S. Korea

Advanced Colloids Experiment – 1 (ACE – 1)

Science Concept Review

At NASA GRC, meet in building 77, room 245.

WebEx and teleconference instructions on next page.

June 14, 2011

Phone numbers to use:

Country	Local / Toll Number	Freephone / Toll Free Number
France (Lyon)	33-4-26-69-12-98	080-563-6109
France (Marseille)	33-4-86-06-00-98	080-563-6109
Germany	49-69-2222-4872	0800-664-4253
Italy	39-02-3600-6015	800-986-992
Netherlands	31-20-718-8595	0800-020-1390
S. Korea	82-2-6744-1078	00798-14800-7192
USA	1-517-466-2153	866-692-4541

If you get cut-off and the above numbers do not work, call the mobile numbers listed on page 5 for Ron Sicker and Bill Meyer.
Certain dialing restrictions can apply from specific countries. To ensure that your participants have the correct dialing procedures, please include this link in your invitation:
https://www.mymeetings.com/audioconferencing/pdf/GlobalAccessDialingInformation.pdf
<https://www.mymeetings.com/audioconferencing/pdf/GlobalAccessDialingInformation.pdf>

Joining a phone conference:

1. *You must use a touch-tone phone to participate in an Instant Meeting conference.*
2. *Dial the appropriate access number for your country (provided above).*
3. *Participants: Enter your numeric participant passcode of 2163814 followed by a # sign.*

Joining WebEx: Topic: ACE Science Concept Review, Date: Tuesday, June 14, 2011, Time: 7:30 am, Eastern Time (New York, GMT-04:00)
Meeting Number: 990 606 202, Meeting Password: ACE061411#

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1. Go to https://nasa.webex.com/nasa/j.php?ED=162586077&UID=0&PW=NMTRlYTZmNGI0&RT=MiMxMQ%3D%3D
2. Enter your name and email address.
3. Enter the meeting password: ACE061411#
4. Click "Join Now".

To view in other time zones or languages, please click the link:
https://nasa.webex.com/nasa/j.php?ED=162586077&UID=0&PW=NMTRlYTZmNGI0&ORT=MiMxMQ%3D%3D

For assistance: 1. Go to https://nasa.webex.com/nasa/mc, 2. On the left navigation bar, click "Support".

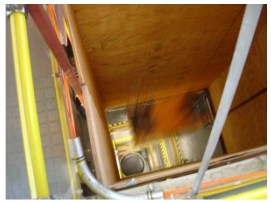
Agenda - Science Concept Review (SCR)

EDT (NASA)	CEST (ESA)	KST (S. Korea)	**June 14th, 2011 (Tuesday)** Each of 7 science teams have 50 minutes, including time for questions.
7:45 am	1:45 pm	8:45 pm	Phone-in (confirm connections using phone numbers provided on page 2)
8:00 am	2:00 pm	9:00 pm	Welcome; Fred Kohl – EDT
8:05 am	2:05 pm	9:05 pm	Charge to Panel; Fran Chiaramonte – EDT
8:25 am	2:25 pm	9:25 pm	Introduction of ACE Management and Engineering Team; Ron Sicker – EDT
8:30 am	2:30 pm	9:30 pm	LMM Hardware Overview for ACE-1; Ron Sicker and Tibor Lorik – EDT
8:50 am	2:50 pm	9:50 pm	Status of ESA Instrumentation for Colloids; Stefano Mazzoni – CEST
8:55 am	2:55 pm	9:55 pm	Introduction of Science Teams and Science Review Panel; Bill Meyer – EDT
9:00 am	3:00 pm	10:00 pm	Science Overview: Team 1; Dave Weitz and Peter Lu – EDT
9:50 am	3:50 pm	10:50 pm	Science Overview: Team 2; Chang-Soo Lee – KST
10:40 am	4:40 pm	11:40 pm	Coffee / Tea Break (15 minutes)
10:55 am	4:55 pm		Science Overview: Team 3; Peter Schall, Sandra Veen, Gerard Wegdam – CEST
11:45 am	5:45 pm		Lunch / Dinner break (1 hour)
12:45 pm	6:45 pm		Science Overview: Team 4; Stefano Buzzaccaro, Luca Cipelletti, Roberto Piazza – CEST
1:35 pm	7:35 pm		Science Overview: Team 5; Arjun Yodh, Peter Yunker – EDT
2:25 pm	8:25 pm		Coffee / Tea Break (15 minutes)
2:40 pm	8:40 pm		Science Overview: Team 6; Matt Lynch, Tom Kodger – EDT
3:30 pm	9:30 pm		Science Overview: Team 7; Paul Chaikin, Andy Hollingsworth, David Pine, Stefano Sacanna, Ned Seeman – EDT
4:20 pm	10:20 pm		Meeting adjourns. Science Review Panel Deliberation and Report (by June 17) – EDT and CEST

ISS Research at Glenn Research Center

TSC

User Labs



2.2-Second Drop Tower

KC-135

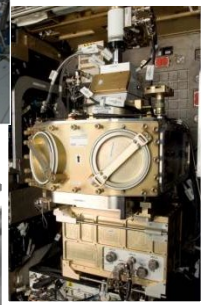
Zero-Gravity Drop Tower

Ground-Based Research Facilities

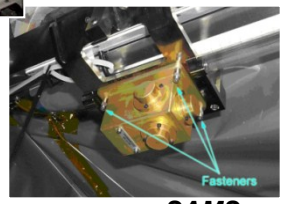
MSG

CIR

FIR



LMM



SAMS

On-Orbit Research Capabilities

SAME Ops

BCAT Ops

InSPACE Ops

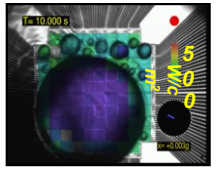
DAFT Ops

CFE Ops

SHERE Ops

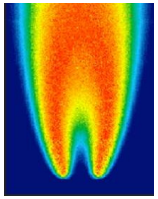
MISSE Installation

Operations



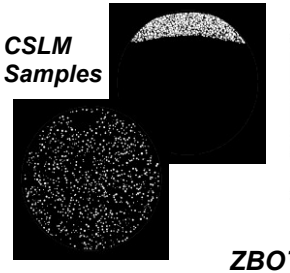
Pool Boiling

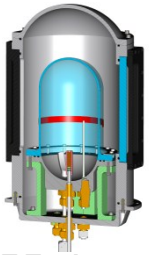
Flame Design



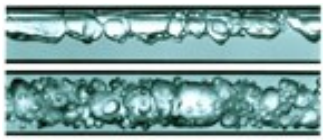
CLD Flame

CSLM Samples





ZBOT Tank



Two-Phase Flow

Science

GRC has been a leader in Microgravity Research since the mid-1960's.

Package updated June 13, 2011

Gravity-Dependent Physical Sciences

Combustion Science

- Spacecraft fire safety
- Solids, liquids, droplets, gasses
- Supercritical reacting fluids
- Soot

Fluid Physics

- Two-phase flow
- Phase separation
- Boiling, condensation
- Capillary and interfacial phenomena

Materials Science

- Solidification
- Crystal growth
- Metals, alloys
- Electronic materials
- Glasses, ceramics

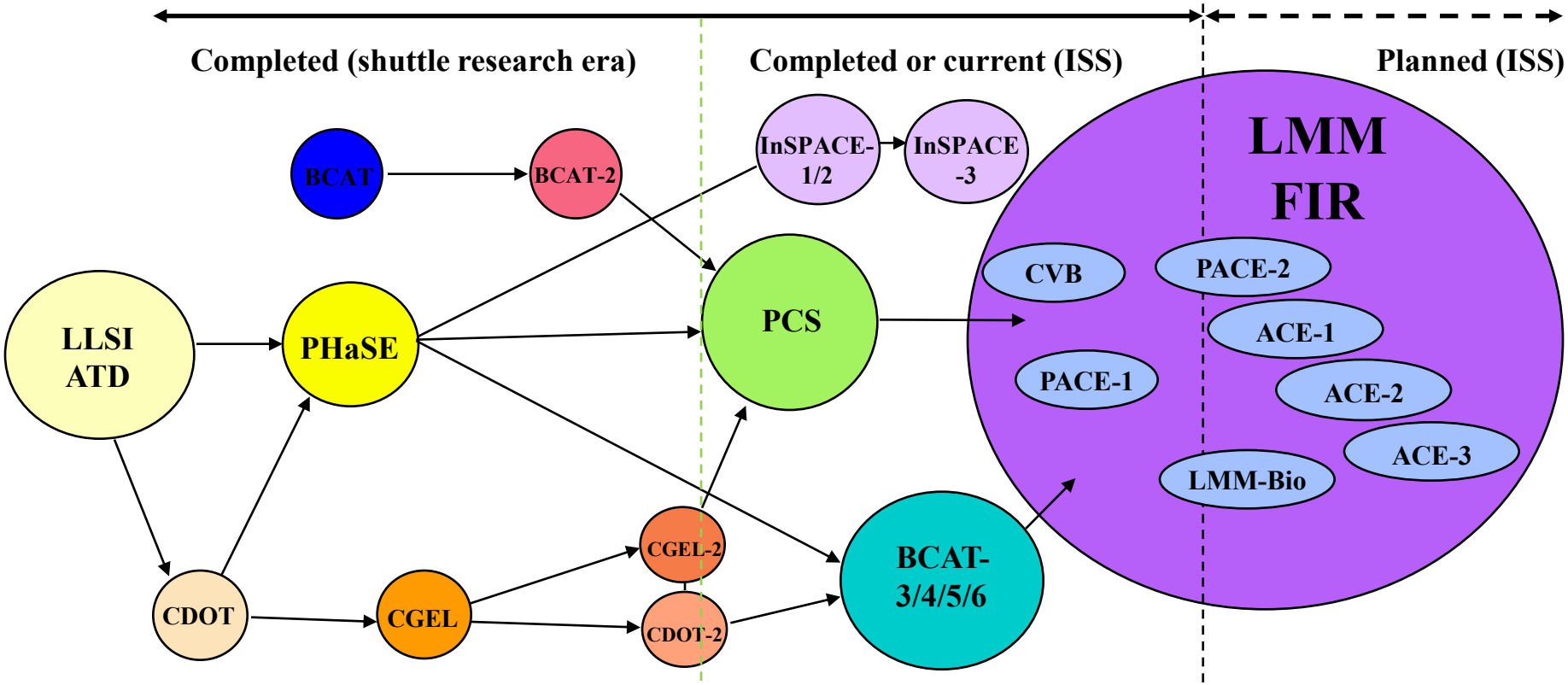
Fundamental Physics

- Atomic Clock
- Low temperature physics
- Quantum measurement techniques
- Ultra-cold atom physics
- Test mass techniques

Complex Fluids

- Colloids
- Liquid crystals
- Foams
- Dusty plasmas
- Granular flows

NASA Flight Hardware Used for Colloids Research

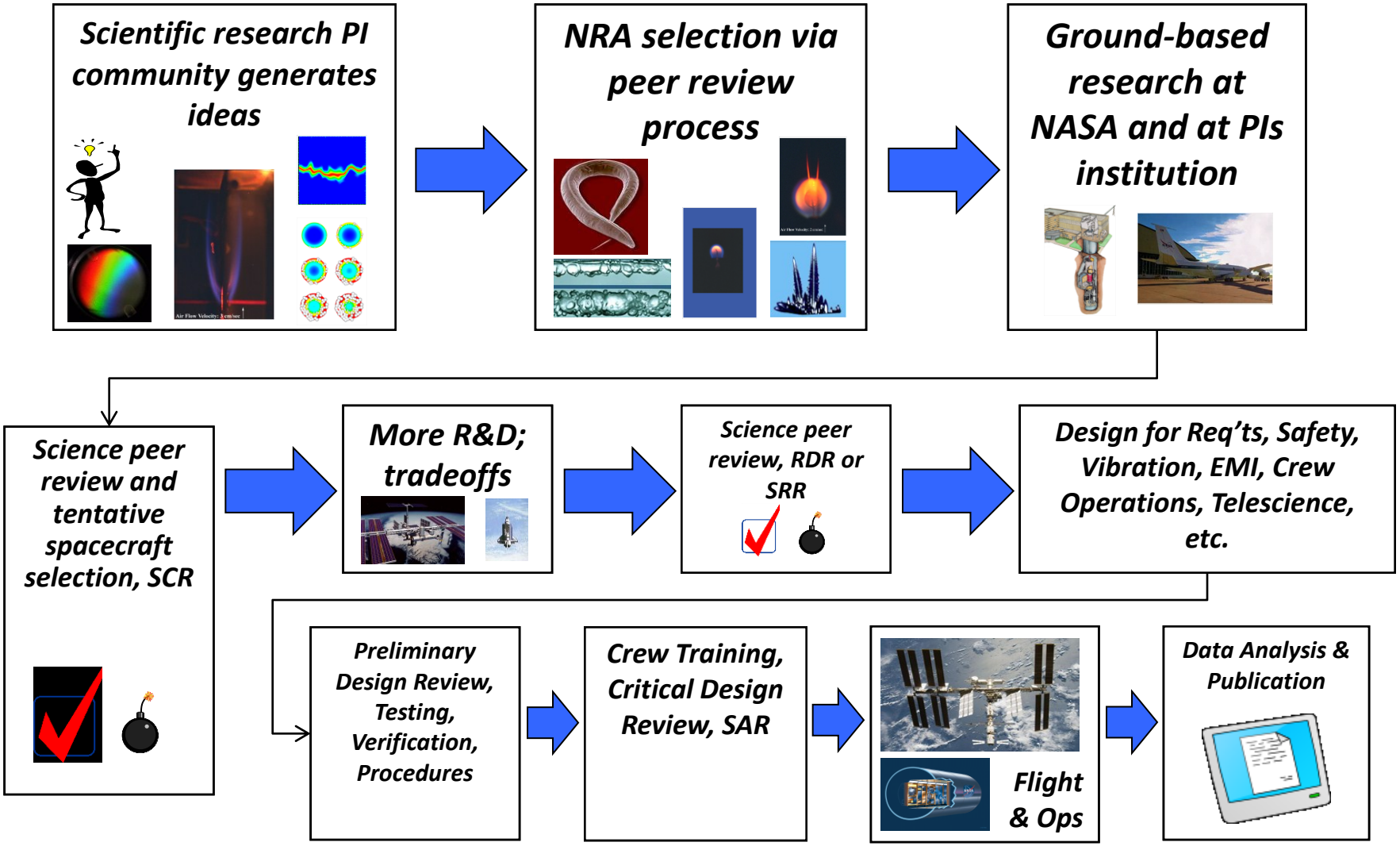


LLSI ATD: Laser Light Scattering Instrument Advanced Technology Development
CDOT: Colloidal Disorder/Order Transition
PHaSE: Physics of Hard Spheres Experiment
BCAT: Binary Colloidal Alloy Test
InSPACE: Investigate Structure of Paramagnetic Aggregates from Colloidal Emulsions

ACE: Advanced Colloids Experiment
FIR: Fluids Integrated Rack
CGel: Colloidal Gelation
PCS: Physics of Colloids in Space
CVB: Constrained Vapor Bubble
LMM: Light Microscopy Module
PACE: Pre-Advance Colloids Experiment

Package updated June 13, 2011

The Flight Experiment Process



Science Review Panel Charter

1. Reaffirm the scientific and technical merit, and significance of the research objectives.
2. Reaffirm the need for a long-duration microgravity environment.
3. Review the research requirements, assess their maturity and prioritize them with respect to their impact on the experiment objectives.
4. Confirm the adequacy of the test matrix and mission success criteria.
5. Assess the general engineering feasibility of implementing the proposed experiment concept. This includes assessing ground-based testing, development issues, carrier selection, etc.
6. Confirm that the experiment hardware design concept demonstrates compliance or has a credible plan to demonstrate compliance with the research requirements.
7. Assess adequacy of the proposed data and model deliverables.

Outcome:

Provide an overall assessment on the project's maturity to enter the flight development phase based on the following: that the project is scientifically sound, technically useful to the liquid crystal science and industry, there are no science or engineering feasibility issues and that the proposed engineering path appears credible. Provide recommendations as appropriate on or before Friday, June 17, 2011.

Request for Action (RFA)

- RFA forms are available to everyone in paper at the review. Electronic versions are available in the ACE e-room.
- RFAs must be consolidated by Project Scientist and Project Manager by COB June 21, 2011 (in one week).
- Forms are to be used for a specific request, not for general questions.
- The Project Manager will summarize all formal RFAs and be responsible for ensuring closure.
- Closure of the RFA is achieved when the Project Manager documents the response in a memorandum to the requester, and the convening authority concurs.
- Status of all RFAs will be reported at the System Acceptance Review (SAR).

ACE-1 Team Members

NASA Management Team:

Dr. Francis Chiaramonte	NASA HQ Program Executive for Physical Sciences; Tel.: (202) 358-0693; Francis.P.Chiaramonte@NASA.gov
Dr. Fred Kohl	NASA GRC ISS Research Project Manager; Tel.: (216) 433-2866; Fred.J.Kohl@NASA.Gov
Thomas St. Onge	NASA GRC ISS and Crew Health Office Chief; Tel.: (216) 433-3557; Thomas.H.Stonge@NASA.Gov
Ronald Sicker, P.E.	NASA GRC Project Manager Tel.: (216) 433-6498; Mobile: (216) 308-0616; Ronald.J.Sicker@NASA.gov
Dr. William (Bill) Meyer	NASA Project Scientist through USRA Tel.: (216) 433-5011; Mobile: (216) 337-6064; William.V.Meyer@NASA.Gov

ESA Management Team:

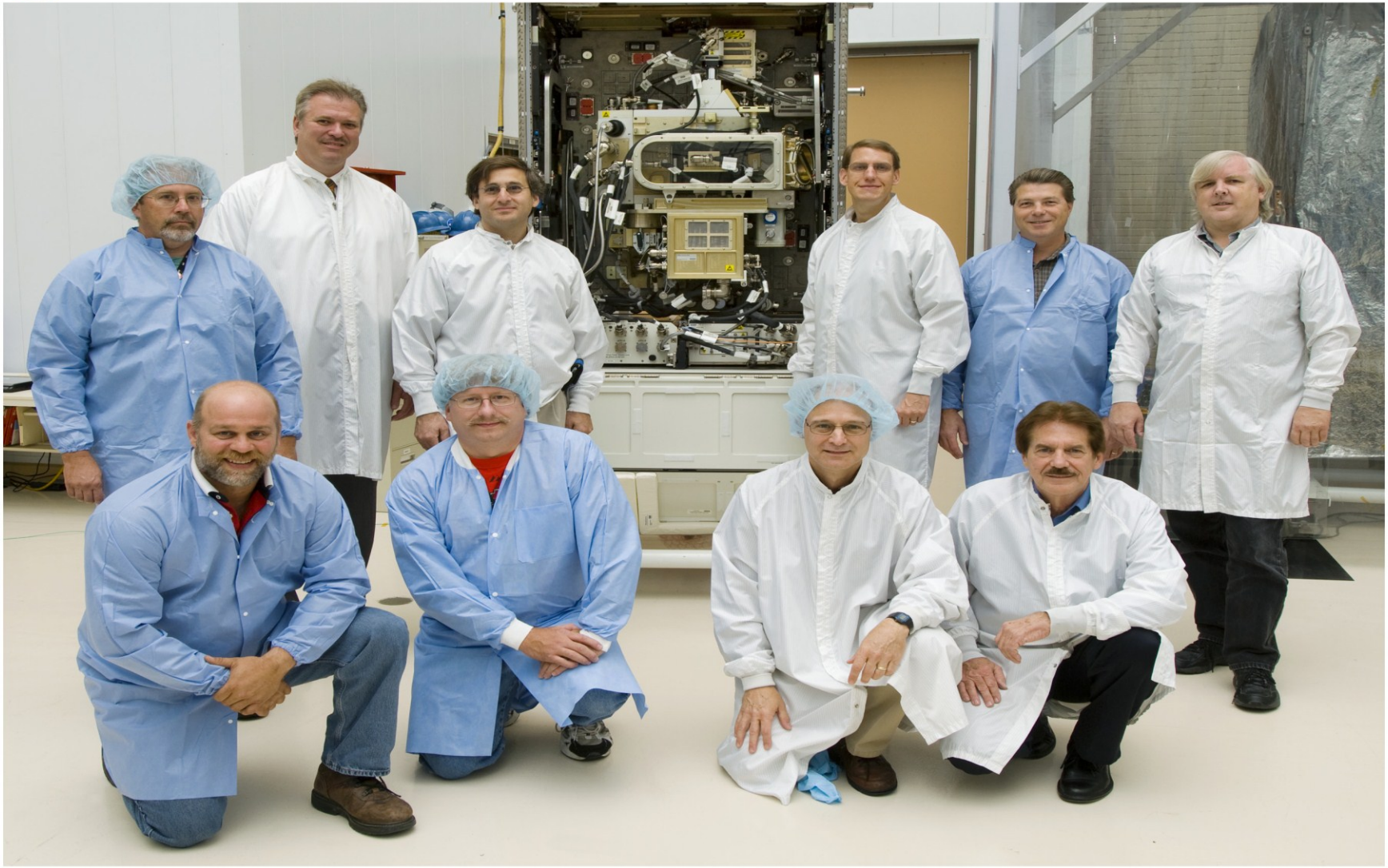
Dr. Olivier Minster	ESA / ESTEC Head Physical Sciences Unit, ISS Utilization and Microgravity Unit Tel.: +31 71 565 4764; Olivier.Minster@esa.int
Dr. Sefano Mazzoni	ESA / ESTEC Project Scientist; Tel.: +31 71 565 8377; Stefano.Mazzoni@esa.int

ZIN Engineering Team:

Tibor Lorik	Project Task Lead; Tel.: (440) 625-2324; LorikT@ZIN-Tech.Com
John Eustace	Physicist / Optical Lead
Russell Valentine	Mechanical
Greg Pruett	Electrical Engineer
Louis Chestney	Software Engineer
Clarise Shinn	Safety and QA
TBD	Systems / Integration Engineer

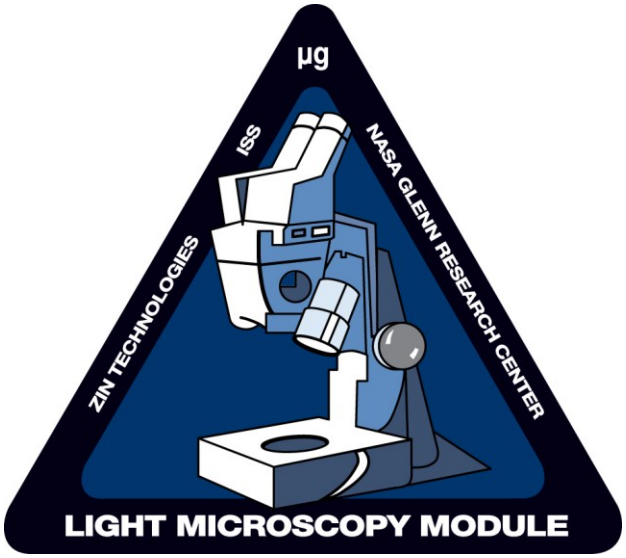
ACE's

C-2008-2915



National Aeronautics and Space Administration
John H. Glenn Research Center at Lewis Field

Status of the Light Microscopy Module and the Advanced Colloids Experiment



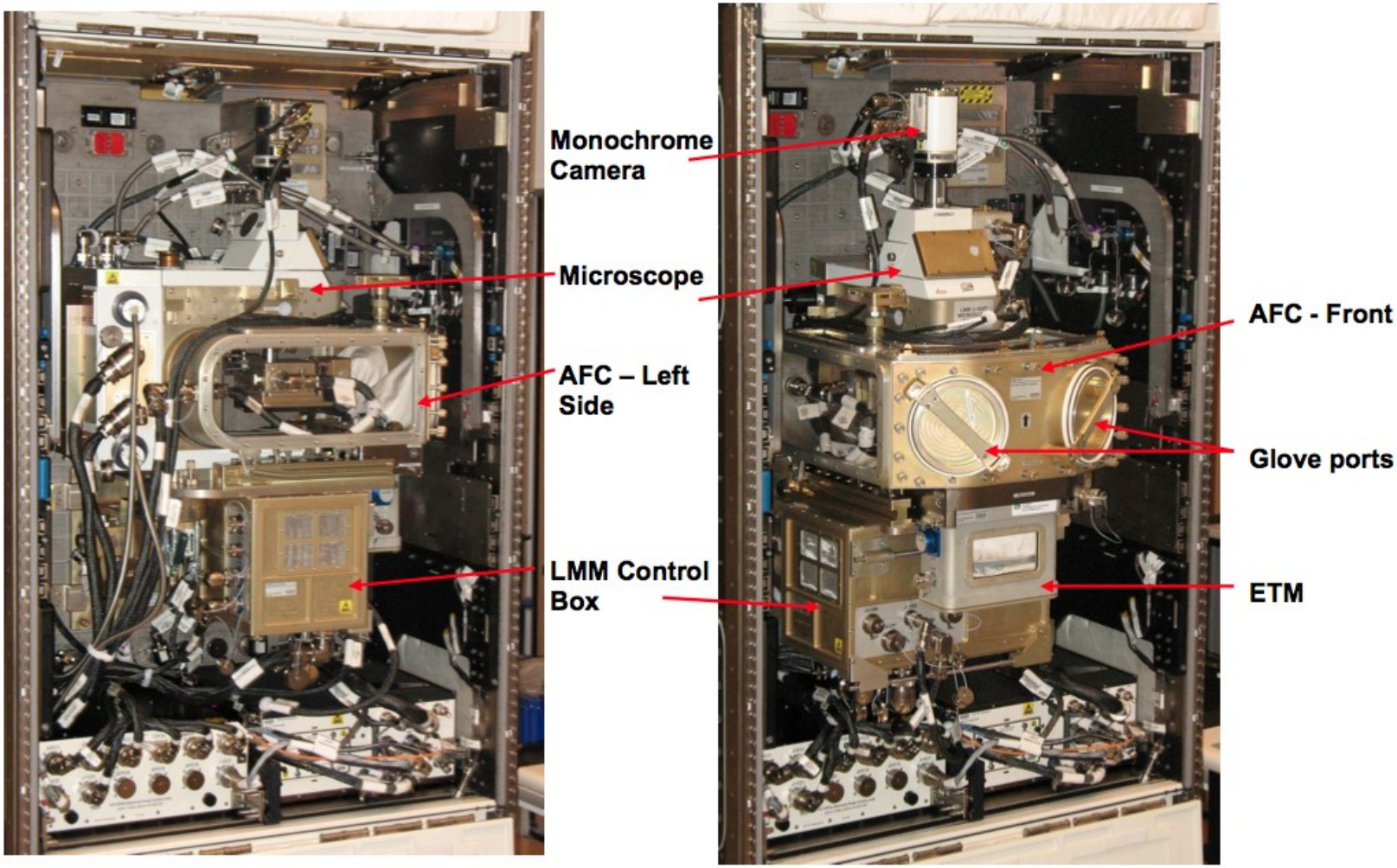
ISS021E033216

Fluid Integrated Rack (FIR) and Light Microscopy Module (LMM) launched August 2009.

Assembly and checkout complete January 2011.

Light Microscopy Module & Fluid Integrated Rack

Figure 1 LMM Installed Inside FIR



LMM in the Closed Position or Operating Configuration

LMM in the Open Position or Installation/Service Configuration

FIR/LMM Status

- First Experiment Constrained Vapor Bubble (CVB) (3/2010 – 11/2010)
- 15 publications
- Successfully Demonstrated:

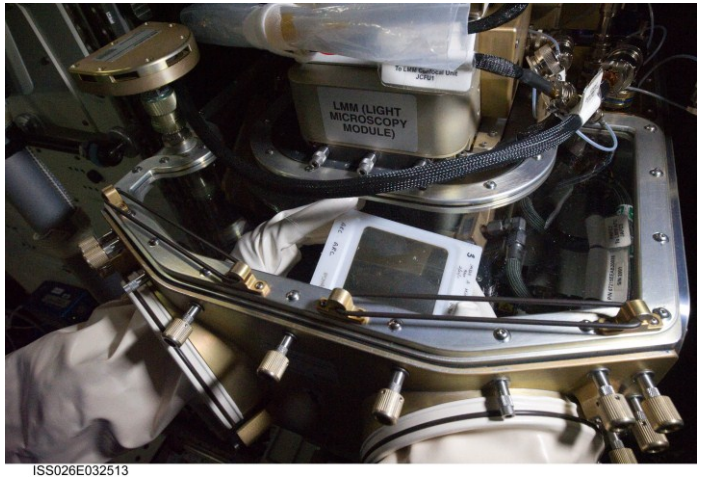
  Epi-illumination, commanding, 10x and 50x objectives,

  Q-Imaging Camera, 15fps video.

ISS023E056027

FIR/LMM Status

- Technical Demonstrations and small payloads.
- Pre Advanced Colloids Experiments (PACE) – successful test 100x and manual oil dispensing (2010).
- PACE-2 – test particles, fixed biological samples (11/2011)
- LMM Bio-1, -2 – Live samples (4/2011 and 6/2011)
- PACE LED Illumination Kit (8/2011)



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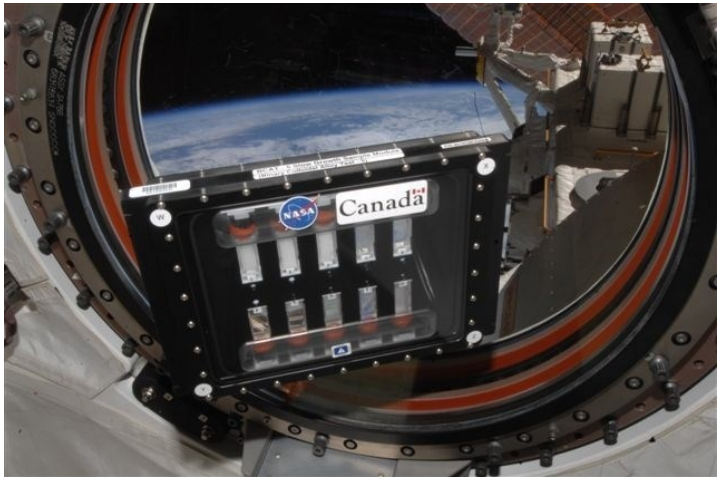
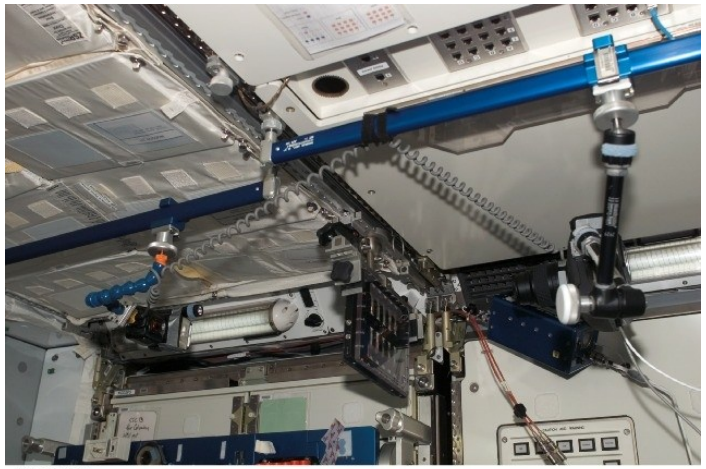
BCAT

- Binary Colloidal Alloy Test 3,4,5 and 6 (2003 – Present)
- Soft-Condensed Matter Experiments at macroscopic level.
- 40 samples – about 60% complete.
- Multiple investigators including Harvard, UPENN, NYU, P&G, CSA, ESA.





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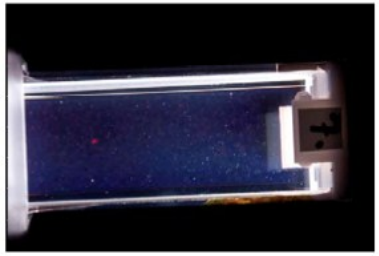

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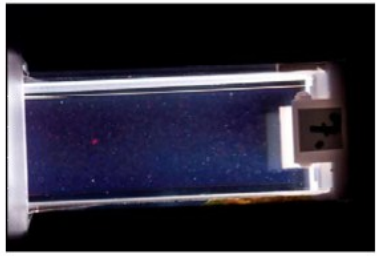

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Advanced Colloids Experiment Background

Three of original four experiments proposed for LMM:

- PCS-2 – Harvard
- PHaSE-2 – Princeton / NYU
- EDCA – UPenn
- SCR 2004
- LMM-Colloids put on hold 2006 (BCAT continued)
- LMM-Colloids restarted (engineering team) June 2011

  Additional science added, 7 science teams (used to be 3: USA, ESA, S. Korea, JAXA in future)

  Microscopy, specialty cells, and confocal returning

ACE Implementation

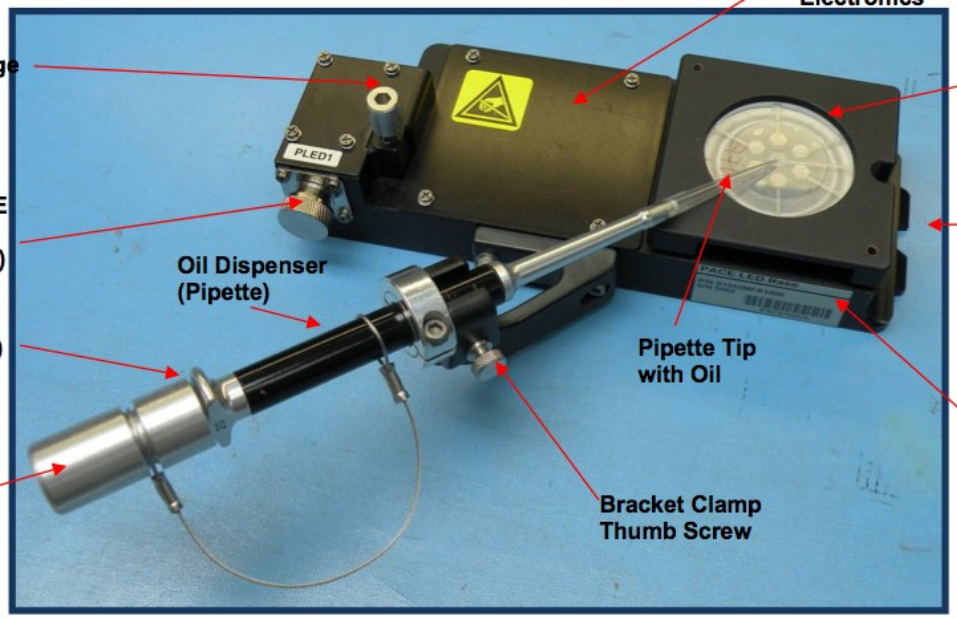
- Incremental approach for development and utilization to show results along the way.
- Use existing hardware while developing new capabilities.
- Use Commercial parts when practical (saves money).
- Work within time and budget constraints.

ACE-1A

- Use existing PACE illumination sample holder.
- Adapt original spectracell "workhorse" design to fit sample holder.
- Available objectives: 10x, 20x, 40x, 50x, 63x dry, 63x oil and 100x oil
- Manual sample mixing (with a possible two-hour time delay before viewing)
- Launch (5/2012)

PACE LED BASE

Top View of PACE LED Base



PACE LED Base with Oil Dispenser

ACE-1B Concept

- Begin specialty cell development with existing temperature control (CVB) control unit
- Upgrade to automatic in-situ mixing for non-viscous samples (enable rapid viewing after mixing)
- Investigate upgraded illumination (provide both incoherent and coherent light sources)
- Launch (10/2013)

ACE-2 Concept

- Develop upgraded stage.
- Provide COTS condenser.
- Flight harden and test e-field and thermal gradient specialty cells.
- Launch (10/2014)
- Possible camera upgrade

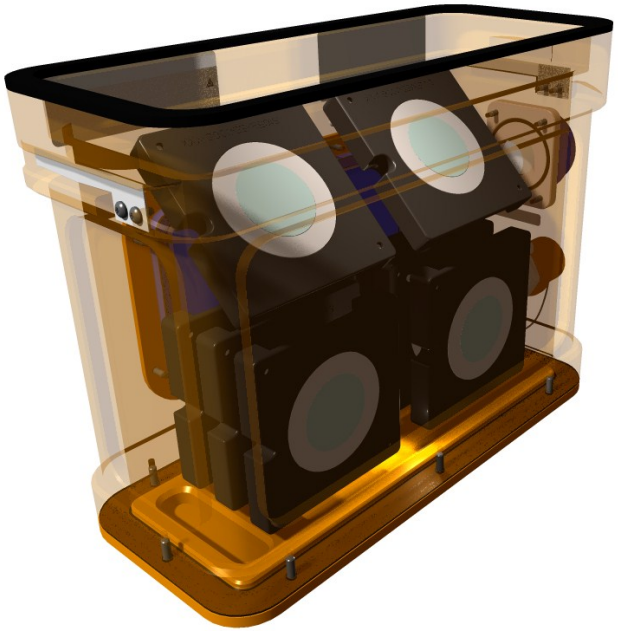
ACE-3 Concept

- Add laser souce.
- Develop confocal system.
- Launch (12/2015)

ACE-1A & ACE-1B Overview

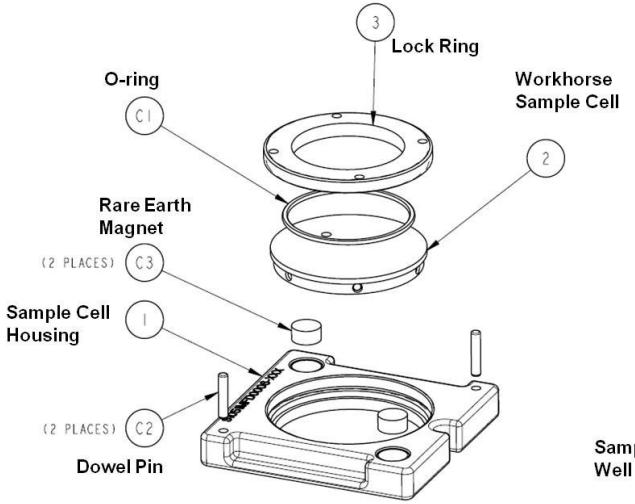
- Equipment Transfer Module (ETM) designed for CVB will be utilized to contain the workhorse cell assemblies.
- A total of 8 cell assemblies can fit into the ETM.

- The ETM interfaces to the LMM glovebox and provides a level of containment.
- The ETM will contain a foam insert (not shown) to contain the cell assembly.
- The ETM has overall dimensions of 280 x 191 x 105 mm.



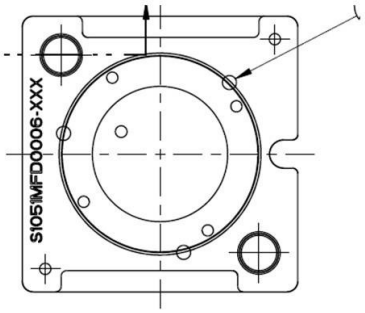
ACE-1A & ACE-1B Overview

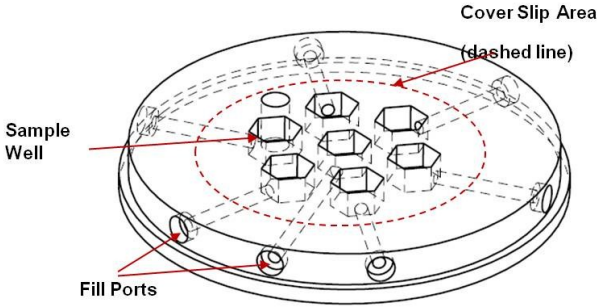
- Each workhorse cell assembly is expected to include 10 individual sample wells
- The volume of each well will be determined by science requirements



Workhorse Cell Assembly

Exploded View

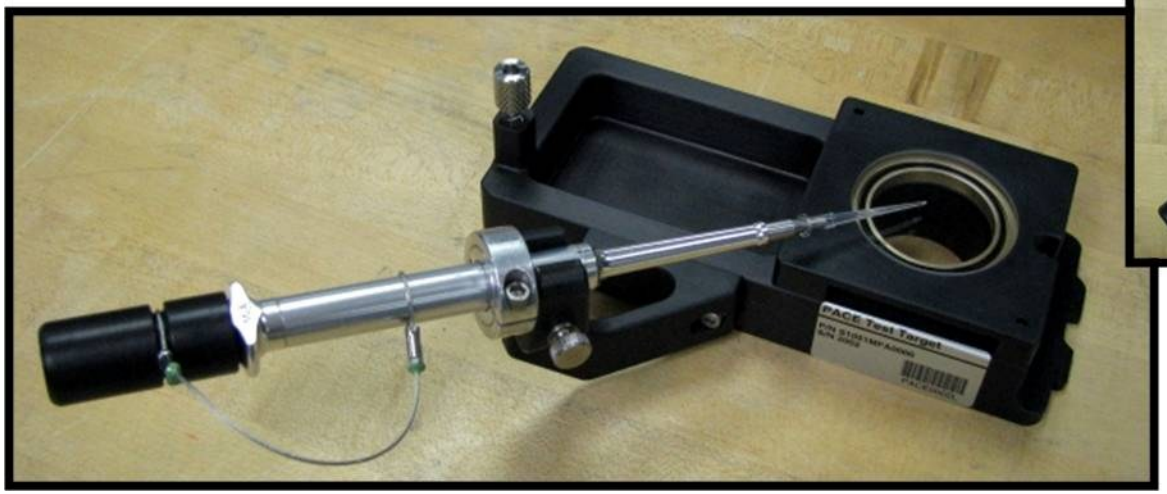




Workhorse Sample Cell
Base

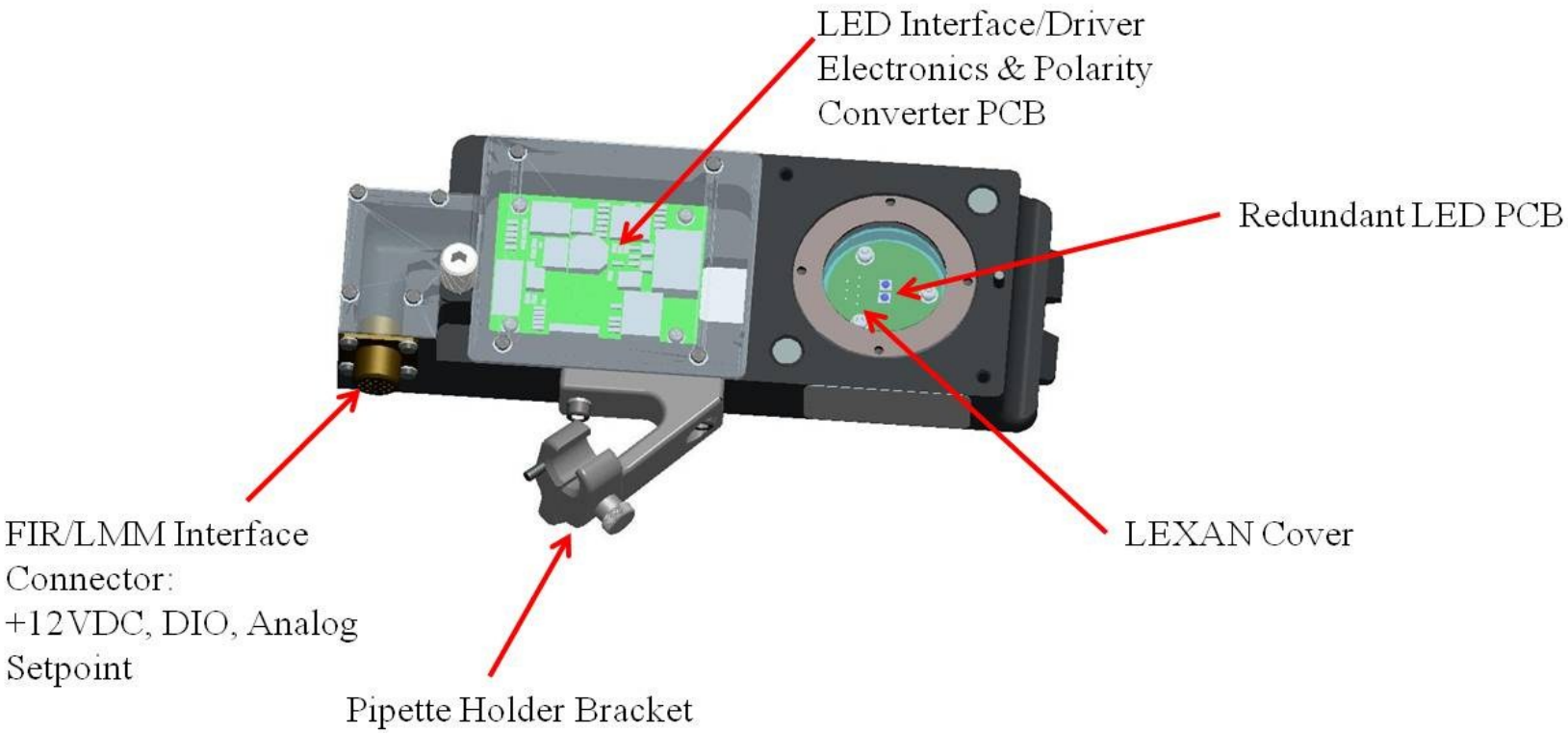
ACE-1A & ACE-1B Overview

- The workhorse cell assembly will mount to the PACE Target Base or the Trans-illumination Assembly.
- Each base type is capable of supporting oil dispensing.
- The base will mount to the LMM Microscope XY-Stage with cold-plate.

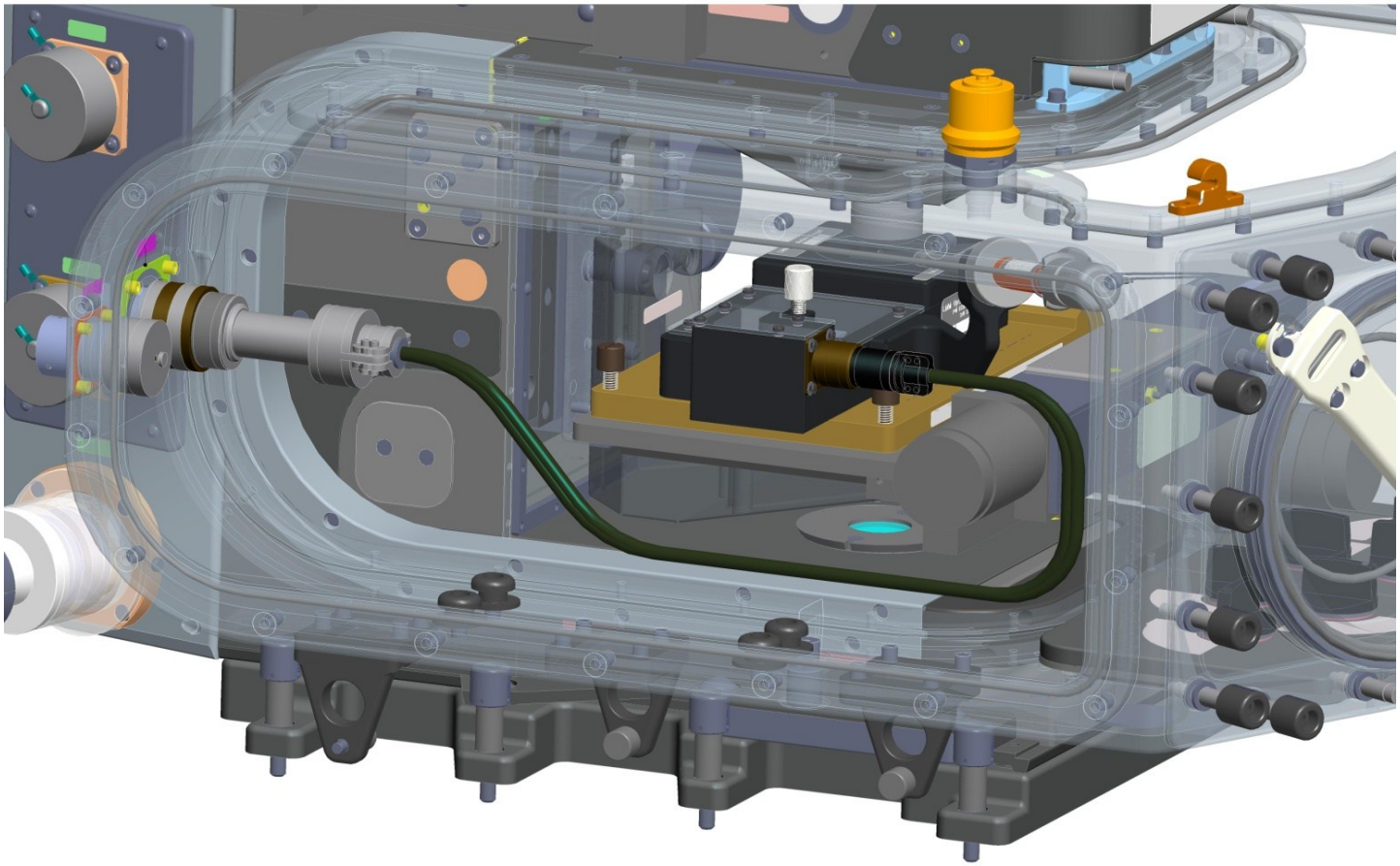


Top View of Test Target with Dispenser

ACE-1A & ACE-1B Overview



ACE-1A & ACE-1B Overview



Science Presentations

W. Meyer
ACE NASA Project Scientist

ACE-1 Science Team Members (1/3)

Science Team Members:

Key Personnel [Affiliation] / Role	Contact Information (Contacts listed in alphabetical order)
Dr. Stefano Buzzaccaro [ESA Team: Milan and Montpellier] Co-PI / Provide flight samples, science requirements, and data analysis	Professor, Dipartimento di Chimica, Materiali e Ingegneria Chimica Politecnico di Milano - Sede Ponzio Edificio Ce.S.N.E.F. - Soft Condensed Matter Lab via Ponzio 34/3, 20133 MILANO (Italy) Tel: +39-0223996361/6337; Fax +39-0223996309; stefano.buzzaccaro@mail.polimi.it
Prof. Paul Chaikin [NASA Team: NYU] PI / Provide flight samples, science requirements, and data analysis	Professor of Physics, Department of Physics New York University, 607 Meyer Hall 4 Washington Place at Broadway; New York, NY 10003 Tel: 212-998-7694; Fax: 212-995-4016; chaikin@nyu.edu
Prof. Luca Cipelletti [ESA Team: Milan and Montpellier] Co-PI / Provide flight samples, science requirements, and data analysis	Professor, Laboratoire des Colloïdes Verres et Nanomatériaux (UMR CNRS-UM2 5587), CC26, Université Montpellier 2, 34095 Montpellier Cedex 5, France Tel: +33 4 67 1 435 89; luca.cipelletti@univ-montp2.fr
Dr. Andrew Hollingsworth [NASA Team: NYU] Co-I / Provide flight samples, science requirements, and data analysis	Research Scientist, Department of Physics New York University 4 Washington Place - Office 826; New York, NY 10003 Tel: 212-998-8428; andrewdh@nyu.edu
Thomas Kodger [NASA Team: P & G and Harvard] Co-I / Provide flight samples, science requirements, and data analysis	Research Scientist, Department of Physics Harvard University, McKay 517 17 Oxford Street; Cambridge, MA 02138 Tel: 617-460-7659; tkodger@fas.harvard.edu
Prof. Chang-Soo Lee [S. KoreanTeam: CNU] PI / Provide flight samples, science requirements, and data analysis	Professor of Chemical Eng., Department of Chemical Engineering School of Engineering, 1-258 Chungnam National University Daejeon, Korea Tel: 82-42-821-5896; rhadum@cnu.ac.kr

ACE-1 Science Team Members (2/3)

Science Team Members (continued):

Key Personnel [Affiliation] / Role	Contact Information (Contacts listed in alphabetical order)
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♪*ACE-1 Science Review Panel members are the original NASA Science Review Panel for LMM with an additional ESA member added.*

Suggested Outline for Science Presentations

(50 minutes each with questions)

- Picture of speaker and team with names
- Executive Summary
- Brief Science Overview / Review
- Affirm Scientific and Technical Merit
- Justification for ISS (long duration micro-gravity)
- Presentation of Relevant Ground-based Work
- Proposed Experiment
  - Does the proposed hardware meet your science needs?
  - Requirements summary
  - Required data / Test matrix
  - Success criteria
- Summary / Questions