N94- 33644

Emergency Medical Services

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When NASA was established in 1958 it was known that space flight would require efforts beyond those of NASA to ensure the health and safety of our astronauts. On August 10, 1958, a Secretary of Defense memorandum was signed that assigned the first Department of Defense (DOD) Manager to provide support to NASA for Project Mercury. This established a chain of command through the Joint Chiefs of Staff to the Secretary of Defense. The current charter is dated March 19, 1986, and assigns the DOD Manager responsibilities to the Commander in Chief, United States Space Command. The DOD Managers charter has many support areas and among them are recovery of astronauts and medical support.

Today these efforts support the Space Shuttle and Space Station Programs. Briefly, the program works with each organization tasking the other through a requirements document. Level of care, communications, and recovery requirements are established; NASA and the DOD provide the capability to meet them. NASA is also responsible for the specialized training and equipment needed to meet these requirements.

A Shuttle launch at Kennedy Space Center (KSC) requires an Emergency Medical Services (EMS) coordinator on console to facilitate communications, ensure proper coverage, and coordinate with area hospitals. A contingent of NASA medical personnel are assembled to provide triage and medical support capabilities. The DOD provides medical evacuation (MEDEVAC) helicopters with surgeons and pararescue specialists (PJs) or emergency medical technicians (EMTs). Each helicopter is equipped with at least one doctor and one PJ/EMT per astronaut crew member. Transoceanic abort landing (TAL) sites and end of mission (EOM) sites have similar structures, with TAL sites utilizing fixed wing aircraft for MEDEVAC. The DOD also supports contingency planning for the support and return of crew members from the Space Station Freedom. Much of this support has been directed at the recovery of crew members following the landing of an Assured Crew Return Vehicle.

The EMS programs are expensive and would have been difficult for NASA to implement without DOD support. The DOD has gained valuable experience with deployments to areas such as Ben Guerir, Morocco, and Banjul, The Gambia. They have used this experience to improve their own military operations. This has also been the case with the operations at the Continental United States (CONUS) landing sites. Shuttle contingency exercises provide DOD personnel opportunities to participate in decontamination, triage, field medical care, and MEDEVAC simulations. This is often used to fulfill military training requirements and to provide the surgeons the opportunities to perform medical procedures in rotary and fixed wing aircraft.

The unique hazards associated with space flight and the Shuttle have also led to improvements in the capabilities of some DOD units. Support to the Shuttle Program requires that the surgeons be Advanced Cardiac Life Support (ACLS) and Advanced Trauma Life Support (ATLS) qualified, with refresher training every 4 years. A NASA Flight Surgeon Training Course is also required and taught at JSC. This course is taught to approximately 50 surgeons each year and provides the participants insight into the Shuttle operations and hazards, the JSC medical operations branch astronaut care program, and the NASA and DOD EMS system that is in place to support space flight. Both the military and NASA have benefited from this relationship.

Preliminary Health Survey Results from Over 250 High Flyer Pilots with Occupational Exposures to Altitudes Over 60,000 Feet

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High Flyer Health Survey

Decompression Sickness Workshop - 1990

- Review Pathophysiology Of DCS
- Evaluate Existing Options for Predicting DCS
- Defining Problems of DCS in Space
- Documenting Current Incidence of DCS in Aviation
- Discussing "Acceptable Risk" of Altitude DCS
- Listing Areas of Needed DCS Research

An Accurate Accounting Operational Incidence of DCS Does Not Exist

High Flyer Health Survey

DCS Survey - Beale AFB 1991

- 40 AD U-2/TR-1 Pilots (Anonymous)
- One or More Episodes Self-Diagnosed DCS
  - 57.5 - 65%
- Rates:
  - 4-5 % per mission
  - 8-9 % per 1000 hours exposure
- Reluctance to Report - Fear
  - Aeromedical Response
- Number 1 Occupational Health Concern
  - Exposure to Ionizing Radiation (75%)

High Flyer Health Survey

Occupational Health of U-2/TR-1 Pilots

- Decompression Sickness
  - Long Term Sequela Unknown
  - Musculoskeletal
  - CNS
- Ionizing Radiation
  - Long latency
  - Exposure Levels Unknown
  - Somatic (Cataracts)
  - Genetic (Neoplastic)
  - Teratogenic (Reproductive)

High Flyer Health Survey

Biological Effects of Radiation

- Enzymatic Alterations
- DNA Strand Breaks
- Chromosomal Aberrations

- Technologically Enhanced Radiation
  - Linear Energy Transfer
  - Dose Rate
  - Environmental Factors

High Flyer Health Survey

Cosmic Radiation

- Galactic
  - Protons, Alpha particles, Heavy Nuclei
  - Secondary Ionizing Particles - 65,000 ft
- Solar
  - Protons, Alpha, Gamma
  - 11-Year Cycle
- OSHA Standards (500 mrem/yr)

High Flyer Health Survey

Regulation and Monitoring

- High Flyer TLD/TED Dosimetry
  - SR-71 (1983): 1.04 mrem/hr
  - WB-57(1982): 0.9-1.5 mrem/hr
  - U-2 (1987): 1.48 mrem/hr
  - U-2 (1990): 0.5-0.6 mrem/hr
- Increasing Public Health Concern
- ICRP, NCRP, EPA, OSHA, FAA, USAF

High Flyer Health Survey

Hammer - 1984

1. Formal designation of high flyers as occupationally exposed
2. Monitoring of Cockpit Dose Rates
3. Early Warning of Solar Flare Events
4. Occupational Monitoring
5. Personal Lifetime Dose Monitoring
6. Life Long Surveillance

High Flyer Health Survey

Study Design

- 16 Page Survey
  - General Health Demographic Data
  - Health Status Review
  - DCS Survey
- Cohort: 503 U-2/TR-1 Pilots
- Addresses: 416
- Response: 269 Returned/36 Deceased
  - 73 Percent Response rate

High Flyer Health Survey Preliminary Results

Demographic Data

- Mean Age: 50 yrs
  - 27% over age 60
  - 72% Retired; 28% Active Duty
  - 7.7% Medically Retired/Partial Disability
- AF Flight Time: 4390 hrs
- High Fly (U-2/TR-1): 1028 hrs
- Missions: 144 (59% > 100)
- FL250 Exposure: 701 hrs

High Flyer Health Survey Preliminary Results

Demographic Data

- General Health
  - Good to Excellent: 94%
  - Retirees: Fair (3.7%) Poor (1.5%)
- Diet
  - Low Cholesterol: 30%
- Tobacco: 10-12% continue (50%users)
- Alcohol: 84% (4.6 beers/5.3 mixed/wk)

High Flyer Health Survey Preliminary Results

Medical History

- Regular/Continuing Doctor's Care
  - 23%
- Medications
  - 27% (Regularly take 1 or more meds)
  - 7% (3 or more medications daily)
- Surgeries
  - 55.4% (One or more surgeries)
- History of malignancy - 28.5%

High Flyer Health Survey Preliminary Results

Problems with Eyes or Vision

N = 267

Hx Eye Probs	Cataracts	Glaucoma
10.9%	2.6%	4.1%

Problems with Ears or Hearing

Hx Ear Probs	HFHL	Disequilib
31.1%	26.6%	3 - 5%

Sinuses, Mouth, Throat

Hx of ENT	Sinusitis	Oral CA
25.1%	9.4%	1.5%

High Flyer Health Survey Preliminary Results

Heart and Circulatory System

N = 267

Any Heart	42.7%	114
Hypercholesterolemia	31.8%	85
Hypertension	12.4%	33
Coronary Bypass	3.4%	9
Stroke/CVA	1.5%	4
Myocardial Infarction	1.5%	4
Valvular Disease	0.7%	2
Congestive Failure	0.4%	1
Other Heart	3.4%	9

High Flyer Health Survey Preliminary Results

N = 267

Pulmonary/Lung

Any Lung Probs	7.5%	20
COPD	4.5%	12
Lung Cancer	1.1%	3
Tuberculosis	0.7%	2
Freq Pneumonia	0.4%	1
Other Lung	1.1%	3

High Flyer Health Survey Preliminary Results

Gastrointestinal

N = 267

Any GI Probs	18.4%	49
Gastritis/Heartburn	6.0%	16
Ulcer Disease	3.7%	10
Gallbladder Dz	2.6%	7
Hepatitis	2.6%	7
Polyposis	1.9%	5
Colon/Rectal CA	1.5%	4
Liver CA	0.4%	1
Other GI	4.1%	11

High Flyer Health Survey Preliminary Results

N = 267

Renal/Kidney Problems

Any Hx of Kidney Dz	9.7%	26
Kidney Stones	6.7%	18
Hematuria	3.4%	9
Renal Tumor	0.4%	1
Glomerulonephritis	0.4%	1
Other Kidney	0%	0

High Flyer Health Survey Preliminary Results

N = 267

Hematopoetic/Metabolic

Tumor of Lymph Nodes or Glands	1.1%	3
Leukemia	0.4%	1
Thyroid CA	0.4%	1
Hodgkin's	0.0%	0

High Flyer Health Survey Preliminary Results

N = 267

Bones, Joints, Muscles

Any Musculoskeletal	44.2%	118
Back/Disk Problems	26.6%	71
Arthritis	19.5%	52
Pain/Tremors of Hands	4.9%	13
Progressive Weakness	3.4%	9
Other M-S Problems	7.5%	20

High Flyer Health Survey Preliminary Results

Neurologic/Psychologic

N = 267

Any Hx Neuropsych	10.9%	29
Numbness/Tingling	3.7%	10
Memory Loss	1.5%	4
Paralytic Symptoms	1.5%	4
Fainting Spells	1.1%	3
Slurred Speech	1.1%	3
Seizures	0.7%	2
Depression/Anxiety	0.7%	2
Other N-P Probs	1.1%	3

High Flyer Health Survey Preliminary Results

Skin

N = 267

Any Skin Problems	28.8%	77
Basal Cell Carcinoma	8.6%	23
Eczema/Psoriasis	5.6%	15
Frequent Rashes	5.2%	14
Melanoma	3.7%	10
Squamous Cell CA	2.2%	6
Other Skin	9.4%	25

High Flyer Health Survey Preliminary Results

DCS

N = 232

	Percent	Pilots	Events
Limb/Joint Pain	64.7%	150	1520
Headaches	29.4%	68	73
Skin Manifestation	19.4%	45	278
Inappropriate Fatigue	17.0%	39	424
Cognitive Problems	10.4%	24	123
CNS Sensory/Motor	3.0%	7	8

High Flyer Health Survey

Discussion

- ► Sample Size
  - False Reassurance
- ► Incomplete Exposure Data
  - Dosimetry, Latitudes, Solar Flare Activity
- ► Duration of Exposure
- ► Multiple End Points
- ► Long latency
- ► Recall Bias, Incomplete recall, non-response

High Flyer Health Survey

Forecast??

Conclusion

Session L3: TELEMEDICINE

Session Chair: Dr. Gerald Taylor