Research on textile based insulation materials for humanitarian uses

IFRC-SRU Winterization conference
Luxemburg, 20-21/5/2015

Ine De Vilder, Centexbel
Outline

Centexbel

S(P)EEDKITS

Concept

Material selection

Confectioning

Performance
Centexbel

Collective research and technical centre

Membership organisation
  Belgian textile producing companies
  Associated member companies and organisations

Staff
  150 skilled and highly educated men and women
Centexbel

Research/testing department dealing with plastics
Microbiological tests

Burning behaviour

Chemical analyses

Physical analyses
Centexbel

- Certification
- Training
- Standardisation
- Consultancy
Testing of emergency relief items

Wide range of emergency relief items is textile-based

- Sleeping mats
- Insecticide nets
- Family tents
- Thermal fleece blankets
- Sanitary cloths
- Tarpaulins in sheets/rolls
- Semi-collapsible jerry cans
Outline

Centexbel

S(P)EEDKITS

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Field testing

Conclusion
S(P)EEDKITS is ...

- ... a 4 year European FP7 project

- ... a consortium of research, industry and humanitarian partners

- ... dealing with emergency kits:
  - For shelter, watsan and infrastructure
  - Considering their packaging & deployment

- ... combining SPEED and SEED:
  - SPEED for rapid deployment
  - SEED for sustainable development
Concept and objectives

- Development of speedkits...
  - Transportability maximised: easy to handle, light weight, adaptable...
  - Tools/Software for deployment/tracking
  - Various time crucial domains: medical infrastructure, water & sanitation kits, shelters,…

- ... and seedkits... (figurative meaning!)
  - Useful for long term sustained self recovery of local people
  - E.g. shelters, energy generation, debris recuperation…
Shelter

Type 1
Clever roof

Type 2
Multipurpose unit

Type 3
Progressive house unit

Type 4
Mobile Modular 120 m² Unit

Material development

SPEEDKITS
Shelter

Problems in very cold climates (up to -35°C)
→ Need to create a liveable shelter!

Solutions

Nowadays:
Distribution of winter kits
→ not sufficient

Future: Insulated inner tents?
Outline

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Concept

End-user
IFRC-SRU

Research Institute
Centexbel

Manufacturer
Sioen

2015 / 05 / 20-21
Concept

Replace inner tent by an insulated version
Concept

Reduction of inner tent volume
→ maintain an acceptable temperature at night
Concept

- Maximum energy efficiency
- Safe: stove outside inner tent (CO, CO₂)

IR reflection
Focus points

<table>
<thead>
<tr>
<th></th>
<th>Breathable</th>
<th>Vapour barrier (foil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comfort</td>
<td>+</td>
<td>- (ventilated +)</td>
</tr>
<tr>
<td>Need for ventilation</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Insulation</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

- Flexible  
  Limited volume & weight  
  ease of transport

- Material with high thermal insulation → high R value

Optimal parameters!
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Evaluation of insulating properties based on EN ISO 6942

Protective clothing - Protection against heat and fire - Method of test: Evaluation of materials and material assemblies when exposed to a source of radiant heat (ISO 6942:2002)

→ Comparison of different materials
Radiant panel

Radiation: 10 kW/m²
Currently used materials

Temp Rise [°C/s]

- no material: 1.5
- PES/CO 440 gsm: 1.0
- PES/CO 350 gsm: 0.7
- PES/CO 200 gsm: 0.7
- PES/CO 130 gsm: 0.5
Nonwoven materials

Temp Rise [°C/s]

- NW-dens_1cm
- NW-dens_1.5cm
- NW-dens_2cm
- NW2.5cm
- NW3.4cm
- no material
- PES/CO 130 gsm
Foils

Temp Rise [°C/s]

- PE-foil
- AIPE
- no material

2015 / 05 / 20-21
Combined

![Graph showing temp rise vs materials]

- PE-foil
- NW2-2,5cm
- NW2-2,5cm + PE
- AIPE
- NW2-2,5cm + AIPE
- no material

Temp Rise [°C/s]

Material of choice
Insulated inner tent

Aluminised tape fabric laminated on nonwoven

- Aluminised PE tape fabric
- Nonwoven
  - 2 cm thickness
  - → 600 g/m² → R = 0.5 m².K/W
  - 4 cm thickness
  - → 1050 g/m² → R = 1 m².K/W
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Ways of connecting tent materials

Sewing

Welding

Glueing

Working principles / pro’s / con’s
Sewing

Working principle
• Connecting fabrics by means of sewing threads

Pro’s
• All materials possible
• Easy to disassemble

Con’s
• Point-concentrated loads
• Not waterproof
  – Can be solved by tape seam sealing / use of swelling yarn
Welding

Working principle
- By heating the material melts together
- Thermal, high frequent & ultrasonic welding

Pro’s
- One continuous seam → very strong
- Good transfer of loads → no point-concentrated load
- Good waterproofness

Con’s
- Only for thermoplastic materials like PE, PVC, TPU...
- Not possible to disassemble
Glueing

Working principle

• Connecting fabrics by means of thermoplastic adhesives
• Adhesive film is heated and applied on the fabric

Pro’s

• Possible to connect different materials
• No point-concentrated load
• Good waterproofness
• Possibility to disassemble

Con’s

• Not suitable for high loads
• Moisture, UV-light,… can have a negative impact on the glue
Impressions of the manufacturing process

Insulative inner tent is made by sewing
Final inner tent
Final inner tent

- Aluminised fabric on the inside: reflection of heat → wall, floor & roof
- PVC ground sheet: to protect against moisture
- Window for light & ventilation
- Door: overlap of wall material → reduce heat loss
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Field testing

See upcoming presentation
Shelter Research Unit!

CAMP LAYOUT
1. Improved Family tent
2. Standard Family tent
3. Canadian design shelter commercial tent
4. Standard Turk Kiralay tent (Cotton outside Cotton inside)
5. Variation on Standard Turk Kiralay tent (Cotton outside Felt inside)
6. Variation on Standard Turk Kiralay tent (Cotton outside Reflective 20mm Felt inside)
7. Variation on Standard Turk Kiralay tent (Cotton outside Reflective 40mm Felt inside)
8. Foster + Partners prototype tent
9. SRU prototype tent, Hexagonal
10. SRU prototype tent, Turk Kiralay Winterization
“There are two big forces at work: internal and external. We have very little control over external forces, such as tornadoes, earthquakes, floods, disasters, illness and pain. What really matters is the internal force. How do I respond to those disasters?”

- Leo Buscaglia -