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# **Kennedy Space Center Medical Operations and Medical Kit**

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Medical Operations Manager, KSC**



## Space Transportation System

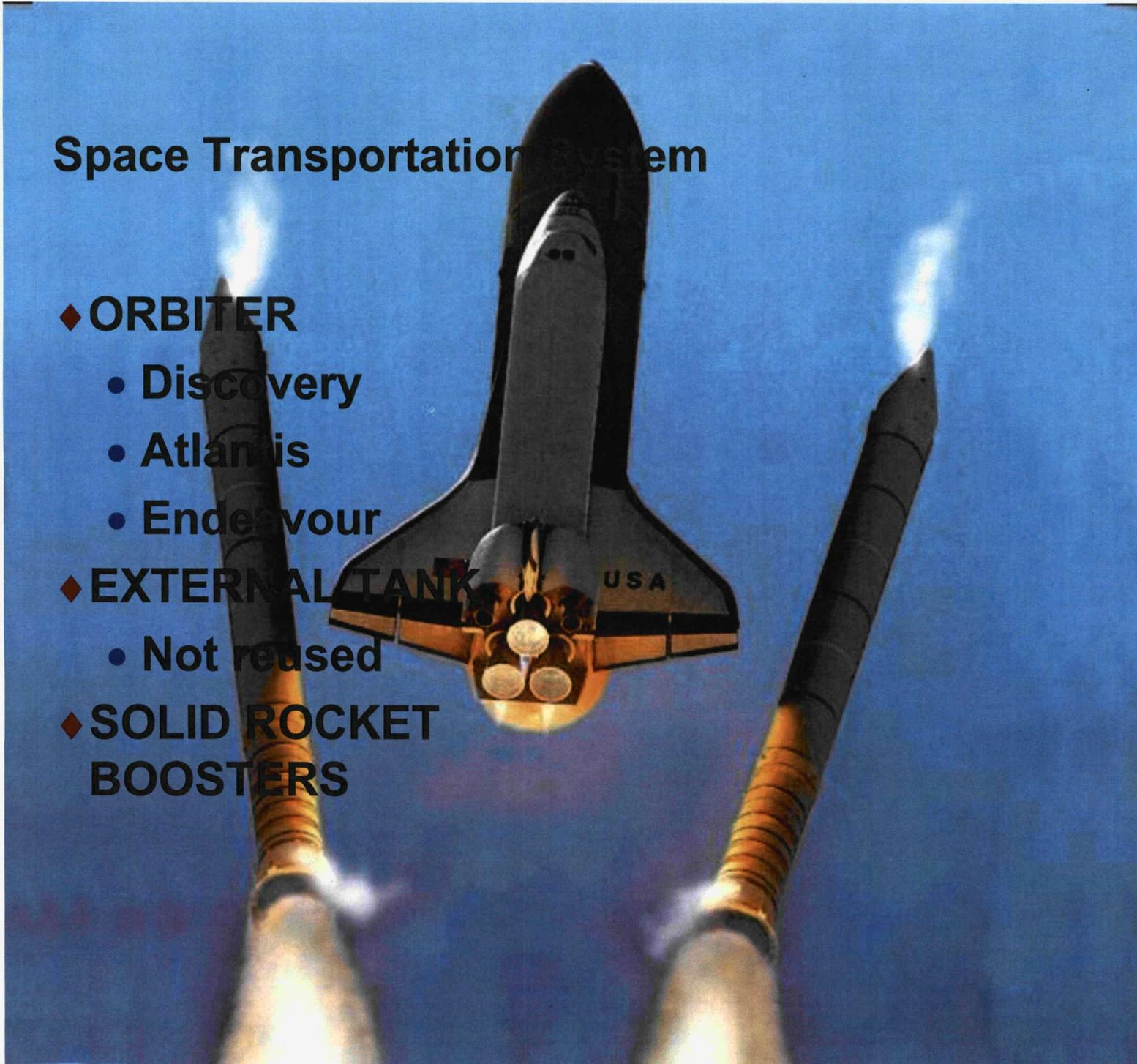
### ◆ ORBITER

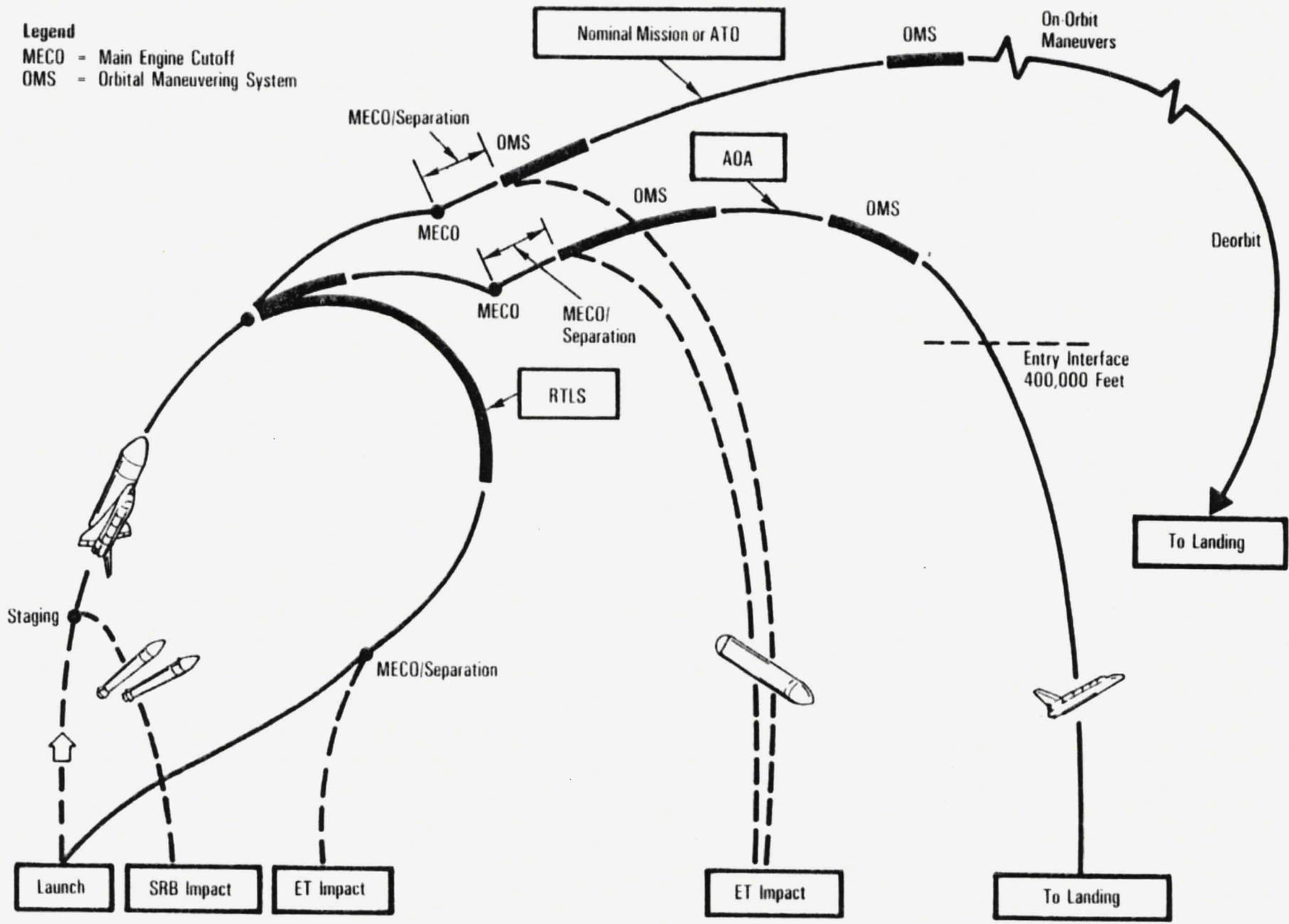
- Discovery
- Atlantis
- Endeavour

### ◆ EXTERNAL TANK

- Not reused

### ◆ SOLID ROCKET BOOSTERS





*Abort and Normal Mission Profile*



# Potential Injuries to Astronauts

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



# EMS Flow

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## ◆ **MODE DECLARATION**

- Identifying the problem
- Initiating response

## ◆ **RESCUE/EGRESS**

- Transfer to triage site

## ◆ **TRIAGE**

- Decontamination, initial tx and stabilization

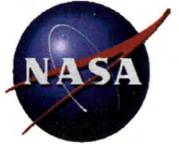
## ◆ **MEDEVAC**

- Ground or Air



# EMS Flow

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## ◆ **MEDEVAC**

- Ground or Air



## LAUNCH Contingency Modes

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



# LANDING Contingency Modes

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- ◆ **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

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## ◆ **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

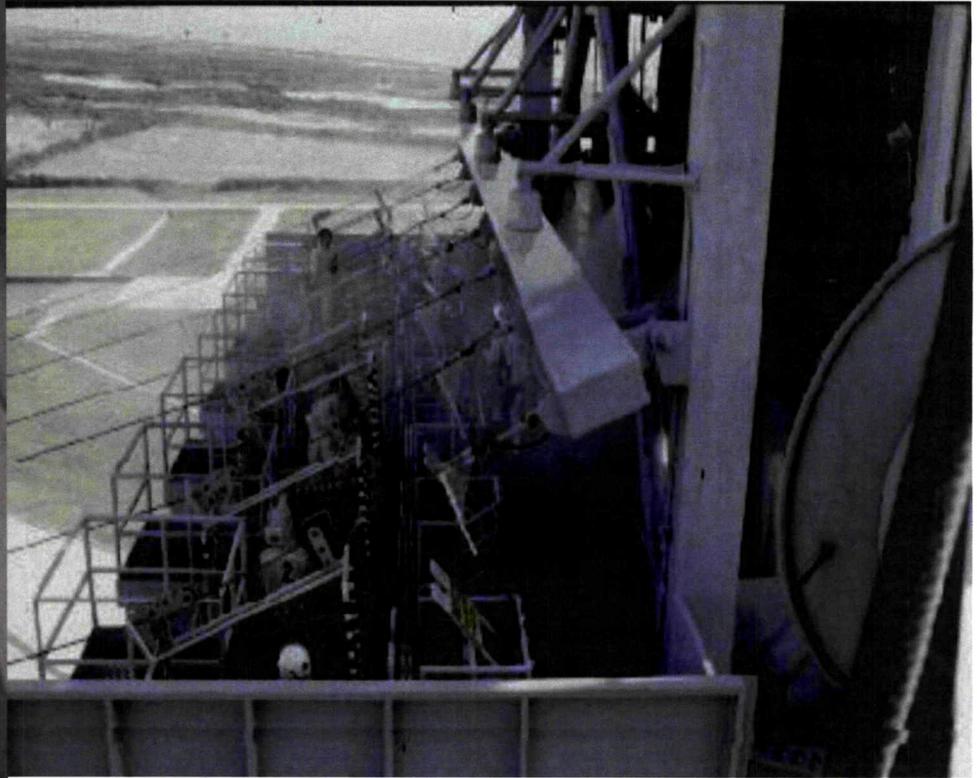




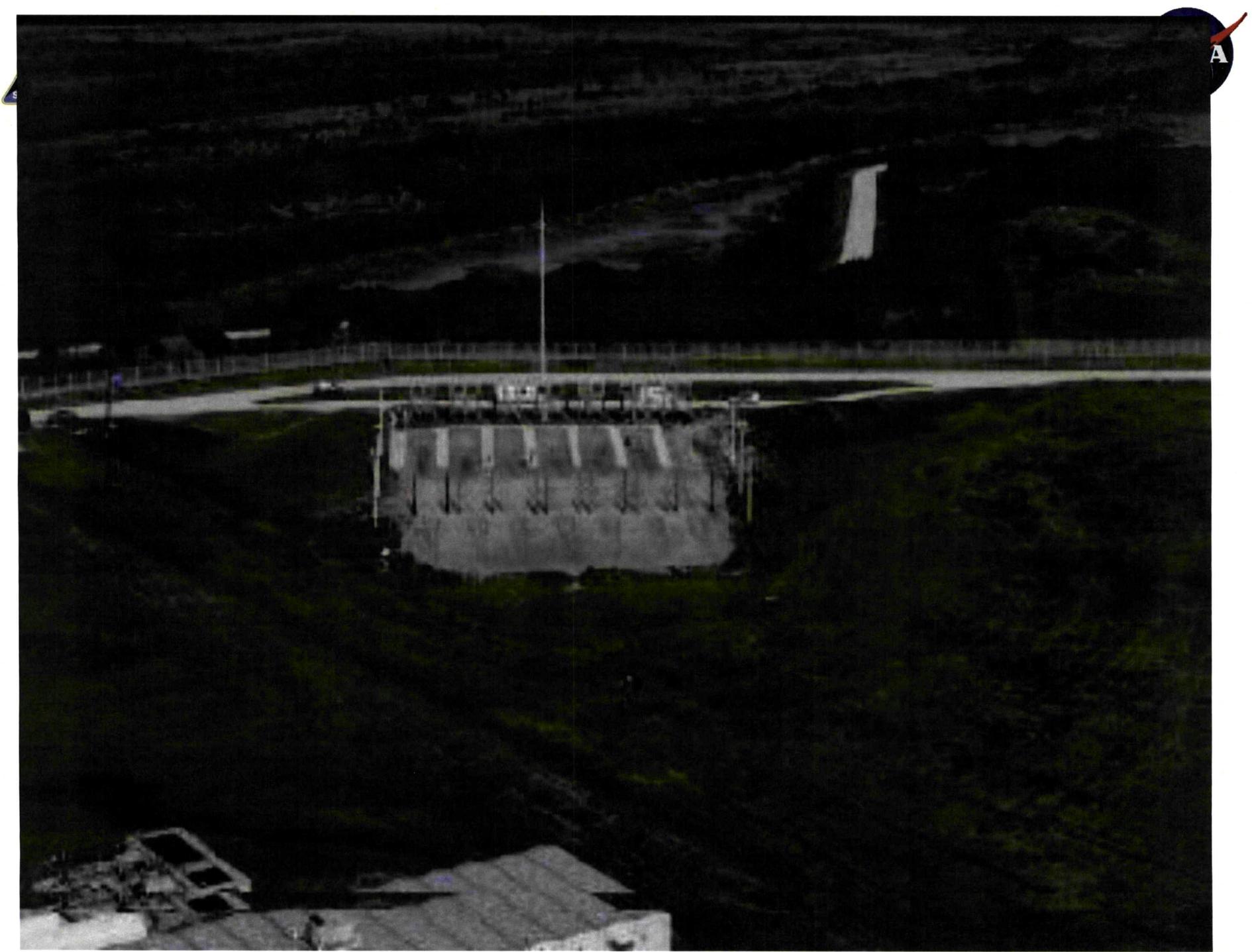
# Mode 1

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# Mode 2

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# Mode 3 & 4

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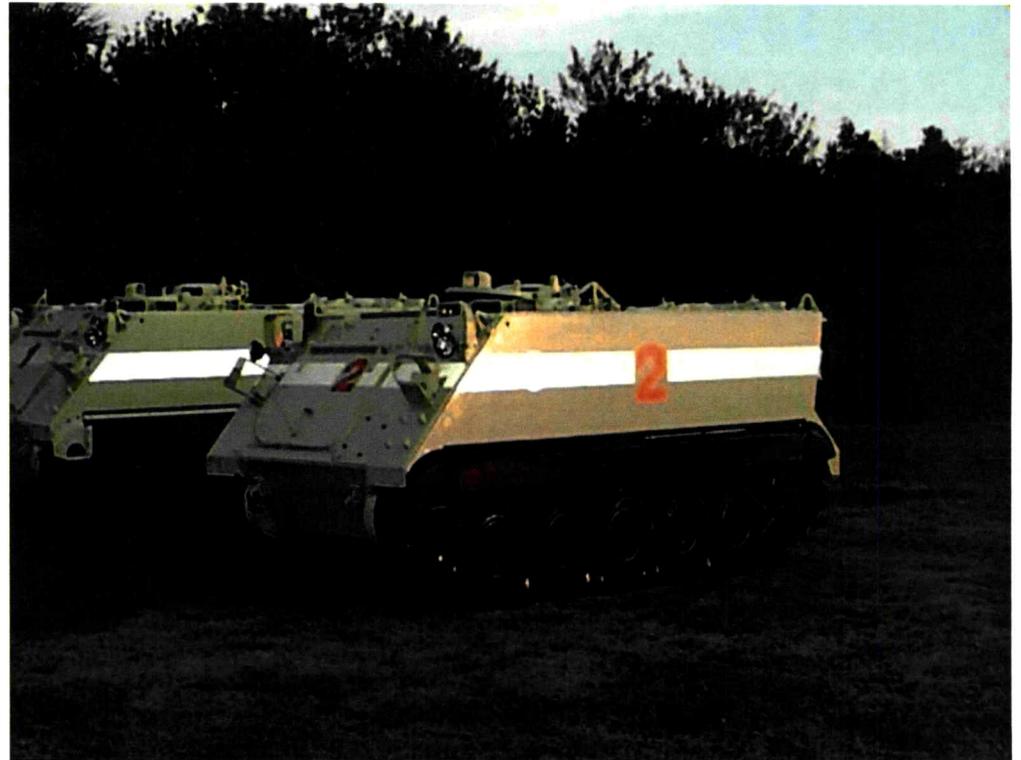


## RESCUE FORCES – Pad Launch Modes

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- Pad Rescue Team
- 14 Fire/Rescue Spec.  
(7 up to Tower)
- 2 Armored Personnel  
Carriers

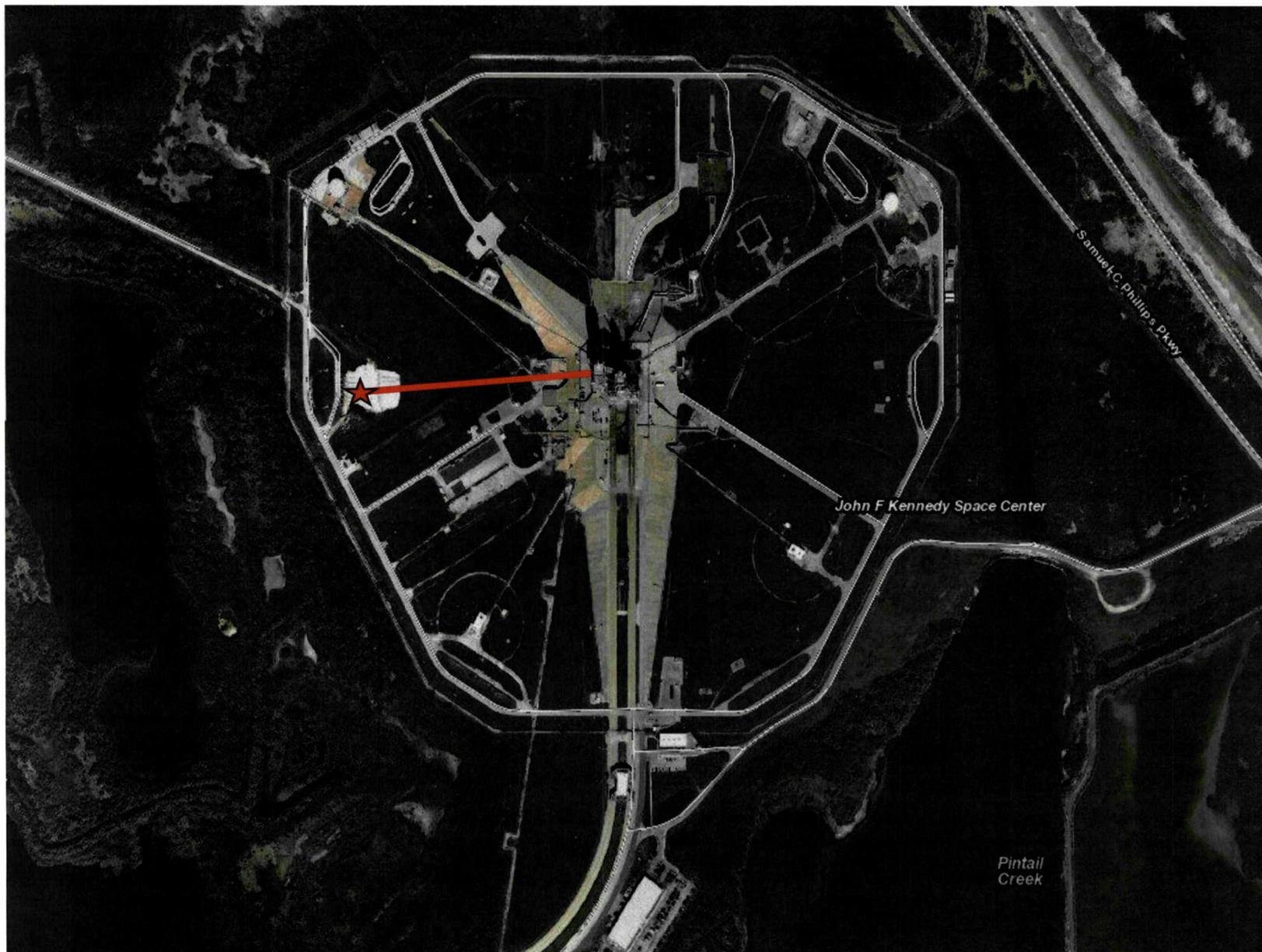
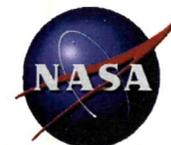








# Pad Emergency Escape Slide Wire System







# Pad to Bunker to Triage Site



Launch Tower

Slide wire System  
to Bunker



Bunker Ops

Fire & Rescue  
from  
fallback location



Triage Site

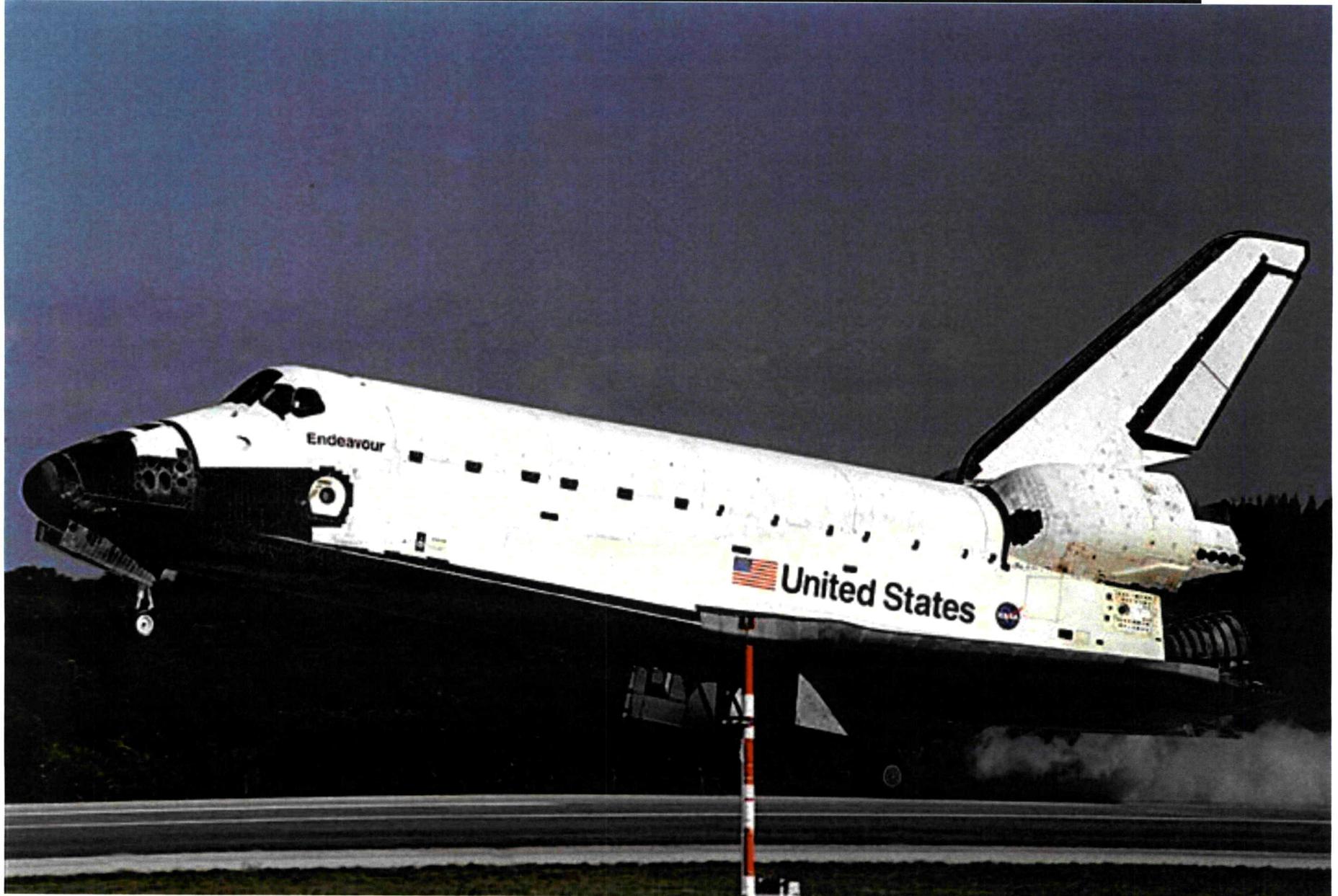


M113 to Triage Site



Exit Bunker and Enter M113







# Mode 5

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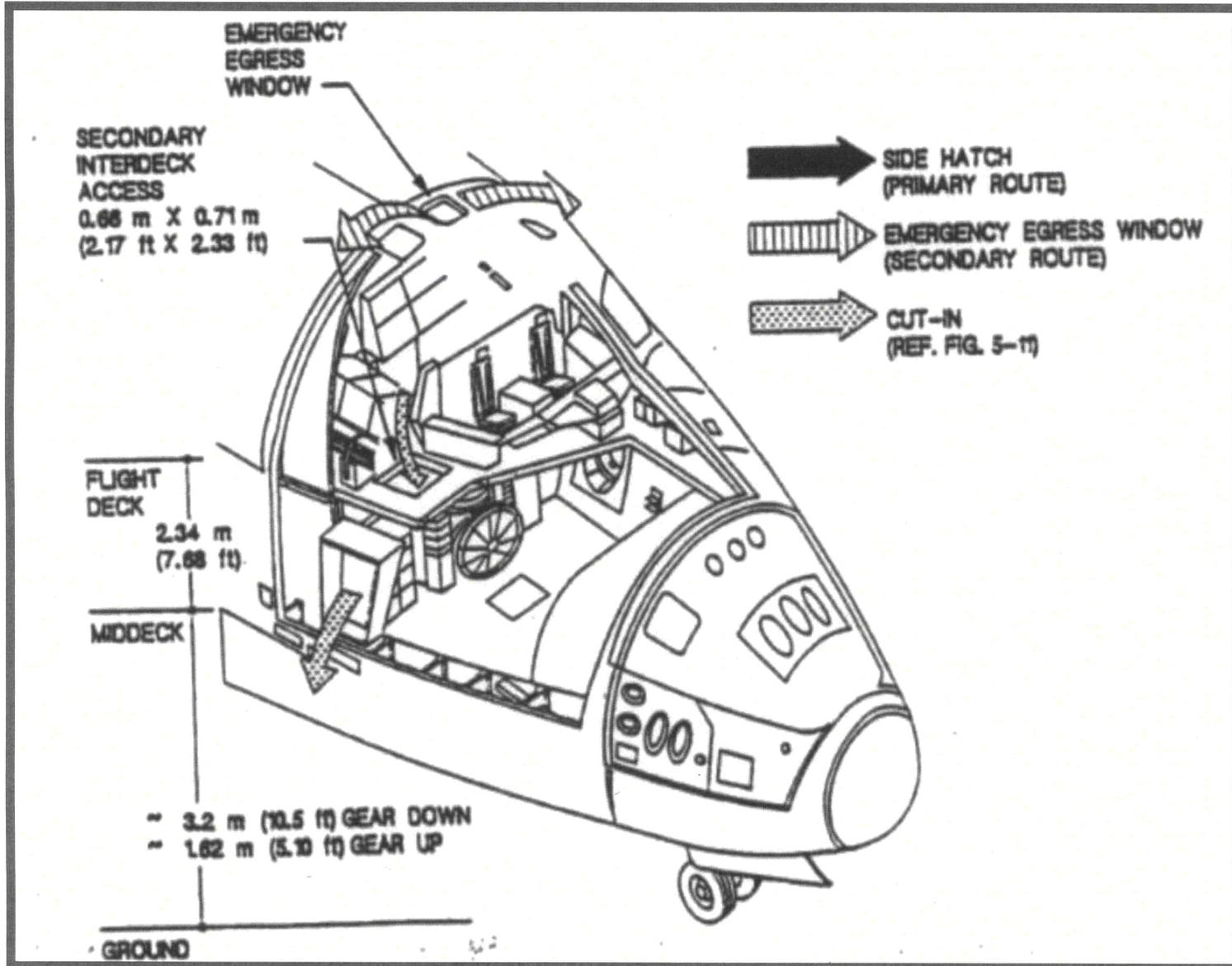
# Mode 6

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# SHUTTLE EGRESS



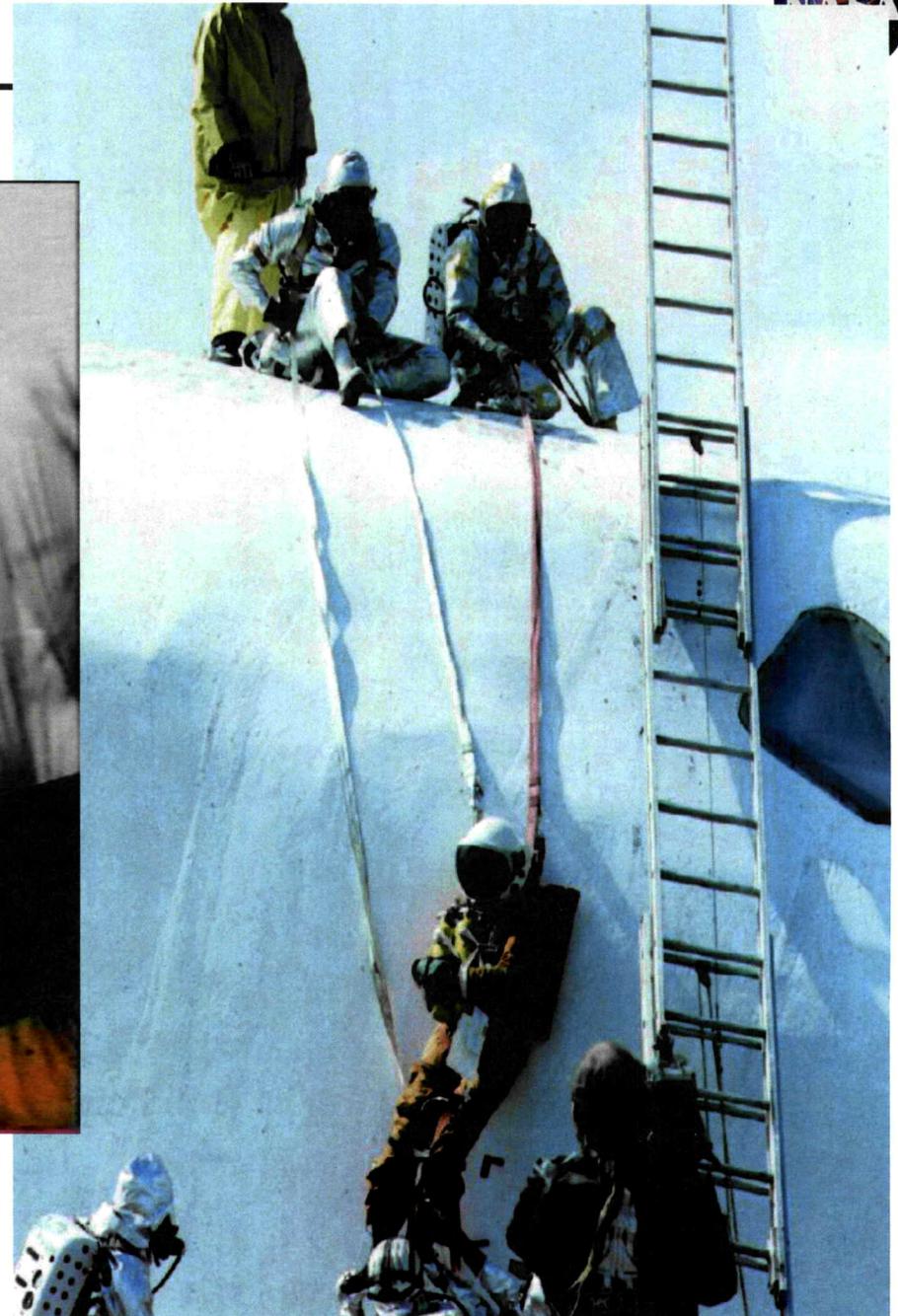
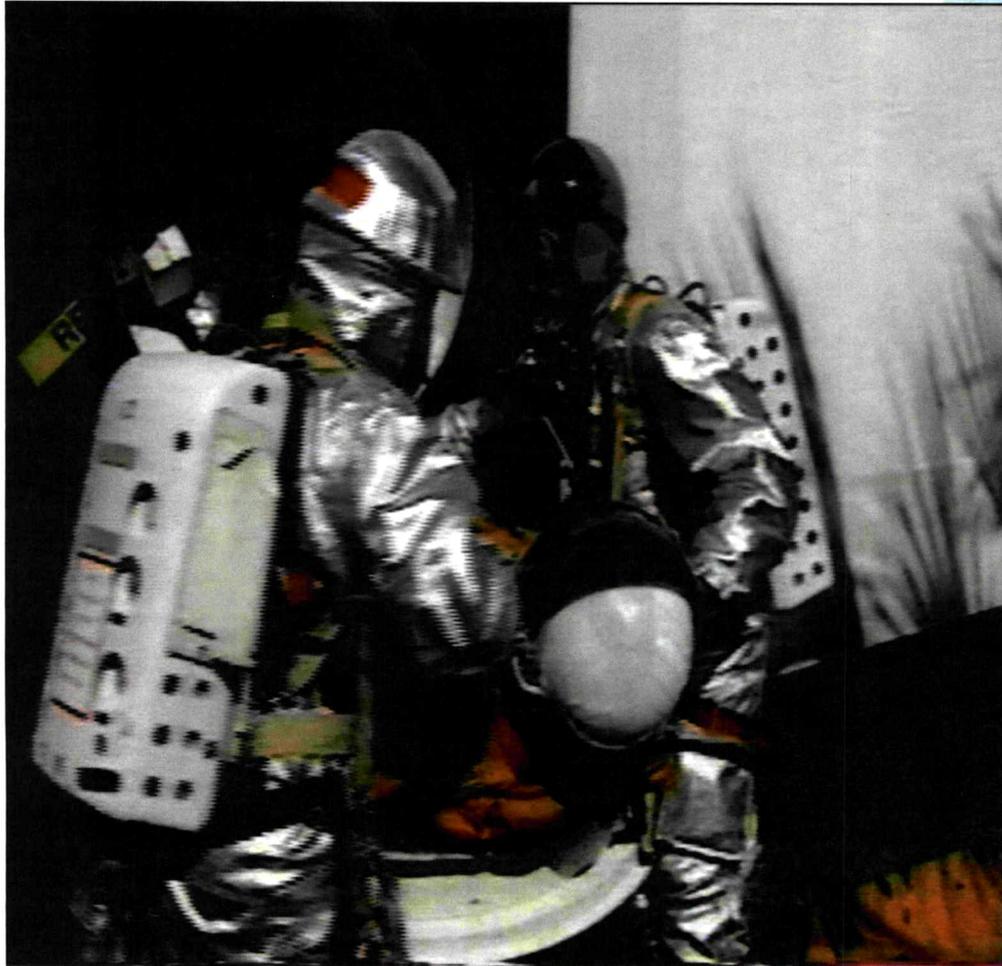


## Mode 6 Rescue Forces

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- **14 Fire/Rescue Spec.**
- **Van**





# Mode 7

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## Mode 7 – Rescue Forces

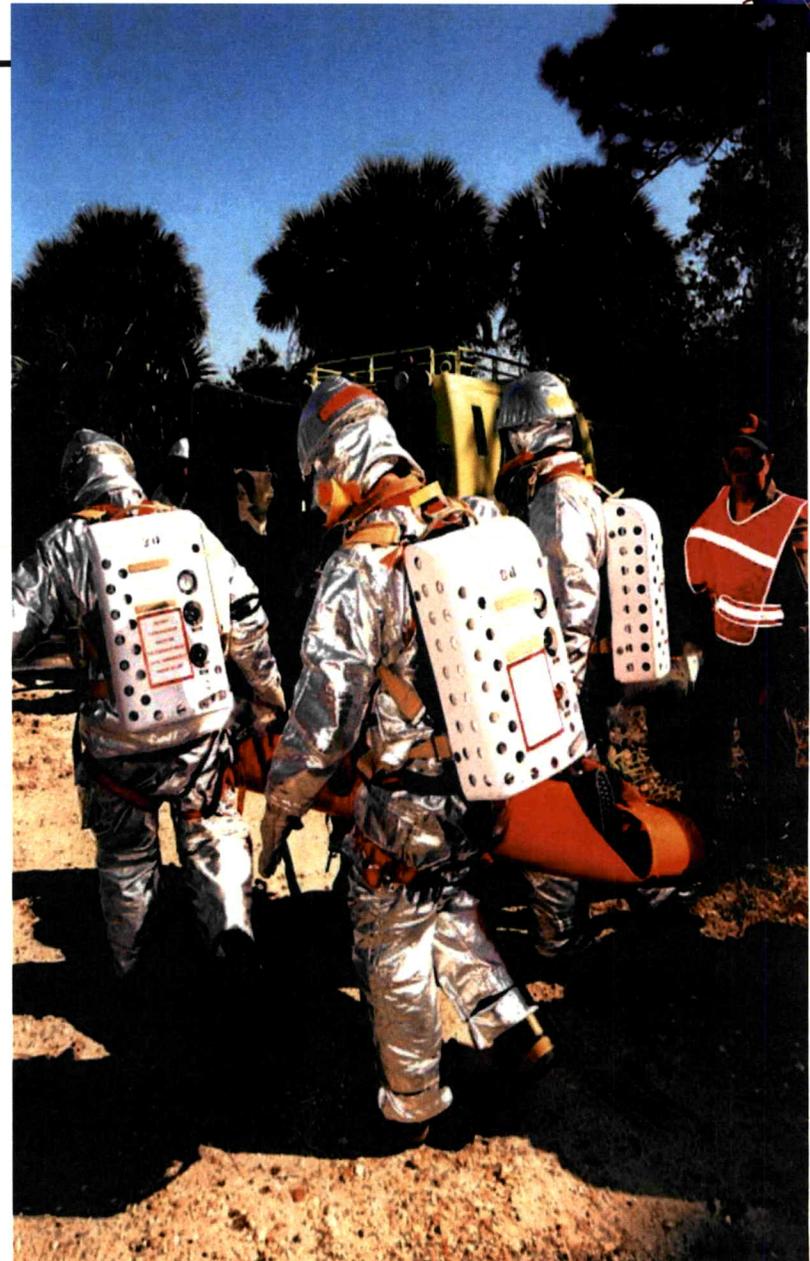
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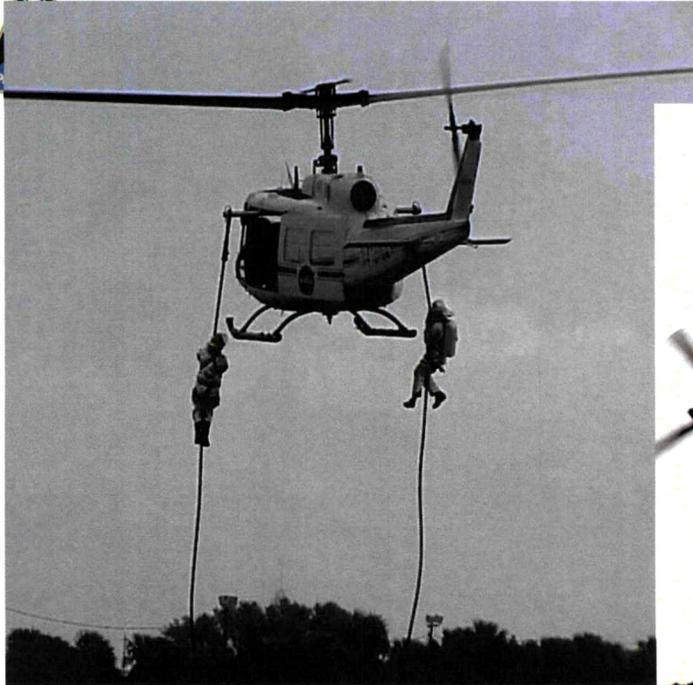
- 14 Fire/Rescue Spec.
- Bearcat
- Helo

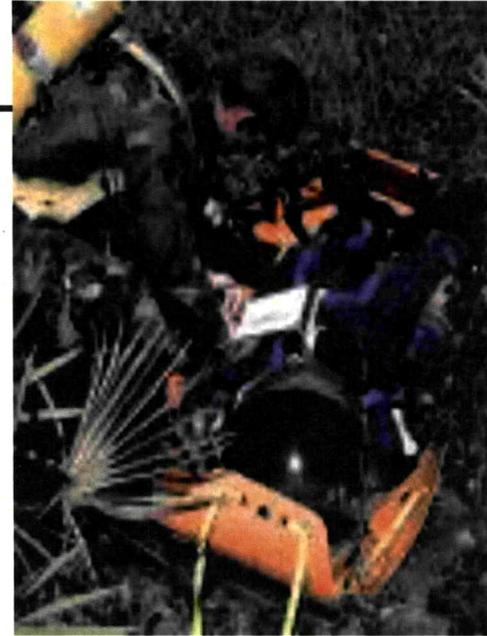
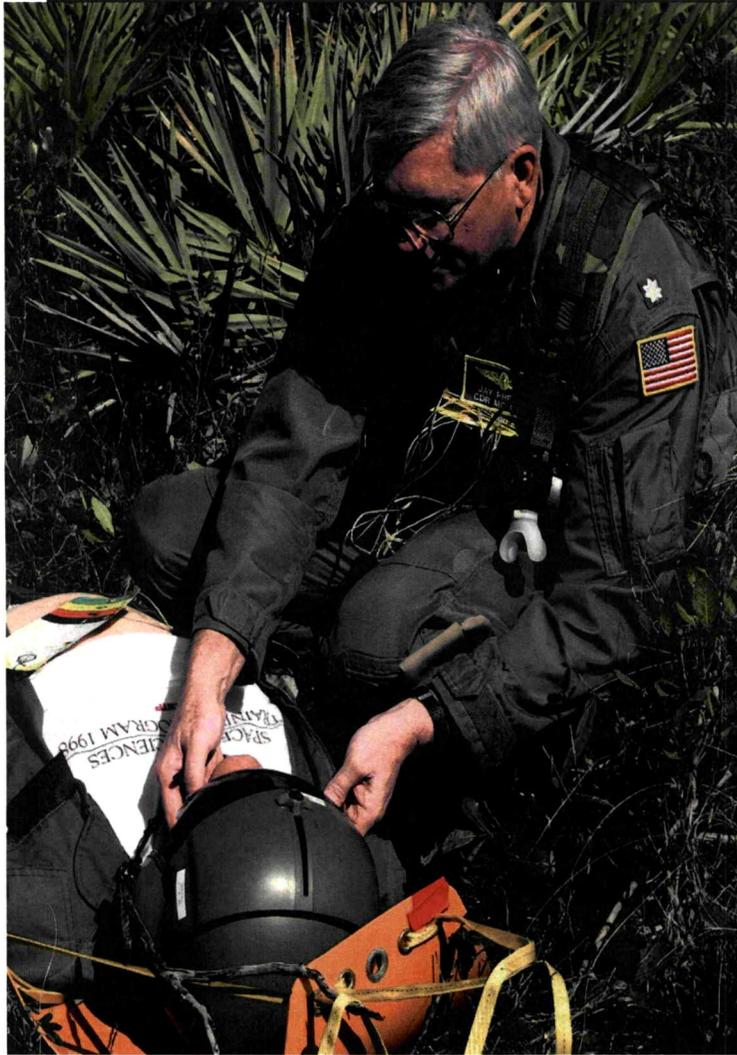














# Mode 8

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## Mode 8 - Rescue

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# EMS Flow

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## ◆ **MODE DECLARATION**

- Identifying the problem
- Initiating response

## ◆ **RESCUE/EGRESS**

- Transfer to triage site

## ◆ **TRIAGE**

- Decontamination, initial tx and stabilization

## ◆ **MEDEVAC**

- Ground or Air



# Triage Site Selection

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- Wind Direction
- Proximity to contingency



# Triage Site – Launch Modes 1- 4



125 ft Helo pad clearance

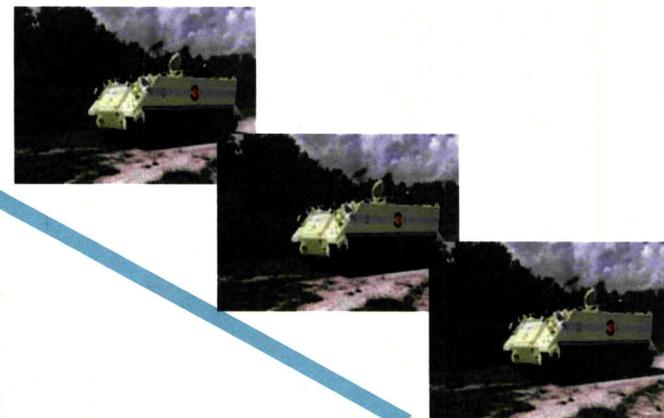


Treatment Area

MOVING VEHICLES  
PARKED VEHICLES/PERSONNEL

Decontamination Area

Clean-Dirty Line



Washdown Truck



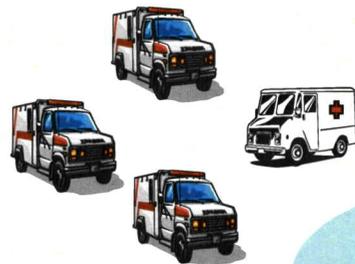
To Pad



# Triage Site – Landing Modes 5 & 6



125 ft Helo pad clearance



Treatment Area

MOVING VEHICLES  
PARKED VEHICLES/PERSONNEL



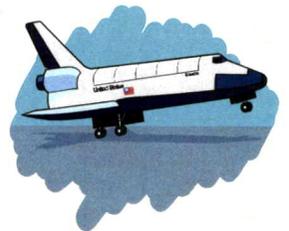
Rescue Vans

Decontamination Area

Clean-Dirty Line



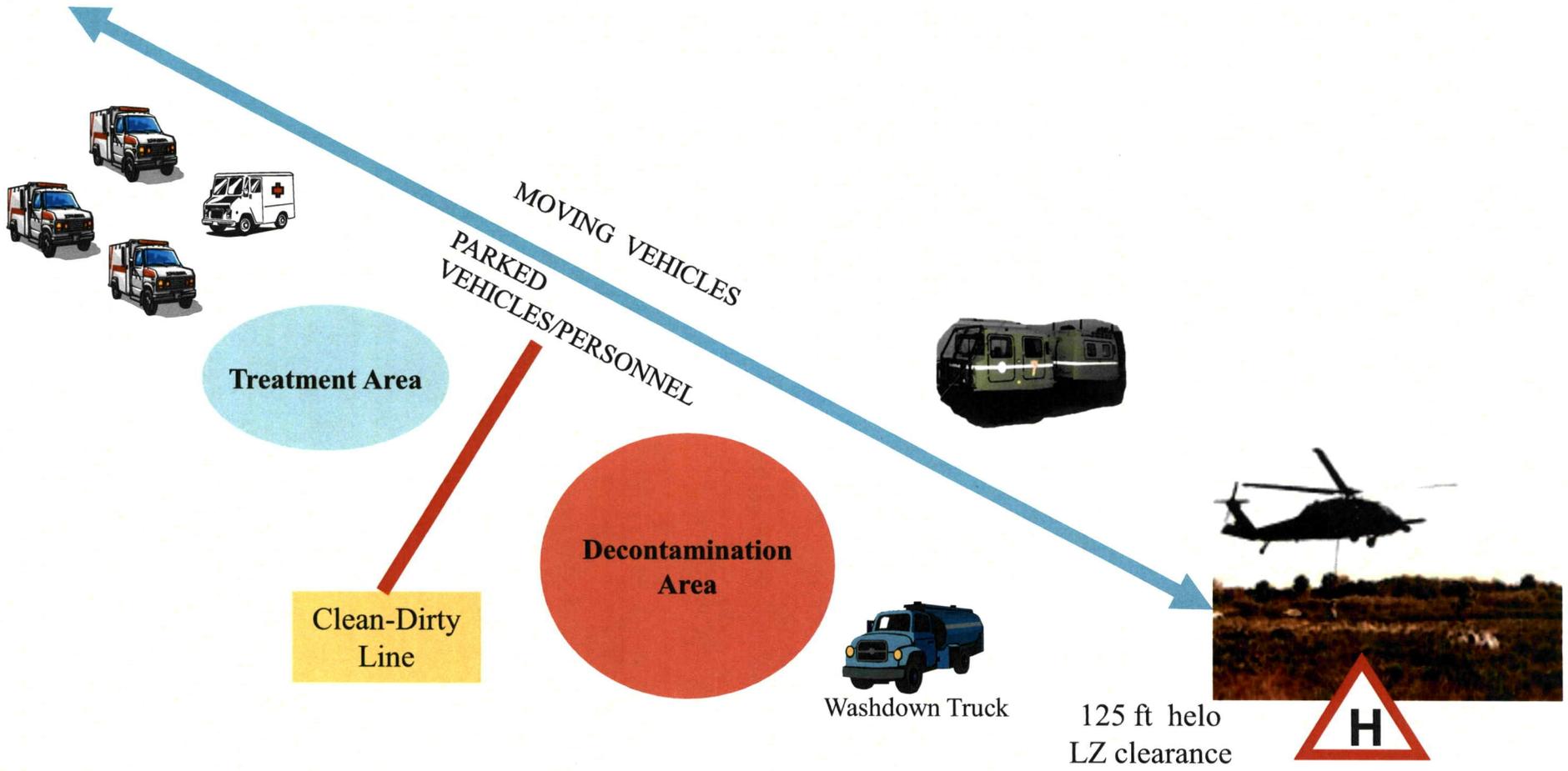
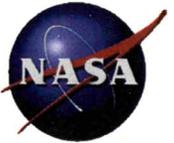
Washdown Truck



To Orbiter



# Triage Site – Mode 7 & 8





# Triage Site Forces

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- Triage Doc
- Trauma Docs (2)
- Crew Surgeon
- Paramedics (4)
- Ambulances (2-3)
- Medical Communicator
- Logistics Coordinator
- Triage Van
- Environmental Health
- Washdown Truck
- Lighting Truck





## Triage Doc

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- ◆ KSC Physician
- ◆ Command and Control of Triage Site
- ◆ Radio and Wireless Telecommunication with EMSC in LCC





## Univ of FL Trauma Docs

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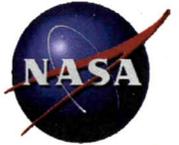
- ◆ Trauma Surgeons/  
ER/Anesthesiology
- ◆ UF Shands/Jacksonville  
and Gainesville
- ◆ Provide ATLS expertise
- ◆ 4 for every Launch





# Flight Crew Surgeons

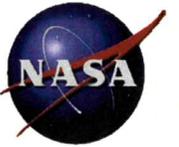
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- ◆ Astronaut's PMD
- ◆ Launch
  - CS at Triage Site
  - DCS with EMSC in LCC
- ◆ Landing
  - CS and DCS in CTV



# 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

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**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

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## ◆ **MODE DECLARATION**

- Identifying the problem
- Initiating response

## ◆ **RESCUE/EGRESS**

- Transfer to triage site

## ◆ **TRIAGE**

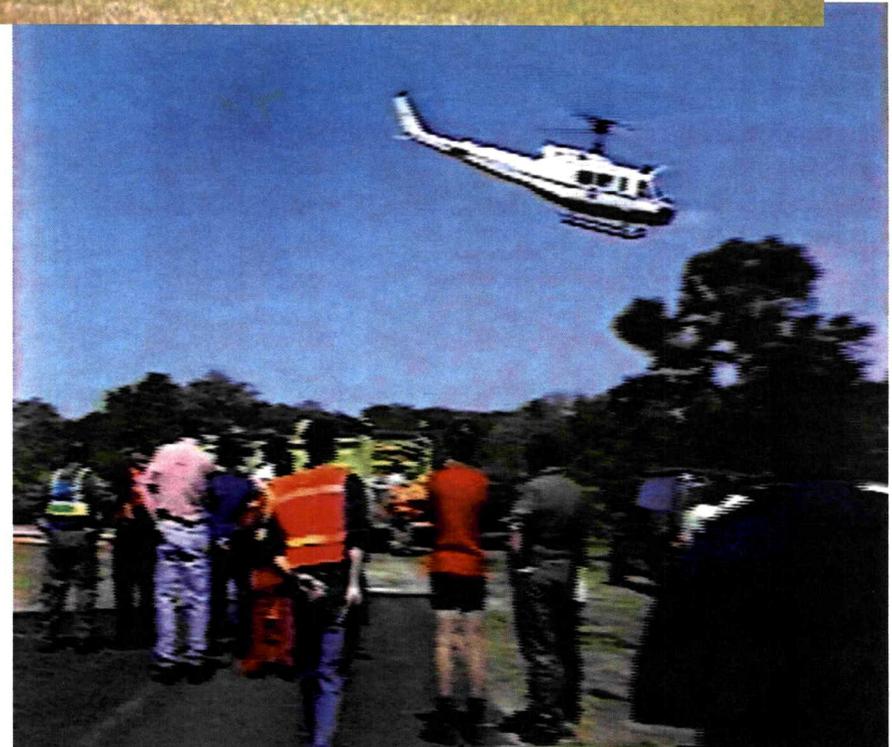
- Decontamination, initial tx and stabilization

## ◆ **MEDEVAC**

- Ground or Air



# Air Medevac





# Air Medevac Forces

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## 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

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- 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

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## First Flight

- Holmes Regional



## AirCare

- ORMC





# Definitive Medical Care





# Medical Care Facilities Supporting KSC

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- ◆ 6 Definitive MCFs
- ◆ 1 Intermediate MCF
- ◆ 2 Alternate MCFs



# Additional Medical Forces

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## ◆ 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)

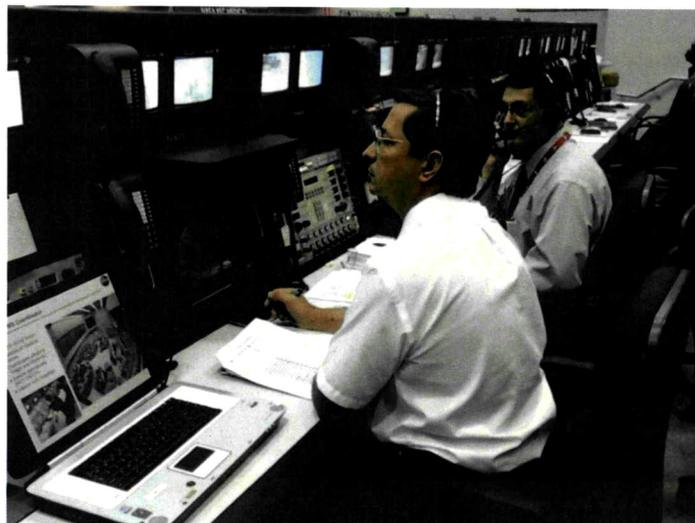
## ◆ Visitor support (RNs and EMTs)



## 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

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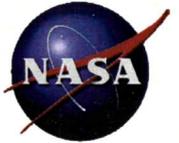


- Medication Bag (Specific medication uses)
- RSI Bag (NASA RSI protocols)
- Air Doc Medical Kit (Bag)



# Medication Bag

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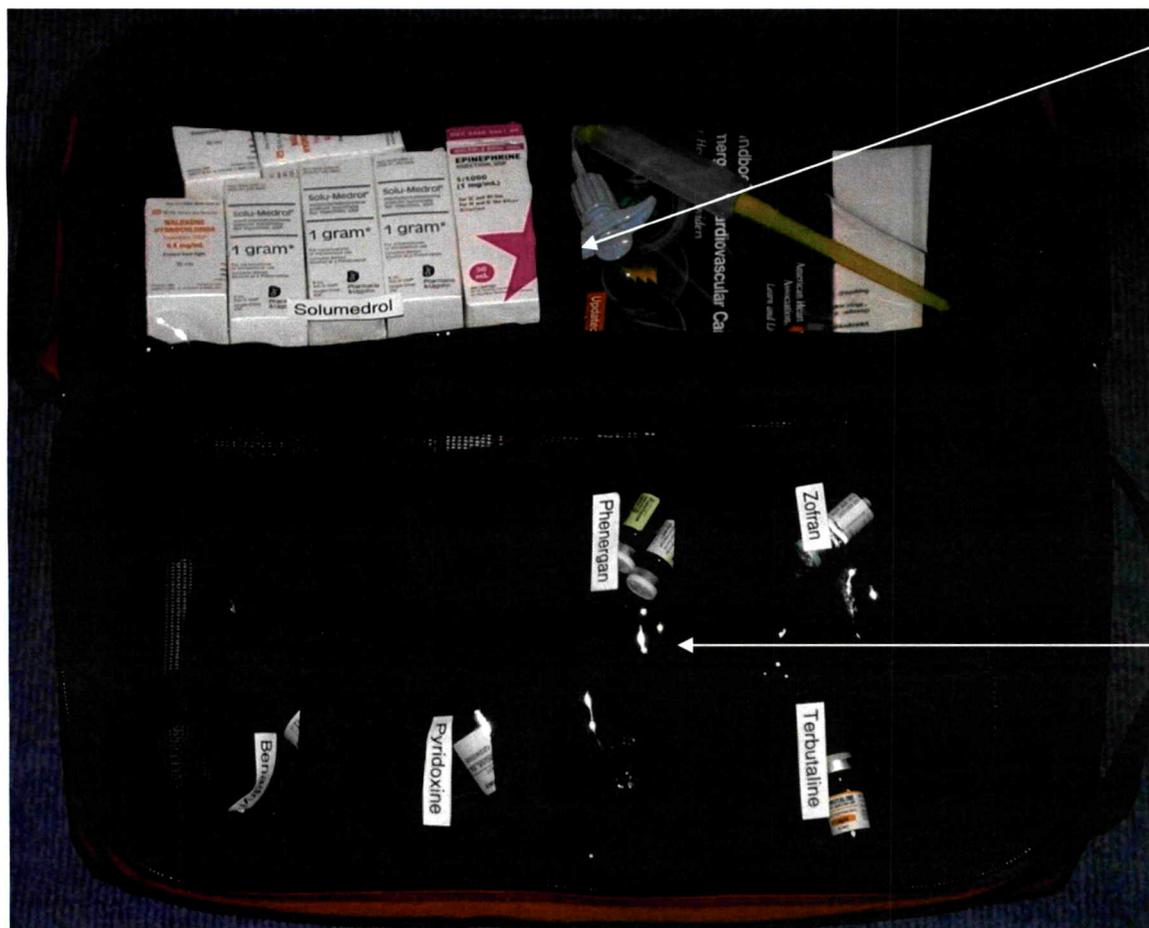


## Bag External





# 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 B<sub>6</sub>) IM or IV drip



# Medication Bag



## Inside bag under mesh cover

*ACLS and other meds*

Epinephrine	Lasix
Lidocaine	Albuterol
Adenosine	Benadryl
Atropine	

## Internal side of flap

*ACLS meds*

Vasopressin	Lopressor
Amiodarone	Dopamine
Mg Sulfate	ASA



# Medication Dosing

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## ◆ Most meds follow

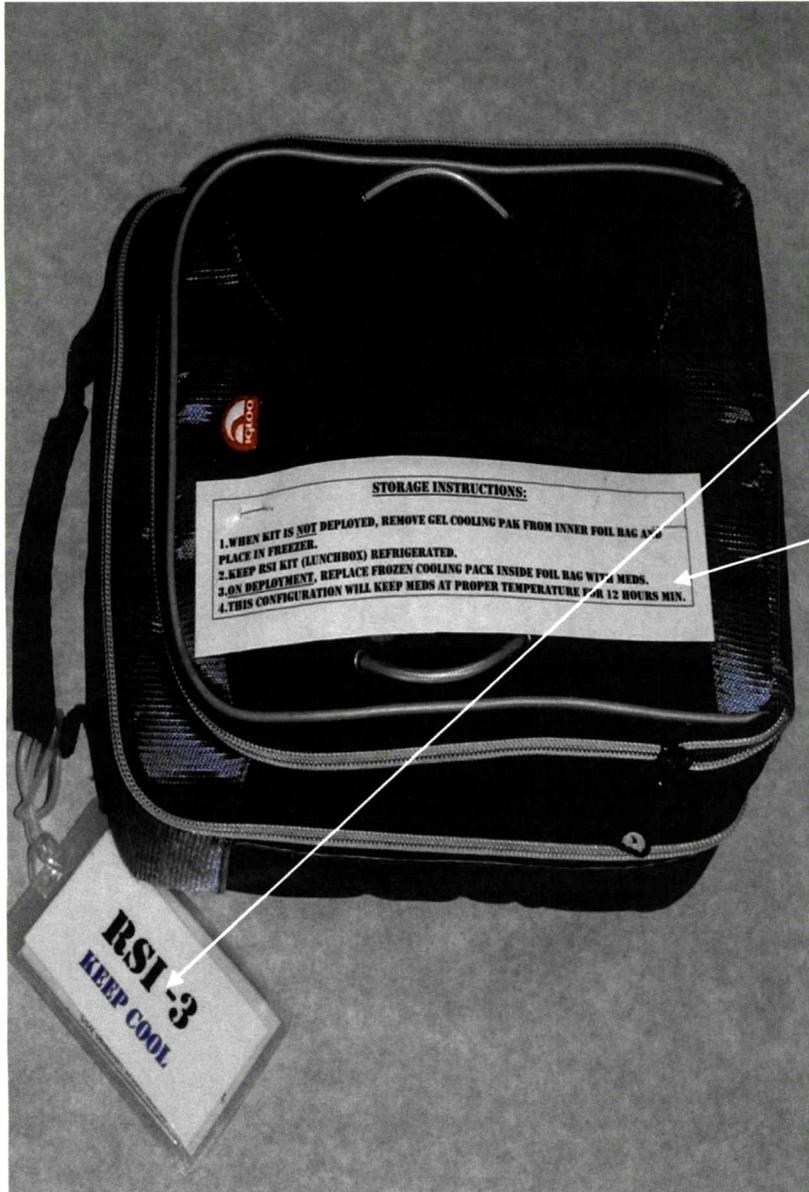
- AHA ACLS Guidelines
- Traditional drugs and dosing as on Earth

## ◆ NASA unique exposures

- Hydrazine
  - Pyridoxine (vitamin B<sub>6</sub>)
  - 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

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## ◆ 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

### **Green Stripe**

Ambu w/mask

Oral Airways

CO2 Detector

Waterproof tape

### **Red Stripe**

Laryngoscope

Blades

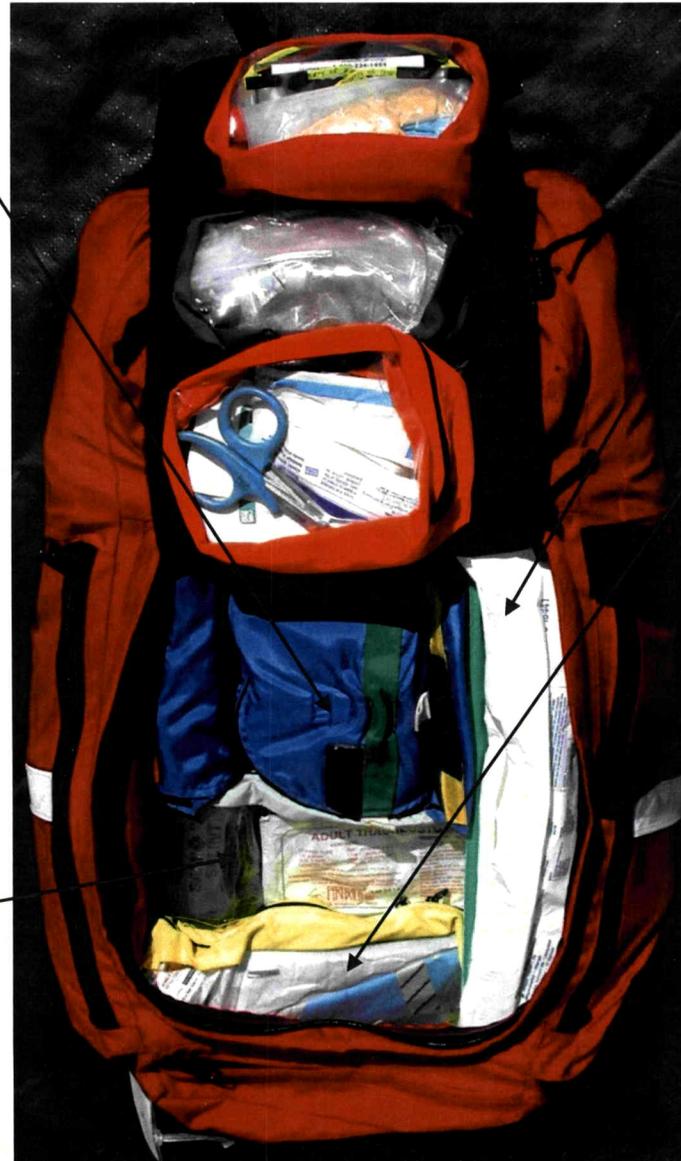
10cc Syringe

Lido Jelly

### **Grey**

Sam Splint

Tracheostomy kit



## **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



# Summary

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## 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