National Aeronautics and Space Administration

Lyndon B. Johnson Space Center

OPERATIONAL TEST REQUIREMENT

FOR

SPACELAB MISSION SIMULATION

Title: SHUTTLE MEDICAL KIT
DEFINITION AND APPLICATION
(SIMULATED AND REAL)

OTR Number

Principal Investigator(s): _____
Signature Date

J. R. Hordinsky, M.D.

SHUTTLE SPACELAB MISSION DEVELOPMENT TEST III (SMD-III)

OPERATIONAL TEST REQUIREMENTS AND CRITERIA

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1. Title OTR No.

DB5 4021

2. Principal Investigator(s) Sponsoring Org. Phone

3. Project Engineer

Division

Chief Date

Directorate

Director Date

SHUTTLE MEDICAL KIT DEFINITION AND APPLICATION

Principal Investigator: J. R. Hordinsky, M.D.

A. Background/Purpose

It is imperative that NASA develop and demonstrate the capability to handle medical situations that may occur during space flights.

The purpose of this requirement is to define an on-board medical capability for Shuttle for both routine monitoring and for contingency purposes. Although not every component will be available for the simulation, it will be assumed that any medical guidance or on-board medical care will be in line with contents as projected for the Space Transportation System (STS) at the time of the test execution. The projected kit content is listed in Appendix A.

This OTR selects three contingencies to rehearse during a SMD-III mission in order to exercise the kit and components of the medical system. These events will occur randomly. The contingencies involve (1) a skin problem, (2) a throat complaint, and (3) a generalized problem presenting with malaise and myalgia.

B. Functional Objectives

The functional objectives of this OTR are:

- To evaluate the efficiency of a specified on-board Shuttle medical capability and the links to and from ground to pass medical data both ways.
- To rehearse the capability to deal with crew illness during actual missions.
- To introduce events that impact mission accomplishment.
- To identify and verify deficiencies in equipping a crew medical system and operating it from ground facilities.

Shuttle Medical Kit Definition and Application (cont'd)

C. Participants

All crewmen are to participate as the subjects who experience the clinical problems. If the MS is a physician and is not himself ill, it is expected that he will work directly with the crew and the Mission Surgeon in the exercise of the medical system capability. The MS/physician will use/and dispense kit items and will advise the mission surgeon on the condition of the patient, therapy and prognosis. The Test Operations Team (TOT) will participate in workarounds and replanning if patient's condition (simulated) warrants, per advice of the mission surgeon.

D. Performance Requirements and Conditions

The kit will be used if medical problems arise during SMD-III and during specific illness simulations conducted according to the plans contained in Appendix B. The MS will ordinarily dispense all medications and handle medical matters. A backup medic must be designated from among available crewmembers. Whenever the ill crewman cannot continue to perform, the Flight Planning group will revise protocols and uplink a workaround performance command. Care and monitoring of the crewman will be worked into the procedure, and quarantine procedures will be implemented as necessary. TOT concurrence will be secured for significant deletions or alterations in the schedule. Abort will not be planned into this simulation.

Sufficient measurements, data, and observations will be recorded to permit an assessment of medical system performance in the mode selected.

E. Environmental Requirements

Equipment operation and storage should be at manned laboratory temperatures to prevent damage or degradation to diagnostic equipment or to drugs. Freezing shall be prohibited as are temperatures above 40° C to prevent deterioration of drugs and self-contained batteries.

Shuttle Medical Kit Definition and Application (cont'd)

F. Hardware Identification and Description

The Shuttle medical kit provided will be one most closely mirroring projected Program Office weight and volume limitations. The medical kit and such monitoring and diagnostic equipment as is on board will be used in simulation or in actuality. This kit is described in Appendix A, and other equipment is described in other E R's and OTR's. The communications system and TV will be used for information exchange and data transmission.

ECG capability will not exist in the medical kit but will be that capability already planned for the Orbiter. As such, utilization of ECG is limited to the Orbiter area by virtue of finite cable lengths.

G. Interface Information

a. Location of Hardware

Kit stowage is TBD in the Orbiter.
The size is approximately 0.0283m^3 (1 cu. ft.).

b. Mounting Requirements

Kits will be stowed in designated lockers and securable on a work surface when in use. The zero g concept employed will be compatible with other Orbiter and Spacelab fixtures.

c. Utility Requirements

Power requirements are TBD. They are minimal and non-exotic. Human specimen storage will not be required apart from that provided for other experiments.

d. Support Equipment Information

Display and recording of clinical data can be real or simulated. Transmission of ECG data may be simulated. Privacy requirements for medical data shall be observed.

H. Test Operational Requirements

a. Preflight (training, support, etc.)

The crew will be briefed on location and function of the kits, and will know of the instructions in the Flight Data File (FDF) on set-up and use of the equipment.

Only the flight crew, the Simulation Supervisor, and Medical Officers not participating in SMD-III will be familiarized with the detailed protocols attached to this OTR. Other TOT members will be made aware only of the general nature of the three medical problems to be simulated prior to actual execution.

b. Inflight (crew requirements, constraints, frequency, etc.)

° Test Preparation

The medical kit will be unstowed on demand.

° Test Operations

Procedures will be initiated in the case of real medical problems.

Scheduled activities will be interrupted occasionally to rehearse procedures for dealing with an ill crewman and for readjusting schedules by injection of contingencies involving simulated crew illness.

These scenarios will be enacted at unannounced times to permit rehearsal of accommodating episodes of illness in the Orbiter or Spacelab. The MS will be alerted whenever an illness is reported. Other activities will give way as necessary to deal with the illness. When the steps of enumerating the patient's complaints, developing the history, referring to the crewman's medical history in MEDICS or other storage, performing diagnostic tests and measurements, establishing a diagnosis, charting treatment, carrying out immediate treatment and disposition, managing isolation as necessary, assuring patient care and monitoring, and providing for re-examination at a later time have been completed, by the MS and mission surgeon, work protocols will be reinitiated according to updated planning from the Test Operations Team.

The crew will be in two-way voice communication with the ground and will be able to input and receive data. This includes TV to the MS's work space. The ECG data is simulated.

I. FDF Requirements

The FDF will contain stowage lists and operating instructions on the kit contents.

J. Data Support Requirements

a. Preflight (including close-out photos)

Storage photographs are required.

Shuttle Medical Kit Definition and Application (cont'd)

b. Inflight

None anticipated.

c. Postflight

Postflight activities will include pertinent photography, documentation, and removal of medical equipment.

Access to logs and patient data will be required.

Photographs may be requested in the event of unanticipated test events. Access will be desired to remove kits in due time.

d. Data Analysis Support

No requirements.

K. Reporting Requirements

The medical event encounters will be independently reported by the MS and mission surgeon. The reports will become part of the Operations Report on SMD-III. The reports must highlight adequacy of system elements employed and contain recommendations for insuring clinical adequacy of the medical system for further simulations and subsequent flight. A report on the conduct of any activity in this OTR will be prepared within 14 days of test completion by the mission surgeon and MS.

An appraisal of the operational impact of crew illness should be developed among the members of the TOT, and means of salvaging the mission should be considered. The results of the deliberations should be incorporated into the Medical Operations Plan for Shuttle missions. Areas of impact would certainly include adequacy of diagnostic and treatment capability, quarantine, isolation of waste products, interface with the mission surgeon,

minimization of crew contact, prophylaxis, additional stores of items such as individual waste collection devices, opportunities for early mission termination, and ground procedures to be instituted at the landing area to handle an ill crewman.

L. Postmission Requirements

Crew debriefing will be required.

Access will be desired to remove kits.

APPENDIX A

TO

OTR - SHUTTLE MEDICAL KIT DEFINITION AND APPLICATION

PROPOSED CONTENTS

SHUTTLE ORBITER MEDICAL SYSTEM (SOMS) KIT

Nomenclature	Qty.
Fluorescein strips	5
Steri-drape	1
Hemostat, mosquito	2
Forceps, tissue	1
Surgical gloves	2
Needle holder, small	1
Scalpel, #10	1
Scissors, suture	1
Suture, chromic catgut, 4-0	2
Suture, dermal, 5-0	2
Suture, silk, 4-0	2
Betadine packets	12
Syringe holder, 1 cc	1
Syringe holder, 2 cc	1
Tourniquet, Velcro	1
Stethoscope	1
Binocular loupe	1
Tuning fork & reflex hammer	1
Bili-lab sticks	5
Finger cots	9
Safety pins	2
Tongue blades	5
Airway, adult	1
Adhesive tape, micropore, 2"	1
Adhesive tape, dermilite, 2"	1
Burn pack	1

APPENDIX A (continued)

Nomenclature	Qty.
Elastic roller bandage, 3"	1
Eye patch, cotton	4
Eye patch, plastic	1
Gauze, roller, 4"	1
Gauze, squares, 2 x 2	5
Gauze, vaseline, 3 x 18	2
Scissors, bandage, 6"	1
Steri-strip	5 pk.
Swabs, cotton (pkg. of 2)	6
Bandaids, 3 x $3^3/4$	10
Bandaids, 3 x 1	10
Alumafoam fence splint	1
Alumafoam finger splint	1
Oto/ophthalmo/laryngoscope	1
BP cuff	1
Thermometer (disposable)	20
Otoscope bulbs	1
Zephiran chloride packets	12
Afrin nasal spray, 15 cc/btl	4
Methylcellulose eye drops, 10 cc/btl	1
Ophthane eye drops, 15 cc/btl	1
Lip balm, Blistex, tube	2
Neosporin ophthalmic ointment 1/8 oz.	4
Sulfamylon cream, 4 oz/tube	1
Surgical lubricant, 1 oz. tube	1
Tinactin cream, 15 gm/tube	1
Neosporin ointment, 1 oz. tube	1
Cough Calmers	20
Throat lozenges	1 pk.
Ampicillin, 0/250, 60 tabs	2 L
Erythromycin, 0/250, 60 tabs	2 L
Actifed, 30 tabs	1 S
Aspirin, 0/300, 30 tabs	1 L

APPENDIX A (concluded)

Nomenclature	Qty.
Pen V-K, 0/250, 60 tabs	2 L
Tetracycline, 0/250, 60 tabs	1 L
Seconal, 0/100, 10 caps	1 L
Inderal, 0/010, 16 tabs	1 S
Lanoxin, 0/00025, 20 tabs	1 S
Pronestyl, 0/500, 10 tabs	1 L
Donnatal, 30 tabs	1 S
Mylanta II, 25 tabs	2 L
Lomotil, 20 tabs	1 S
Pro/Eph, 0/025--0/050, 30 caps	1 L
Scop/Dex, 0/0004--0/005, 30 caps	2 L
Dexedrine, 0/005, 15 tabs	1 S
Aramine (1 cc)	3
Atropine (2 cc)	4
Cedilanid - D (2 cc)	5
Compazine, 5 mg/ml (2 cc)	4
Demerol, 50 mg (1 cc)	2
Epinephrine, 1:1000 (1 cc)	3
Marezine, 50 mg (1 cc)	6
Valium, 5 mg/ml (2 cc)	2
Xylocaine, 2% (2 cc)	5