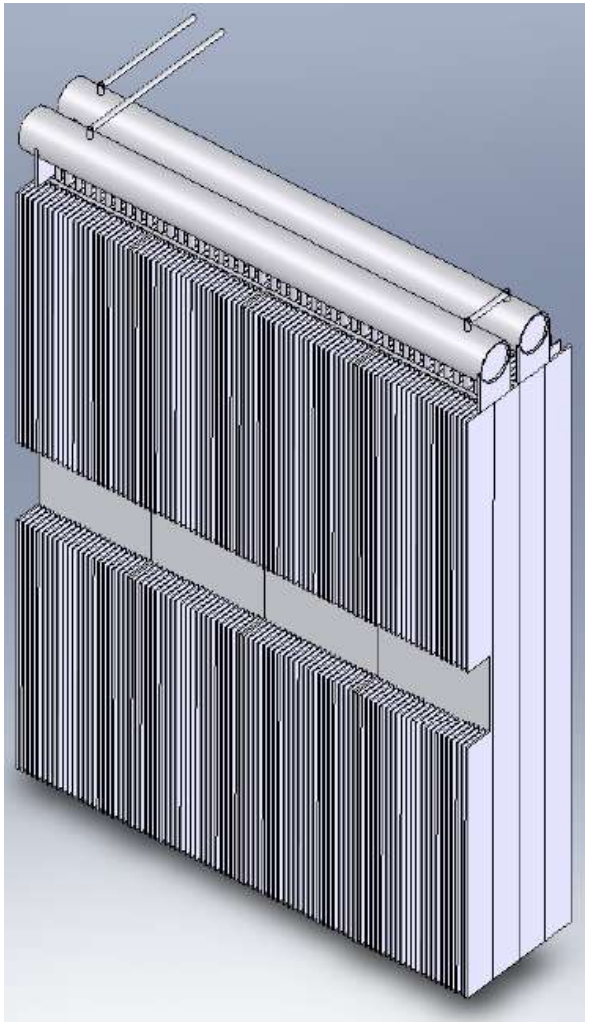


Simple control algorithm



The unit takes shape…

Evaporator



Progress to date:

- System modelled & designed
- Control algorithm chosen
- System components built and assembled
- Heating & cooling water plumbing
- Initial system operation and control tests completed

Further work

- Load carbon into generators
- Assemble and test system
- Deliver for testing in Arizona
- Design the ‘beta’ version?

Thankyou.

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