



The IOC wishes to draw to your attention that live streaming or recording of any part of the Workshop and/or Short Course is expressly forbidden.



IPPW-2019 Sponsors

The IPPW-2019 Committees would like to thank the sponsors for their generosity and enthusiasm for this ever-popular and important community event.











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We also thank the Georgia Tech Department School of Aerospace Engineering for their support of the IPPW Student programme.



IPPW-2019 Welcome

Welcome to Oxford and the 16th meeting of the International Planetary Probe Workshop, hosted by Oxford University. Although Oxford stories abound, one statistic is particularly appropriate for IPPW: teaching has existed at Oxford for almost 1,000 years. By your participation in this year's Workshop and Short Course, you will be continuing the education tradition in Oxford!

Attending IPPW 2019 is an outstanding group of international scientists, engineers, technologists, mission designers, and policy makers. We are pleased to be hosting IPPW 2019 in the United Kingdom, for the first time in our 16-year history. We encourage you to not only learn through your attendance at the workshop but also take the time to view the historic sites of the city. Space-related sites not to miss include Edmond Halley's house and the site of Robert Boyle's laboratory.

IPPW 2019 offers a varied program, as you have already seen from our agenda, along with ample opportunities for networking. We received an overwhelming number of abstracts this year. The Program Organizing Committee worked extremely hard to select the best and most appropriate oral and poster abstracts contributing to the exciting program you will encounter in the next five days. Per IPPW tradition, the Workshop was preceded this year by a weekend Short Course focused on Ice Giants. Over the past 12 months, we've solicited and evaluated nominees for the AI Seiff Memorial Award. Unfortunately, our IPPW 2019 awardee, Athena Coustenis, the Director of Research with the National Centre for Scientific Research (CNRS) of France, is unable to attend this year. However, we are pleased to formally present the 2018 AI Seiff Award to Sushil Atreya during the opening session.

In order to accommodate the number of presenters and posters in a workshop format, we have scheduled short presentations for each technical session followed by brief Q&A sessions so attendees can further explore the presented concepts. In addition, we are highlighting our posters by scheduling brief Poster Short Talks featuring each poster presenter. There are no parallel sessions during IPPW 2019, allowing you to attend all sessions of interest.

We encourage you to attend as many oral presentations and poster viewing opportunities as possible. In addition to the technical content, we have planned various social events during the week. A Welcome Reception, sponsored by Analytical Mechanics Associates, is scheduled on Monday evening to introduce you to the attendees at this year's workshop. On Tuesday and Thursday evenings, our Poster Receptions will afford all attendees the opportunity for detailed viewing and learning from the varied posters on display. After a half-day of presentations on Wednesday morning, the afternoon is devoted to either a visit to two technical facilities in the local area, or Blenheim Palace, the home of the Duke of Marlborough. Following the tour, our annual banquet will be held at Oxford's Keble College Dining Hall.

Since IPPW 2019 is indeed a workshop, we invite you to take advantage of the numerous opportunities during coffee breaks, lunches, and social activities to build collaborative partnerships with other workshop participants. We thank our generous IPPW 2019 sponsors, as listed in this program, for supporting our 16th workshop and for providing funding to support a record number of European and US students who are attending to gain a better understanding of their future career options in planetary probes. This year, we have awarded 25 student scholarships and have



scheduled events with a student focus, including the Student Social, student networking exercises, and the Student Career Development luncheon on Tuesday.

On Friday afternoon, 15 June, we've scheduled a presentation on the plans for IPPW 2020, to be hosted by NASA's Ames Research Center. We encourage you to attend this talk to learn about your next opportunity to join us. In this time of exciting plans for future space exploration, it is all the more valuable for us to reconnect with our colleagues and celebrate our strong planetary probe community. We urge you to actively participate, expand your knowledge, and enjoy our 16th International Planetary Probe Workshop.

Let's make it a great week! Ad Astra.

Bernie Bienstock Caltech / Jet Propulsion Laboratory Chair, IPPW 2019 International Organizing Committee Colin Wilson Oxford University Co-Chair, IPPW 2019 Local Organizing Committee Steve Lingard Vorticity Ltd Co-Chair, IPPW 2019 Local Organizing Committee



A very warm welcome to Oxford, the City of Dreaming Spires

The Local Organizing Committee sends its warm greetings to everyone attending the IPPW-2019 Short Course and Workshop. The University of Oxford's Physics Department is delighted to host the event with our colleagues from Vorticity Ltd.

IPPW-2019 has taken many months of planning and thought, with contributions from the multiple committees that serve this community and sponsorship from local and global organisations. We are delighted to welcome a record number of delegates. The resulting Short Course, workshop programme and social events will, we hope, offer many opportunities for many institution and space agency collaborations going forward.

Oxford is famous the world over for its University. For over 900 years, Oxford has been a home to royalty and scholars, and since the 9th century an established town, although people are known to have lived in the area for thousands of years. Space has been studied in Oxford arguably since 1620, when the first Professorship of Astronomy was established. As to space *travel*, we are approaching the 50th anniversary of Oxford's first instrumentation on space, an infrared radiometer launched aboard NASA's Nimbus-D orbiter. Since then, Oxford's Physics department has contributed instrumentation to dozens of planetary spacecraft, from Venus to Saturn. Currently operating planetary instruments to which we've contributed include InSight's short-period seismometers, which were assembled and calibrated in Oxford, and Mars Reconnaissance Orbiter's Mars Climate Sounder instrument. Oxford hosts well over one hundred researchers working in space-related fields, across many departments, including the Engineering Science department whose hypersonic test facilities, which have been used to test planetary EDLS systems including Huygens and ExoMars, can be toured during this week. Furthermore, Oxfordshire hosts the Harwell Space cluster, where 89 space organisations employing around 1000 people can be found. This site hosts the largest UK government space lab (*RAL Space*), the ESA's UK centre (*ECSAT*), and space companies of all sizes.

Vorticity, located some 10 miles to the south of the city, is probably best known for its work on entry, descent and landing systems for space vehicles, particularly parachute systems for planetary landers. Members of our team have worked on notable missions including the development of the Huygens Descent Control Subsystem (DCSS), the parachute system that safely landed the Huygens probe on Saturn's moon, Titan; and the parachute system for the ESA Schiaparelli mission launched in 2016. Today Vorticity's key focus is the development and testing of the complex 4-parachute descent system for the ESA ExoMars RSP (Rover and Surface Platform) Mission, the International cooperation between ESA, Roscosmos and NASA.

We sincerely hope that you enjoy your time here in Oxford and take up all the opportunities to see the sights and soak up all the history.

Colin Wilson University of Oxford Steve Lingard Vorticity Ltd Sarah Griffey Vorticity Ltd

The Local Organising Committee



Oxford Landmarks



Top row, from Left to Right – The Bridge of Sighs, Radcliffe Camera, Sheldonian Museum – Middle Row – from Left to Right – punts at Cherwell; the Bank Restaurant exterior and interior; Taylors' of Oxford deli – Bottom Row – from Left to Right –stonework at University Church of St Mary the Virgin; the Turf Tavern; interior of the Vaults

http://www.oxfordcityguide.com/oxford-tourist-information



Julian Nott: a celebration of life

The IPPW community were saddened to hear in March 2019 of the loss of one of its strongest supporters and innovators.

Julian passed away peacefully on March 26, 2019 after suffering multiple injuries from an extraordinary and unforeseeable accident following a successful balloon flight and landing in Warner Springs, California. Julian was flying an innovative new balloon design that he invented to test high altitude technology for scientific and engineering applications. His loving partner of 30 years, artist Anne Luther, was at his side.

Julian Richard Nott was born in Bristol and attended Epsom College and St John's College, Oxford, going on to gain a master's in Physical Chemistry. He then worked in Bangladesh with the Voluntary Services Oversees (VSO), the equivalent of the American Peace Corps.

Known as the founder of the modern ballooning movement, and one of its most creative and innovative exponents, Julian was changing the course of balloon history with the development of an entirely new system in which conventional ballast is replaced with cryogenic helium. He has broken 79 World Ballooning Records and 96 British Records including exceeding 55,000 feet in a hot air balloon.



"Science, freedom, beauty, adventure: what more could you ask of bfe?" Charles Lindbergh

Besides being a leading scientist in his field and an engineering genius, Julian was also one of the world's great experimental test pilots. The Smithsonian Air and Space Museum has described Julian as "a central figure in the expansion of ballooning as an organizer, pilot, and most of all as arguably the leading figure to apply modern science to manned balloon design."

"Most of all I hope to use science to advance and innovate, however, setting a world record is indisputable proof of the success of a new design." Julian Nott

A driving force behind the advancement of balloons for the exploration of planets, Julian was also an avid supporter of the International Planetary Probe Workshop, contributing game changing research to enable balloons to fly on Titan and Venus.

We say farewell to a great scholar, a true gentleman, a unique genius and a very close friend!

Contact

Please direct enquiries to Hannes Griebel at hsg@gmx.tw





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Poll the Panel!

IPPW will have an online poll for workshop attendees to prioritize questions for the Monday morning keynote speaker panel session.

Questions submitted by the community have been assembled into a comprehensive set and will be available before the start of the conference. Attendees are encouraged to use the online poll to "upvote" these questions prior to the start of the Panel Session.

Please visit https://arc.cnf.io/ and then select the IPPW session. Please enter the password when prompted **voteIPPW**.



General Information

All the information presented in this booklet is also available on the IPPW-2019 website https://ippw2019.uk/

Venue

The IPPW 2019 Workshop and Short Course will be held in the Martin Wood Lecture Theatre, Department of Physics, The University of Oxford, 20 Parks Road, Oxford OX1 3PU.

On-site contacts

The best way to contact the LOC is by email at ippw2019@maillist.ox.ac.uk

Any logistical questions related to the venue may be addressed to the Physics Dept reception by telephone: +44 (0) 1865 272200.

Workshop and Short Course

The Workshop will take place from Monday 8th July to Friday 12th July 2019. The Workshop will be preceded by the Short Course, focusing on Ice Giants, on the weekend of 6th to 7th July 2019.

The Martin Wood Lecture Theatre is located at The Physics Building, 20, Parks Road, OXFORD OX1 3PU.

Registration, poster and breakout room locations

Registration, coffee and breakout room 1 are located on the ground floor of the Martin Wood Complex. The Tuesday and Thursday poster session locations are set out in Figure 1 below.



1 Registration, Posters & Breakout Room 1

2 Breakout Rooms 2 and 3



Conference Badges and Official ID

You will be provided with an official IPPW-2019 conference badge during Registration at the Physics Building. Do please wear your badge during your attendance at the Short Course, the Workshop, and at our social events. International visitors need not carry their passports for the purposes of identification unless they choose to do so.

Parking

There is virtually no car parking available at the venue. The LOC strongly recommends that delegates do not book rental cars. Some of the recommended hotels (Best Western Linton Lodge, and Oxford Spires) offer onsite parking. For delegates with mobility issues please contact the LOC and we will be pleased to make arrangements on your behalf for car parking. On-street parking at St Giles is limited to two or three-hour time slots at a cost of £2 per hour.

Meals

Breakfast

- Keble College & St Hugh's Breakfast is served in the traditional dining hall
- Rewley House Breakfast is served in the modern dining room.
- Oxford Spires, Best Western Linton Lodge Hotel, Eastgate Mercure Hotel Breakfast is provided in the room rate
- Coffee will be served in the area adjacent to the Lecture Theatre.

Lunch

To encourage greater networking and give all delegates an opportunity to see this historic city, here is a shortlist of the LOC's favourite traditional pubs, sandwich bars and restaurants all within 5-10 minutes' walk of the venue. You are by no means limited to using just this list; it is only a suggestion.

Venue Type	Name	Address
Gourmet Sandwich & Deli	Taylors, Oxford	31 St Giles, Oxford
serving tea, coffee, sandwiches,	Taylors Café, Woodstock Road	1 Woodstock Rd, Oxford OX2 6HA
soups and baguettes to eat in or		
takeaway		
French Brasserie serving	Café Rouge Oxford	11 Little Clarendon St, Oxford
breakfast, lunch and dinner		
Online ordering & takeaway is		
available		
French Brasserie serving lunches	Pierre Victoire	9 Little Clarendon Street Oxford OX1 2HP
from 12.00 to 2.pm (& dinner 6.0		
– 11.00pm)		
Classic Pub	The Royal Oak	42-44 Woodstock Rd, Oxford OX2 6HT
Serving lunch and drinks to eat in		
the bar or in the patio garden		
All-day Brasserie and bar	Browns Oxford	5-11 Woodstock Rd, Oxford OX2 6HA
Bakery serving coffee, breakfasts	Gail's Bakery Jericho	21-22 Little Clarendon Street Oxford, OX1 2HU
and lunch		
Ordering online& takeaway is		
available		
Ancient Pub (c 1607)	The King's Arms	40 Holywell Street, Oxford OX1 3SP
Serving fine cask ales, hearty		
homemade food and has a		
resident ghost		



Lunch venue web links

https://www.taylorsoxford.co.uk/

https://www.caferouge.com/bistro-brasserie/oxford/little-clarendon-street

https://www.pierrevictoire.co.uk/home

https://www.theroyaloakoxford.co.uk

https://www.browns-restaurants.co.uk/restaurants/southeast/oxford

https://gailsbread.co.uk/our-food/bakers-breakfast/

https://gailsbread.co.uk/our-food/lunch/

https://gailsbread.co.uk/order/

Snacks

Coffee, tea, water and biscuits will be served during the breaks.

Dinner

- Monday 8th July Welcome Reception at the Oxford University Museum of Natural History

 main courses and puddings will be served; with wine, beer and soft drinks. This is a standing rather than seated event.
- *Tuesday 9th July* delegates have a free evening after the poster session.
- Wednesday 10th July Formal Dinner at Keble College Dining Hall four courses with wine and soft drinks.
- Thursday 11th July IOC Committee Dinner at the Oxford Vaults. Delegates have a free evening after the poster session.

Wifi

Wi-Fi will be available throughout the Workshop. You will be given the group username and password at Registration. Please remember to bring your UK power adapter with you.

Time Zone

Clocks will be set to British Summer Time (which starts on 31 March 2019 and ends on 27 October 2019).

Local weather

English summer weather can range from cool (16 Celsius) to very hot (28 Celsius) and occasionally humid. We recommend you bring an umbrella, just in case the famous British rain decides to fall.



Local map and venue map

The local map of Oxford is also available on the IPPW-2019 website https://ippw2019.uk/index.php/venue-accommodation/



3 Local Map of Oxford and IPPW-2019 points of interest



The IPPW-2019 Committees

International Organising Committee

Chair: Bernie Bienstock

Jet Propulsion Laboratory

Co-Chairs:	
Ashley Korzun	NASA Langley
Robert Buchwald	Airbus Defence and Space
IOC Members:	
Michael Amato	NASA Goddard Space Flight Center
Jim Arnold	NASA Ames Research Center
David Atkinson	Jet Propulsion Laboratory
Giles Bailet	CentraleSupélec, Université Paris Saclay
Tibor Balint	Jet Propulsion Laboratory
Andrew Ball	ESA
Michael Barnhart	NASA Ames Research Center
Pat Beauchamp	Jet Propulsion Laboratory
Jens Biele	German Aerospace Center (DLR)
Jean-Marc Bouilly	ArianeGroup
Bobby Braun	University of Colorado
Robert Buchwald	Airbus Defence and Space
Neil Cheatwood	NASA Langley Research Center
Ed Chester	System Level Ltd
David Cornelius	NASA Ames Research Center-AMA
Athena Coustenis	Observatory of Paris
Jim Cutts	Jet Propulsion Laboratory
Manuel Dominguez-Pumar	Univ. Politecnica de Catalunya
Soumyo Dutta	NASA Langley Research Center
Karl Edquist	NASA Langley Research Center
Larry Esposito	University of Colorado
Jim Garvin	NASA Goddard Space Flight Center
Ingo Gerth	OHB System AG
Aga Goodsell	NASA Ames Research Center
Sarah Griffey	Vorticity Ltd
Lewis Groswald	Colorado State University, Boulder
Ali Guelhan	German Aerospace Center (DLR)
Rodrigo Haya-Ramos	SENER
Joern Helbert	German Aerospace Center (DLR)
Jeff Herath	NASA Langley Research Center
Kenneth Hibbard	APL



Scott Hubbard Helen Hwang Jacob Izraelevitz **Ozgur Karatekin** Julia Kowalski **Dean Kontinos** Siddharth Krishnamoorthy Jean-Pierre Lebreton Steve Lingard Marcus Lobbia Ralph Lorenz Milad Mahzari Sharon McKee David Mimoun **Aaron Morris** Michelle Munk Adam Nelessen Clara O'Farrell **Richard Otero** Periklis Papadopoulos **Miguel Perez Ayucar** Scott Perino Cheryl Reed Kim Reh Heiko Ritter **Michelle Rodio** Steve Ruffin Isil Sakraker Margaret Simon **Brandon Smith** Eric Carl Stern Christine Szalai Tanno Hideyuki Jan Thoemel Raj Venkatapathy **Gregory Villar Thomas Voirin** Todd White Colin Wilson Al Witkowski

Stanford University **NASA Ames Research Center** Jet Propulsion Laboratory Royal Observatory of Belgium **Aachen University** NASA Ames Research Center Jet Propulsion Laboratory **CNRS** Vorticity Ltd Jet Propulsion Laboratory APL NASA Ames Research Center NASA Ames (AMA) ISAE NASA Langley / Teams 2 NASA Langley Research Center Jet Propulsion Laboratory Jet Propulsion Laboratory Jet Propulsion Laboratory San Jose State ESA Jet Propulsion Laboratory APL Jet Propulsion Laboratory ESA NASA LaRC Georgia Tech German Aerospace Center (DLR) APL Blue Origin NASA Ames Research Center Jet Propulsion Laboratory JAXA GOMSPACE NASA Ames Research Center Jet Propulsion Laboratory ESA NASA Ames Research Center University of Oxford Katabasis Engineering



Svenja Woicke Michael Wright Tetsuya Yamada Aline Zimmer German Aerospace Center (DLR) NASA Ames Research Center JAXA Jet Propulsion Laboratory

Programme Organizing Committee

Co-chairs:

Soumyo Dutta Joern Helbert Todd White

POC Members:

Aaron Stehura Al Witkowski Aline Zimmer Ashley Korzun **Benoit Pigneur** Bernie Bienstock **Brooke Harper** Christian Grimm Clara O'Farrell **Dave Atkinson** David Mimoun **Dmitriy Shutin** Eric Stern Ethiraj Venkatapathy **Gilles Bailet Gregory Villar** Jacob Izraelevitz Jean-Pierre Lebreton Julia Kowalski Karl Edguist Manuel Dominguez-Pumar Marcus Lobbia Matthias Grott **Michael Wright Michelle Munk Michelle Rodio Miguel Perez Ayucar** Milad Mahzari **Olivier Mousis**

NASA Langley Research Center German Aerospace Center (DLR NASA Ames Research Center

Jet Propulsion Laboratory Katabasis Engineering Jet Propulsion Laboratory NASA Langley Research Center University College of London Jet Propulsion Laboratory Jet Propulsion Laboratory German Aerospace Center (DLR) Jet Propulsion Laboratory Jet Propulsion Laboratory ISAE German Aerospace Center (DLR) NASA Ames Research Center NASA Ames Research Center CentraleSupélec, France Jet Propulsion Laboratory Jet Propulsion Laboratory **CNRS-Orleans Aachen University** NASA Langley Research Center Universitat Politecnica de Catalunya Jet Propulsion Laboratory German Aerospace Center (DLR) NASA Ames Research Center NASA Langley Research Center/HQ NASA Langley Research Center **FSA** NASA Ames Research Center Laboratoire d'Astrophysique de Marseille



- Pat Beauchamp Rafael Lugo Robert Dillman Rodrigo Haya Ramos Ryan Timoney Sahadeo Ramjatan Scott Perino Siddharth Krishnamoorthy Thibault Cavalie Tom West
- Jet Propulsion Laboratory NASA Langley Research Center NASA Langley Research Center Sener University of Glasgow University of Minnesota Jet Propulsion Laboratory Jet Propulsion Laboratory NASA Langley Research Center

Short Course Committee

Patrick Irwin	Chair (Oxford)
David Atkinson	Jet Propulsion Laboratory
Tom Spilker	Independent Consultant
Olivier Mousis	Laboratory for Astrophysics (Marseille)

Student Organizing Committee

Europe Co-chair Svenja Woicke

German Aerospace Center (DLR)

Members

Robert Buchwald	Airbus Defence and Space
Ingo Gerth	OHB System AG
Ozgur Karatekin	Royal Observatory of Belgium
Jean-Pierre Lebreton	CNRS
David Mimoun	ISAE
Isil Sakraker	German Aerospace Center (DLR)
Thomas Voirin	European Space Agency

US Co-chairs

Siddharth Krishnamoorthy	Jet Propulsion Laboratory
Michelle Rodio	NASA Langley Research Center

Al Seiff Award Committee

Jim Arnold David Atkinson Alicia Dwyer Cianciolo Julia Kowalski Miguel Perez Ayucar NASA Ames Research Center Jet Propulsion Laboratory NASA Langley Research Center Aachen University ESA



Local Organizing Committee

Co-chairs:

Colin Wilson	University of Oxford
Steve Lingard	Vorticity Ltd
Sarah Griffey	Vorticity Ltd

IPPW-2020 Local Organising Committee

Aga Goodsell – Lead	NASA Ames Research Center
Sharon McKee	NASA Ames Research Center
David Cornelius	NASA Ames Research Center-Analytical Mechanics Associates, Inc
Helen Hwang	NASA Ames Research Center
Todd White	NASA Ames Research Center
Ethiraj Venkatapathy	NASA Ames Research Center



Oral and Poster presentations

FAQ

There is no set IPPW template for presentations. Feel free to use the template from your own organization or group. The presentations will be shown on projectors that are set for the traditional 4:3 aspect ratio.

Poster presenters are asked to put their poster number on the posters. This is the location where your poster will be. For example, if you have the order "A18", then that is your poster number. Poster presentation locations are on the website.

poster-session-i poster-session-ii

Posters by student presenters should have the words "student poster" marked on the poster so that it can be visible to reviewers

ORAL presenters

- Presentations are limited to **10 minutes** with 2 additional minutes for presenter introduction and questions. Session conveners will be strictly enforcing the 10 min time to keep the program running smoothly.
- 2. Presentations and accompanying material (e.g. videos) must be uploaded to the submission website no later than **Sunday**, **July 7th** (hard deadline).
 - 1. Go to <u>https://ippw.jpl.nasa.gov/</u> and sign in with your personal user credentials (same as used for abstract submission).
 - Upload your presentation material into the same "presentation folder" as your abstract. From the drop-down box, select what type of document you are uploading (oral presentation / poster / abstract / 1-slide / other for media files). Note that you may upload multiple files into your presentation folder.
 - 3. Please make certain to delete any obsolete file versions.
 - 4. Note that the system will automatically rename your files with consistent naming and assign them to the relevant session.
- 3. If you submit a paper, a preliminary version shall also be uploaded by July 7th in the same manner as described above. A paper template is available at: <u>https://ippw2019.uk</u>
- 4. One PC laptop, a projector, and a remote pointer will be available during the workshop sessions for oral talk presentations.
- 5. Ensure that your presentation displays all media files and graphics on a standard Windows laptop equipped with Microsoft Office and PDF reader.
- 6. You may include additional "backup" slides to briefly address anticipated questions and for archiving purposes. All presentations, with "backup" slides (if submitted), will be archived.
- 7. In order to facilitate a smooth transition between speakers, we will pre-load all files on the presentation computer. Your contact point for questions will be your session convener. Please review and verify the proper functioning of your files, at the following times on the day of your presentation:
 - 1. AM Presentations: 8:00 AM
 - 2. PM Presentations: 1:30 PM (Except on Monday when it is 2:30 PM)
 - 3. During breaks the days before your presentation



POSTER presenters

- Posters can be in portrait or landscape orientation, with maximum dimensions of size A0 (841 x 1189 mm). Poster boards will be provided. Pins will be provided to allow you to affix your poster to the board.
- 2. Poster Setup & Breakdown Times:
- 3. Tuesday Evening Presenters
 - Setup: Monday, July 8, starting at 8:00 am
 - o Breakdown: Tuesday, July 9, after the Tuesday Poster Session closes at 7:00pm
- 4. Thursday Evening Presenters
 - Setup: Wednesday, July 10, starting at 8:00 am
 - Breakdown: Friday, July 12, by 2:00 pm
- 5. Poster authors will be provided assigned locations for their posters. These instructions will be sent prior to the workshop.
- 6. Your poster file (as a PDF) and a one-slide introduction presentation must be uploaded to the submission website no later than **July 7th**(hard deadline).
- 7. Go to <u>https://ippw.jpl.nasa.gov/</u> and sign in with your personal user credentials (same as used for abstract submission).
- Upload your poster and your one-slide introduction presentation into the same "presentation folder" as your abstract. From the drop-down box, select what type of document you are uploading (oral presentation / poster / abstract / 1-slide / other for media files). Note that you may upload multiple files into your presentation folder.
- 9. Please make certain to delete any obsolete file versions.
- 10. Note that the system will automatically rename your files with consistent naming and assign them to the relevant session.
- 11. 1-slide introduction during the 1-min speech
 - 1. Each poster presenter will be allocated 1 minute to provide a very brief overview of their poster. Presenters may use no more than a single slide, either an explanatory brief narrative or the poster itself, to "advertise" their poster during their 1-minute presentation.
 - 2. In lieu of a 1-min introduction speech with your 1-slide presentation, you can upload a 1-min long video that will be shown instead of your 1-min speech.
 - 3. 1-min speech times will be strictly enforced due to the large number of poster introductions. In order to adhere to the allocated time, we will pre-load the 1-slide poster presentations to the workshop computer. Note, that due to the large number of posters, no last-minute updates to the poster presentations can be accommodated.
 - 4. Presenters are strongly urged to actually produce a 1-min presentation or video. Posters will not be displayed on the screen during the 1-min speech time
- 12. All posters should include: Poster title, Author name(s), Author institution(s), Institutional logo(s), and the abstract number near the top of your poster
- **13.**Local printing instructions: Posters can be printed locally at the Oxford Print Centre <u>oxford-print-centre.co.uk</u>. Mention IPPW-2019 when you order.



Abstracts

Abstracts for 2019 are available to download in pdf format via the Abstracts section of the ippw 2019 website. https://ippw2019.uk/index.php/abstracts/

Student Competition

The IPPW Student Organizing Committee invites you to cast your vote in the student paper and poster competition!

Shortly before 08:00 GMT on Monday, July 8, 2019, you will receive an email (in your conferenceregistered email inbox) from the IPPW SOC (ippwsoc@gmail.com), which contains a link to an electronic ballot. This ballot will be used to record audience scores for all student presentations and posters during IPPW 2019.To access the ballot, click the red "Access the Ballot" button in the email. To score the participants, choose either the "Paper Competition" or "Poster Competition" option, and press "Next". On either the paper or poster competition pages, select the name of the contestant from the drop-down menu and enter your score using the buttons provided. When you click "Next", your score will be saved, and you will be returned to the option selection page.

Each ballot is unique to your email ID, please do not forward this link to anyone. Further, you are allowed to alter your scores until you submit the ballot. You are allowed to skip participants in the ballot, but must go through the "Submit Your Ballot" option on the option selection page in order to have your scores considered. Please submit your ballot by noon GMT on Friday, July 12, 2019.

We thank you for your participation!



Al Seiff Award

The Alvin Seiff Memorial Award, presented annually at the International Planetary Probe Workshop, recognizes and honours a scientist, engineer, technologist, or mission planner for outstanding career contributions to the understanding of solar system atmospheres and/or planetary atmospheric flight utilizing probes and/or entry, descent and landed systems, and mentorship of the next generation of solar system explorers.

About the Award

The young researchers today will stand on the shoulders of the giants from the past to discover great things in the future.

An important element of the International Planetary Probe Workshops is to introduce, motivate and educate young people in the field of scientific studies of planetary atmospheres. Only by placing today's research activities in the proper historical context through recognizing, appreciating, and understanding the contributions of our predecessors and utilizing the experience and knowledge gained by past generations of explorers, can we define a framework for future explorations.

As solar system explorers, we are bound by our colleagues' achievements and are obligated to further this chain of scientific discovery to the next generation. This award and lecture is named for Seiff to celebrate his lifetime of dedication to the engineering, technology, and scientific studies of planetary atmospheres or atmospheric flight, and to provide young researchers who never had the chance to know him with the opportunity to learn how his work truly influences virtually every aspect of planetary exploration.

Selecting the 2019 Recipient of the Al Seiff Award

Anyone may nominate an exceptional candidate for this award. Members of the IPPW-2019 Al Seiff Award Committee evaluated the nominees, and recommended their candidate to the International Organizing Committee. The Al Seiff Award Committee for 2019 comprised five individuals: Miguel Pérez-Ayúcar (co-chair), David H. Atkinson (co-chair), Jim Arnold, Alicia Dwyer Cianciolo, and Julia Kowalski.

The selection process starts with a thorough review of the received nominee's packages, followed by several meetings and discussions among the committee members. Scoring metrics are used to assist the committee members in the assessment of the candidate's excellence, with respect to a set of key factors that reflect the Award motivation.

In 2019 the Award featured a new category "International participation and collaboration fostering" which was added to the metrics. It was felt that this is a key element of IPPW and for the Al Seiff Award, not included in the previous scoring metrics.

The scoring system is provided below, with weights for each category.



Factor	Range	Weight	Max Score
Contributions to projects and missions	0-10	2	20
(shorter duration)			
Impacts of total career's body of work (long	0-10	2.5	25
duration)			
Technical impacts (science/engineering)	0-10	2	20
International participation and	0-10	1	10
collaboration fostering			
Mentoring	0-10	1.5	15
Service to IPPW	0-10	1	10
TOTAL (MAX)	60	10	100

After final deliberations, the Committee unanimously selected and recommend *Dr Athena Coustenis*.



The 2019 Recipient: Athena Coustenis, Paris Observatory, Meudon, France

Athena Coustenis, Director of Research with the National Centre for Scientific Research (CNRS) of France at Paris Observatory

"In recognition of her career contributions to the advancement of outer solar system science, particularly atmospheres and surfaces of icy satellites in the outer solar system, for contributions to in situ and remote sensing exploration of Titan with the Huygens probe and the

Cassini orbiter, for her dedicated advocacy for future in situ missions to study outer solar system destinations, for all her efforts in organizing sessions and conferences that promoted planetary science at large, for her continued engagement of young researchers in planetary research programs, and for her active role in fostering international participation and collaboration."

2018 Recipient: Sushil K. Atreya, University of Michigan



Sushil K. Atreya, Professor of Climate and Space Sciences and Engineering & Director, Planetary Science Laboratory, University of Michigan. The Award will be presented to Professor Atreya at IPPW-2019.

"In recognition of his career achievements in advancing the knowledge of the origin, formation, and evolution of the solar system and solar system atmospheres, planetary atmospheric structure, chemistry, and cloud physics; developing and continued promotion of and advocacy for the concept of multiple probe missions to multiple

outer planets; and his significant contributions to developing the future generation of planetary explorers."



Previous Winners of the Alvin Seiff Memorial Award

2017 – Benton C. Clark, Lockheed Martin

In recognition of his exemplary contributions as a scientist and visionary in conceiving novel mission concepts, his perseverance in ensuring that his visions became reality by mentoring and leading the community of scientists, engineers, mission designers and instrument developers around the world is an enduring tribute to his legacy, and his critical contributions not only to every Mars Orbiter and Lander that Lockheed Martin build and delivered, but also to sample return missions beginning with Stardust and continuing with OSIRIS-REx.

2017 – Chul Park, Korea Advanced Institute of Science and Technology

In recognition of his exemplary contributions in atmospheric entry technology development, his work, through personal research and as a teacher, in the field of aerothermodynamics, has resulted in worldwide capabilities to predict entry environments and design vehicles for both robotic and human missions.

2016 - Rob Manning, Jet Propulsion Laboratory

Rob Manning has been deeply involved in in the technical design of nearly every US Mars mission that has occurred during the Mars Renaissance of the past 20 years. Rob's first foray into the world of interplanetary missions began in 1993 when he was appointed Chief Engineer for Mars Pathfinder and subsequently volunteered to lead Pathfinder's Entry Descent and Landing (EDL) team. From then on, Rob's career has followed the trajectory of the successful Mars program. Mars EDL problems are intense and demand a knowledgable team with a diverse set of disciplines and human talent; Rob's skill and team leadership have been well imprinted on NASA's Mars Exploration program.

2015 - Boris Ragent, NASA Ames Research Laboratory

In recognition of his outstanding contributions to our understanding of planetary atmospheres and cloud structure, including service as the Principal Investigator for the Pioneer Venus and Galileo Nephelometers, the Co-PI, with former Al Seiff award winner Jaques Blamont, of the VEGA Nephelometer, as well as significant mentoring and teaching of the next generation, including positions at Stanford and the University of California extension system.

2014 – Gentry Lee, Jet Propulsion Laboratory

In recognition of his outstanding contributions to Solar System exploration, including service as the Chief Engineer for Galileo, Director of Science Analysis and Mission Planning for Viking, engineering oversight of multiple missions including MER, Stardust and MSL, and significant mentoring and public outreach that has grown the planetary science and space technology community.

2013 - Dr. James Arnold, NASA Ames

In recognition of his 51 years of accomplishments in planetary entry, including pioneering work on shock layer radiation physics, re-entry aerothermodynamics, and thermal protection systems, his leadership of NASA Ames high enthalpy facilities and entry system technologies, and his mentorship of countless young engineers.



2013 – Prof. Mikhail Marov, Vernadsky Institute of Geochemistry

In recognition of his exemplary and unique contributions to planetary exploration, including taking the first direct measurements of the atmospheric pressures of Mars and Venus. Dr. Marov served as the PI or Co-PI of 15 different planetary probe instruments over a span of more than 30 years, and was the project scientist for 8 generations of Russia's Mars and Venus landers.

2012 - Dr. Robert Braun, University of Colorado Boulder (then at Georgia Tech)

In recognition of his extraordinary and on-going contributions to the field of planetary entry, descent and landing (EDL), including teaching a new generation of EDL system engineers, serving as the first NASA Chief Technologist in over a decade, and his leadership and engineering knowledge that have contributed greatly to all NASA Mars surface missions from Pathfinder to MSL.

2011 – Dr. Jean-Pierre Lebreton, CNRS

In recognition of his extraordinary contributions to the field of space exploration, including his service as a co-founder of the IPPW series, mentoring younger researchers and especially for his leadership that led to the spectacular success of the Cassini-Huygens probe mission to Titan, the IOC of the IPPW bestows the 2011 Alvin Seiff award upon Dr. Jean-Pierre Lebreton.

2010 – Dr. Martin Tomasko, University of Arizona

In recognition of seminal contributions to the development of instrumentation for in situ studies of planetary atmospheres, including the Venus atmosphere from the Pioneer multiprobe mission, the Jupiter atmosphere from the Galileo probe, and the Titan atmosphere from the Huygens probe, and for career achievements in the understanding of the composition, cloud structure, and heat balance of planetary atmospheres throughout the solar system, the IOC of International Planetary Probe Workshop bestows the 2010 Alvin Seiff award upon Dr. Martin Tomasko.

2010 - Mr. Michael Tauber, Eloret Corporation

In recognition of his contributions over the past fifty years as an Entry System Engineer, as a teacher and in developing concepts and successfully leading thermal protection systems (TPS) and entry system design of such missions as Galileo and Mars Pathfinder, the IOC of the International Planetary Probe Workshop bestows the 2010 Alvin Seiff award upon Mr. Michael E. Tauber.

2008 - Professor Jacques Blamont, University of Paris

In recognition of his contributions to the Pioneer-Venus and Vega Missions, the development of nephelometry and balloon technologies for atmospheric exploration, for decades of landmark scientific achievements and for his key contributions to establishing a European presence in modern solar system exploration.

2007 – Dr. Hasso B. Niemann, NASA Goddard Space Flight Center

In recognition of his contributions to the advancement of mass spectrometry technologies and the development and use of the techniques of gas chromatography and mass spectrometry to solar system exploration spanning the missions from PAET to Huygens.



Social Events throughout the week

At a glance...

	Day	Afternoon/Evening
Saturday 6 th July	Short Course – Day 1	Free Evening
Sunday 7 th July	Short Course – Day 2	<i>5:30 pm</i> Student Social Event Punting from Cherwell Boathouse followed by dinner at the Victoria Arms riverside pub. If the weather is unsuited to punting, the local committee will arrange for taxis to go directly to the Victoria Arms
Monday 8 th July	1:15 pm IPPW-2019 Dignitaries Luncheon – by invitation only The Pike Room at the Parsonage Dining Hotel	6:30 pm - Welcome Reception for all delegates at the Oxford University Museum of Natural History Main courses and puddings; wine and soft drinks.
Tuesday 9 th July	12 noon - Student Development Luncheon Earth Sciences Faculty	Free evening after the poster session.
Wednesday 10 th July	Pre-booked guided tours 2:00 pm departure Blenheim Palace ESA Harwell Space Cluster Oxford University Hypersonic Wind Tunnel	7:00 pm Formal Dinner, Keble College Dining Hall Four course menu served with wine and soft drinks. Keble bar will be open from 6pm
Thursday 11 th July	12 noon - Women's Networking Lunch Beecroft Foyer, the Physics Building	7:00 pm IOC Committee Dinner at the Oxford Vaults. Delegates have a free evening after the poster session.
Friday 12 th July	<i>1:30 pm</i> Student Organizing Committee Awards Ceremony	4:30 pm Julian Nott – a celebration of life. A short ceremony celebrating Julian's life will be held at St John's College Chapel followed by a Reception.



Sunday 7th July 2019



5:20pm onwards *Student Social Event*, Punting from Cherwell Boathouse followed by dinner at the Victoria Arms.

Punting has been a much loved feature of Oxford life since Victorian times, popular both with students and with visitors. For centuries, flat-bottomed boats had been used either for carrying cargo or for fishing, but it was not until the 1860s that the first

'pleasure punts' appeared. Its popularity grew quickly, not least because the Cherwell – shallow, slow-moving and largely free of other river traffic – proved an ideal setting.

Cherwell Boathouse, Bardwell Rd, Oxford OX2 6ST. The Cherwell Boathouse was built in 1904 by Thomas Tims, the University Waterman.

Victoria Arms, Mill Ln, Old Marston OX3 OQA. Known locally as the '**Vicky Arms**', the pub is frequented by people out punting during the summer. It is possible to moor punts in the grounds of the pub. An inn was originally constructed during the 17th century and was then rebuilt in 1840. It was closed in 1958 and bought by the Oxford Preservation Trust in 1961. Publicans Fred and Ruby Elkins took over the buildings and operated the pub as a Free House. During this time they added extensions to the old buildings. They also operated the small wooden line-ferry across the Cherwell for many years prior to the opening of the link road. It was later leased to the brewery Wadworth's, refurbished, and reopened in 1986.

Monday 8th July 2019



1:15pm *Dignitaries Lunch** at the Pike Room, The Old Parsonage Hotel, 1-3 Banbury Road Oxford OX2 6NN

*Invitations to the lunch will be issued by Bernie Bienstock.

The Old Parsonage has stood on the present site since 1660 when Edward Selwood, the prosperous chef of nearby St John's College, completed the original and principal part of the house, which he had begun twenty years earlier. The land on which Selwood built his house was owned by University College, one of Oxford's oldest seats of learning, which had bought the land as an endowment for their early scholars. The college has remained the ground landlord

for over six centuries. Lessees and occupiers of the Old Parsonage over the years represent a fascinating mixture of professions, crafts and trades including a master in Chancery to Edward IV, two Mayors of Oxford, a wig-maker, a sculptor, also maltsters and chefs.



6:30 pm *Welcome Reception* for all delegates. *The Oxford University Museum of Natural History*, Parks Rd, Oxford OX1 3PW. This event is sponsored by AMA, the Analytical Mechanics



Associates. A three-course menu served in bowls and drink will be served throughout the evening. This is a standing reception.

Oxford University Museum of Natural History was established in 1860 to draw together scientific studies from across the University of Oxford. Highlights in the collections include the world's first scientifically described dinosaur – Megalosaurus bucklandii – and the world-famous Oxford Dodo, the only soft tissue remains of the extinct dodo. The Museum is famous for hosting "a clash of ideologies... that became known as The Great Debate" one of the most controversial ideas of the 19th century – Charles Darwin's theory of evolution by natural selection.

Tuesday 9th July 2019

12:00 *Student Development Lunch*, Earth Sciences Faculty. Common Room and Balcony5:40 pm *Poster Session* at the Physics Building. Finger food and drinks will be served throughout the event.

Wednesday 10th July 2019

1:30pm – 5:45 pm Pre-Booked Guided Tours



Blenheim Palace, a designated World Heritage Site, Historic House and Gardens.

2:00 pm Coaches depart Physics Building for Blenheim Palace, Woodstock OX20 1PP

2:45 pm Arrive at the Palace. Free time to walk through the gardens and visit the cafes and souvenir shops

4:00 pm Private Guided Tour of the Palace5:00 pm Depart Blenheim for Oxford5:45 pm Coach arrives at Keble College

Blenheim Palace is the principal residence of the Dukes of Marlborough. The palace is named after the 1704 Battle of Blenheim. Designed in the rare, and short-lived, English Baroque style, architectural appreciation of the palace is as divided today as it was in the 1720s. It is unique in its combined use as a family home, mausoleum and national monument. The palace is notable as the birthplace and ancestral home of Sir Winston Churchill.

ESA Harwell Space Cluster, visit to RAL Space R100 Testing and Integration Facility; and Mars Yard



2:00pm Coach/taxis department Physics
Building for ESA Harwell, Fermi Avenue, Harwell
Campus, Didcot, OX11 0FD
2:45pm arrive at Harwell
3:00pm Guided tour of facilities
5:00pm Depart facilities
5.45 Arrive Oxford



ECSAT (European Centre for Space Applications and Telecommunications) is the European Space Agency's centre in the UK at Harwell. ECSAT supports European and Canadian industry in developing commercial satcom products and services, downstream applications and the 'spin-out' of space into non-space sectors.

Harwell is steeped in world firsts: from the discovery of the world's largest prime number, to the building of Europe's first energy producing fission reactor and the launch of the transistorised computer. Harwell is proud of its links with leading universities and the broader R&D community both in the UK and internationally.

RAL Space R100 Test and Integration Facilities - The facility has been created to meet the comprehensive and exacting needs of RAL Space customers and collaborators, provide capability for the needs of the next generation of spacecraft and instruments, and to contribute to the growing community of space focused businesses, capabilities and skills located at the Harwell Campus. The building has been designed with the requirements of testing for space in mind. This means that where possible facilities have been optimised for access and location within the building to reduce staff movements and increase access to the facilities customers require.

RAL Space Mars Yard - RAL Space's Autonomous Systems Group manages a small outdoor rover testing area. This is an open air space that, while not a close analogue for space applications like other Mars Yards, does allow for small-scale field testing and realistic shakedown tests for any ground robotic platform.

Oxford University Hypersonic Wind Tunnel facilities

Department of Engineering Science, Osney Mead Industrial Estate, Oxford, OX2 OES



2:00pm Coach/taxis
department Physics Building
2:15 pm Arrive Engineering
Science Labs for guided tour
3:15 pm Leave facility
3:30 pm Arrive Physics Building





7:00 pm Banquet at Keble College Dining Hall

A four course menu with wine and soft drinks will be served throughout the evening. The bar will be open from 6:00pm and will close at 11:30pm. Keble College is opposite the Physics Building.

The Hall, which was opened in 1878, is the longest in Oxford. It seats 300 diners. The College founders aimed to create an institution where an Oxford education could be made available for 'gentlemen wishing to live economically'. One stipulation was that all meals would be taken in common in the dining-hall, eliminating the private entertaining in undergraduates' rooms that was a chief feature of social life in other colleges.

Thursday 11th July 2019

1:00pm Women's Networking Lunch - Beecroft Foyer (Physics Building)

7:00pm International Organizing Committee Dinner*



University Church of St Mary the Virgin, The Vaults and Gardens

^{*}Invitations to the Dinner will be managed by Bernie Bienstock

Buffet dinner served with wine, beer and soft drinks.

The building housing the Vaults café was built in 1320 and housed the original meetings of the University's governing body; the upper

floor was the original site of the first collection of books which became the University's Library. The philosophy of the Vaults is to source local, organic and ethically produced goods and ingredients, coupled with "no waste" catering. The Vaults were awarded the "Most Sustainable Restaurant in Oxford" award by the Good Food Oxford network in 2016 and Best Oxford Café/Deli in 2017 by In Oxford magazine.

Friday 12th July 2019

1:00pm Student Organizing Committee Awards Ceremony

4:30pm Julian Nott - a celebration of life - St John's College Chapel, St Giles, OX1 3JP

A short ceremony celebrating Julian's life will be held at St John's College Chapel followed by a Reception. Those of you who wish to attend this event are asked to contact Hannes Griebel at hg@gmx.tw



Short Course Program

Ice Giants: Exciting Targets for Solar System Entry Probes Exploration

The International Planetary Probe Workshop (IPPW) Short Course will take place on the weekend preceding the IPPW conference, 6-7 July 2019, and will address the topic of in situ exploration of the ice giant planets.

The Course will be delivered in the Martin Wood Lecture Theatre, the same location as the Workshop.

Overview

Galileo and Cassini performed spectacular in situ investigations of Jupiter and Saturn, and Juno continues to explore the deep atmosphere of Jupiter. The remaining solar system atmospheres for which in-situ explorations have not been performed are the ice giants, Uranus and Neptune. In addition, the Kepler mission and microlensing surveys have shown that many exoplanets are ice giant sized. Therefore, Uranus and Neptune are the obvious and most scientifically important next step in giant planet atmosphere exploration. Fundamentally different from the gas giants Jupiter and Saturn, a comprehensive mission that includes an in-situ atmospheric element to study an ice giant offers enormous potential for new discoveries, as well as a valuable context for and an improved understanding of the formation, evolution, and current structure of the solar system and exoplanetary systems.

The 2013-2022 Decadal Survey specifically calls out the ice giants as key targets for future investigations, designating a Uranus orbiter and probe mission as the third highest priority following MAX-C (which has morphed into Mars 2020) as the initial step of the NASA-ESA Mars Sample Return campaign, and the Europa Project which comprises a Europa Orbiter, possibly followed by a Europa Lander. With Mars 2020 and the Europa mission well underway, it is hoped that the next step will be along the path leading towards a future ice giant mission.

The short course will comprise two days of presentations by experts in the field of solar system formation and evolution, giant planets and planetary atmospheres, in situ exploration of planetary atmospheres including science and instrumentation, technology requirements, and concepts for ice giant entry probe missions.

On day#1, the science of the ice giants, where the ice giants fit into the spectrum of solar system bodies that include the terrestrial planets and the gas giants, why it is important to explore the ice giants, science goals and objectives, relative benefits of exploring Uranus and Neptune, and the relationship to exoplanet studies will be addressed.

On the second day, the focus will shift to discussions on possible mission architectures, post-release techniques for coast, entry and descent, instrumentation to address the science goals, and ice giant probe technologies, with emphasis on specific challenges facing outer solar system probes, including power, thermal, and telecommunications.



Short Course Timetable 6th and 7th July 2019

	IPPW 2019 Conveners	Course: I David H	ce Giants: Exciting Targets for Solar System Entry Probes Exploration . Atkinson, Patrick Irwin, Tom Spilker	
	Saturday,	6 July: Inti	roduction/Background on Ice Giants, Policy, and Science	
	Time		Торіс	Presenter
	9:00	0.40	Registration	
Start 9:30	9:30	0.15	Welcome/Logistics; Introduction, Short Course Overview and Goals	Conveners
	9:45	0:45	Formation of the Giant Planets from Comparative Planetology and In Situ Exploration	Sushil Atreya
Coffee	18.35	336	Coffee Break	
	11:00	0:30	Ice Giant System Exploration - Historical Perspective: Voyager, HST, Earth-based observations. What do we know and how do we know it?	Ralph Lorenz
	11:30	0:45	Uranus and Neptune: formation, evolution & internal structure	Ravit Helled
Lunch	12:15	1.30	Lunch	
-	13:45	0:30	Ice Giant Magnetic Fields	Adam Masters
	14:15	0:30	Ice Giant Interiors	Tristan Guillot
	14:45	0:30	Ice Giant Atmospheres - Clouds and Dynamics	Peter Read
Coffee	15:15	0.30	Coffee Break	
	15:45	0:30	Ice Giant Exploration - Motivation and Science Objectives for In Situ Exploration; Tier 1 and Tier 2 science including question of depth.	Thibault Cavalie
	16:15	0:30	Remote sensing (orbiter, flyby, and Earth-based) to support in situ science	Thibault Cavalie
	16:45	0:15	Summary of state of Ice Giant Science, What is needed and where will Ice Giant exploration lead us? Questions, Discussion	Conveners
	17.00	0	Adjoum	
1		1		
	Sunday, 7	July: Tech	nologies, Instrumentation, and Mission Concepts	
	Time		Topic Technologies, Instrumentation, and Mission Concepts	
Start	9400	0-10	Second day introduction and outline	
	9-10	0:20	Trajectories - Probe delivery to atmosphere entry interface point; Probe targetting	Michael Khan
	9:30	0:30	Technologies - TPS and Entry Systems	Raj Venkatapathy
	10:00	0:30	Technologies - Probe Coast, Telecommunications (incl atmospheric effects), Power, Thermal, Structural	Kim Reh
Cottee	10:30	0.30	Coffee Break	
	11:00	0:30	Challenges and Options for Deep Atmospheric Measurements	Tom Spilker
	11:30	0:20	Instrumentation - Payload Selection Considerations	Andrew Ball
	11.50	0.00		47 . 43 . 4
	11:50	0:20	Instrumentation - Entry merbal measurements: probe attitude and trajectory determination and atmosphenic proble reconstruction.	Alessio Aboudan
Lunch	12.10	1.20	Lunch	
	13:30	0:20	Instrumentation - Composition I - MS	Peter Wurz
	13:50	0:20	Instrumentation - Composition II - TLS	Andrew Morse
	14:10	0:20	Instrumentation - Atmospheric Structure (ASI)	Francesca Ferri
	14:30	0:20	Instrumentation - Clouds and Aerosols / Nephelometer	Jean-Baptiste Renard
	14:50	0:20	Instrumentation - Dynamics (DWE)	Sami Asmar
	15:10	0:20	Acoustic Sensing and Hydrogen Spin (Ortho:Para)	Ralph Lorenz
Coffee	15.40	0.30	Coffee Break	
	16:00	0.20	Viewer Connector Califor Her Strend Bacher Southern Muhala Bacher	Kunia Samana
	10.00	0.20	Aussion Concepts - Gameorane, Saged Flodes, Sitiansais, Andappe Flodes	azono sajanagi
	16:20	0:20	Ramuncabons of 1ce Grant System Architectures for Mission Architecture Design	1 om Spilker
	16:40	0:20	Questions, Discussion, Wrapup, and Closing	Conveners
End	17:00		Adjourn	



IPPW-2019 Workshop Programme

Monday, 8th July 2019

Opening sess Bienstock	ion conveners: Ethiraj Venkatapathy, Miguel Perez Ayucar, and Bernie
9:00 AM	LOC Welcome Colin Wilson, University of Oxford; Steve Lingard, Vorticity
9:15 AM	IOC Welcome Bernie Bienstock, Jet Propulsion Laboratory, California Institute of Technology
9:30 AM	Al Seiff Award - 2018 and 2019 Miguel Perez Ayucar, Aurora Technology B.V. for ESA
9:40 AM	2018 Al Seiff Award Winner Lecture Sushil Atreya, University of Michigan, Keynote Speaker
10:10 AM	Coffee Break
10:35 AM	Introduction to the Keynote Address and Panel Discussion Ethiraj Venkatapathy, NASA Ames Research Center
10:38 AM	European Space Agency Program Discussion Luigi Colangeli, ESA, Keynote Speaker
11:12 AM	China's Deep-Space Exploration and Planetary Research in the Past, Current and in the Near Future <i>Chi Wang, National Space Science Center, Chinese Academy of Sciences,</i> Keynote Speaker
11:46 AM	Updates on NASA's Planetary Science Programs Carolyn R Mercer, NASA Headquarters, Keynote Speaker
12.20 PM	Brief Comments from UK Space Agency Chris Lee, UK Space Agency, Key Note Speaker
12:25 PM	Moderated Panel Ethiraj Venkatapathy, NASA Ames Research Center Robert Buchwald, Airbus Defence and Space
1:10 PM	Lunch

Science Instrumentation, Experiments, and In-Situ Measurements

Conveners: Manuel Dominguez, Rafael Lugo, Ryan Timoney, and Gregory Villar

In-situ planetary science measurements are fundamental to our understanding of the solar system. This session covers the development and implementation of past, present and future science and engineering instrumentation for spacecraft exploring planets, moons and small bodies. Abstracts for



probe and lander instruments for current and proposed missions (e.g. InSight, Mars2020, ExoMars 2020, Luna 27, Dragonfly, Europa, CAESAR, MMX/Phobos) as well as future opportunities (e.g. lunar surface instrumentation) are invited. This session will discuss the fundamental goals and challenges of instrumentation, practical limitations of data collection, and lessons-learned from past efforts.

2:35 PM	Poster Introductions
2:47 PM	The PanCam instrument for the Rosalind Franklin (ExoMars 2020) rover Andrew Coates, UCL Mullard Space Science Laboratory
2:59 PM	The Jet Propulsion Laboratory, California Institute of Technology Venus Aerosol Mass Spectrometer Concept Kevin Baines, Jet Propulsion Laboratory, California Institute of Technology
3:11 PM	Dragonfly: In Situ Exploration of Titan's Organic Chemistry and Habitability Elizabeth Turtle, Johns Hopkins Applied Physics Laboratory
3:33 PM	Coffee Break
3:58 PM	The Entry Descent and Landing Instrumentation Suite for the Mars 2020 Mission Todd White, NASA Ames Research Center
4:10 PM	Piezo-Electric Inlet System for Atmospheric Descent Probe Jurij Simcic, Jet Propulsion Laboratory, California Institute of Technology
4:22 PM	Exploring the Performance of a Miniature 3D Wind Sensor Under Extreme Martian Winds Up To The Dust Devil Scale Manuel Dominguez-Pumar, Technical University of Catalonia
4:34 PM	Assessing the Habitability of Icy Ocean Worlds Samuel Kounaves, Tufts University
4:46 PM	i-Drill: An Instrumented Drill for Lunar Polar Volatiles Ryan Timoney, University of Glasgow, Student
4:58 PM	Laser Nephelometer for In-Situ Particle Detection in Planetary Atmospheres Vandana Jha, NASA Ames Research Center
5:10 PM	ESA plans for Planetary Defense and Small Satellites Frederic Teston, Head of Systems Department, D/TEC Keynote Speaker
5:40 PM	Break
6:30 PM	Industry Reception at University of Oxford Natural History Museum, Sponsored by Analytical Mechanics Associates
9:30 PM	Event Closes



Tuesday 9th July 2019

Mars Exploration

Conveners: Ashley Korzun, David Mimoun, Michelle Munk, and Brooke Harper

This session will concentrate on current and proposed missions to Mars. Topics may include missions, science, technology, and systems dealing with the in situ exploration of Mars, such as landers, aerobraking, or entry probes. Contributions to this session can address aspects such as atmospheric science and environment characterization, robotic and human EDL, and sample return. The successful 2018 Mars InSight lander mission will be featured in this session.

8:30 AM	Poster Introductions
8:45 AM	InSight EDL Overview and As-Flown Performance Rob Grover, Jet Propulsion Laboratory, California Institute of Technology, Invited Speaker
8:57 AM	Mars InSight Trajectory and Atmosphere Reconstruction Chris Karlgaard, AMA, Inc. at NASA Langley Research Center, Invited Speaker
9:09 AM	Insight Approach Operations During Dust-Storm Season Eugene Bonfiglio, Jet Propulsion Laboratory California Institute of Technology, Invited Speaker
9:21 AM	Performance of the InSight Spacecraft During Entry, Descent, and Landing at Mars Mark Johnson, Lockheed Martin Space, Invited Speaker
9:33 AM	EDL Comm featuring MarCO CubeSat Performance Sanford Krasner, Jet Propulsion Laboratory, California Institute of Technology, Invited Speaker
9:45 AM	Simulation of InSight Plume Induced Surface Cratering and Validation Through Imagery Based 3D Topology Reconstruction Peter Liever, CFD Research Corp, Invited Speaker
9:57 AM	Comparison of the Reconstructed Entry, Descent, and Landing Phase of the InSight and Phoenix Mars Landers Aline Zimmer, Jet Propulsion Laboratory, California Institute of Technology, Invited Speaker
10·09 AM	Coffee Break
10:30 AM	Reconstruction of Schiaparelli and Comars Flight Data Aaron Brandis, AMA Inc at NASA Ames Research Center
10:42 AM	Mars 2020 Entry, Descent, and Landing Update Aaron Stehur, Jet Propulsion Laboratory, California Institute of Technology
10:54 AM	Mars 2020 EDL System Performance at Jezero Crater David Way, NASA Langley Research Center



11:06 AM	The Mars 2020 Lander Vision System: Architecture And V&V Results James Montgomery, Jet Propulsion Laboratory, California Institute of Technology/Caltech
11:18 AM	ExoMars 2020 Entry, Descent And Landing System John Underwood, Vorticity Ltd
11:30 AM	Systems Analysis of an Inflatable Entry Concept for Human Mars Mission Jamshid Samareh, NASA Langley Research Center
11:42 AM	Application of Direct Force Control to Human-Scale Mars Entry, Descent, and Landing Rafael Lugo, NASA Langley Research Center
11:54 AM	Lunch Student Development Career Lunch Event - Common Room and Balcony, Earth Sciences Faculty
1:30 PM	ESA Talk including discussion on ESA's contribution to Mars Sample Return David Parker, European Space Agency, Keynote Speaker
2:00 PM	Mars Sample Return - A reference campaign architecture for joint ESA-NASA studies and early mission concepts Sanjay Vijendran, European Space Agency
2:12 PM	Mars Sample Return: Sample Retrieval Lander Concept Overview Martin Greco, Jet Propulsion Laboratory, California Institute of Technology
2:24 PM	Mars Sample Return EDL Flight Performance Challenges And Mitigation Strategies Mark Ivanov, Jet Propulsion Laboratory, California Institute of Technology
2:36 PM	Poster Introductions
2:48 PM	Robotic Mars Sample Return Earth Entry Vehicle Concept Development Marcus Lobbia, Jet Propulsion Laboratory, California Institute of Technology
3:00 PM	HEEET Material Modeling and Earth Entry Vehicle Landing Analyses for Potential Mars Sample Return Aaron Siddens, Jet Propulsion Laboratory, California Institute of Technology
3:12 PM	Break the Chain and Containment Assurance Concepts for Mars Sample Return and Beyond
	Morgan Hendry, Jet Propulsion Laboratory, California Institute of Technology
3:24 PM	Mars Sample Return - Earth Return Orbiter: Design and Validation of a Guidance, Navigation and Control System for Martian Rendezvous Marc Chapuy, Airbus Defence and Space
3:36 PM	The DLR Sample Analysis Laboratory Joern Helbert DLR



3:48 PM Successes with Exo-Brake Development and Targeting for Future Sample Return Capability: TES-6, 7, 8 Flight Experiments *Marcus Murbach, NASA Ames Research Center*

4:00 PM Coffee Break

Innovative Concepts for Exploration

Conveners: Robert Dillman, Dmitriy Shutin, Gilles Bailet, and Siddharth Krishnamoorthy

This session present abstracts on new and innovative mission concepts, scientific instruments, and technologies for solar system exploration. Innovative concepts may discuss new techniques of studying solar system bodies or ways to reduce mission risk and/or life cycle costs. Mission concepts may be small probes that augment a primary spacecraft's mission, missions of opportunity, or standalone missions.

4:24 PM	Poster Introductions
4:36 PM	Deployable Aeroshell Technology For Small-Class Planetary Exploration Mission <i>Kazuhiko Yamada,</i> JAXA, <i>Invited Speaker</i>
4:48 PM	Dragonfly: In situ Terrain Relative Navigation for Titan Surface Exploration Kenneth Hibbard, Johns Hopkins Applied Physics Laboratory
5:00 PM	BioSats: Distributed Sensing of Venus' Atmosphere through Microprobes Katharina Hildebrandt, European Space Agency
5:12 PM	Swarm Navigation and Exploration for Planetary Surface Missions: Experimental Results Emanuel Staudinger, German Aerospace Center (DLR)
5:24 PM	Triple: Autonomous Subglacial Lake Exploration As A Stepping Stone Towards Icy Worlds Ocean Exploration Christoph Waldmann, University of Bremen/MARUM
5:40 PM	Tuesday Poster Sessions Science Instrumentation, Experiments, and In-Situ Measurements Mars Exploration Sample Return to Earth Innovative Concepts for Exploration
7:10 PM	Session closes



Wednesday 10th July 2019

Solar System Exploration I - Mercury, Venus, Giant Planets, and Titan

Conveners: Thibault Cavalie, Jacob Izraelevitz, Olivier Mousis

The focus of the Solar System Exploration Session is on planetary probe/lander exploration of Mercury, Venus, the gas and ice giant planets, and Titan. The giant planets represent time capsules from the epoch of solar system formation, and within the atmospheres and deep interiors of the giant planets, fingerprints can be found of the chemical and physical conditions at the time of solar system formation and the processes by which the giant planets formed and the solar system evolved. Venus and Titan, with dense atmospheres, complex atmospheric processes, and surface-atmosphere interactions, form natural laboratories to study similar phenomena on Earth. Additionally, the prospect of a putative subsurface ocean on Titan presents a potentially habitable environment has exciting implications for astrobiology and could offer important clues to answer fundamental questions regarding pre-biotic and biotic chemistries, and life. With the discovery on Mercury of surface organics (a building block for life), relatively young water ice in permanently shadowed craters, and abundances of magnesium and sulfur that exceed that of the other terrestrial planets, the surface of Mercury remains a mysterious and intriguing target.

The Solar System Exploration Session solicits papers addressing the science and science drivers, technologies, instrumentation, entry conditions, entry and deceleration systems, descent vehicle systems, and in-situ mission concepts for entry probe, lander, and aerobotic exploration of the extreme environments found at Mercury, Venus, the gas and ice giant planets, and Titan. Papers addressing lessons learned and results from previous missions are also welcomed.

8:30 AM	Poster Introductions

8:42 AM	The Decade of Venus: Revitalizing Exploration of our Sister Planet
	James Cutts, Jet Propulsion Laboratory, California Institute of Technology

- 8:54 AM Mercury Vapor Rankine Power Cycle For A Venus Surface Lander Christopher Greer, The Pennsylvania State University
- 9:06 AM Long-Duration Venus Probes and Landers Tibor Kremic, NASA Glenn Research Center
- 9:18 AM The Cupid's Arrow Mission Concept: Hypervelocity Sampling In The Upper Atmosphere of Venus Jason Rabinovitch, Jet Propulsion Laboratory, California Institute of Technology
- 9:30 AM Balloon-Borne Infrasound As A Remote Sensing Tool For Venus Progress In 2018 James Cutts, Jet Propulsion Laboratory, California Institute of Technology
- 9:42 AM Altitude-Controlled Balloon Concepts for Venus and Titan: Energy, Mass, and Stability Tradeoffs Jacob Izraelevitz, NASA Jet Propulsion Laboratory, California Institute of Technology
- 9:54 AM Coffee Break



10:18 AM	Advances in Mechanical Compression Altitude Control Balloon Technology for Venus and Titan <i>Maxim de Jong, Thin Red Line Aerospace</i>
10:30 AM	Sampling Titan'S Surface With Dragonfly Ralph Lorenz, Johns Hopkins Applied Physics Laboratory
10:42 AM	Study on ESA Contribution To NASA-Led Ice Giants Mission Gonzalo Saavedra Criado, European Space Agency
10:54 AM	The deep composition of Uranus and Neptune from mass spectrometry and thermochemical modeling <i>Thibault Cavalié , Laboratoire d'Astrophysique de Bordeaux</i>
11:06 AM	Key Atmospheric Signatures For Deciphering The Formation Conditions Of Uranus And Neptune In The Protosolar Nebula Thibault Cavalié , Laboratoire d'Astrophysique de Bordeaux
11:18 AM	Ice Giant Aerocapture Using Low-L/D Aeroshells: Uncertainty Quantification and Risk Assessment Athul Pradeepkumar Girija, Purdue University
11:30 AM	Atmospheric Link Science And Communications With Planetary Entry Probes Via Direct-To-Earth And Relay Radio Link Methods. Sami Asmar, Jet Propulsion Laboratory, California Institute of Technology
11:42 AM	The Challenges of Landing on Uncertain Terrain " Alejandro San Martin, Jet Propulsion Laboratory, California Institute of Technology
12:12 PM	Lunch Information about transport for the pre-booked tours will be announced at the lunch-break
2.00 PM	 Pre-booked Guided Tours depart: Blenheim Palace ESA Harwell Space Cluster Oxford University Hypersonic Wind Tunnel
5:00 PM	Return to Oxford
6.00 PM	Keble College Cash Bar opens

7:00 PM IPPW Banquet – Keble College Dining Hall



Thursday 11th July 2019

Entry, Descent, and Landing Technologies

Conveners: Tom West, Rodrigo Haya Ramos, Milad Mahzari, Karl Edquist, and Eric Stern

This session is focused on the engineering, physics, and technology of end-to-end EDL architectures, including landers, probes, and deployment of flight vehicles. Talks are welcome in, but not limited to, the fields of aerodynamic decelerators, parachutes, rigid/inflatable heat shields, aerothermodynamics, thermal protection systems (TPS), GN&C, aerobraking, retro-propulsion, phase transitions, touchdown/landing systems, and EDL instrumentation (e.g., aerothermodynamic sensor systems, sensors, hazard detection and avoidance, pinpoint landing, etc.). Discussion on new developments, cross-cutting, transversal or Earth demonstration is fostered.

- 8:30 AM Poster Introductions
- 8:45 AM Study of Neuromorphic Application Using Spiking Neural Network For Terrain Relative Navigation *Kazuki Kariya, The Graduate University for Advanced Studies* Student
- 8:57 AM Crater-based Optical Navigation Technologies for Lunar Precision Landing in SLIM Project Takayuki Ishida, JAXA
- 9:09 AM Map matching during descent for terrain relative navigation on Titan Larry Matthies, Jet Propulsion Laboratory, California Institute of Technology
- 9:21 AM Mars 2020 Hazard Map for Terrain Relative Navigation Richard Otero, Jet Propulsion Laboratory, California Institute of Technology
- 9:33 AM Onboard Autonomous Trajectory Planner: A guidance routine to assist in enabling pinpoint landing and in-flight trajectory analysis *Justin Green, NASA Langley Research Center*
- 9:45 AM Design Of The Pinpoint Landing GNC Of Space Rider Rodrigo Haya Ramos, SENER Aerospace

9:57 AM Coffee Break

- 10:18 AM An Uncoupled Range Control Approach to Fully Numerical Predictor-Corrector Entry Guidance Breanna Johnson, NASA Johnson Space Center
- 10:30 AM The SPLICE Project: Safe and Precise Landing Technology Development and Testing Jay Estes, NASA Johnson Space Center
- 10:42 AMStability Analysis and Control Design for a Deployable Entry Vehicle with
Aerodynamic Control Surfaces
Wendy Okolo, NASA Ames Research Center



10:54 AM	The Dragonfly Entry And Descent System Michael Wright, NASA Ames Research Center
11:06 AM	European Solutions for Heatshields of High Energy Entry Probes Jean-Marc Bouilly, ArianeGroup SAS
11:18 AM	Sustaining Phenolic Impregnated Carbon Ablator (PICA) for Future NASA Missions Including Discovery and New Frontiers Donald Ellerby, NASA Ames Research Center
11:30 AM	ADEPT Sounding Rocket One Flight Test Overview Alan Cassell, NASA Ames Research Center
11:42 AM	Technology Readiness Assessment For HEEET TPS Peter Gage, Neerim Corp at NASA Ames Research Center
11:54 AM	The Challenges of Seam Design in Tiled Thermal Protection Systems Cole Kazemba, NASA Ames Research Center
12:06 PM	Lunch Women's Networking Lunch, the Beecroft Foyer, Physics Building
1:34 PM	Damage Assessment during a Structural and Thermal Test Campaign of a 1-meter Diameter Heatshield with a 3-D Woven Thermal Protection System for Extreme Environments Sarah Langston, NASA Langley Research Center
1:46 PM	LOFTID Aeroshell System Overview Stephen Hughes, NASA Langley Research Center
1:58 PM	LOFTID Aeroshell Engineering Development Unit Structural Testing Greg Swanso , NASA Ames Research Center
2:10 PM	Retro Propulsion Assisted Landing Technologies (RETALT) Ali Guelhan, DLR e.V.
2:22 PM	Designing A Supersonic Retropropulsion Test For The NASA Langley Unitary Plan Wind Tunnel Karl Edquist, NASA Langley Research Center
2:34 PM	Experimental Investigation of Magnetohydrodynamic Energy Generation in Conditions and Configurations Relevant to Planetary Entry Hisham Ali, Georgia Institute of Technology, Student
2:46 PM	Design And Qualification Testing Of Two European Parachute Mortars for the ESA ExoMars 2020 Mission Rudi Matthijssen, APP-ArianeGroup
2:58 PM	Coffee Break



Solar System Exploration II – Airless Planetary Satellites, Asteroids, and Comets

Conveners: Aline Zimmer, Christian Grimm, Michelle Rodio, and Benoit Pigneur

This session focuses on the in situ exploration of the Earth's moon, other airless planetary satellites (examples include but are not limited to Europa, Ganymede, Enceladus, and Triton), as well as small solar system bodies characterized by weak gravitational fields such as asteroids and comets. The session covers scientific goals, mission concepts, mission and flight system elements, operations strategies, and payload capabilities for current projects, concepts for future missions, and lessons learned from past missions.

3:22 PM	Poster Introductions
3:34 PM	Europa Lander Mission Concept Overview and Update Steve Sell, Jet Propulsion Laboratory, California Institute of Technology
3:46 PM	A New Mission Concept for Further Exploration of Enceladus Stephanie Mottershead, University College London, Student
3:58 PM	Surface Accessibility with Vertical Controlled Landing on 67P / Churyumov- Gerasimenko Alena Probst, Bundeswehr University Munich, Student
4:10 PM	Juventas - Attempting to Land a CubeSat on Didymoon for the Hera Mission Hannah Goldberg, GomSpace
4:22 PM	Moon Diver: A Discovery Mission Concept For The Exploration Of A Lunar Pit In Mare Tranquillitatis Richard Kornfeld, Jet Propulsion Laboratory, California Institute of Technology
4:34 PM	HERACLES - Human-Enhanced Robotic Architecture and Capability for Lunar Exploration and Science Robert Buchwald, Airbus
4:46 PM	Overview of NASA's Human Landing System for Lunar Exploration Alicia Dwyer Cianciolo, NASA Langley Research Center
4:58 PM	Technology Investments At The Moon To Enable Entry, Descent, And Landing For Humans At Mars Alicia Dwyer Cianciolo, NASA Langley Research Center
5:10 PM	ExoMars 2020 - Rosalind Franklin Rover Integration and Test Status Dave Pecover, Airbus UK Keynote Speaker
5:40 PM	Poster Session
7:10 PM	IOC Dinner – by invitation only



Friday 12th July 2019

Modeling, Simulation, Testing, and Validation

Conveners: Clara O'Farrell, Michael Wright, Julia Kowalski, Al Witkowski, and Aaron Stehura

This session will focus on modeling and simulation advancements for planetary probes including: entry, descent and landing, computational fluid dynamics (CFD), guidance, navigation and control (GNC), materials and thermal protection systems (TPS) modeling, decelerator systems, surface operations, integrated/optimized capabilities, and related disciplines. Current work in testing and demonstration techniques, model validation, and diagnostics, are also a major component of this session. Work that is advancing the state-of-the-art of the current scientific theories, capabilities or technologies, or comparing or leveraging both testing and computational models including datadriven modeling, is especially relevant. Preference for talks should be regarding the application of models, simulations, ground testing, flight tests, and validation directly related to entry, descent, and landing missions and proposals instead of general model development.

8:30 AM	Further Aerodynamic Characterization of the ESA Huygens Probe and its Appendages: A Combined Testing and Modeling Approach Simon Couche, Polytech Orleans - University of Orleans
8:42 AM	Dragonfly: Modeling, Testing, and Validation for Atmospheric Flight on Titan Douglas Adams, Johns Hopkins Applied Physics Laboratory
8:54 AM	Integrated Modeling And Simulation Of Autonomous Parafoil Descent On Titan Larry Matthies, Jet Propulsion Laboratory, California Institute of Technology
9:06 AM	Static and Dynamic Testing Of Blunt Bodies in A Subsonic Magnetic Suspension Wind Tunnel Mark Schoenenberger, NASA Langley Research Center
9:18 AM	Recent Developments in Free-Flight CFD Joseph Brock, AMA Inc. at NASA Ames Research Center
9:30 AM	Plume-Surface Interaction (PSI): A New (Old) Challenge for Descent and Landing Michelle Munk, NASA STMD
9:42 AM	Application of Petascale Computing to Simulation of Powered Descent in Atmospheric Environments Ashley Korzun, NASA Langley Research Center
9:54 AM	Coffee Break
10:18 AM	Reconstructed Disk-Gap-Band Parachute Performance During the Third ASPIRE Supersonic Flight Test Christopher Tanner, Jet Propulsion Laboratory, California Institute of Technology
10:30 AM	ADEPT SR-1 Flight Test Performance Summary Soumyo Dutta, NASA Langley Research Center



10:42 AM	Aeroheating Tests of Hayabusa Sample Return Capsule In Shock Tunnel And Expasion Tube Hide Tanno, JAXA Kakuda
10:54 AM	Challenges In Qualification Of Thermal Protection Systems In Extreme Entry Environments <i>Milad Mahzari, NASA Ames Research Center</i>
11:06 AM	Progress towards Modeling the Mars Science Laboratory Pica-Nusil Heatshield Brody Bessire, NASA Ames Research Center
11:18 AM	Preliminary Results from Shock-layer Radiation Experiments in the T6 Aluminium Shock Tube Peter Collen, University of Oxford
11:30 AM	Current Status of Shock Layer Radiation Studies for Planetary Probes Brett Cruden, AMA Inc. at NASA Ames Research Center
11:42 AM	Mars 2020 EDL System Test Design and Progress Mallory Lefland , Jet Propulsion Laboratory, California Institute of Technology
11:54 AM	Validation of the Mars 2020 Dsends Simulation Of Entry, Descent, And Landing Using MSL Reconstruction Data Clara O'Farrell Jet Propulsion Laboratory, California Institute of Technology

12:06 PM Lunch

Closing Session - Conveners: Pat Beauchamp and Jean-Pierre Lebreton

1:30 PM	SOC Awards Ceremony
1:42 PM	Decadal Survey Bernie Bienstock, Jim Cutts, Pat Beauchamp Jet Propulsion Laboratory, California Institute of Technology
1:57 PM	White Papers For The Next Decadal Survey: Thermal Protection Systems And Instrumentation <i>Helen Hwang, NASA Ames Research Center</i>
2:07 PM	Insight Overview Tom Hoffman, Jet Propulsion Laboratory, California Institute of Technology
2:37 PM	Silicon Seismometers, from Mars to Europa and Beyond Tom Pike, Imperial College London
3:10 PM	IPPW-2020 Aga Goodsell, NASA Ames Research Center & David Cornelius, AMA Inc. at NASA Ames Research Center



- 3:25 PM IOC Closing Remarks Bernie Bienstock, Jet Propulsion Laboratory, California Institute of Technology
- 4.15PM Julian Nott: A celebration of Life, St John's College Chapel



Poster Presentations

Poster Session I - Tuesday 9th July 2019

Order	1-min	1-min Presentation	Part of which	Title	Name	Affiliation	Status
	Order	 before what 	Session				
		Session					
A1		Science	Science	INES-a flexible and innovative payload for	Gilles Bailet	CentraleSupélec	
	I.1.	Instrumentation,	Instrumentation,	measuring radiation in the presence of			
		Experiments,	Experiments, and	ablation			
		and In-Situ	In-				
		Measurements	Situ Measurements				
A2	1.2	Science	Science	Laboratory-Based Thermal Shock Investigation of	Ruth Miller	AMA Inc. at NASA	
		Instrumentation,	Instrumentation,	Heat Flux Sensors for the Mars 2020 Backshell		Ames Research	
		Experiments,	Experiments, and			Center	
		and In-Situ	In-				
		Measurements	Situ Measurements				
A3	1.3	Science	Science	The LONSCAPE (Light Optical Nephelometer Sizer	Jean-Baptiste	LPC2E-CNRS	
		Instrumentation,	Instrumentation,	and Counter for Aero-sols in Planetary	Renard		
		Experiments,	Experiments, and	Environments) instrument: concept and application			
		and In-Situ	In-	for the in situ detection of liquid and solid particles			
		Measurements	Situ Measurements				
A4	1.4	Science	Science	GeMini Plus: Preparing the Way for Future	John Goldsten	Johns Hopkins	
		Instrumentation,	Instrumentation,	Planetary Elemental Composition		Applied Physics	
		Experiments,	Experiments, and	Measurements Throughout the Solar System Using		Laboratory	
		and In-Situ	In-	Gamma-Ray Spectroscopy			
		Measurements	Situ Measurements				
A5	1.5	Science	Science	High Temperature Operation of Gallium Nitride	Hannah Alpert	Stanford University	Student
		Instrumentation,	Instrumentation,	Hall-Effect Sensors			
		Experiments,	Experiments, and				
		and In-Situ	In-				
		Measurements	Situ Measurements				
A6	1.6	Science	Science	An Energetic Particle Monitor for Ice Giant	Nicolas Andre	IRAP, CNRS, UPS,	
		Instrumentation,	Instrumentation,	Atmospheric Probes		CNES	
		Experiments,	Experiments, and				
		and In-Situ	In-				



Order	1-min	1-min Presentation	Part of which	Title	Name	Affiliation	Status
	Order	 before what 	Session				
		Session					
		Measurements	Situ Measurements				
A7	1.7	Science	Science	Radio Science from Venus Probe/Lander Mission	Robert Frampton	Boeing	
		Instrumentation,	Instrumentation,				
		Experiments,	Experiments, and				
		and In-Situ	In-				
		Measurements	Situ Measurements				
A8	II.1	Mars Exploration	Mars Exploration	InSight's Reconstructed Aerothermal Environments	Jarvis Songer	Lockheed Martin	
						Space	
A9	11.2	Mars Exploration	Mars Exploration	Reconstruction of the Performance of Mars InSight	Ian Clark	Jet Propulsion	
				Lander's Supersonic Parachute		Laboratory,	
						California Institute	
						of Technology	
A10	11.3	Mars Exploration	Mars Exploration	Landing Radar Performance Reconstruction for	Dave Eckart	Lockheed Martin	
				Entry, Descent, and Landing of the		Space	
				InSight Mars Lander			
A11	11.4	Mars Exploration	Mars Exploration	InSight Entry, Descent and Landing Operations	Julie Wertz Chen	Jet Propulsion	
				Overview		Laboratory,	
						California Institute	
						of Technology	
A12	11.5	Mars Exploration	Mars Exploration	InSight Entry, Descent, And Landing Post-Flight	Carlie Zumwalt	NASA Langley	
				Simulation Assessment		Research Center	
A13	11.6	Mars Exploration	Mars Exploration	InSight Landing Safety Assessment During Approach	Evgeniy	Jet Propulsion	
					Sklyanskiy	Laboratory,	
						California Institute	
						of Technology	
A14	11.7	Mars Exploration	Mars Exploration	Trajectory Analysis of the ExoMars Schiaparelli	Emma Johnstone	Fluid Gravity	
				Descent Probe		Engineering	
A15	11.8	Mars Exploration	Mars Exploration	Challenges For Mars 2020 EDL At The Jezero Crater	Erisa Stilley	Jet Propulsion	
				Landing Site		Laboratory,	
						California Institute	
						of Technology	
A16	11.9	Mars Exploration	Mars Exploration	AMELIA: The EDL Science Experiment For The Entry	Francesca Ferri	CISAS - Univ.	
				And Descent Module Of The		Padova	



Order	1-min Order	1-min Presentation	Part of which	Title	Name	Affiliation	Status
	order	Session	56351011				
				EXOMARS 2020 Mission			
A17	II.10	Mars Exploration	Mars Exploration	Modelling Sensitivities and Knowledge Gaps Associated with Mars-atmosphere Destructive Entry Applied to Planetary Protection	James Merrifield	Fluid Gravity Engineering	
A18	II.11	Mars Exploration	Mars Exploration	Aerothermal Analysis and Thermal Protection System [TPS] Design of the Mars Sample Retrieval Lander [SRL] Concept	Suman Muppidi	AMA Inc. at NASA Ames Research Center	
A19	II.12	Mars Exploration	Mars Exploration	ExoMars Rover and Surface Platform Mission: Technical Status	Andrew Ball	European Space Agency ESTEC	
A20	.1	Sample Return to Earth	Sample Return to Earth	A Dynamic Topology Optimization Method for Sizing Internal Components of the Potential Mars Sample Return Earth Entry Vehicle	Cameron Grace	University at Buffalo	Student
A21	111.2	Sample Return to Earth	Sample Return to Earth	Implementing CubeSat Avionics Components to Full-Scale Capsule Return Missions	Zachary Hughes	San Jose State University	Student
A22	III.3						
A23	111.4	Sample Return to Earth	Sample Return to Earth	Structural Analysis of Impact-Tolerant Latched Containment Mechanisms for Mars Sample Return	Emma Shupper	Jet Propulsion Laboratory, California Institute of Technology	
A24	111.5	Sample Return to Earth	Sample Return to Earth	High Velocity Impact Performance of a Dual Layer Thermal Protection System for the Mars Sample Return Earth Entry Vehicle	Benjamin Libben	NASA Ames Research Center	
A25	IV.1	Innovative Concepts for Exploration	Innovative Concepts for Exploration	TOUTATIS-Ex: A CubeSat testbed for entry experiments on Mars	Chloe Gentgen	CentraleSupélec	Student
A26	IV.2	Innovative Concepts for Exploration	Innovative Concepts for Exploration	Lunar Gateway LASC Module for Innovative Concepts for Exploration: A Laserpowered Apparatus for Satellite Charging	Brandon Biggs	San Jose State University	Student
A27	IV.3	Innovative Concepts for Exploration	Innovative Concepts for Exploration	Virtual Validation and Verification of the VaMEx Initiative	Philipp Dittmann	University of Bremen	Student
A28	IV.4	Innovative	Modeling,	Aerodynamic heating estimation of deployable	Tomoya Kazama	Tokyo University of	Student



Order	1-min	1-min Presentation	Part of which	Title	Name	Affiliation	Status
	Order	 before what 	Session				
		Session					
		Concepts for	Simulation, Testing,	inflatable aeroshell for Martian penetrator entry		Science	
		Exploration	and Validation	system			
A29	IV.5	Innovative	Modeling,	Modal Analysis of the Orion Capsule Two Parachute	Jing Pei	NASA Langley	
		Concepts for	Simulation, Testing,	System		Research Center	
		Exploration	and Validation				
A30	IV.6	Innovative	Modeling,	Multi-Fidelity Modeling for Efficient Aerothermal	Mario Santos	Missouri University	Student
		Concepts for	Simulation, Testing,	Prediction of HIAD Configurations with Surface		of Science and	
		Exploration	and Validation	Scalloping		Technology	
A31	IV.7	Innovative	Modeling,	Deployable Mars Aero-Decelerators: Rib	Lisa Peacocke	Imperial College	Student
		Concepts for	Simulation, Testing,	Deformation Modelling and Testing		London / Airbus	
		Exploration	and Validation				
A32	IV.8	Innovative	Modeling,	Modeling Thermal and Fluid Response of MMOD	Olivia Schroeder	University of	Student
		Concepts for	Simulation, Testing,	Impacted Thermal Protection Systems		Minnesota	
		Exploration	and Validation				
A33	IV.9	Innovative	Solar System	Enceladus Lander Mission Concept	Leora Peltz	Boeing	
		Concepts for	Exploration II -				
		Exploration	Airless Planetary				
			Satellites,				
			Asteroids, and				
			Comets				



Poster Session II - Thursday 11th July 2019

Order	1-min	1-min Presentation –	Part of which Session	Title	Name	Affiliation	Status
	Order	before what Session					
B1	V.1	Solar System	Solar System Exploration	Altitude Control Balloon Testbed	Jasper Thomas	Camosun College	Student
		Exploration I -	I - Mercury,	For Planetary Atmospheres			
		Mercury,	Venus, Giant Planets,				
		Venus, Giant Planets,	and Titan				
		and Titan					
B2	V.2	Solar System	Solar System Exploration	Investigation Of Suggested	Denise Lainez	San Jose State	Student
		Exploration I -	I - Mercury,	Atmospheric Microbes On Venus		University	
		Mercury,	Venus, Giant Planets,	And Similarities With Earth's			
		Venus, Giant Planets,	and Titan	Atmosphere			
	14.2	and litan					
B3	V.3	Solar System	Solar System Exploration	venus cloud village: An EDL	Stephen Hunt	University of	Student
		Exploration I -	I - Mercury,	Sequence For Bringing Humans To		Southern	
		Mercury,	venus, Glant Planets,	The venusian Atmosphere		California	
		venus, Glant Planets,	and litan				
D.4	N/ 4	and Illan	Color Custore Fueleration	A Comparent Margatile Net Elun	Chabid Aslam	NACA Caddard	
В4	V.4	Soldr System		A compact, versatile Net Flux	Shaniu Asiam	NASA, GOUUdru	
		Exploration 1 -	Vonus Ciant Planets	Radiometer for ice Glant Probes		Space Flight	
		Vonus Giant Planots	and Titan			Center	
		and Titan					
B5	V 5	Solar System	Solar System Exploration	Science Drivers And Measurement	Kandi Jessun	Southwest Research	
55	V.5	Exploration I -	I - Mercury.	Targets For The In-Situ Study Of	Kulturisessup	Institute	
		Mercury.	Venus, Giant Planets,	Venus' Unidentified Cloud			
		Venus. Giant Planets.	and Titan	Absorber			
		and Titan					
B6	V.6	Solar System	Solar System Exploration	Latitudinal variation in abundance	Patrick Irwin	University of Oxford	
		Exploration I -	I - Mercury,	of hydrogen sulphide and			
		Mercury,	Venus, Giant Planets,	methane in the atmospheres of			
		Venus, Giant Planets,	and Titan	Uranus and Neptune: Implication			
		and Titan		for future entry probes			
B7	V.7	Solar System	Solar System Exploration	Investigation of Aerocapture G&C	Benjamin Tackett	AMA Inc. at NASA	
		Exploration I -	I - Mercury,	for Ice Giants Missions		Langley Research	
		Mercury,	Venus, Giant Planets,			Center	



Order	1-min	1-min Presentation –	Part of which Session	Title	Name	Affiliation	Status
	Order	before what Session					
		Venus, Giant Planets,	and Titan				
		and Titan					
B8	V.8	Solar System	Solar System Exploration	The Annwn Probe: A Scalable Titan	David Davies	UCL/MSSL	Student
		Exploration I -	I - Mercury,	Mission Concept for Tracking the			
		Mercury,	Venus, Giant Planets,	Hydrocarbon Cycle			
		venus, Glant Planets,	and Ittan				
DO	1/1.1	driu ritari	Fata Decent and			ControloCurcíloo	Chudout
В9	VI.1	Entry, Descent, and	Entry, Descent, and	SERENADE-EX: an entry capsule	Tanguy Krzymuski	CentraleSupelec	Student
		Lanung rechnologies	Landing rechnologies	Martian atmosphere and to			
				provide flight data			
B10	VI 2	Entry Descent and	Entry Descent and	AeroDrop: Dual Aerocapture-Entry	Samuel Albert	University of	Student
510		Landing Technologies	Landing Technologies	Architecture for Multiple		Colorado, Boulder	••••••
				Spacecraft Missions			
B11	VI.3	Entry, Descent, and	Entry, Descent, and	Obstacle Avoidance With	Padraig Lysandrou	University of	Student
		Landing Technologies	Landing Technologies	Sequential Convex Optimal		Colorado, Boulder	
				Powered Descent Guidance			
B12	VI.4	Entry, Descent, and	Entry, Descent, and	Optimal Lift and Drag Modulation	Nicklaus Richardson	University of Illinois	Student
		Landing Technologies	Landing Technologies	Hypersonic Control Options for		at Urbana-	
				High Ballistic Coefficient Entry		Champaign	
				Vehicles at Mars			
B13	VI.5	Entry, Descent, and	Entry, Descent, and	Atmospheric Neural Net	Shayna Hume	University of	Student
		Landing Technologies	Landing Technologies	Application To Martian Entry,		Colorado, Boulder	
D14	N/I C	Fata Decent and	Fata Decent and	Descent, And Landing	Devialle O'Drissell	Immerial Callega	Chudout
B14	VI.6	Entry, Descent, and	Entry, Descent, and	Deployable Martian Aero-	Danielle O Driscoli	Imperial College,	Student
		Lanung rechnologies	Landing rechnologies	TPS Folding Concent		LUHUUH	
B15	VI 7	Entry Descent and	Entry Descent and	Analytical Assessment Of	Michelle McClary	University of Illinois	Student
010	•,	Landing Technologies	Landing Technologies	Hypersonic Separation Dynamics	interience integrary	at Urbana-	otadent
				For Drag Modulation Systems		Champaign	
B16	VI.8	Entry, Descent, and	Entry, Descent, and	Supersonic Retro-Propulsion For	Kieran Montgomery	Imperial College,	Student
		Landing Technologies	Landing Technologies	Launch Vehicle Stage Recovery		London	
				And Entry, Descent And Landing			
				Applications			



Order	1-min Order	1-min Presentation – before what Session	Part of which Session	Title	Name	Affiliation	Status
B17	VI.9	Entry, Descent, and	Entry, Descent, and	An Accessory Minimization	Casey Heidrich	University of	Student
		Landing Technologies	Landing Technologies	Problem for Robust Numerical		Colorado, Boulder	
				Predictor-Corrector Aerocapture			
				Guidance			
B18	VI.10	Entry, Descent, and	Entry, Descent, and	Operations Plans for the LOFTID 6-	Robert Dillman	NASA Langley	
		Landing Technologies	Landing Technologies	meter HIAD Flight Demonstration		Research Center	
B19	VI.11	Entry, Descent, and	Entry, Descent, and	Scalable Non-Propulsive Dynamic			
		Landing Technologies	Landing Technologies	Mass-Shifting Control System For			
				Entry, Descent, And			
				Landing Systems			
B20	VI.12	Entry, Descent, and	Entry, Descent, and	Analysis of Tip-Off Rates During	Annika Rollock	University of	
		Landing Technologies	Landing Technologies	Discrete-Event Drag Modulation		Colorado, Boulder	
				for Venus Aerocapture			
B21	VI.13	Entry, Descent, and	Entry, Descent, and	Flight Control Techniques for	Rohan Deshmukh	Purdue University	Student
		Landing Technologies	Landing Technologies	Optimal Aerocapture Guidance			
B22	VII.1	Solar System	Solar System Exploration	Science investigations of small	Ozgur Karatekin	Royal Observatory of	
		Exploration II - Airless	II - Airless	solar system bodies with a landed		Belgium	
		Planetary Satellites,	Planetary Satellites,	CubeSat platform			
		Asteroids, and Comets	Asteroids, and Comets				
B23	VII.2	Solar System	Solar System Exploration	Icy Moon Sub-Surface Probe	Daniel Kramer	University of Dayton	
		Exploration II - Airless	II - Airless	Radioisotope Heat Source			
		Planetary Satellites,	Planetary Satellites,	Considerations			
		Asteroids, and Comets	Asteroids, and Comets				
B24	VII.3	Solar System	Solar System Exploration	Sample Return from a Relic Ocean	Lucy Kissick	University of Oxford	Student
		Exploration II - Airless	II - Airless	World: the Calathus Mission to			
		Planetary Satellites,	Planetary Satellites,	Occator Crater, Ceres			
		Asteroids, and Comets	Asteroids, and Comets				
B25	VII.4	Solar System	Modeling, Simulation,	Maturation of Heatshield for	Joseph Williams	AMA Inc. at NASA	
		Exploration II - Airless	Testing, and	Extreme Entry Environment		Ames Research	
		Planetary Satellites,	Validation	Technology (HEEET) through		Center	
		Asteroids, and Comets		Extreme Aero-thermal Ground			
				Testing at Arnold Engineering			
				Development Complex (AEDC)			
B26	VII.5	Solar System	Modeling, Simulation,	Heatshield Entry Modeling Using A	Jeremie Meurisse	STC at NASA Ames	



Order	1-min	1-min Presentation –	Part of which Session	Title	Name	Affiliation	Status
	Order	before what Session					
		Exploration II - Airless	Testing, and	Design, Analysis, And Optimization		Research Center	
		Planetary Satellites,	Validation	Toolbox			
		Asteroids, and Comets					
B27	VII.6	Solar System	Modeling, Simulation,	Hypersonic Flows in	Monal Patel	Imperial College	Student
		Exploration II - Airless	Testing, and	Thermochemical Nonequilibrium		London	
		Planetary Satellites,	Validation	with Immersed Boundary Method			
		Asteroids, and Comets		and Adaptive Mesh Refinement			
B28	VII.7	Solar System	Modeling, Simulation,	Comparison of Chemical Kinetic	Alex Carroll	University of	Student
		Exploration II - Airless	Testing, and	Models for Aerothermal		Michigan - Ann Arbor	
		Planetary Satellites,	Validation	Simulations of Entry into Gas			
		Asteroids, and Comets		Giants			
B29	VII.8	Solar System	Modeling, Simulation,	Commissioning of the Oxford T6	Suria Subiah	Oxford University	Student
		Exploration II - Airless	Testing, and	Stalker Tunnel in Reflected Shock			
		Planetary Satellites,	Validation	Tunnel Mode			
		Asteroids, and Comets					
B30	VII.9	Solar System	Modeling, Simulation,	Status Of Global Reference	Hilary Justh	NASA Marshall Space	
		Exploration II - Airless	Testing, and	Atmospheric Model (GRAM)		Flight Center	
		Planetary Satellites,	Validation	Upgrades			
		Asteroids, and Comets					
B31	VII.10	Solar System	Modeling, Simulation,	Development of Patch Integral	Jon Cheatwood	Virginia Tech	Student
		Exploration II - Airless	Testing, and	Method for Hypersonic Thermal			
		Planetary Satellites,	Validation	Imaging Analysis			
		Asteroids, and Comets					
B32	VII.11	Solar System	Modeling, Simulation,	DSMC Simulation Of Hypersonic	Sahadeo Ramjatan	University of	Student
		Exploration II - Airless	Testing, and	Flow Over TPS Microstructures		Minnesota	
		Planetary Satellites,	Validation				
		Asteroids, and Comets					