

MARS SAMPLE RETURN MISSIONS
SAFETY REQUIREMENTS

by

LAWRENCE B. HALL
PLANETARY QUARANTINE OFFICER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
HEADQUARTERS
WASHINGTON, D.C. 20546

**AN OVERRIDING CONSIDERATION
FOR A MSSR MISSION IS SAFETY
FROM THE HAZARD OF A CATAS-
TROPIC BIOLOGICAL ACCIDENT**

IMPACT GROUPS

● **SCIENTISTS**

● **REGULATORY AGENCIES**

● **PUBLIC**

SCIENTISTS

- **DIVIDED ON THE PROBABILITY OF EXISTENCE OF MARTIAN LIFE,
AND THE ABILITY OF ITS DISTANTLY EVOLVED FORMS TO INFECT
TERRESTRIAL LIFE.**
- **CANNOT PROVE THAT MARTIAN LIFE DOES NOT EXIST NOR THAT
IT CANNOT INFECT**

COSPAR POSITION

- "THE PROBABILITY THAT LIFE EXISTS ON ANY PLANET SHOULD BE THOROUGHLY EXPLORED BY AUTOMATED LIFE DETECTION EXPERIMENTS BEFORE ANY MISSIONS ARE ATTEMPTED THAT ARE DESIGNED TO RETURN TO EARTH"

COSPAR - PRAGUE 1969

- "WITH REGARD TO POSSIBLE HAZARDS INVOLVED IN HANDLING RETURN SAMPLES FROM MARS THE PANEL WANTS TO EMPHASIZE THAT CURRENT MISSION PLANNING MUST NOT INCLUDE SUCH EFFORTS UNTIL INSTRUMENTED PROBES AND EXPERIMENTAL MICROBIAL ECOLOGY HAVE GIVEN A REASONABLE ASSURANCE THAT SAMPLES CAN BE RETURNED WITHOUT UNACCEPTABLE RISKS TO THE ECOLOGY OF EARTH"

COSPAR - LENIGRAD 1970

EXPEDITING SCIENTIFIC EXPLORATION ACCEPTANCE OF SAFETY RESPONSIBILITY

- **SCIENCE (MANKIND) IS UNWILLING TO WAIT FOR THOROUGH, AUTOMATED, EXPLORATION TO BE ACCOMPLISHED, WITH ITS CONCOMITANT ULTIMATE SAFETY.**
- **SCIENCE, HAVING RECOGNIZED THAT A POTENTIAL CATASTROPHIC HAZARD EXISTS, AND HAVING THE POWER TO INCUR OR REJECT IT, MUST ACCEPT THE RESPONSIBILITY FOR MANKIND.**

REGULATORY AGENCIES

AGENCIES:

- CENTER FOR DISEASE CONTROL (USPHS-HEW)
- DEPARTMENT OF AGRICULTURE
- DEPARTMENT OF INTERIOR
- E.P.A. ?

POSITION:

ABSENCE OF HAZARD CANNOT BE PROVEN,
MUST BE PRESUMED TO EXIST, AND BARRIERS
MUST BE ERECTED.

AUTHORITY:

LEGISLATIVE AUTHORITY NOT CLEAR,
BUT IS INFERRED.

Action?

THE CONTAMINATION HAZARD

- GIVEN SUFFICIENT TRAFFIC, "THE EARTH WILL EVENTUALLY BE CONTAMINATED IF CONTAMINATION IS POSSIBLE."
- "OBJECTIVE OF QUARANTINE IS TO PROTECT THE EARTH FROM IMMEDIATE INFECTION UNTIL VACCINES AND OTHER DEFENSES CAN BE ESTABLISHED."

ASSISTANT SURGEON GENERAL, USPHS
1964 SSB CONFERENCE ON "POTENTIAL
HAZARDS OF BACK CONTAMINATION
FROM THE PLANETS."

PUBLIC

CONGRESS ?

- **UNAWARE AT PRESENT**
- **SMALL SEGMENT WILL BECOME AWARE, AND KNOWLEDGEABLE, EARLY IN A MISSION**
- **MAJORITY WILL BECOME AWARE LATE IN A MISSION AND COULD EXERT PRESSURE TO CANCEL (SST, TRANS-ALASKA PIPELINE, NUCLEAR PLANT SITING)**
- **NEED FOR EARLY, THOROUGH EDUCATION**

**CONTAMINATION PREVENTION
MAJOR ALTERNATIVE COURSES OF ACTION**

● **DO NOT REMOVE A SAMPLE FROM MARS.**

— COMPLETE SAFETY ASSURED

CONTAMINATION PREVENTION (Continued)

- RETURN A SAMPLE TO THE VICINITY OF EARTH FOR AUTOMATED EXAMINATION.

--SAFE

- RETURN A SAMPLE TO THE VICINITY OF EARTH FOR MANNED EXAMINATION IN ORBIT.

--EXTREMELY DIFFICULT AND EXPENSIVE WITH HIGH RISK TO THE CREW AND EARTH.

CONTAMINATION PREVENTION (Continued)

- **RETURN A SAMPLE, STERILIZED ENROUTE, TO EARTH FOR EXAMINATION IN NORMAL LABORATORIES.**

— MODERATE HAZARD.

- **RETURN A SAMPLE, CONTAINED AND STERILIZED ON THE EXTERIOR, DIRECTLY TO EARTH FOR EXAMINATION BEHIND BARRIERS IN HIGH SECURITY LABORATORIES.**

— REASONABLE SAFETY.

— ACCEPTABLE (INFORMALLY) TO REGULATORY AUTHORITIES.

INITIAL RESEARCH NEEDED FOR MARS SURFACE SAMPLE RETURN

2000
1500
1000

- STUDY LEGISLATIVE NEEDS FOR EFFICIENT QUARANTINE MANAGEMENT 200 K
- RETRIEVE AND RECORD PROBLEMS ENCOUNTERED IN APOLLO QUARANTINE 150 K
- DEVELOP CRITERIA AND PARAMETERS FOR RISK ASSESSMENT 1,000 K
- DEVELOP TECHNOLOGY FOR REMOTE/AUTOMATED INSERTION, CONTAINMENT AND SEALING 1,500 K
- DEVELOP REMOTE/AUTOMATED VERIFICATION OF SEAL INTEGRITY 500 K
- DEVELOP PYROTECHNIC METHODS OF STERILIZING CONTAINER OUTER SURFACES IN SPACE 500 K
- STUDIES OF FAIL-SAFE REENTRY SYSTEMS 1,500 K
- TRANSFER OF VIKING '75 RESULTS TO THE SAMPLE SAFE RETURN PROBLEM 450 K

450 K
\$5,800 K

● *micro techniques for sample analysis to preclude giving up all 200 grams for quarantine report.*