Kennedy Space Center
Medical Operations and Medical Kit

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Space Transportation System

♦ ORBITER
  • Discovery
  • Atlantis
  • Endeavour
♦ EXTERNAL TANK
  • Not reused
♦ SOLID ROCKET BOOSTERS
Abort and Normal Mission Profile
Potential Injuries to Astronauts

- FALLS
- BURNS - FIRE
- BLAST / EXPLOSION
- TOXIC CHEMICAL EXPOSURES
- DECELERATION / IMPACT
- DECOMPRESSION
- HYPOXIA – GH2, GN2 purges
- HYPOTHERMIA
- POST-FLIGHT ISSUES
EMS Flow

- **MODE DECLARATION**
  - Identifying the problem
  - Initiating response

- **RESCUE/EGRESS**
  - Transfer to triage site

- **TRIAGE**
  - Decontamination, initial tx and stabilization

- **MEDEVAC**
  - Ground or Air
EMS Flow

- **MODE DECLARATION**
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- **MEDEVCAC**
  - Ground or Air
LAUNCH Contingency Modes

- **MODE 1** - PRE_LAUNCH – UNAIDED EGRESS AND ESCAPE (6/7).
- **MODE 2** - PRE_LAUNCH - EGRESS AND ESCAPE AIDED BY CLOSEOUT CREW (6/7 + 6).
- **MODE 3** - PRE_LAUNCH - EGRESS AND ESCAPE AIDED BY PAD RESCUE TEAM (6/7 + 7).
- **MODE 4** - PRE_LAUNCH - EGRESS AND ESCAPE AIDED BY PAD RESCUE TEAM, CLOSEOUT CREW ON STATION (6/7 + 7 + 7).
LANDING Contingency Modes

- **MODE 5** - UNAIDED EGRESS AND RESCUE.
- **MODE 6** - AIDED EGRESS AND ESCAPE FOLLOWING A MISHAP ON OR NEAR THE SLF RUNWAY.
- **MODE 7** - AIDED EGRESS AND ESCAPE FOLLOWING A MISHAP IN A REMOTE AREA.
- **MODE 8** - EGRESS AND ESCAPE IN FLIGHT (BAILOUT).
EMS Flow

♦ MODE DECLARATION
  • Identifying the problem
  • Initiating response

♦ RESCUE/EGRESS
  • Rescue and Transfer to triage site

♦ TRIAGE
  • Decontamination, initial tx and stabilization

♦ MEDEVAC
  • Ground or Air
Mode 2
Mode 3 & 4
RESCUE FORCES – Pad Launch Modes

- Pad Rescue Team
- 14 Fire/Rescue Spec. (7 up to Tower)
- 2 Armored Personnel Carriers
Pad Emergency Escape Slide Wire System
Pad to Bunker to Triage Site

Slide wire System to Bunker

Launch Tower

Bunker Ops

Fire & Rescue from fallback location

Triage Site

M113 to Triage Site

Exit Bunker and Enter M113
Mode 5
Mode 6
SHUTTLE EGRESS

- Secondary Interdeck Access: 0.68 m x 0.71 m (2.17 ft x 2.33 ft)
- Emergency Egress Window
- Side Hatch (Primary Route)
- Emergency Egress Window (Secondary Route)
- Cut-in (Ref. Fig. 5-11)

- Flight Deck: 2.34 m (7.68 ft)
- Middeck
- Ground

- 3.2 m (10.5 ft) Gear Down
- 1.82 m (5.97 ft) Gear Up
Mode 6 Rescue Forces

- 14 Fire/Rescue Spec.
- Van
Mode 7
Mode 7 – Rescue Forces

- 14 Fire/Rescue Spec.
- Bearcat
- Helo
Mode 8
Mode 8 - Rescue
EMS Flow

遍 MODE DECLARATION
- Identifying the problem
- Initiating response

遍 RESCUE/EGRESS
- Transfer to triage site

遍 TRIAGE
- Decontamination, initial tx and stabilization

遍 MEDEVAC
- Ground or Air
Triage Site Selection

• Wind Direction
• Proximity to contingency
Triage Site – Launch Modes 1-4

125 ft Helo pad clearance

MOving Vehicles

Parked Vehicles/Personnel

Treatment Area

Decontamination Area

Clean-Dirty Line

Washdown Truck

To Pad
Triage Site – Landing Modes 5 & 6

125 ft Helo pad clearance

MOVING VEHICLES

PARKED VEHICLES/PERSONNEL

Treatment Area

Decontamination Area

Clean-Dirty Line

Rescue Vans

Washdown Truck

To Orbiter
Triage Site Forces

- Triage Doc
- Trauma Docs (2)
- Crew Surgeon
- Paramedics (4)
- Ambulances (2-3)
- Medical Communicator
- Logistics Coordinator
- Triage Van
- Environmental Health
- Washdown Truck
- Lighting Truck
KSC Physician
Command and Control of Triage Site
Radio and Wireless Telecommunication with EMSC in LCC
Univ of FL Trauma Docs

- Trauma Surgeons/ER/Anesthesiology
- UF Shands/Jacksonville and Gainesville
- Provide ATLS expertise
- 4 for every Launch
Flight Crew Surgeons

- Astronaut's PMD
- Launch
  - CS at Triage Site
  - DCS with EMSC in LCC
- Landing
  - CS and DCS in CTV
Triage Site - Decon Area

EH Specialists “Sniffing”
Advance Paramedics “Assessing”

Firefighter “Washing”
Triage Site - Treatment Area

Evaluation and Treatment by Paramedics and Trauma Docs
Mode 7 & 8 – Triage Site vs Direct to Hospital

In Modes 7 & 8 Air Doc can assess and choose Triage Site or go to Hospital

Directly to Hospital – To minimize delay if survivable, need for surgery, neuro trauma, DCS, imaging other than US.

Triage Site – nearby, trauma surgeons, need for further decon, toxicology expertise, extra resources (equipment, IV fluids, meds, personnel, crew surgeons), unable to do needed procedures in helo, initial stabilization if think patient unlikely to survive trip to hospital (some transports to Level I DMCFs can be ~1hr with ground transport arms or distance), med code zeros.
EMS Flow

♦ **MODE DECLARATION**
  - Identifying the problem
  - Initiating response

♦ **RESCUE/EGRESS**
  - Transfer to triage site

♦ **TRIAGE**
  - Decontamination, initial tx and stabilization

♦ **MEDEVAC**
  - Ground or Air
Air Medevac
Air Medevac Forces

DoD HH-60 Helicopters (2)
- 1 “AirDoc” and 2 “PJs” per helo
- Carries 2 patients

NASA Hueys (2)
- 2 Paramedics
- 1 Doc
- Carries 2 patients
Transport Officer

- Coordinates all traffic into and out of the Triage Site
- Usually a KSC Fire Chief
- Designates and Polices the LZ
- Assures proper patient handling and transport to/from vehicles
- Communicates activity with Medical forces and EMSC
Community Helicopters

First Flight
- Holmes Regional

AirCare
- ORMC
Definitive Medical Care
Medical Care Facilities Supporting KSC

- 6 Definitive MCFs
- 1 Intermediate MCF
- 2 Alternate MCFs
Additional Medical Forces

♦ KSC Clinic
  • KSC Medical Dispatch
  • Trauma Docs (2)
  • Ambulance (1)
  • Paramedics (4)
  • Nurses/MDs
  • NASA "Search 2" Helo

♦ Biomed Offices
  • "KMD" (2)
  • "KRN" (1-2)
  • Clinical Lab

♦ SLF
  • Ambulance (2 adv PM), Washdown truck

♦ EHF Command Post

♦ Fire Station 1 at CCAFS (2 ambulances)

♦ Visitor support (RNs and EMTs)
EMS Coordinator and CBSE

- In LCC Firing Room
- Controls all Medical Forces
- Coordinates Triage and Medevac (with DOD Surg in Modes 7&8)
- Selects appropriate IMCF/DMCFs
- Liaison with Hospitals/EOCs
NASA/DOD Helo Medical Kit

- Medication Bag (Specific medication uses)
- RSI Bag (NASA RSI protocols)
- Air Doc Medical Kit (Bag)
Medication Bag

Top of bag
(two clear plastic sections)
- Solumedrol
- Narcan
- Epi vial- 1:1000
- Pack contents list
- ACLS med guide
- Treatment cards

External Flap
- Zofran
- Phenergan
- Terbutaline
- Pyridoxine (Vit B₆) IM or IV drip
Medication Bag

**Inside bag under mesh cover**
- ACLS and other med
- Epinephrine
- Lidocaine
- Adenosine
- Atropine
- Lasix
- Albuterol
- Benadryl

**Internal side of flap**
- ACLS meds
- Vasopressin
- Amiodarone
- Mg Sulfate
- Lopressor
- Dopamine
- ASA

**NASA**
Medication Dosing

♦ Most meds follow
  • AHA ACLS Guidelines
  • Traditional drugs and dosing as on Earth

♦ NASA unique exposures
  • Hydrazine
    - Pyridoxine (vitamin B\textsubscript{6})
    - Administer – 25 mg/kg IV over 30 to 60 minutes, one time dose
  • Nitrogen Tetroxide
    - Solumedrol
    - Administer – 30 mg/kg IVP over 10 minutes, then Q6hr
RSI Bag

Outside of Bag
- Label of Bag number on handle
- Instructions for storage
- Configured for deployment
- Ice bag inside
RSI Bag

Outside Pocket
Etomidate

Inside Flap
Lidocaine

Inside Foil Packet
Succinylcholine
Rocuronium
Ativan
Cerebryx (cool)
Diltiazem (cool)
NASA Specific RSI Protocols

Based on NASA Anesthesia Summit in 5/2003

- Astronaut on return tx different: sensitivity to anesthetics, pain meds, sedatives, depolarizing agents
  - Avoid Thiopental, Propofol, Ketamine, Morphine Sulfate (cardiac depression and vasodilation)
  - Avoid cell membrane depolarizing agents (eg, Succinylcholine)
  - Consider Lidocaine in all RSIs to protect the heart
  - Start all meds at lowest range and redose as necessary

RSI

- Pre-flight = Lido, Etom, Sux
- Post-flight or Head/Burns/Crush/Eye = Lido, Etom, Roc

- RSI use is based on competency
Air Doc Medical Kit (Bag)

- Periphery = Circulation
- Inner = Airway / Breathing
Air Doc Trauma Kit (Bag)

**Left Side**
- Saline 1000ml
- Ringers 1000ml
- IV Tubing
- IV Catheters
- IV Start kit

**Bottom Compartment**
- F.A.S.T IO Kit
- 14 ga CV cath
- Sterile Gloves
- Syringes, Needles, Tape

**Right Side**
- Dopamine
- Lidocaine
- Mannitol 20% 500ml
- Saline 100ml
- Saline 250 ml
- 36 fr Chest Tube
Air Doc Trauma Kit (Bag)

**Precautions/Red**
- Sharps shuttle
- Goggles
- Exam Gloves
- Bio haz bag
- Mask

**Airway acc/Grey**
- Y-Connector
- Nasal Cannula
- Non Rebreather mask

**Miscellaneous/Orange**
- Gauze
- Eye pads
- Adaptic dressing
- Epistaxis sponge
- Foley Cath
- Trauma shears
Air Doc Trauma Kit (Bag)

**Airway Kit/Blue**
- Yellow Stripe
  - ET Tubes
  - Ambu w/mask
  - Oral Airways
  - CO2 Detector
  - Waterproof tape

**Green Stripe**
- Laryngoscope
- Blades
- 10cc Syringe
- Lido Jelly

**Red Stripe**
- Sam Splint
- Tracheostomy kit

**Grey**
- 1cc Dcc Syringe

**Interior (side)**
- King Airway

**Chest Tube/Yellow**
- Petroleum Gauze Tape
- 16ga Catheter
- Scalpel
- Betadine Prep
- Heimlich Valve
- Finger Cots
- Kelly clamp
- Xylo 1%/Epi
- Instrument set
- Suture
- 10cc Syringe

**Syringe**
- 1 cc Dcc
Summary

Introduction to:
- Local KSC EMS ops: Declaration, Rescue/Egress, Triage, Medevac
- KSC Launch and Landing Contingency Modes (1-8)
  - Mechanisms of Injury, Types of Tx needed
- Triage Site – set up, flow, resources
- Helo Medical Kit