



# HUMAN PERFORMANCE

*Human Performance and Effectiveness in a System-of-Systems*

## Highlights

### Why is Human Performance Important?

- Humans contribute to 20-53% of system failures (Shapiro et al. 1960).
- Human performance can degrade significantly in military situations (Lieberman et al. 2005).
- The military has identified Human Performance Modeling as a challenge and as a requirement (DoD 5000.59-P, 1995).
- SoS analysis without humans is optimistic.

### What are the Objectives for Developing this Capability?

- Most work has been done at the individual or small-group level (IMPRINT, <http://www.arl.army.mil/ARL-Directorates/HRED/imb/imprint>).
- Capturing the inherent unpredictability of a single human is difficult... 100s? 1000s?
- The goal is to incorporate enough detail in human performance to allow a realistic view of an operating system-of-systems.

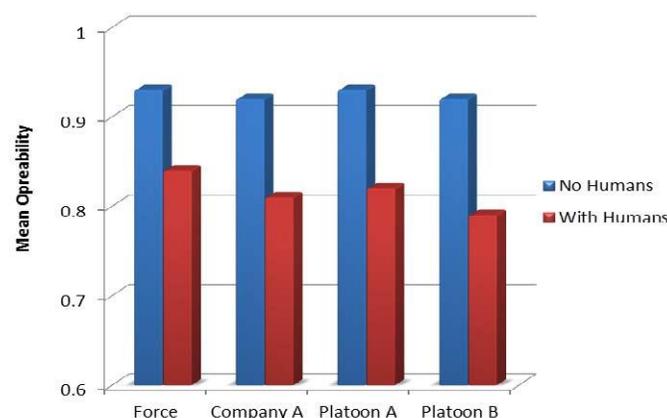


### What are the Research Areas?

- Future research: Adaptive SoSAT—use full cognitive models of decision makers to evaluate adaptive behavior of a system-of-systems:
  - In case of combat damage
  - In severe environmental conditions

## Human Performance Overview

Assessing the involvement of humans in a system-of-systems (SoS) is difficult because of the number of humans and the poorly defined nature and variety of tasks that each human must perform. Sandia has developed an approach to the problem that is analogous to hardware reliability modeling. In this approach, tasks are generalized. Human “inoperability” is a function of human error rate and human recovery time, for recoverable errors. For non-recoverable errors, human failure is a function of catastrophic failure rate with an associated replacement time. Also, as with hardware systems, the environment can affect human performance; performance-shaping factors, e.g. stress and fatigue, can be used to modify the human error rate. The resulting human performance model has been incorporated in SoSAT. SoS assessments with the human performance model indicate that human errors contribute to approximately 30% of the unavailability of the force, a fraction that is consistent with values reported in the literature.



*Example results showing a marked decrease in force operability when human performance is included in the assessment.*

