Advanced, Energy Efficient Shelter Systems for Contingency Basing & Other Applications

POC:

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"For the Army, we're going to have to conduct what I call expeditionary maneuver. That's rapidly deploying forces to unexpected locations to bypass anti-access. But that can't just be a force that gets there. It has to be a force that has the mobility, protection and have lethality to operate." Lt. Gen. H.R. McMaster Director, Army Capabilities Integration Center and Deputy Commanding General, Futures, U.S. Army Training and Doctrine Command.

US ARMY RDECOM

US ARMY NATICK SOLDIER RD&E CENTER

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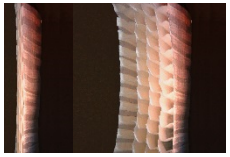
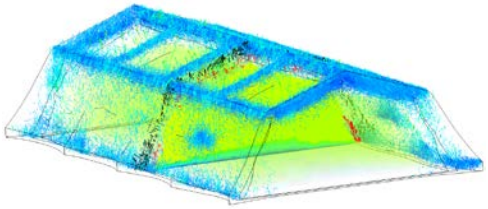
Operational Energy Capabilities Improvement Fund










Purpose: This is a Joint Service, multi-organizational program to address inefficiencies with energy usage and fuel consumption of shelter systems.

Results/Products:

- Initial Demonstrations – Evaluation of complete, state-of-the-art shelter systems in operational environments
- Technology Development – Mature DOD and industry developed technologies to advance the state-of-the-art to reduce logistics/cost impact and further reduce fuel consumption on the battlefield.
- Follow On Demonstrations – Leverage lessons learned in the Initial Demonstrations and Technology Development into optimized shelter systems and validate in the AOR.

Payoff:

- Increased energy performance at the tactical edge of the battlefield.
- Energy efficient shelter systems that are optimized to reduce fuel consumption on the battlefield and manpower requirements for the Warfighter.
- 50% reduction in shelter system power consumption

Schedule & Cost

MILESTONES	FY12	FY13	FY14	FY15	FY16
Initial Demonstrations					
Technology Development					
Follow On Demonstrations					
TOTAL PE/Project S&T $M	4.5	3.9	4.0	1.0	

Milestone Indicators: TRL or SRL: ◆ Milestone Timeline: ▬

POC:

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Key Partners & Stakeholders

- Project Sponsor: OSD Operational Energy Plans & Programs Office
- Project Lead: Natick Soldier Research, Development & Engineering Center (NSRDEC)
- Air Force Base Expeditionary Airfield Resources (BEAR) Global Management Office
- Air Force Civil Engineer Center (AFCEC/CXA)
- Army Corps of Engineers, Engineer Research and Development Center -Construction Engineering Research Laboratory (ERDC-CERL)
- Army Materiel Command - Project Manager Expeditionary Energy & Sustainment Systems (PM-E2S2),Product Manager Force Sustainment Systems (PdM-FSS)
- Maneuver Support Center of Excellence (MSCoE)
- Combined Arms Support Command (CASCOM)
- Transformative Reductions in Operational Energy Consumption (TROPEC)

Ali Al Salem, Kuwait Evaluation Site

Kuwait Evaluation Site

Initial Demonstration: Guam Evaluation

4 Army shelters deployed Aug 2014 to TF Talon site at Andersen AFB Guam

- 1 TEMPER AS with 250 G lofted liner, F100 ECU, Rigid Floor
- 1 TEMPER AS with TempShield radiant liner, F100 ECU, Rigid floor
- 2 Base-X 305 shelters with TempShield liner.
  - 1 shelter with 3 ton ECU
  - 1 shelter with F100 ECU

US Army Cold Weather Evaluation: CRTC Ft Greely, AK

- 6 shelters
- 1 baseline TEMPER Air Supported with 250G lofted liner with legacy MTH 150 fuel fired heater
- 1 “energy efficient baseline” TEMPER Air Supported with 250G lofted liner and New MTH 200 fuel fired heater
- X-Dome AirBeam shelter
- V1.5 AirBeam shelter
- 1 RDS 635 Frame shelter with 250 G lofted liner
- 1 TEMPER Air Supported with prototype cellular insulation
- All shelters used fuel fired heaters
  - MTH 150 and MTH 200
- All shelters will have data acquisition collecting weather data, internal temperature conditions and fuel data

Mississippi Range at CRTC

Mississippi Range at CRTC

X-Dome Prototype Shelter

- X-Dome Prototype shelter
  - Triple layer radiant liner
  - Integrated plenum and flexible strip LED lights
  - Sealed liner to floor and incorporated attic space
  - Passive ventilation
  - Does not require to be staked prior to inflation, is self supporting through inflation

X-Dome

X-Dome

V1.5 Airbeam

- Utilizes current TEMPER Air Supported footprint and capabilities like end wall complexing
- Attic space
- Integrated plenum
- Flexible LED lights
- Sealed liner to floor
- Passive ventilation
- Double layer radiant liner

V1.5 Airbeam

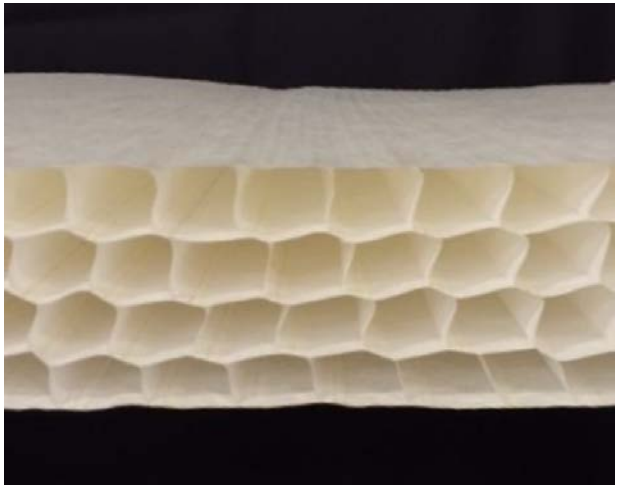
V1.5 Airbeam

Prototype Cellular Insulation

- Production of first prototype cellular thermal insulation
- Packs flat and deploys to 3.5in thick

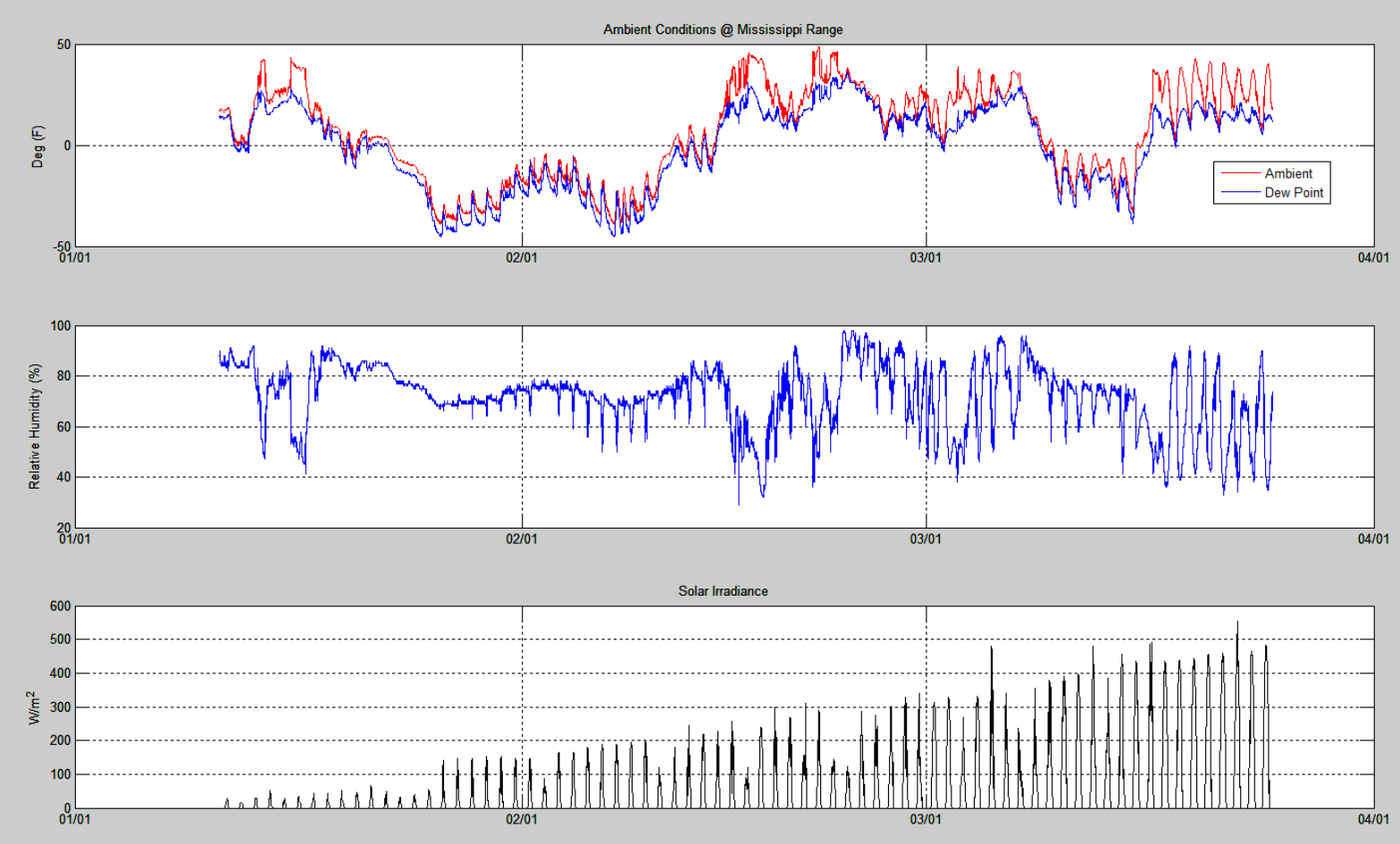
- FR issues addressed
- TEMPER AS evaluated in AK
- Frame shelter prototype currently

in production for summer evaluation



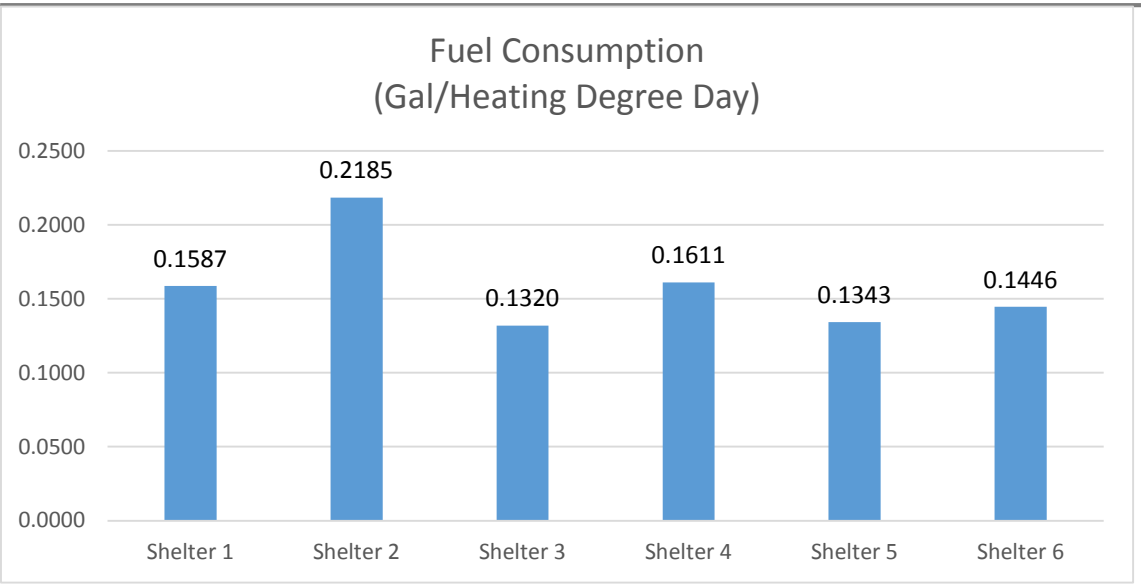
Prototype Cellular Insulation

Results



Max high temp: 49ºF
Min temp: -39.5ºF
88.5ºF temp range
Max wind gust (2m): 43 knots

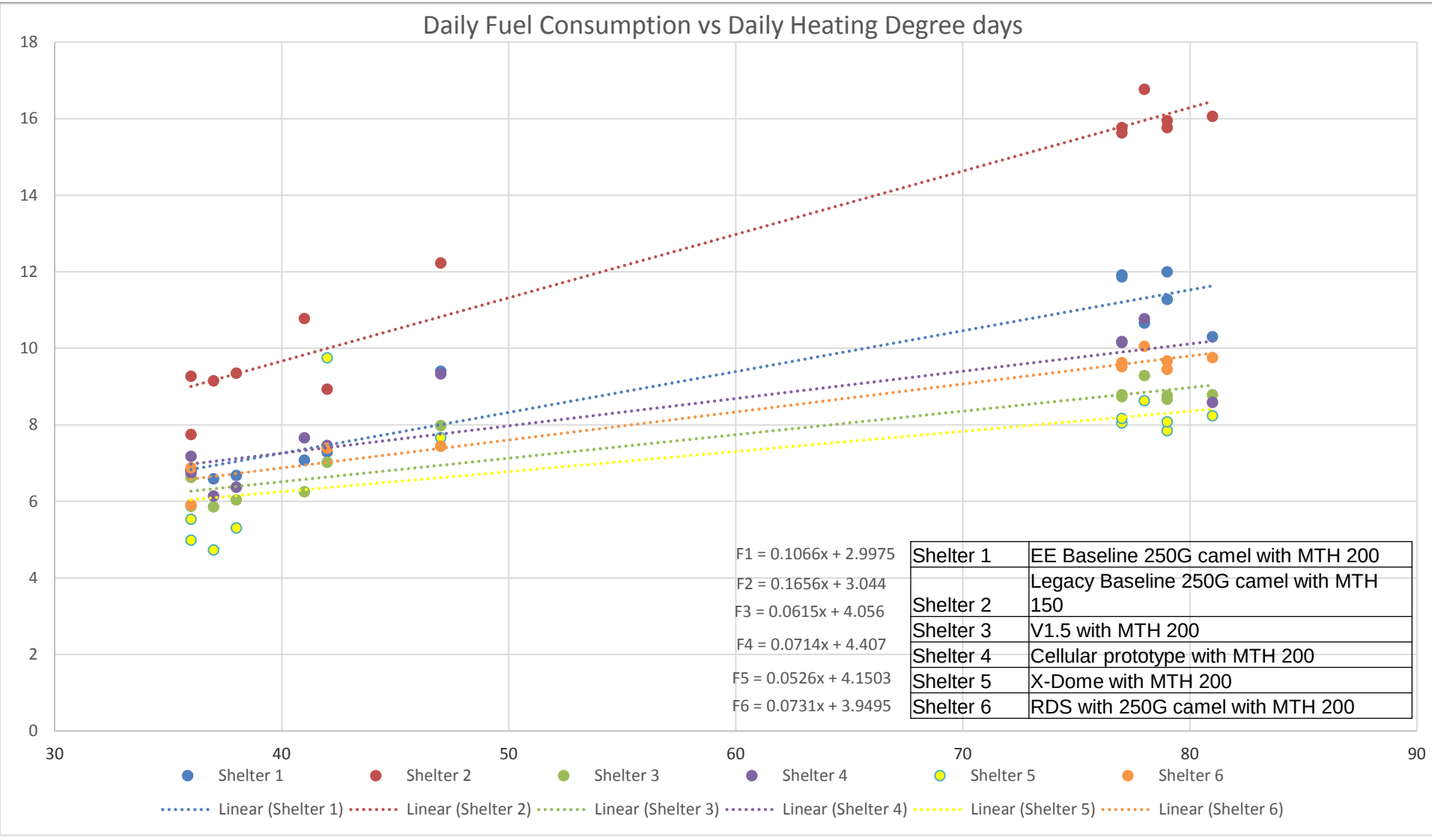
Results



Shelter 1	EE Baseline 250G camel with MTH 200
Shelter 2	Legacy Baseline 250G camel with MTH 150
Shelter 3	V1.5 with MTH 200
Shelter 4	Cellular prototype with MTH 200
Shelter 5	X-Dome with MTH 200
Shelter 6	RDS with 250G camel with MTH 200

	Mean Annual HDD	Shelter 1	Shelter 2	Shelter 3	Shelter 4	Shelter 5	Shelter 6
One Shelter	12775	2027.26	2790.86	1685.69	2057.80	1715.07	1847.01
11 Shelters (150 Man FP)		22299.89	30699.45	18542.54	22635.84	18865.78	20317.13
Savings over Legacy BL		8399.56		12156.92	8063.61	11833.67	10382.33
Savings over EE BL				3757.35	-335.95	3434.11	1982.76
% savings over Legacy BL		27.36		39.60	26.27	38.55	33.82
% savings over EE BL				16.85	1.48	15.40	8.89
Savings over Legacy BL 234 FP Modules		1965497.6		2844718.213	1886884.249	2769078.941	2429464.343

Results



Shelter 1	EE Baseline 250G camel with MTH 200
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Shelter 6	RDS with 250G camel with MTH 200

Results

- Heating season from Fairbanks, AK Oct-April
- MTH200 heater accounts for 27.4% savings
  - Equates to 8400 gallons of fuel saved per 150 man Force Provider basecamp per year
- V1.5 with MTH200 saves 39.6% over legacy baseline
  - Equates to 12156 gallons of fuel saved per 150 man Force Provider basecamp per year
- X-Dome with MTH200 saves 38.5% over legacy baseline
  - Equates to 11833 gallons of fuel saved per 150 man Force Provider basecamp per year
- Cellular insulation prototype is currently not out preforming the EE Baseline

Path Forward

- Shelters will be evaluated at Holloman AFB from June-Sept 2015
- Generation two prototype of cellular insulation being developed and will be in the Holloman evaluation both RDS and Airbeam
- Technologies being investigated and knowledge gained have TTA's with CASCOM, MSCoE and PdM-FSS (Draft)
  - PM-E2S2 interested in using V1.5 in CPOES
- Pursuing follow on funding

Questions & Discussion

Increased energy performance at the tactical edge of the battlefield