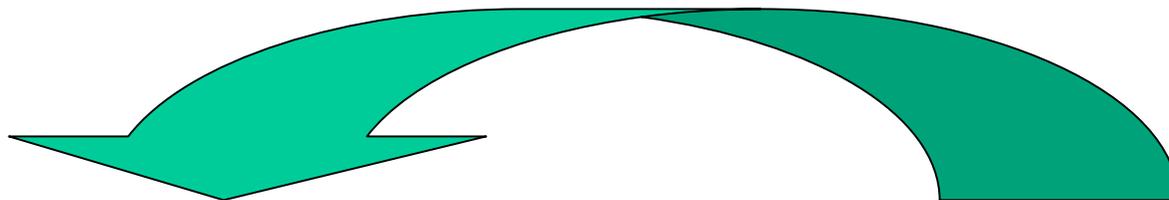




*U.S. Army Medical Research and Materiel Command
Walter Reed Army Institute of Research*



Computer-Assisted Automation of Medical Treatment
in Critical Care Environments:
“Closing the Loop” for Military Medical Applications



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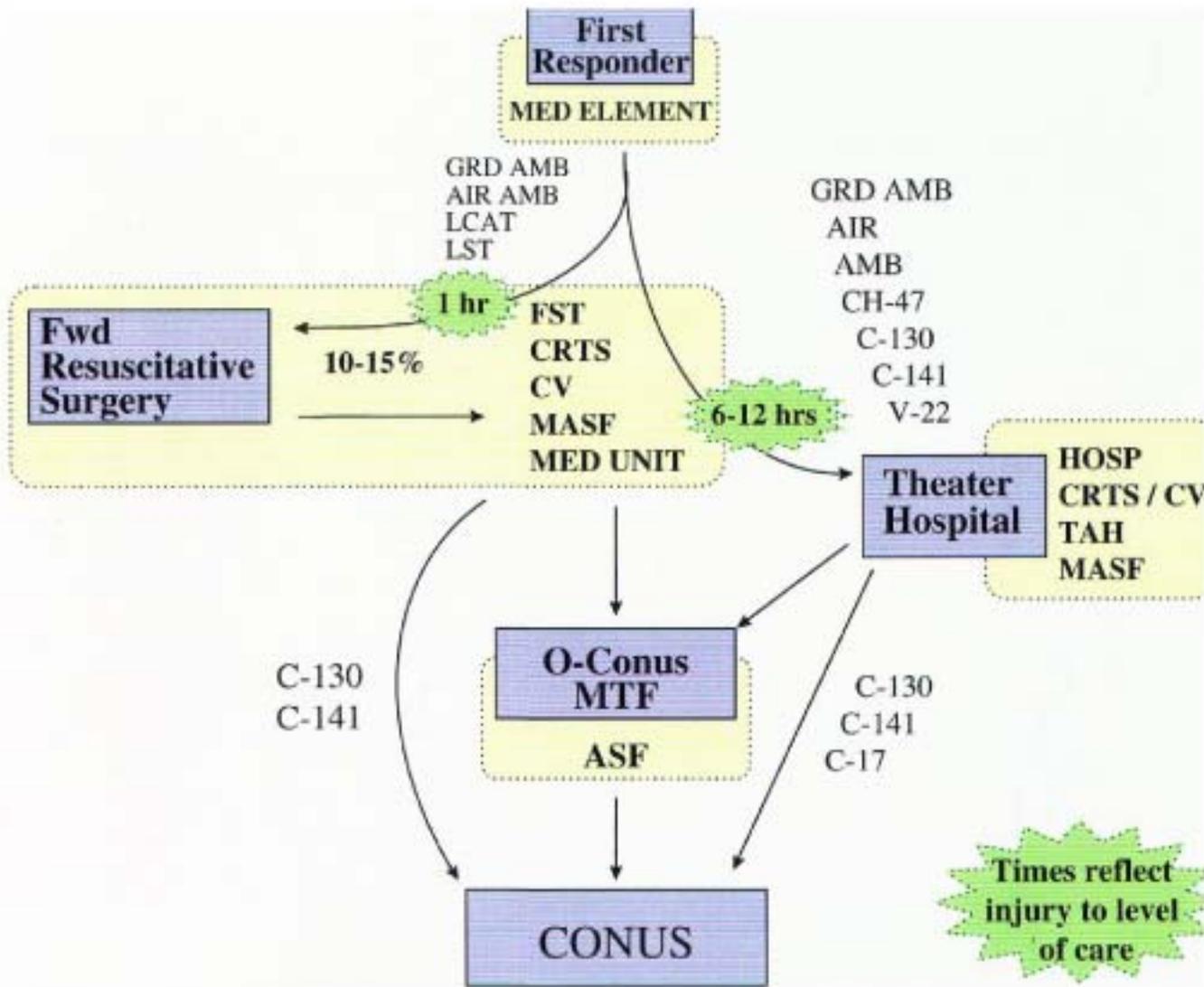
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*JHSS Vision 2010 Template
ENROUTE CARE*



Moving the Critical Patient

TODAY



TOMORROW



IN COMMON

- NATO litter
- EKG
- Suction
- IV Pole
- Oxygen
- Ventilator
- Defibrillator
- Pulse Oximeter
- Battery Pack(s)

LSTAT ADDED

- ISTAT
- ProPac 106
- IV infusion pump(3)
- Secondary Display
- Power Converters
- Data Logging Computer



DEPMED FTX at WRAMC
85th General Hospital
September 14-25, 1998





Transportable Automated Life Support System

Technical Description

Therapeutic

- *Ventilator*
- *Oxygen blender*
- *Internal/external O₂ supply*
- *Suction*
- *3 channel IV drug infusion pump (1L/hr)*
- *Resuscitation pump (6L/hr)*



Diagnostic

- *Physiological monitor*
 - *Pulse oximetry*
 - *Capnography*
 - *Hemodynamics*
- *Blood chemistry analyzer*

Telecommunications

- *Data display (local/remote)*
- *Wireless command & control*
- *Network capable*
- *Data logging*
 - *medical*
 - *system*



Transportable Automated Life Support System

Technical Description



- *Constrain external dimensions to existing NATO stretcher envelope*
 - Avoid diminishing vehicle patient transport capacity
 - Avoid need for vehicle retrofits
 - Accommodate Army/Navy/Air Force and Marine ground and air evacuation vehicles
- *Maintain independence of NATO litter from critical care capability*
 - “break-away” feature to preserve forward area utility



Transportable Automated Life Support System

Technical Description

- *Integrate power, data and medical systems for optimization of power use and medical care*
- *Accommodate telecommunications requirements for “reach-back” capability*
 - open software architecture
 - modular sensor hardware
 - local decision and remote decision assistance
- *Employ servo-controlled automation & data logging to leverage care-giver’s time*
 - servo-control ventilation, O₂, and fluid delivery
 - continuous logging of all medical and system data



Status of Current MRMC Effort

- *Continuation of DARPA effort*
- *FDA licensed*
- *Currently open looped system weighs 154 lbs without the litter*
- *Need to reduce weight to 75 lbs to reach ORD objective weight*
- *22 systems will be completed by 1Q FY03 for field assessments*

Additional R & D required

- feedback control algorithm development and testing (pre-clinical & clinical)
- implement weight reduction strategy using OEM board level integration rather than COTS





Transportable Automated Life Support System

Technical Description

- *Servo-controlled components*
 - Infusion pump (6L/min) driven by proportional controller using a SP of 90 mmHg as target for resuscitation (**conserves fluid/blood**)
 - Ventilator driven by an hybrid minimum work of breathing and arterial blood pH, pO_2 and pCO_2 algorithm (**conserves oxygen**)
 - Oxygen blender driven by proportional controller using oxygen saturation from pulse oximeter or indwelling or arterial line (**conserves oxygen**)



Transportable Automated Life Support System

Interest Outside of DOD

- *ICU bed shortage*
 - Hospital systems investigating concept of mobile ICU facilities (i.e. busses, trailers)
- *Intra and inter-hospital patient transports*
- *Natural disaster management*
- *Homeland Defense*
- *Foreign militaries looking to modernize*

