The NASA Clinic System

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NASA Medical Care

Underwater...

..on the ground...

...through the air...

...and into space
Authority for NASA Health Care: Occupational Health

5 USC 7901

- The head of each agency of the Government of the United States may establish, within the limits of appropriations available, a health service program to promote and maintain the physical and mental fitness of employees under his jurisdiction.

- A health service program is limited to
  1. treatment of on-the-job illness and dental conditions requiring emergency attention;
  2. pre-employment and other examinations;
  3. referral of employees to private physicians and dentists; and
  4. preventive programs relating to health.
Authority for NASA Health Care: Astronaut Health

- **31 USC 1301(a)**
  - Appropriations shall be applied only to the objects for which the appropriations were made except as otherwise provided by law.

  - The “Necessary Expense Doctrine”
Comprehensive Health Care for NASA Employees

- Federal Employees Health Benefits Program – administered by the US Office of Personnel Management
  - Health
  - Vision
  - Dental
  - Flexible spending accounts
  - Long term care

- TRICARE
  - Department of Defense personnel detailed to NASA
NASA Facilities and Clinics

18,500 Civil Service Employees Agency-Wide

Kennedy Space Center - NASA Principal Center for Occupational Health

Johnson Space Center – NASA Principal Center for Human Space Flight
NASA Occupational Exposures (Ground Based)

- Noise
- Fuels
- Solvents
- Paints
- Pyrotechnics/explosives
- Pressure changes
- Closed spaces
- Office ergonomics
- Heat/cold
- Heights
- Radiation, etc.
NASA Occupational Health Services (Ground Based)

- Occupational Medicine
  - Emergency care
  - Preventive health care
  - Occupational health monitoring
  - Limited treatment of occupational injury/illness

- Industrial Hygiene

- Employee Assistance Program

- Workers’ Compensation Program
NASA Occupational Health Clinics

NASA launch site uses DoD helicopters, ambulances and medical staff to cover visitors as well as the astronauts
NASA Medical Launch and Landing Support (Space Shuttle)
KSC uses DOD helicopters and ambulances to cover visitors as well as the astronauts.
The 2005 hurricane season will long be remembered both for the record-breaking number of early storms and the emergence of a powerful Category 5 hurricane in the central Gulf of Mexico—Hurricane Katrina.

Seventeen days after Katrina flooded New Orleans, much of the city is still under water. In this pair of images, the affected areas can clearly be seen. The flooded parts of the city appear dark blue, and the areas that have dried out appear light blue-grey.

Hurricane Katrina strengthened into a powerful Category Five hurricane with sustained winds of 180 mph. The floods came just hours after Katrina reached Category 5, with wind of 145 mph, as it gathered energy from the warm water of the Gulf of Mexico. Here it continues on its path towards the Louisiana-Mississippi coastline.
The Space Environment

- Temperature extremes
- Vacuum
- Isolation & confinement
- Circadian rhythms

- 49,000,000 km
- 22 minute 1-way communication
- Circadian rhythms

- Water & food availability
- New geosystem
- Reduced gravity
- Fuel & oxygen

Civilization & isolation temperature extremes vacuum isolation & confinement

1 yr

Circadian rhythms
Physiology of Spaceflight

- Psychological
- Neurosensory & Neuromotor
- Muscle
- Musculoskeletal
- Cardiovascular/Pulmonary
- Endocrine/Immune/Hematology
- Fluid Shifting
- Radiation
- Musculoskeletal
- Psychosocial/cultural
- Confinement

Microgravity
Radiation
Johnson Space Center Flight Medicine Clinic

- Comprehensive health care for astronauts on active duty with NASA and limited health care for their dependents (space available basis)
- Longitudinal Study of Astronaut Health for all astronauts, active and former
  - Annual executive physical with examinations targeted to space exposures
  - Records of all episodes of health care
Medical Care in Space: Telemedicine Based
Delivery of Medical Care in Microgravity and Space
ISS004-E-8510 (11 March 2002) --- Astronaut Carl E. Walz, Expedition Four flight engineer, performs cardio-pulmonary resuscitation (CPR) on a jerry-rigged “human chest” dummy in the Destiny laboratory on the International Space Station (ISS).


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Communications Challenges

IMAGE
DEGRADATION

INTERRUPTIONS

DELAY (>2 sec.)

Voice
Reference Files
Procedures

Voice
Real-time video (US)
Real-time video (other?)
Files (stills and cine)
Recorded Video

PRIVACY
Mercury: 5-12 min., 57 million km
Venus: 2-15 min., 26 million km
Mars: 4-22 min., 49 million km
Jupiter: 34-52 min., 391 million km
Saturn: 71-88 min., 795 million km
Uranus: 151-168 min., 1693 million km
Neptune: 241-259 min., 2706 million km
Pluto: 320-337 min., 3573 million km

* Mean distances from Earth
Self-replicating, self-repairing, & complex
Interconnected & autonomous
Smart & communicative
Human-centered
Human-assisted
Human-enabled

Nanotechnology

Biotechnology

Information Technology
Adaptive Automation
Multipurpose Tactile Interface
Biosensors for environmental and physiologic monitoring
Genetic profiling
Genetic diagnosis
Genetic vaccines
Tissue engineering

Biologically-Inspired Robots
Biotech based immunotherapy
Functionally-Adaptive Biomimetics
Nanomachines (self assembly)
Cell herding, genetic surgery
Biologically based nanocomputers
Artificial intelligence
Smart/haptic systems
Virtual physician

Future of Health Care in Space
NASA On Site Medical Clinics

- NASA maintains on site occupational health clinics at all Centers and major facilities.
- NASA maintains an on-site clinic that offers comprehensive health care to astronauts at the Johnson Space Center.
- NASA deploys limited health care capability to space and extreme environments.
- Focus is always on preventive health care.