Weathering the Cold:

DND-NRC R&D for Successful Arctic Operations

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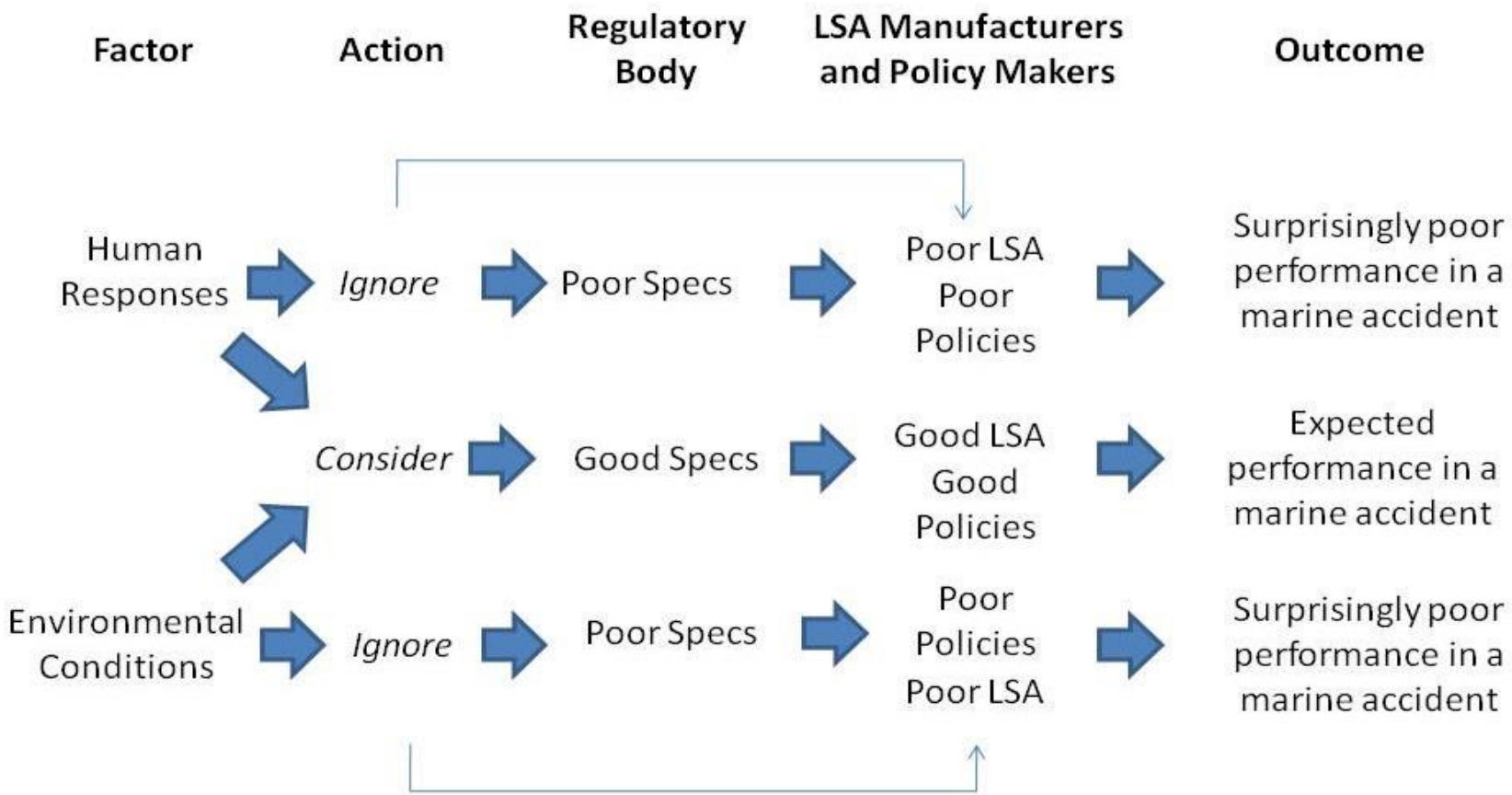
Why Safety R&D?

Calm water (control) test at NRC – conditions not often found outside of the laboratory.

- Equipment often tested/certified in benign conditions.
- Poor performance in real world conditions.
- Results in a knowledge gap – expected vs actual performance.

How Knowledge Gaps Are Created



Adapted from: Tipton MJ (1995). Immersion fatalities: hazardous responses and dangerous discrepancies. J R Nav Med Serv. Summer;81(2):101-7.

Marine Safety Research at NRC

Marine Safety Technologies for Extreme Environments (MSTEE)

- **Increase safety and improve performance in harsh conditions – land and sea**

Harsh Environment Safety R&D at NRC

- MSTEE uses NRC facilities and expertise to test in realistic conditions to measure *actual* performance.
- If *actual* performance is lacking, work with stakeholders to investigate new technologies.

Harsh Environment Safety R&D at NRC

Life Saving Appliances

On-ice evacuation

Personal Protective Equipment

Who is CANSOFCOM?

The Canadian Special Operations Forces Command (CANSOFCOM) is a high-readiness organization, able to deploy special operations forces on very short notice to protect Canadians from threats at home and abroad.

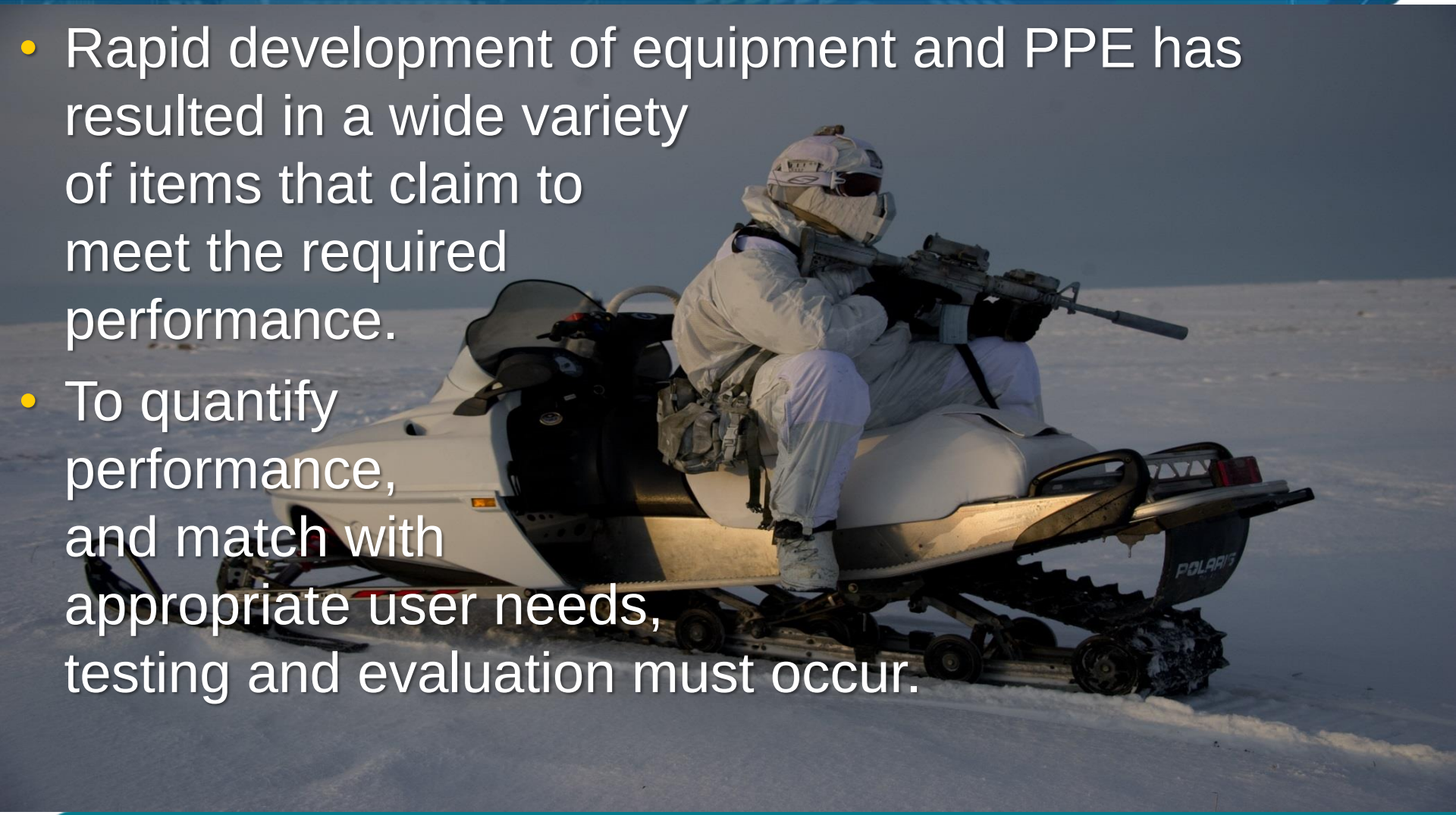
We provide National Defence and the Canadian Armed Forces with agile, highly specialized forces.

- Extreme conditions in the Arctic make operations more challenging and costly.
- Increased reliance on PPE to allow for soldiers to perform required duties.

New technologies are only effective if their operators can function in harsh conditions

CANSOFCOM Collaboration Background

- Rapid development of equipment and PPE has resulted in a wide variety of items that claim to meet the required performance.
- To quantify performance, and match with appropriate user needs, testing and evaluation must occur.



CANSOFCOM – NRC Collaboration

Performance evaluation of:

- Cold weather clothing
- Sleeping bag systems

Objective:

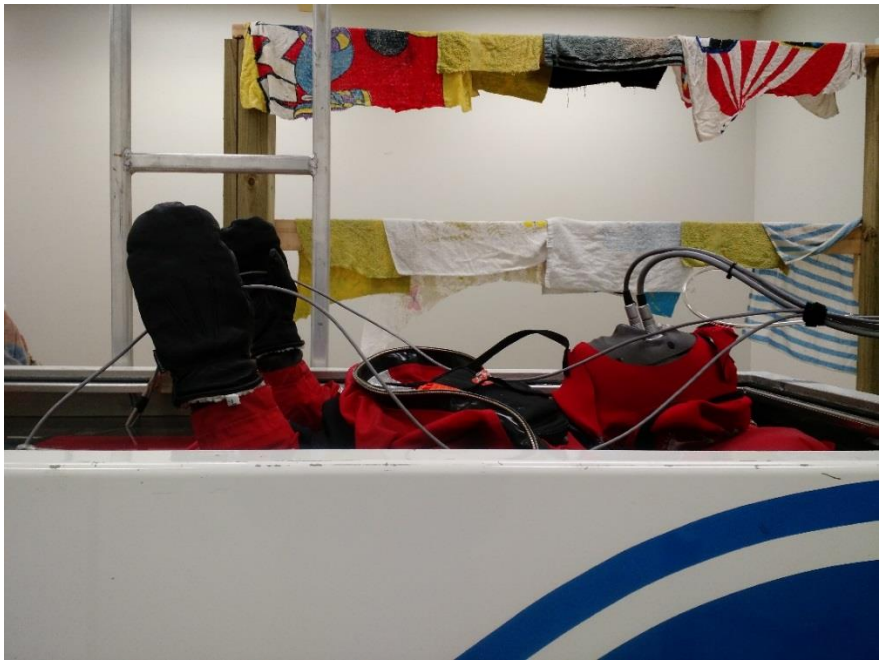
- Asses equipment performance to allow CANSOFCOM to choose appropriate equipment for extreme conditions.

Methodology

- All tests took place in Thermal Measurements Lab (TML).
- TML is a temp controlled facility (5-30°C) with immersion tank.
- 23 zone, immersible thermal manikin (NEMO) used.

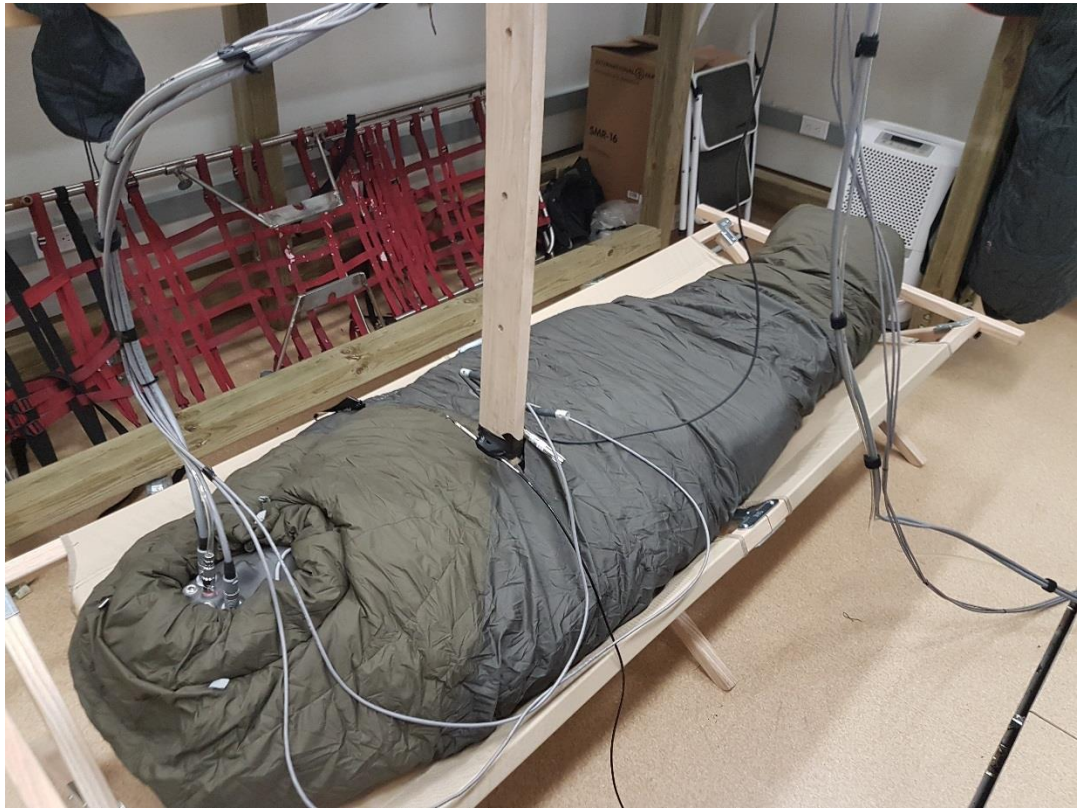
NEMO

- NEMO is a useful tool for measuring insulation.
- Cost effective alternative to some human testing.
- Standardized procedures
- When used with other NRC facilities can account for accurate measurements of clothing in the harshest conditions (e.g. wind and waves)



Cold Weather Garments

Sleeping Bag Systems



Sleeping Bag Systems - Saturated

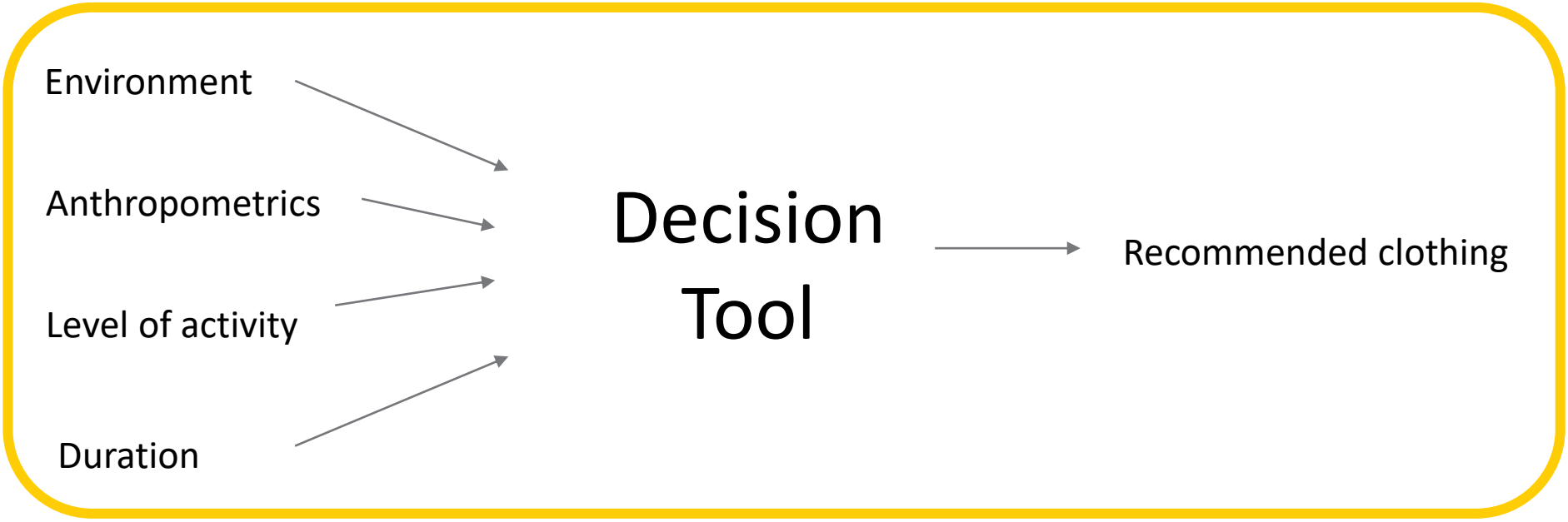
Outcomes

1. A more accurate appreciation of clothing performance vs relying on manufacturer marketing.
2. Optimizes the soldier to minimize impairment on the battlefield.

Future Work

CANSOFCOM Clothing Decision Tool:

- Enables decision making for team leaders to maximize human performance through the selection of the best clothing for a specific environment.



Looking Ahead

- Rapid advancement in technologies (phase change materials, “smart” clothing, etc.) may significantly change performance.
- To achieve optimal performance, technologies need to be evaluated in real world conditions – results are then applicable and useable in the field.
- Examine non-confidential areas of research that can be shared between organizations, where prioritization of personnel health and performance are at the forefront.

Summary

- **Arctic conditions are some of the harshest on planet.**
- **Arctic sovereignty operations will require equipment to meet those challenges.**
- **Equipment *must* be tested in representative conditions to avoid knowledge gaps.**
- **Once equipment performance established - best can be selected for use with knowledge on how to use them effectively.**

Overall R&D Outcome

Personnel equipped and prepared for optimized operations in harsh environmental conditions.

Thank you

Questions?

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