TRB EMS Subcommittee ANB10(5)

EMS Safety Summit 2012

Safety Systems, Strategies and Solutions

Bridging Ergonomics, Operational Task Analysis and Automotive Safety

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Bridging Ergonomics, Operational Task Analysis and Automotive Safety

Chris Fitzgerald (Ergonomist)

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Overview

- Ergonomics factors relevant to ambulance design
- Using operational task analysis to understand what is done
- Understanding body size and biomechanics
- Fundamental design requirements for ambulance:
  - automotive safety and occupant protection, then
  - operational tasks and ergonomics /human factors
- Incorporating ergonomics in ambulance design

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Ergonomics

- …interactions of humans within a system.
- …optimizing human well being and system performance.
- Iterative approach - there are benefits to be had!
- Key (physical) factors:
  - Task analysis – what people do
  - Anthropometry – body size
  - Biomechanics – human movement
- Other factors:
  - Lighting, air quality and thermal comfort
  - Usability and cognition

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Task analysis – what people do

- Operational task analysis
  - Defining what people (paramedics) do
  - Develop and test designs that optimize paramedic / patient / equipment placement and performance
- … in practical terms tasks analysis defines the system
- Can be conducted prospectively for all known or anticipated interactions (you end up with a lot of data)
- Once task behaviours are known design consideration for safety and efficiency can be made and tested
- Task analysis should involve “operators” and represent a true description of what is done

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Anthropometry – Body Size

- Who are we designing for?
  - Patients
  - Paramedics and other occupants
- Need to accommodate full range of the population
  - Gender (to reflect workforce participation rates)
  - Body size
  - Functional task performance and biomechanics

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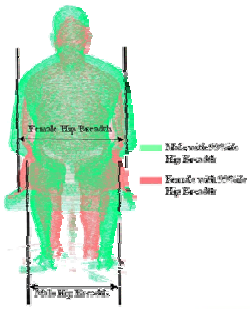
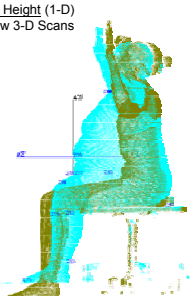
Gender / Body Size



Two Women:
Same Sitting Height (1-D)
Side View 3-D Scans



Images courtesy of Dr Kathleen Robinette
US Airforce

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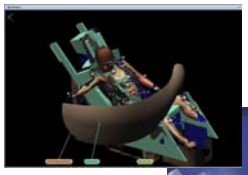
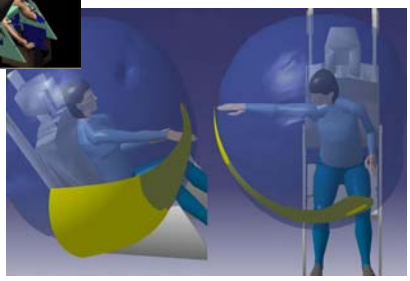
Functional Task Performance





the result of the frequency analysis, green dots mark equipment used every time the ambulance is driven, orange

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Automotive Safety the basics

- Ergonomics design to occur within the context of automotive occupant safety principles:
  - Forward / rearward facing seats
  - No side facing seats (during transit)
  - Restraint of all persons at all times
  - Restraint of equipment (at least 10 G in all directions + 20 G in forward direction)
- Design challenge:
  - Fitting the users, occupants and equipment
  - Create accessibility to equipment / tasks
  - Retaining these occupant safety principles
  - Ultimately, this requires mobility with the ambulance

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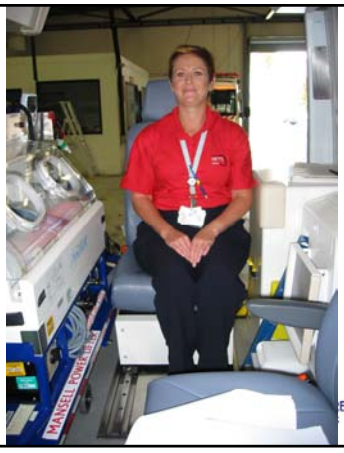

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Summary

Systems

- Effective application of ergonomics can help to define the system in a meaningful and useful way

Strategies

- Task analysis
- Anthropometry
- Functional task performance / biomechanics
- In the context of inherent automotive safety and occupant protection needs

Solutions

- Creative designs that orient the users and occupants safely, provide mobility within the ambulance and enable people and objects to be restrained.

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