

Clinical Subgroup Report on Countermeasures

I. Nature of the Problem

The International Space Station (ISS) will be used to define the life sciences needs for both long stays in low earth orbit (LEO), and exploration class missions (including Moon and Mars missions). By use of the ISS facilities and crew, NASA will achieve an incremental gain in data and knowledge which will be reviewed and revised on a periodic basis. There is a large overlap in knowledge required for safe execution of long term LEO missions and exploration missions. Some exploration requirements are unique and will require unique investigations and highly specific countermeasures and health monitoring.

For long term flights, the very important issues of radiation exposure, psychosocial adaptation, extravehicular performance, and routine and emergency medical care need to be considered, and they are currently being considered by other groups within NASA.

II. Countermeasures to the Problem

Countermeasures in the space shuttle and space station programs impacting clinical medical issues are summarized in Table 1. The majority of the issues delineated are described in a general context, since most of these countermeasure activities, (e.g., exercise) are described in considerable detail in the other discipline reports.

III. Concerns:

The clinical subgroup of the task force found that some basic background and descriptive work in problem definition was lacking. While the research community has focused on slices of the problems, a more all encompassing, clinical approach has not been employed.

TABLE 1

ACCEPTED	POTENTIAL
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Preflight	*Health Stabilization Program	*Conditioning program
	*Circadian shifting	*Psychological support
	*Schedule adjustment	*Nutritional guidance and support
	*Medical training/education	
	*Drug sensitivity testing	
	*Selection physical	
	*Flight certification	
In-flight		
Psychosocial	*Sleep/rest/schedule adjustment	*Conditioning program
	*Exercise	*Psychosocial support
		*Medications
Space Adaptation Syndrome	*oral and IM Phenergan	*Preadaptation
	*Private Medical Conference	
	*Good hydration	
	*Schedule adjustment	
		*Medications
Bone Loss		*Exercise
	*Exercise	
Aerobic Capacity		*Exercise
Muscle Loss		
	*Balanced diet, vitamins	
General Health		
	*Anti-G suit	*Medications
Entry/Landing Syndrome	*Cooling Garment	*In-flight exercise
	*Fluid loading	
	*Recumbent Seats	
Post-flight	*Rehabilitation (long duration)	*Rehabilitation
		*Conditioning Program

IV. Recommendations:

1. A critical review of all laboratory work-up data and medical reports performed on a routine basis during the Space Shuttle program must be undertaken. This review should include studies done as part of the selection, annual physical, and flight-related medical exams. This review should help determine those studies that will be necessary to make real time decisions and to practice preventive medicine on all flights regardless of duration. This review of historical clinical data also can be used to assess which laboratory studies should be monitored on a regular basis and the outcomes may provide information to highlight previously unidentified potential problems.

2. The problems associated with re-entry and landing, i.e., “Re-entry and Landing Syndrome”, need to be carefully described through a review of medical records and existing performance data as well as via collection of prospective data. This description should include the full symptom complex, incidence, time course and treatments. It is expected that this Syndrome cuts across the cardiovascular, neuro-vestibular and musculoskeletal disciplines. In addition, any real problems which have occurred as a result of this syndrome should be catalogued. The ‘requirements’ for performance of crew egress, in a normal and emergency situation, should be defined and accepted by NASA program management.

3. The Countermeasure Research Plan should be developed in a manner that integrates all research disciplines to get the most efficient system of countermeasures possible. For example, a countermeasure could be developed such that its effectiveness cuts across disciplines, and addresses two or three (or more) physiologic systems. It is essential that the medical operations staff work closely with the research team(s) to ensure a clinical and operational focus to the countermeasure integrated plan. The medical operations team could also provide input to ensure that the research and subsequent countermeasure(s) are compatible with the spacecraft environment and crew schedule so that the countermeasure program will yield maximum crew cooperation and compliance.