

**Soldier Systems TRM
Visioning Workshop**

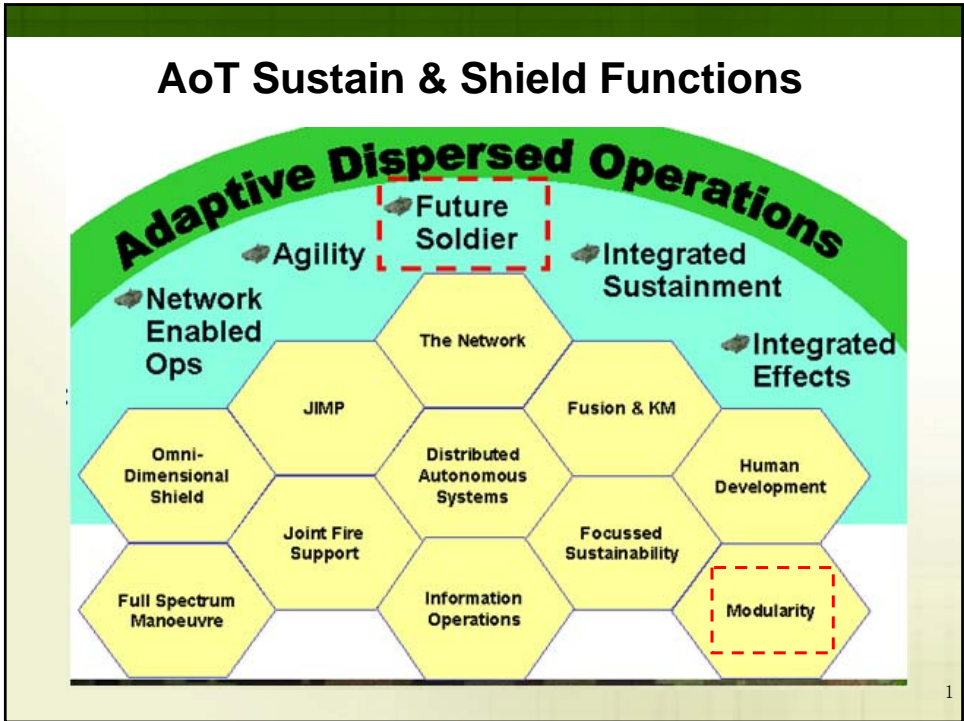
**Clothing Footwear Load Carriage Equipment
Vision and Future Requirements**
Gatineau, QC, 16-17 June 2009

**Major L.A. Coghill
DLR-5-10**

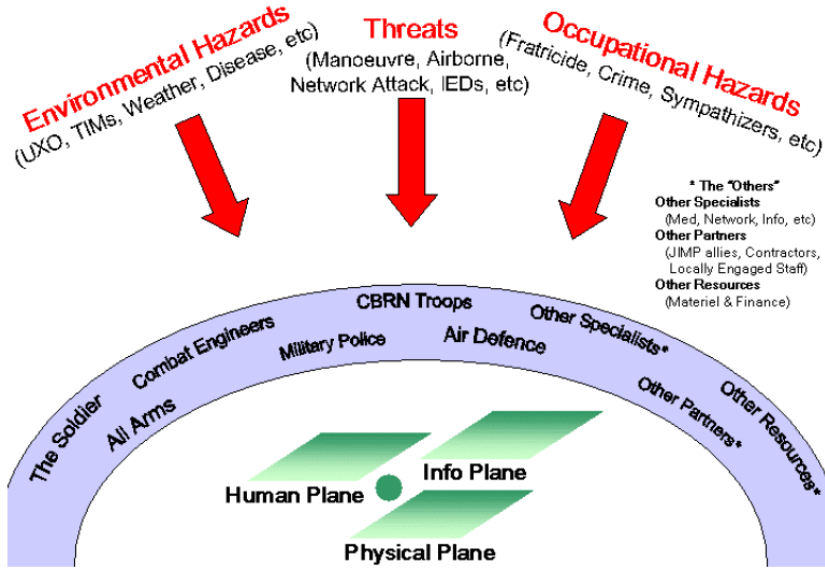
uniform, lightweight protective clothes, flexible displays, wireless network, biometric identification, event dr, info, posititon & motion sensors, pda tags, digital identif, 5 YRS, wearable power, μ, μ-fue, solar cell in-foil, nutraceuticals, membranes food/water/air, health sensors, wearabele rf/ric/opto/acoustic, tissue, fluidic sors

Government of Canada / Gouvernement du Canada

Canada



Omni-Dimensional Shield



NATO Threat & Hazard Categories

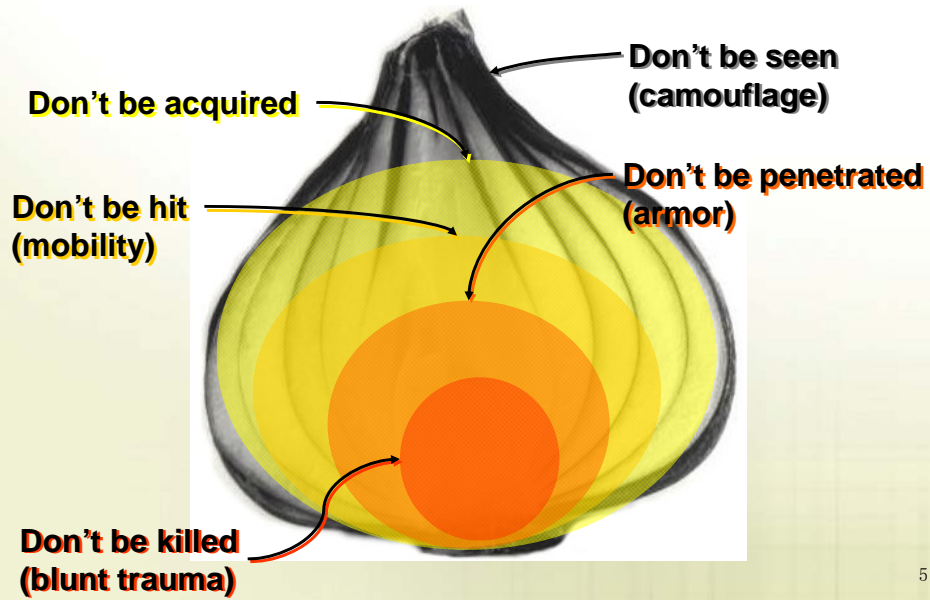
Threat spectrum category	Comments
Natural threat	Threats and Hazards imposed by the natural environment, climate and geography conditions to the dismounted soldier system. See Annex A, table A.1
Human factors	The dismounted soldier system is a <ul style="list-style-type: none"> • human being and thus will interpret and react on ongoing actions (psychological related threats); • 'system' and thus also needs sustainability (physiological related threats). See Annex A, table A.2
Threat of detection	Threat of detection as the threat: <ul style="list-style-type: none"> • to be detected in situations that the dismounted soldier system does not want to be detected due to the possible initiation of action of opposing forces; • to be not detected in situations that the dismounted soldier system wants to be detected and identified correctly so that his presence is evident for all parties involved. See Annex A, Table A.3
Man-made threat	Threats with a technological origin, which may be employed by the opposing parties, such as ballistic, blast, fire & flame, mechanic, radiation, chemical, biological, NLW threat. See Annex A, table A.4-A.12
Industrial dangerous goods	Threats related to industrial dangerous goods, which the dismounted soldier system may be exposed to when employed by opposing parties, acts of terrorism or as a consequence of collateral damage. See Annex A, table A.13
Dynamic environment	Due to combat the theatre may be altered, and thus may include additional threats for the dismounted soldier system, for instance collapsed buildings, industrial sites, electrical wires, fire etc. See Annex A, table A.14

Threat Risk and Impact

Severity of Effect	Probability of Occurrence			
	N.A.	LOW	MEDIUM	HIGH
HIGH	N.A.	UNLIKELY	MEDIUM	HIGH
MEDIUM	N.A.	LOW	MEDIUM	MEDIUM
LOW	N.A.	LOW	LOW	DEFAULT
N.A.	N.A.	N.A.	N.A.	N.A.

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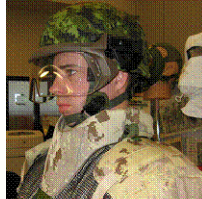
The Survivability Chain



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Clothing Equipment Protection Relative Threats & Challenges

- Ballistic
- Fragmentation
- Flame, Flash & Heat
- Blast (Overpressure)
- Laser
- Noise
- Non-Ballistic Threats
- Concealment
- Fratricide
- Environmental
- CBRN



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Understanding “Natural Environment” Threat (NATO document AC/225)

Climatic/Weather Conditions (STANAG 4370, AECTP 200)

- Solar Radiation
- Temperature & Humidity
- Wet Weather
- Wind & Dust

Environmental/Mechanical Conditions

- Abrasion
- Thorns/Vegetation
- Wires
- Immersion

Environmental Conditions that Trigger Diseases

- Natural Bacteria/Diseases
- Biting Insects & Animals

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Threat: - Climatic/Weather Conditions (1)

STANAG 4370, AECTP 200

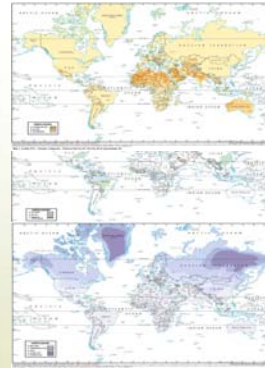
Category 230 Climatic Conditions
Section 2311 Worldwide Extreme Climatic & Environmental
Conditions For Defining
Design/Test Criteria (page 168-243)

A1 / A2 / A3 Extreme Hot / Hot Dry / Intermediate

B1 / B2 / B3 Wet Warm / Wet Hot / Humid Hot Coastal
Desert

C0 / C1 / C2 / Mild Cold / Intermediate Cold / Cold /
C3 / C4 Severe Cold / Extreme Cold

M1 / M2 / M3 Marine Hot / Marine Intermediate / Marine Cold



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Threat: - Climatic/Weather Conditions (2)

Solar Radiation

Heat Stress
Sunburn
Dehydration
Snow Blindness

Temperature & Humidity

Heat Stress
Dehydration
Hypothermia
Frost Bite

Wet Weather

Hypothermia
Reduced Visibility

Wind & Dust

Hypothermia (through wind chill)
Reduced Visibility
Reduced Mobility
Dehydration



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Threat: - Mechanical Conditions

Abrasion

Vegetation/Thorns
Wires

Immersion



Bruises or lacerations to the body
Infection

Drowning
Immediate or subsequent hypothermia



Threat: - Conditions that Trigger Diseases

Natural Disease

Reaction of the body's immune system
causing pain, immobility, disorientation etc.

Biting Insects & Animals

Inability of the body's immune system to function
Distraction

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Available Solutions...

Hot weather conditions

Lightweight breathable materials
BDU with ventilation holes (zippers)
Moisture wicking underwear, socks
Desert / jungle hot climate boots
Protection goggles (UV, dust)
Sunhat / shemagh
Lightweight desert / jungle sleeping systems
...

Mechanical stress

Elbow, knee pads
Reinforcements
Training

Protection against Insects/Diseases

Mosquito nets / shemagh
Anti-bug finish
Better hygiene
Training

Cold weather conditions

Waterproof, windproof BDU or additional layer
Gloves, wristlets, contact gloves
Insulation layers
Heating systems
Thermal moisture wicking underwear, socks
Insulated boots /ski march boots /toe covers / gaiters
Ponchos
Protection goggles
Winter cap / face mask
Winter sleeping systems / sleeping bag covers
Shelters / bivouac
...

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Capability Gaps

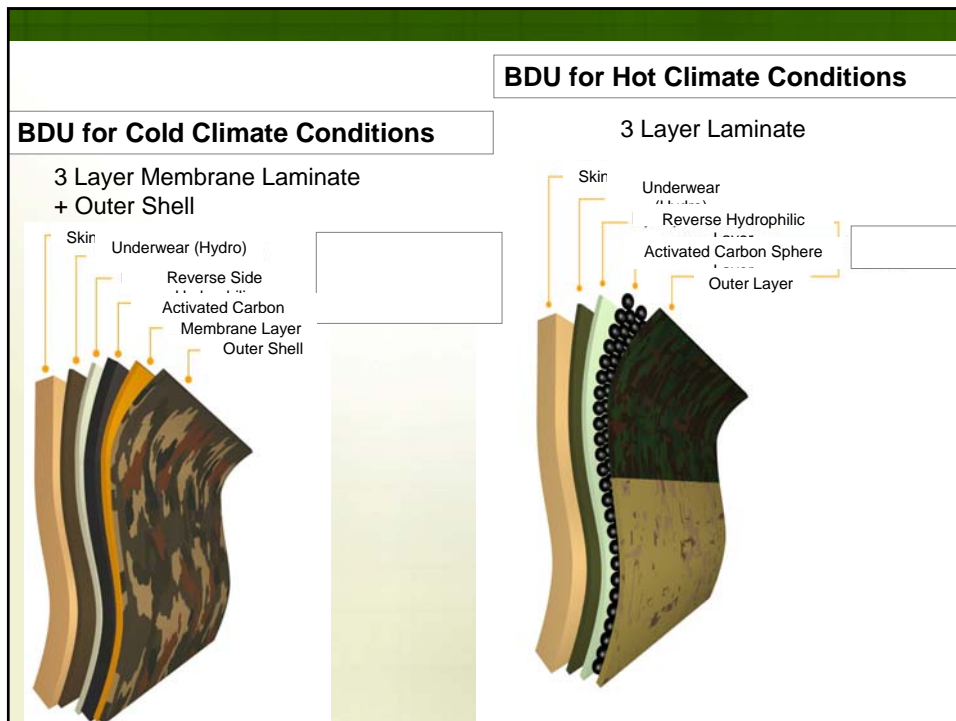
Mid term gaps:

- Lightweight multifunctional materials (combined layers)
- Active sweat regulation management systems / cooling systems
- Integration of ballistic elements while obtaining wear comfort
- Permanent anti-bug treatment
- Ballistic/load carrying vest with buoyant elements

Short term gap:

- Integrated protective pads

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Federal Office of Defense Technology & Procurement Bundeswehr

Battle Dress Uniform

BDU for

Underwear (cold climates)

- Long Sleeve/L
- Lightweight
- Hydrophilic
- Specific kni
- Seamless

Combination-Shirt Soft Ballistic Vest (SK1) + Ventilation System

Load Carrying Vest

Accessories Gloves

BC Protective Gloves

- Winter
 - membrane + carbon spheres
 - stretchable Nomex + flame-retardant leather
 - knuckle protection
 - palm protection
 - ergonomically designed fingers
 - seamless finger tips
 - finger knobs
 - velour on thumb to wipe nose
- Summer

Tactical Gloves

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2010

2020

Revolutionary change or Evolutionary change?

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Potential of Nanotechnologies

Plasters with wound treatment agents and RF-sensing function (moisture, bacterial activity)
Acoustic and RF-sensors on interior layer of suit or body
Integration lab-on-chip sensor + sampling device in equipment/uniforms
Modular sensor card system (NBC, bioparameter)

Acoustic sensors for bone fracture detection, noise detection in body (flow, breathing, movement)

Acoustic / RF sensors

RF-plasters

Nano-cal meter

Smart skin P-sensor in foot

Modular sensor system (IK, B, C, Body)

Display

Lab-on-chip

Insulation/Ventilation

Options

- Use dense fabrics (2000mm / 8000gr), treated
- Combine with aerogels in fabric, inflatable parts
- Switchable fabrics with molecular anchors
- Small cooling (microcirculation, heat exchangers, temperature-sensitive material)
- Combine with T and humidity sensors

Aerogels

Principles of ventilation mechanics

Nanofibers

p-flaps

Health Monitoring

The Future in Clothing

- **Future Combat Uniform (FCU)**
- Fully integrated system by 2020?
- Convergence
- Multi-layers system (7 or more layers)
- Multi-function (Climate, CBRN, Hybrids)
- SMART Textiles
- **Multispectral camouflage**



Army Operational Footwear Where we are and where we need to go

4 types of Operational footwear systems for the land forces

- Desert Combat boot and Hot weather sock and footbed System
- General purpose Combat boot and CTS sock and footbed System
- Wet weather boot and CTS sock and footbed System
- Mukluk and CTS sock system (arctic)

All 4 systems are under review and some development is on going.

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Combat Boot Future considerations

Technical: Design and development strategies

- Clearly defined Requirements based on performance
- User input
- industry input
- Science/engineering and technology
- Competing with marketing strategies from out side industries

User Acceptance is the most difficult end to achieve as many wear their own boots in theater.

Programmatic: Testing procedures and Procurement strategies

- Scientific material and systems testing as well as Trials of 1500 to 3000
- Verify performance criteria of materials and systems
- Ability to modify design
- Rapid procurement

Validation of requirement and performance in the best interest of the user and industry will increase the achievement of user acceptance

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Load Carriage

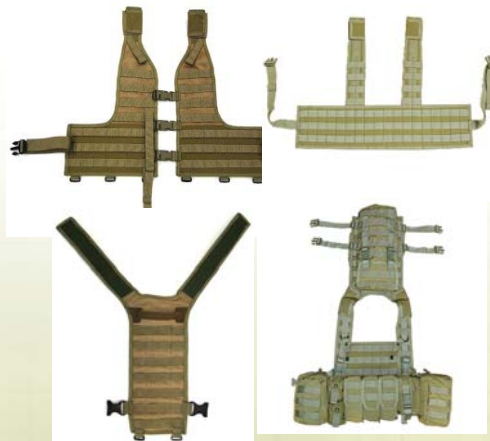
- Real-Estate Management
 - ***Must*** leave the front panel **Free For Immediate Combat Critical Gear**
- Back Free for heavy loads, vehicle seating
- Sides is for slim attachments



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Load Carriage Considerations

- Systems Approach
- Weight Management
- Modular
- Flexible
- Universal Attachment (MOLLE / PALS)



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KEY CRITERIA FOR CFLC SUCCESS: SOLDIER ACCEPTANCE



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QUESTIONS ?



For more information, please consult:
<http://soldiersystems-systemesdusoldat.collaboration.gc.ca>