MARS SAMPLE HANDLING PROTOCOL WORKSHOP SERIES

WORKSHOP #1 SUB-GROUP MEMBERS AND TASKS

(3/16/00 DRAFT)

Sub-Group #1: Preliminary Sample Characterization Requirements

This sub-group is tasked with specifying the information about the samples required to enable effective life-detection and/or biohazard testing. The focus will be on sample characteristics that could be determinative in understanding the results of both *in vitro* and *in vivo* testing that may be required. Example information that may be available or obtainable includes: site of collection on Mars; preservation conditions *en route* to Earth and the sample-containment laboratory; elemental composition; mineralogical characteristics; mass; volume; etc.

Fishbein, William (Sub-group #1 Chairperson)
Maurel, Marie-Christine (Sub-group #1 Co-Chairperson)
Cronin, John
Flandrois, Jean-Pierre
Friedmann, E. Imre
Gerba, Charles
Grange, Jacques
Johnson, Dale
Khan, Ali
Marty, Bernard
Murphy, William
Mustin, Christian
Nealson, Ken
Pepper, Ian
Relman, David
Sogin, Mitchell
Walker, Robert

Sub-Group #2: Representative Sub-Samples; Nature of Sample

This sub-group is tasked with specifying the preliminary characterization data required to enable partitioning of the entire body of returned samples into representative sub-sample allocations for testing, and recommending a process whereby returned samples can be sub-sampled effectively. The sub-group should also specify the information about the samples that should be obtained within containment-either to support sample characterization and distribution for later scientific analysis, because of time-critical measurement requirements, or to understand the requirements for long-term preservation of the samples in curation.

MacPherson, Glenn (Sub-group #2 Chairperson)
Bibring, Jean-Pierre (Sub-group #2 Co-Chairperson)
Allen, Carl
Allton, Judith
Bogard, Donald
Bradley, John
Des Marais, David
Holland, Heinrich
Papanastassiou, Dimitri
Pavé, Alain
Prieur, Daniel
Treiman, Alan
Vasil, Indra
Wainwright, Norman
Zaccai, Joseph

Sub-Group #3: Sequence of Tests; Types of Testing Possible; Range of Results re: Release Criteria

This sub-group is tasked with addressing the end-to-end requirements of an effective sample-testing protocol. The strawman protocol may be used as a departure, or the sub-group may define their own strawman protocol. Attention will be given to the sequence of testing, the timing and availability of complementary test results to support other testing anticipated in the process, and the nature of the criteria that shall be met to enable sample release for scientific analysis. To the extent possible, an end-to-end protocol should be blocked out for further discussion.

Jahrling, Peter (Sub-group #3 Chairperson)
Sourdive, David (Sub-group #3 Co-Chairperson)
Candresse, Thierry
Chyba, Christopher
Crissman, Harry
Eisen, Jonathan
Fultz, Patricia
Gabriel, Dean
Hawley, Robert
Kovacs, Gregory
Leonard, Debra
Moutou, François
Persing, David
Richmond, Jonathan
Tennant, Raymond
Viso, Michel
Wall, Diana

Sub-Group #4: Physical/Chemical Analyses-Methods, Sample State, Containment, Controls

This sub-group is tasked with addressing desired methods to conduct physical and chemical analyses of the sample and sub-samples to meet the requirements of the sample-analysis protocol, curation, and storage. Methods will be assessed for their ability to obtain the required information while minimizing destruction of the samples tested, and as to their ability to be performed inside of the containment facility or on sterilized samples (sterilization methods TBD) outside of containment.

Bogard, Donald (Sub-group #4 Chairperson)
Marty, Bernard (Sub-group #4 Co-Chairperson)
Allen, Carl
Allton, Judith
Bibring, Jean-Pierre
Bradley, John
Cronin, John
Holland, Heinrich
Johnson, Dale
MacPherson, Glenn
Mustin, Christian
Papanastassiou, Dimitri
Treiman, Alan
Walker, Robert

Sub-Group #5: Candidate Life Detection Tests-Qualifiers, Contraindications, Controls, Characterization

This sub-group is tasked with the preliminary identification of measurements and tests that should be applied to the samples to look for evidence of life or life-related molecules. Methods and instrumentation to be used should be identified to the extent possible. The relationships of the information to be gained from complementary life-detection tests should be specified to the degree possible. This sub-group will recommend methods and concepts to be discussed at a later workshop in support of protocol development.

Sogin, Mitchell (Sub-group #5 Chairperson)
Prieur, Daniel (Sub-group #5 Co-Chairperson)
Crissman, Harry
Des Marais, David
Flandrois, Jean-Pierre
Friedmann, E. Imre
Maurel, Marie-Christine
Nealson, Ken
Pavé, Alain
Pepper, Ian
Persing, David
Wainwright, Norman
Zaccai, Joseph

Sub-Group #6: Candidate Biohazard Tests-Qualifiers, Contraindications, Controls, Characterization

This sub-group is tasked with the preliminary identification of measurements and tests that should be applied to the samples to test for biohazards that may be present in the samples, without regard to evidence of life or life-related molecules within the samples. Methods, test systems, and instrumentation to be used should be identified to the extent possible. The relationships of the information to be gained from complementary biohazard tests, and anticipated problems in testing martian materials in such a fashion should be specified to the degree possible. This sub-group will recommend methods and concepts to be discussed at a later workshop in support of protocol development.

Hawley, Robert (Sub-group #6 Chairperson)
Sourdive, David (Sub-group #6 Co-Chairperson)
Candresse, Thierry
Eisen, Jonathan
Fishbein, William
Fultz, Patricia
Gabriel, Dean
Gerba, Charles
Grange, Jacques
Khan, Ali
Kovacs, Gregory
Leonard, Debra
Moutou, François
Murphy, William
Relman, David
Richmond, Jonathan
Tennant, Raymond
Vasil, Indra
Viso, Michel

Participants not assigned to a specific sub-group ("floaters")

Acevedo, Sara
Bielitzki, Joseph
Counil, Jean-Louis
Debus, André
DeVincenzi, Donald L.
Dick, Steven
Gershman, Robert
Korwek, Edward
Levinthal, Elliott
Morowitz, Harold
Prufert-Bebout, Lee
Race, Margaret
Rummel, John D.
Schad, P. Jack
Stabekis, Pericles
Wharton, Robert

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MARS SAMPLE HANDLING PROTOCOL WORKSHOP SERIES

WORKSHOP #1: PARTICIPANTS

The following is an alphabetical listing of all persons who are confirmed participants for Workshop #1. (The list of proposed French participants follows).

NAME	TITLE & AFFILIATION	AREA OF EXPERTISE
Acevedo, Sara E.	SETI Institute	(Planning Committee Member)
Allen, Carl	NASA Johnson Space Center	Sample Handling and Curation; Physical/Earth and Planetary Sciences
Allton, Judith H.	NASA Johnson Space Center	Sample Handling and Curation; Physical/Earth and Planetary Sciences
Bielitzki, Joseph	NASA Ames Research Center	
Bogard, Donald	NASA Johnson Space Center	Sample Handling and Curation
Bradley, John	MVA Associates, Norcross GA	Electron Microscopy; Physical/Earth and Planetary Sciences
Brownlee, Donald E.	Professor of Astronomy, University of Washington	Analytical Methods for Microsamples; Physical/Earth and Planetary Sciences
Chyba, Christopher	Carl Sagan Chair for the Study of Life in the Universe, SETI Institute	Prebiotic Chemistry; Physical/Earth and Planetary Sciences
Clegg, Michael T.	Distinguished Professor, Genetics, University of California, Davis	Protocol Applications for Risk Analysis: Plant Sciences and Genomics; Biohazard Testing; Cellular and Molecular Genetic Mechanisms in Pathogenesis
Counil, Jean-Louis	CNES	(Planning Committee Member)
Crissman, Harry A.	Los Alamos National Lab	Flow Cytology and Cytochemical Life Detection Methods; Life Detection
Cronin, John	Professor, Chemistry and Biochemistry, Arizona State University	Chemistry; Physical/Earth and Planetary Sciences
Des Marais, David	NASA Ames Research Center	Biogeochemistry; Physical/Earth and Planetary Sciences
DeVincenzi, Donald	NASA Ames Research Center	(Planning Committee Member)
Dick, Steven J.	US Naval Observatory	
Farmer, Jack	Professor, Department of Geology, Arizona State University	Biogeochemistry; Physical/Earth and Planetary Sciences
Fishbein, William N.	Dept. of Environment and Toxicologic Pathology, Armed Forces Institute of Pathology	Molecular Toxicology; Biochemical and Molecular Pathology; Biohazard Testing; Cellular and Molecular Genetic Mechanisms in Pathogenesis
Friedmann, E. Imre	Florida State University	Microbiology in Extreme Environments; Life Detection
Gabriel, Dean W.	Professor, Molecular Plant Pathology, University of Florida	Molecular Plant Pathology; Biohazard Testing; Cellular and Molecular Genetic Mechanisms in Pathogenesis
Gershman, Robert	Jet Propulsion Laboratory	Mars Sample Return Mission Design
Hawley, Robert	USAMRIID, Ft. Detrick MD	Biosafety, Emergent Biohazard Detection, and Containment Methods; Biohazard Testing; Cellular and Molecular Genetic Mechanisms in Pathogenesis
Helmke, Philip A.	Professor, Soil Chemistry, University of Wisconsin, Madison	Soil Chemistry; Physical/Earth and Planetary Sciences
Holland, Heinrich D.	Harvard University, Department of Earth and Planetary Sciences	

Jahrling, Peter	USAMRIID, Ft. Detrick MD	Biosafety, Emergent Biohazard Detection, and Containment Methods; Biohazard Testing; Cellular and Molecular Genetic Mechanisms in Pathogenesis
Johnson, Dale W.	Research Professor, Soil Chemistry, Desert Research Institute	Soil Chemistry; Physical/Earth and Planetary Sciences
Kahn, Ali S.	National Center for Infectious Diseases, Centers for Disease Control and Prevention	Biodefense; Biohazard Testing; Cellular and Molecular Genetic Mechanisms in Pathogenesis
Klein, Harold P.	SETI Institute	Mars Viking Life Detection; Exobiology; Former Director, Space Science Directorate, NASA Ames Research Center
Korwek, Edward	Law Offices of Hogan and Hartson	
Kovacs, Gregory T.A.	Associate Professor, Electrical Engineering, Stanford University	Biodefense; Biohazard Testing; Cellular and Molecular Genetic Mechanisms in Pathogenesis
Leonard, Debra G.B.	Dept. of Pathology and Laboratory Medicine University of Pennsylvania	Molecular Pathology of Infectious Diseases; Biohazard Testing; Cellular and Molecular Genetic Mechanisms in Pathogenesis
Levinthal, Elliott	Stanford University	
Ligler, Frances S.	U.S. Naval Research Laboratory, Washington DC	Microbial Immunoassays as Life Detection Methods; Life Detection
MacPherson, Glenn	Department of Mineral Sciences, National Museum of Natural History, Smithsonian Institution	(Planning Committee Member)
Morowitz, Harold J.	George Mason University	
Nealson, Kenneth	Jet Propulsion Laboratory	Post-Viking Microbiology/Environmental Microbiology; Life Detection
O'Brien, Stephen J.	Chief, Laboratory of Genomic Diversity, National Institutes of Health	Microbial Biodiversity, Evolution of Viral Diseases, Genomics; Biohazard Testing; Cellular and Molecular Genetic Mechanisms in Pathogenesis
Papanastassiou, Dimitri A.	Jet Propulsion Laboratory	Options for Mars Sample Handling
Pepper, Ian L.	Professor, Environmental Microbiology, University of Arizona	Soil Microbes in Arid Environments; Life Detection
Persing, David H.	Corixa Corporation Seattle WA	Microbial Detection Methods for Unrecognized Organisms; Life Detection
Prufert-Bebout, Lee	NASA Ames Research Center	(Planning Committee Member)
Race, Margaret	SETI Institute	(Planning Committee Member)
Relman, David A.	Dept. of Microbiology and Immunology, Stanford University	Microbial Detection Methods for Unrecognized Organisms; Life Detection
Richmond, Jonathan Y.	Director, Office of Health and Safety, Centers for Disease Control and Prevention	Biosafety, Emergent Biohazard Detection, and Containment Methods; Biohazard Testing; Cellular and Molecular Genetic Mechanisms in Pathogenesis
Rummel, John	Planetary Protection Officer, NASA Headquarters	(Planning Committee Chairperson)
Schad, Jack	NASA Headquarters	(Planning Committee Member)
Schopf, J. William	Professor, Dept. Earth and Planetary Sciences, University of California, Los Angeles	Paleobiology; Physical/Earth and Planetary Sciences
Sogin, Mitchell L.	Biology and Evolution, Marine Biological Laboratory	Comparative Molecular Biology and Evolution; Life Detection
Stabekis, Pericles D.	Lockheed-Martin, Washington DC	(Planning Committee Member)

Tennant, Raymond E.	National Institute of Environmental Health Sciences, National Institutes of Health	Efficacy of In Vitro Methods; Biohazard Testing; Cellular and Molecular Genetic Mechanisms in Pathogenesis
Treiman, Alan H.	Lunar and Planetary Institute, Houston TX	Geology; Physical/Earth and Planetary Sciences
Vasil, Indra K.	Professor, Plant Cell and Molecular Biology, University of Florida	Plant Tissue Culture Methods; Biohazard Testing; Cellular and Molecular Genetic Mechanisms in Pathogenesis
Wainwright, Norman R.	Senior Scientist, Molecular Biology, Marine Biological Laboratory	Comparative Molecular Biology and Evolution; Life Detection
Walker, Robert M.	Director, McDonnell Ctr. for the Space Sciences, Department of Physics, Washington University in St. Louis	
Wall, Diana H.	Professor, Rangeland Ecosystem Science Colorado State University	Protocol Applications for Risk Analysis: Ecology; Biohazard Testing; Cellular and Molecular Genetic Mechanisms in Pathogenesis
Wharton, Jr., Robert	NASA Ames Research Center	(Planning Committee Member)

MARS SAMPLE HANDLING PROTOCOL WORKSHOP SERIES

WORKSHOP #1: PROPOSED FRENCH PARTICIPANTS

NAME	AFFILIATION	AREA OF EXPERTISE
Bibring, Jean-Pierre	IAS	Planetology; Sample handling; Curation facility.
Debus, André	CNES	Mars Sample Return Planetary Protection project manager.
Grange, Jacques	Laboratoire de Haute Securite P4 Jean Merieux	Research Professor; Doctor Ingenior in Chemistry; Responsible of the MERIEUX Biosafety level 4 Facility; Thesis in Virology; Abilitations in Biochemistry and in Cancerology.
Heulin, Thierry	LEMiR, UMR 163 CNRS-CEA DEVM/DSV CEA Cadarache	Head of Laboratory for Microbial Ecology (LEMiR, CNRS-CEA). PhD in soil microbial ecology. Bacterial phylogeny, taxonomy and genetic diversity. Soil and root-associated bacteria. Colonization and production of exopolysaccharide. Colonization and alteration of meteorite by soil bacteria.
Marty, Bernard	CRPG	Professor of Geochemistry at the National Engineering School of Geology; also at Center for Petrographic and Geochemical studies. Research interests: Isotope geo- and cosmochemistry. Cosmochemistry and Primitive Earth; Mantle geodynamics; Past and present environments; evolution of terrestrial volatiles, planetary volatiles including the Moon Mars and the SNC.
Maurel, Marie-Christine	Institut Jacques Monod	Microbiology; life origins
Mustin, Christian	Centre de Pédologie Biologique	Geologist and physicochemist (Engineer) - Ph.D in geomicrobiology. Current Research Interests: Microbial and physico-chemical aspects relevant to mineral formation, mineral weathering and earth elements uptake. (Bio)chemical reactivity of microorganism-mineral interfaces ; In situ spectroscopic analysis (Raman, LSM, AFM, SNOM) at nanometric and micrometric scales.
Prieur, Daniel	Station Biologique, University of Brest	Microorganisms under extreme conditions.
Sourdive, David J.D.	Centre d'Etudes du Bouchet	Ph.D in Virology; viral immunology, arenaviruses; Biotechnology project leader at CEB (Min. of Defense); High sensitivity detection and identification of potentially hazardous microorganisms
Viso, Michel	CNES	Secretary of the French PP group. Program scientist for animal Physiology and Biology. Radionucleides in biology, Applied Medical Statistics, Animal and Comparative Immunology, Domestic Animal Nutrition.
Zaccai, Joseph	Institut de Biologie Structurale CEA-CNRS	Head of the Laboratory of Molecular Biophysics, Institute of Structural Biology (CNRS-CEA), Grenoble, France. Current Research Interests: Molecular Biophysics; Biochemistry of extreme environments with respect to salinity and temperature - defining extreme limits for the existence of Life forms - defining conditions where traces of their existence more likely

MARS SAMPLE HANDLING PROTOCOL WORKSHOP SERIES

AGENDA FOR WORKSHOP #1

Day 1 Morning Plenary Session (Speakers are shown in parentheses)

8:00 Welcome, logistics
8:10 Organization and Objectives of Workshop Series
Introduction of background lectures for Workshop Series
8:20 Planetary Protection Overview & Mars Architecture Status (J. Rummel)
8:35 French Participation in Mars Sample Return (J.-L. Counil)
8:45 NRC 1992 and 1997 Reports (K. Nealson)
9:10 Mars Sample Return Mission Design (R. Gershman)
9:35 BREAK
10:00 Options in Extraterrestrial Sample Handling and Study (D. Papanastassiou)
10:25 MSHARP Report (D. DeVincenzi)
10:50 Overview of ALH84001 Tests, Equipment, & Interpretation (A. Treiman)
11:15 Lunar Sample Protocol (J. Allton)
11:30 1997 Quarantine Protocol Workshop Overview (M. Race)

Day 1 Afternoon Session

1:00 Plenary
- Organization and Objectives of Workshop #1
- Issues in Protocol Development:
  - Criteria for Release
  - Context of Collection
  - Amount of Sample Available
  - Single/Multiple Containment Facilities

1:30 Introduction to Strawman Protocol
2:00 Establish three sub-groups to deal with key questions from framework
- Preliminary sample characterization requirements
- Representative sub-samples; nature of sample
- Sequence of tests; types of testing possible; range of results re: release criteria

4:30 Sub-groups report status in plenary session
5:30 Adjourn (sub-group chairs assign overnight writing)

Day 2 Morning Session

8:00 Day 1 Sub-groups caucus
8:30 Day 1 Sub-groups report status in plenary session
9:30 Assignments & rationale for forming three sub-groups:
- Physical/Chemical Analyses–methods, sample state, containment, controls
- Candidate life detection tests–qualifiers, contraindications, controls, characterization
- Candidate biohazard tests–qualifiers, contraindications, controls, characterization

10:00 Break out into three sub-groups
12:00 Lunch

MARS SAMPLE HANDLING PROTOCOL WORKSHOP SERIES
AGENDA FOR WORKSHOP #1 (cont.)

Day 2 Afternoon Session

1:30 Continuation of three morning sub-groups
3:30 Plenary status reports from three Day 2 sub-groups
4:00 Plenary Discussion: Quantity of sample required for protocol
5:00 Identification of Issues for Day 3 plenary session
5:30 Adjourn (Day 2 sub-group chairs assign overnight writing)

Day 3 Morning Plenary Session

8:00 Day 2 Sub-groups caucus
8:30 Day 2 Sub-groups report status in plenary session
9:30 Plenary Discussion:
- Criteria for Release
- Context of Collection
  - Single/Multiple Containment Facilities

10:30 Summarize and integrate Workshop #1 results
Identify Open Issues
11:30 Develop and discuss draft protocol and identify action items
Overview of Workshop #2
12:30 Adjourn

Day 3 Afternoon: Executive Work Group (Planning Committee & Select Sub-Group Chairs/Reps)

1:30 Outline Workshop #1 report
Writing assignments & identify Organizing Committee action items

Overview of Mars Sample Hazard Analysis

(Draft)

John D. Rummel
Planetary Protection Officer
Office of Space Science

SSB Recommendations for Mars Sample Return

- Samples returned from Mars should be contained and treated as though potentially hazardous until proven otherwise
- If sample containment cannot be verified en route to Earth, the sample and spacecraft should either be sterilized in space or not returned to Earth
- Integrity of sample containment should be maintained through reentry and transfer to a receiving facility
- Controlled distribution of unsterilized materials should only occur if analyses determine the sample not to contain a biological hazard
- Planetary protection measures adopted for the first sample return should not be relaxed for subsequent missions without thorough scientific review and concurrence by an appropriate independent body

Planning for Sample Hazard Analysis
(Draft)

Protocol Development Workshops

- Plan: A series of workshops will be organized by NASA, with CNES participation, to assess the requirements for sample hazard testing and subsequent release, specify the tests necessary to show that a biological hazard is not present in the sample, and safeguard the samples against the various threats to its purity caused by the Earth's environment.

- For returned martian samples develop a recommended list of comprehensive tests, and their sequential order, that will be performed to fulfill the NRC recommendation that "rigorous analyses determine that the materials do not contain a biological hazard," taking into account the further recommendation that "returned samples should be considered potentially hazardous until they have been reasonably demonstrated to be nonhazardous."

Planning for Sample Hazard Analysis
(Draft)

Questions for Protocol Development Workshops

- Consider:
  - » What criteria must be satisfied to demonstrate that the samples do not present a biohazard?
  - » What will constitute a representative sample to be tested?
  - » What is the minimum allocation of sample material required for analyses exclusive to the protocol, and what physical/chemical analyses are required to complement biochemical or biological screening of sample material?
  - » Which analyses must be done within containment, and which can be accomplished using sterilized material outside of containment?
  - » What facility capabilities are required to complete the protocol? What is the minimum amount of time required to complete the protocol? How are these estimates likely to be affected by technologies brought to practice by 2006?

Planning for Sample Hazard Analysis
(Draft)

- Organizing committee, Chaired by NASA Planetary Protection Officer (with CNES participation)
- Senior-Level Scientific Oversight and Review Panel (~25 people) to advise the organizing committee on the planning, organization, participants, and conduct of the workshops (US and France)
  - » Chosen for their abilities to address key scientific, biohazard evaluation and quarantine protocol issues associated with handling, characterizing, testing, and judging whether returned sample materials are in any way biohazardous, and when and whether they may be certified for controlled distribution outside containment and quarantine
  - » Will provide peer review of the protocol, prior to its release for external review by appropriate groups outside of NASA
- Participants (by invitation)