

# Space Medicine Branch

## Report

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## Medical operations in Space Shuttle

The Medical Operations Branch of the Medical Sciences Division at the Johnson Space Center, Houston, TX, supports all medical aspects of the Shuttle program and future missions. This support includes pre- and postflight programs, as well as ongoing medical education for the physicians of the Branch.

Prior to OFT, STS, and Spacelab flights, it is the responsibility of Medical Operations to develop, coordinate, and document the medical requirements for these missions. These documents outline the roles of JSC, other NASA centers, and the Department of Defense in providing an overall medical plan for missions; they are the baselines from which all medical programs associated with the missions are implemented.

In preparation for missions, crewmen are given medical self-help training that includes instruction in emergency first-aid, cardiopulmonary resuscitation, and techniques of treating sick or injured persons. Instruction is also given on the use of the Shuttle Orbiter Medical Kit and its checklist. The kit has been designed for use in space and consists of two containers with

medical and dental instruments, bandages, and medications (oral, topical, and injectable). Prior to a mission, the crew is tested for possible allergic reactions or idiosyncratic responses to specific drugs in the Kit.

Maintaining crew health pre- and post-flight is an important aspect of Medical Operations support. To this end, good health habits are emphasized. Crewpersons receive medical evaluations during the 30 days prior to spaceflight. Seven days before a mission, the Health Stabilization Program goes into effect. The objective of this program is to minimize and to exclude, if possible, infectious disease exposures to all flight personnel. This is done by reducing the number of persons that come into contact with crewmembers and insuring that the people they come in contact with are healthy. Postflight examinations are performed on each crewmember immediately after landing and 3 days after landing, at which time they are certified for flight as pilots in command of NASA aircraft.

Emergency health care during launch and landing periods is provided by the Emergency Medical Services System, a program

designed and implemented by the Branch. This program consists of personnel, facilities, and equipment for the immediate and coordinated delivery of health care services at launch and at all landing sites.

In order to maintain and enhance their medical skills, the physicians in the Medical Operations Branch regularly attend courses at the University of Texas Medical School. These courses are directed toward maintaining basic medical skills as well as gaining expertise in the area of emergency medicine. The physicians receive instruction in the medically unique aspects of Shuttle, such as the toxicity of propellants and explosive decompression. Other courses give instruction in advanced cardiac life support and advanced trauma life support.

The Medical Operations Branch at JSC works closely with crewmembers to insure proper training for spaceflight as well as the maintenance of good health pre- and post-flight. In addition, the Branch directs other NASA centers in the medical coordination of all missions.

Sam L. Pool, M.D.  
Johnson Space Center

## Shuttle crew prepared for medical emergencies

"Today," a daily newspaper published for Brevard County, FL, gives extensive coverage to the space program. The following article was originally printed last Oct. 19 and was sent to us by Robert J. Benford, M.D. It is reprinted here with the newspaper's permission.

By PETER ADAMS  
TODAY Staff Writer

Astronauts Joe Engle and Richard Truly are hurtling through space at 17,000 miles an hour. During a meal, one of them gets a piece of food lodged in his throat. He starts choking and goes into shock.

With Earth a distant 150 miles below, an accidental death in space could be only a few minutes away . . .

It could happen.

Not everything that could go wrong with the Space Shuttle's Nov. 4 launch involves the fragile multibillion dollar vehicle. The men aboard are vulnerable to all the illnesses and accidents that could occur on the ground.

The difference is that remedial or lifesaving treatment would have to be performed in orbit for about an hour to 90 minutes until an emergency landing.

In most cases the crew members could treat themselves with the aid of two blue backpack-like medical bags.

Weighing only nine pounds together, the Shuttle Orbiter Medical System (SOMS) is equipped with 110 items including 16 different injectable medications, 27 different oral medications, a package of diagnostic equipment, more than a half dozen ointments, stethoscope, catheters, tourniquets, assorted bandages, eye patches, local anesthetics, sutures and a scalpel.

While prepared to do minor surgery if necessary, the astronauts would be brought back to Earth if either one had to go under the knife, said Dr. Jim Vanderploeg, an astronaut physician at Johnson Space Center in Houston.

"Theoretically they could do some minor surgery—like getting a sliver out of an arm," he said.

A decision to abort the Shuttle mission will depend on whether the astronaut can or cannot improve in flight.

"It all boils down to this: is someone likely to worsen by remaining in orbit? If they can improve we would probably keep them up there," Vanderploeg said.

If surgery or some other emergency medical procedure had to be performed onboard, the astronauts would not have to go it alone.

Six flight surgeons at Johnson Space Center will provide around-the-clock advice. And if needed, they are prepared to "walk the astronauts through any emergency procedure," Vanderploeg said.

"The astronauts have a checklist for emergencies and the surgeon can talk to them through a private line if they have to," he said.

The flight surgeons also monitor the atmosphere in the Columbia and the crews' heartbeat at launch and landing through a portable electrocardiograph worn by the astronauts.

If an astronaut feels any chest discomfort during the mission, he can wear the portable heart monitor and get a professional opinion from the ground.

If the event of any broken bones, the astronauts would return. But they are prepared to do some temporary mending with a splint and assorted pain killers.

Another emergency NASA physicians considered in their list of scenarios is an astronaut unable to breathe because something has been lodged in his throat.

The cricothyrotomy setup, which allows one of the astronauts to make an incision into the larynx, "is a last ditch life-saving effort in a case like this," Vanderploeg said.

There also are medications to support blood pressure in case an astronaut goes

into shock and another to ease nausea.

The astronauts' medical bags also contain a variety of antibiotics, headache tablets (20 Tylenol tablets and 30 aspirins), 20 Valiums as well as injectable Valium, Robitussin cough suppressant, 12 Cepacol lozenges and four packages of Q-tips.

"We planned for the most likely illnesses—mild infections, colds or flu," Vanderploeg said.

While not medical doctors, the astronauts almost are as well trained as any emergency medical technician. They are prepared to give medicine intravenously, perform cardiopulmonary resuscitation (CPR) and the Heimlich Maneuver, the bear hug used to force out food caught in the windpipe.

Both Truly and Engle have practiced giving injections to oranges and have drawn blood from NASA physicians.

But once in space, they will find the absence of gravity can throw a ringer into good medical care.

For example bleeding in space could be a far messier problem than on Earth. "The blood just drifts around and sticks to everything it touches. You would want to control that immediately," Vanderploeg said.

CPR, a combination of external heart massage and artificial respiration, will require the astronaut to strap the victim, face up, to the couch in the Shuttle cockpit. Then he must strap himself to the victim. Or he must wedge himself between some furniture since there is less control of movement without the restraining force of gravity.

Choosing the products that go in the Orbiter Medical System was the responsibility of both physician and crew.

"The astronauts tested a variety of medications and we looked at the ones with the best results and the least side effects," Vanderploeg said.

The real test of medical science in the heavens probably won't come until the middle of the decade when Spacelab will carry a crew of as many as six aboard the Shuttle.

For these missions an 18-pound medical kit—sort of an onboard emergency room—will be stored on the Orbiter.

As for the first flight of the Columbia in April, the Orbiter Medical System was hardly touched, Robert Crippen just needed a little something for motion sickness.

## Roy M. Stewart CAMA President

Roy M. Stewart, M.D., since 1970 Consultant in Aviation and Chief of Clinical Assessment in the Medical Services Branch of the Department of National Health and Welfare, Ottawa, Ont., Canada, is the new President of the Civil Aviation Medical Association. He was elected during the Association's Oct. 3-9 meeting in Hawaii.

He served for more than 5 years in World War II, and graduated from Guy's Hospital in 1954. After 9 years in general practice, he left Britain to become Senior Flight Surgeon with the Royal Canadian Air Force.

Dr. Stewart received his diploma in aviation medicine in 1972.

He is an Associate Fellow of the Aerospace Medical Association.

... doctors in the sky

## 50 Years Ago

By Robert J. Benford, M.D.

The centerpiece of early aviation medicine was the qualifying examination given applicants for flying training and, periodically, to licensed pilots. Nearly all WWI research at Hazelhurst Field on Long Island and, after 1926, at Brooks Field in Texas emphasized tests and procedures that investigators hoped would reveal physical qualities and mental skills believed to be essential for successful aviators. Not surprisingly, members of the Aero Medical Association in 1932 continued to discuss their experiences and express their opinions about physical examinations, as reported in the quarterly *Journal of Aviation Medicine*. Here are some verbatim remarks:

● When my friends General Lyster and Colonel Crabtree inducted me into the service, both ships and personnel of the (Army) air service could be counted on two hands . . . and our first duty was to induct into the service a select group of prospective aviators. We were even worse off than England at the beginning of the war . . . We had a problem in picking the men. We had plenty of raw material but we had to select those we thought fitted for this new and hazardous service. We had very little help. We sought the advice of the English, French and Italian (medical officers) . . . One of them told me that all he needed was five men with guts. He would sure get two flyers . . . (But) it takes a lot more than guts to make a flyer.—A. W. McAlester, M.D., Kansas City

● I think every man who has examined men for flying training, who has examined pilots who are experienced, knows full well—or at least fairly well—who should fly a ship . . . When a qualified medical man has decided who is potentially qualified to pursue flying training, that is one thing. When he decided who is actually qualified to take a ship into the air—and when I say that I mean every minute, every hour, every day and every week of the year physically qualified—that is another thing which rests with the flight surgeon and no power or authority, political or otherwise, should be allowed to stand in the way of what that flight surgeon says . . . and no political influence even as high as the Executive of the United States should overrule the finding of that flight surgeon.—Lt. Colonel Glen I. Jones, MC, USA, Chief of Medical Division of the Air Corps, Washington

● I am thoroughly in accord with the idea that we are not looking for supermen. They are difficult to find in any walk of life. I believe the commercial medical examiner can profit by more intimate contact with the actual flying activity in the community in which he resides, especially with the personnel. I think the cultivation of an acquaintanceship with the pilot instructor around a civilian airport, discussing the problems the medical man has in mind, suggesting that he (the instructor) give you the benefit of his

experience, will probably result in a great deal of good in our future work.—Ralph N. Greene, M.D., Association President (1932), Consultant to Eastern Air Transport, Jacksonville

● If our physical requirements are not met, then the applicant must be disqualified. But the Department (of Commerce) in its wisdom has seen fit to qualify, by means of waiver, numerous youngsters who have marked physical defects. As I used to tell Dr. Bauer, I get kind of discouraged once in awhile when I find after fighting and scraping for high physical standards that a couple of senators would get behind somebody and shove him right on through . . . So it ended up in my giving him a waiver. The Department has seen fit to grant 286 waivers—and I want you to get this because it is most important—that I have seen. Two hundred and 86 cases where men coming up for a student permit did not meet our requirements, yet through political influences—the influence of chambers of commerce, mayors, senators, and so on—finally got waivers. And wouldn't you be amused to know that since it began in 1927 we now have six pilots out of that (group of) 286? Well, the answer is if we can't stop 'em, nature will! Harold J. Cooper, M.D., Medical Director, Aeronautics Branch, Department of Commerce, Washington

● I shall try . . . to give you something very practicable about a very great problem, the study of the individual. We speak of it commonly as the personality study . . . Now this examination differs from the (physical) examination you customarily conduct in that it is a battle of wits. You match your art against the evasiveness and withholding of the individual, and perhaps his duplicity. It will be necessary, of course, for you to be very artful and cunning and clever, to be a better man than he is, else you will not gather the information you require to sum up the situation and estimate with some probability whether or not he will succeed in the air.—Raymond F. Longacre, M.D., Assistant Medical Director, Aeronautics Branch, Department of Commerce, Washington

● A man came into my office the other day and I found out afterward that a salesman had already sold him a plane and told him to go over and see the doctor. This man had told the salesman: "I'll be alright if I can get by with my heart, but I don't believe I can." . . . I asked him the usual questions about rheumatism. He said he had never had it and "can play three sets of tennis without getting unduly fatigued." He had no signs of any disorder (in pulse rate or blood pressure) . . . In fact, if you hadn't listened to his heart you would have said there was nothing wrong with him. I looked at him under the fluoroscope and there was no question but what he had a slightly enlarged heart. He happened to be a rather wealthy individual, hasn't the slightest desire in the world to fly a commercial ship, wants to fly his own ship and he won't buy a plane, of course, unless he can be licensed. He wanted to know if there was any opportunity. I told him there was not.—Louis H. Bauer, M.D., Founding President and Editor of *Journal of Aviation Medicine*.