

A brief on IAC2021: Inspire, Innovate and Discover For the Benefit of Humankind

Samar AbdelFattah

Principium Contributing Editor Samar AbdelFattah was the i4is representative at the 2021 International Astronautical Congress (IAC21) in Dubai. Reports on interstellar papers given at the Congress are in our last issue and this one. Here Samar gives us her impressions of the event.

IAC2021 was a source of inspiration for all. From the desert of the UAE, where for the first time in history, the IAC is happening in the Middle-East, to this year's programme addressing the commercialization of space exploration and the expected unique growth in the space industry. Driven by this vision, the scheme of IAC this year focused on space exploration, towards the Moon, to Mars and beyond our Solar System. In addition to the potential and expansion of commercial space services, another critically important topic was discussed this year, which is the use of space exploration to study climate change and Earth sustainability. As a result, sustainable space utilization was one of the essential components in most use cases and missions outlined. Whether it's an LEO satellite, lunar or Martian exploration, or even an interstellar mission, sustainability was a key

element to measure the expected success or even the audience interest in the discussed mission or project. In this article, we covered the relevant interstellar topics that were presented this year. Followed by the interstellar-relevant brief we will walk you through the most recent trends in the space industry that were discussed and can influence the progress and growth of deep space missions and interstellar travel.

The second day technical agenda carried a very interesting series of discussions (oral presentations) around the Space Elevator proposals. The sessions, which were led by Dr Peter Swan- president of International Space Elevator Consortium ISEC, held a portion of approaches towards enabling masses to GEO and beyond. With the masses enablement as a main function, the discussions continued under the main theme of "Green Road to Space" that was established by the [ISEC](#) team.

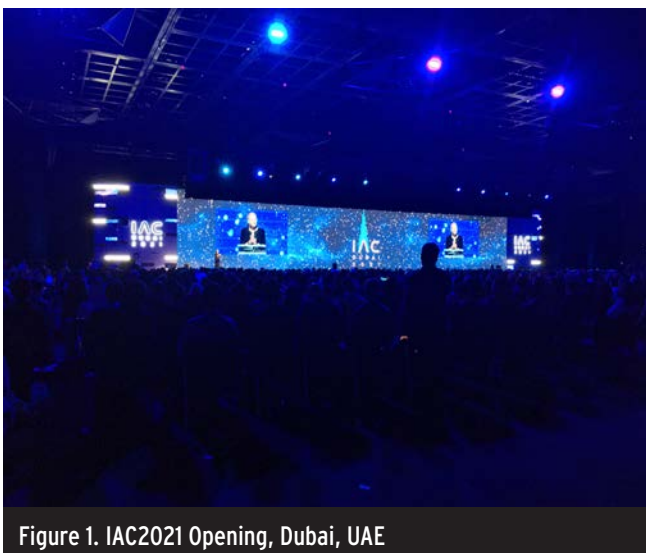


Figure 1. IAC2021 Opening, Dubai, UAE



Figure 2. Dr Peter Swan introduces ISEC Space Elevator Sessions

◀ With their Galactic Harbour architecture they aim to incorporate two space elevator systems, for the transportation and for the enterprise. Basically, the Galactic Harbour will be the volume encompassing the Earth Port and stretching up in a series of cylinders to include two tethers and the region just beyond the Apex Anchors (Figure 3). Such that, customer products/payloads will enter the Galactic Harbour at the Earth Port and exit at some point along the tether. Along the way, there will be tremendous enterprise development such as easy assembly at GEO, refuelling operational satellites and construction, among other things, and release from the Apex Anchor for trips to interplanetary destinations.

In summary, ISEC are trying sustainable and complementary solutions that can address -on an application layer- space solar power to placing masses for industrial purposes in orbit in an eco-friendly manner. However, the concept still faces some technical challenges that the ISEC team addressed during their sessions. For example, space debris as an obstacle for the elevator construction and operations. Also, the lightning effect on the initial 50 km from earth at least.

Finally, they discussed how space elevators can complement current launching systems and integrate with them, so there is more to understand on the “Green Road to Space”. More details about the Space Elevator functions and operations schemes can be found on the ISEC website.

Another highlight was on the fourth day that included a series of sessions on the Interstellar Probe mission by the Johns Hopkins team, Figure 4. The excitement was on all attendees' faces when the team introduced their spacecraft interstellar mission, especially after all the effort placed in the past almost six decades to send a spacecraft to the Interstellar Medium. So far only five spacecraft have achieved that, Pioneer 10 and 11, Voyagers 1 and 2, and New Horizons.

The Interstellar Probe is a joint effort that was requested by the Heliophysics Division within NASA's Science Mission Directorate (SMD), focuses on a pragmatic interstellar probe with the ability to operate at 1000 AU and a design lifetime of 50 years and assesses its technical readiness for a launch in 2030 to help support the next round of Decadal Surveys covering the time frame of 2023–2032.

The spacecraft used New Horizons as a baseline for their design and more details on the model and payload design can be found [here](#).

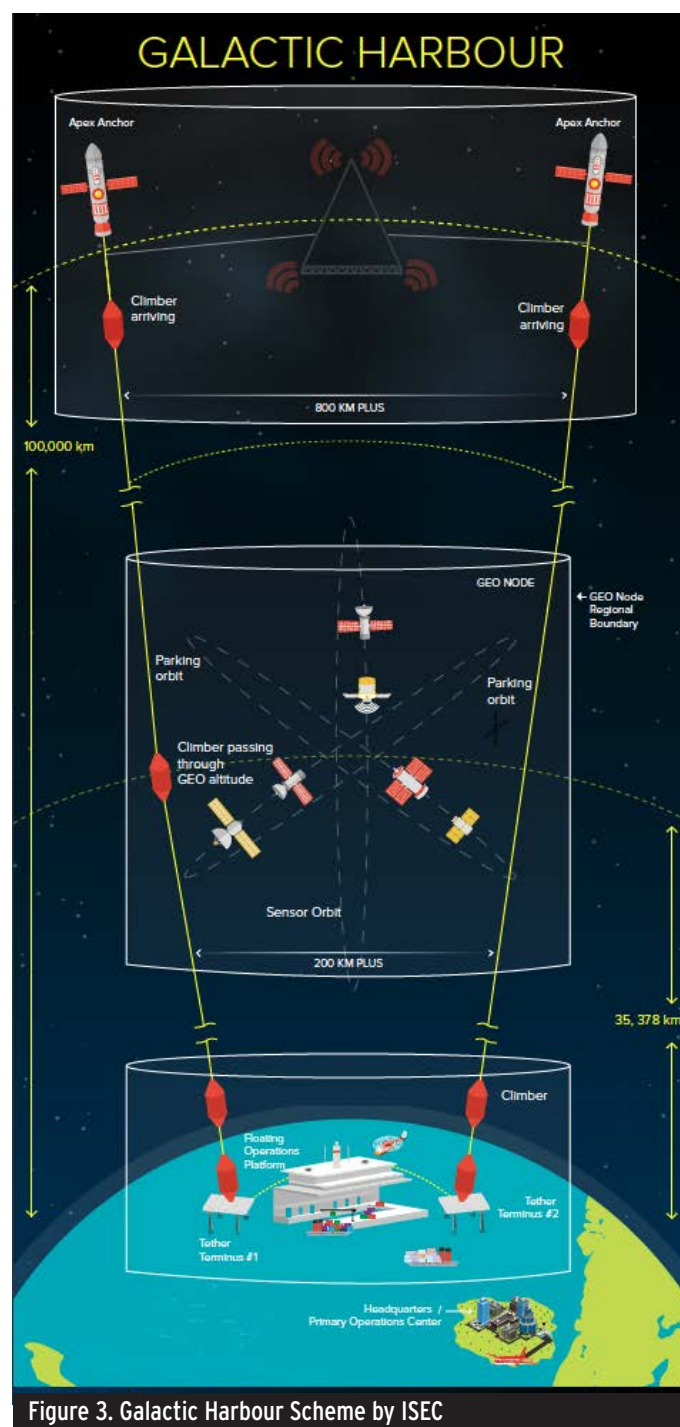




Figure 4. Interstellar Probe Campfire Session: HUMANITY'S FIRST DELIBERATE STEP INTO THE GALAXY BY 2030

With the ambition to fill in the gaps and answer the already existing and recently generated questions by different disciplines, the Interstellar Probe mission will seek to understand more and elaborate on

- Our Heliosphere as a Habitable Astrosphere and its Place in the Galaxy.
- The Origin and Evolution of Planetary Systems.
- How Early Galaxies and Stars were formed.

To penetrate this unexplored territory the Interstellar Probe is planned and expected to flyby Jupiter in less than a year (expectedly by 2030). The ISP report can be very useful to learn more about the mission: interstellarprobe.jhuapl.edu/uploadedDocs/papers/588-ISP-Study-2019-Report_PR.pdf.

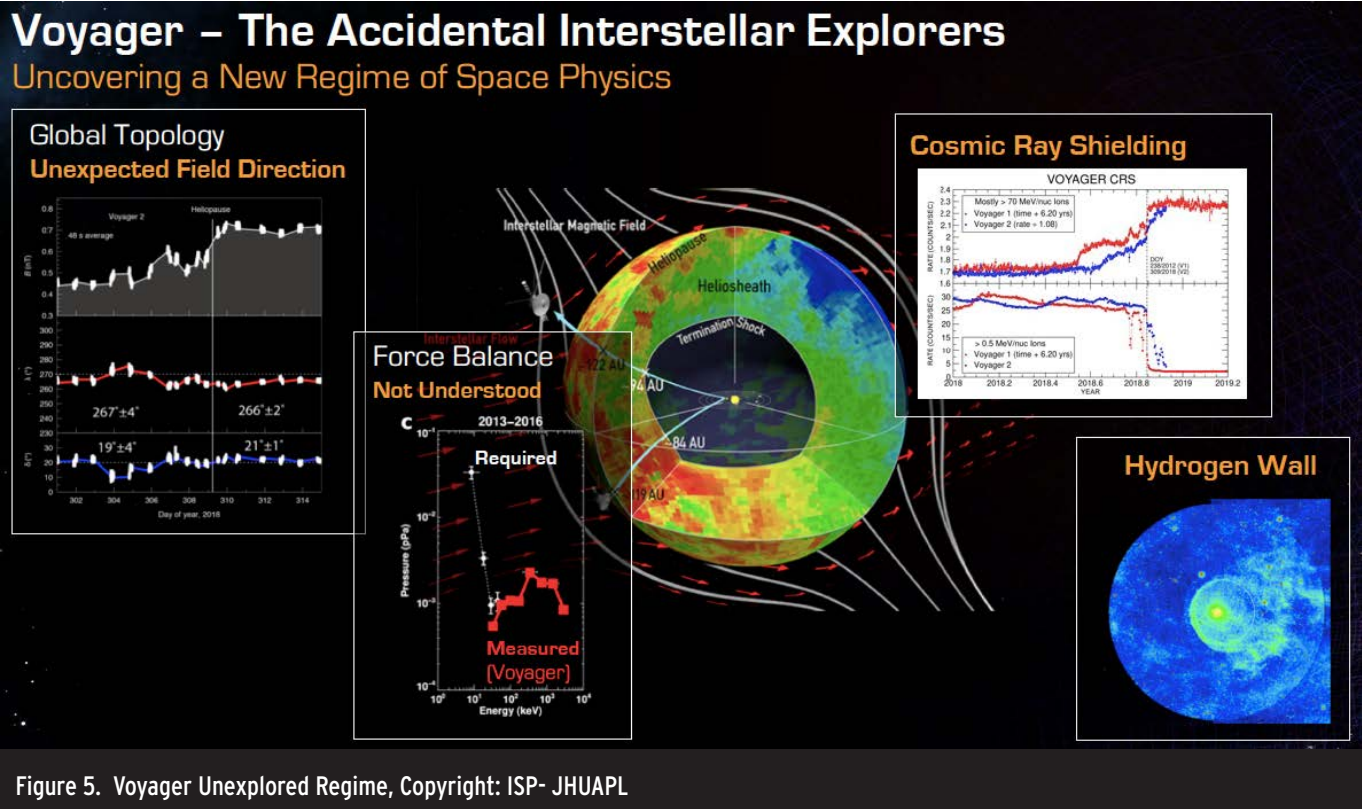


Figure 5. Voyager Unexplored Regime, Copyright: ISP- JHUAPL

◀ One of the most trending keywords during IAC this year has to be access to investments. With the rapid growth of commercial applications of space technologies and introducing space tourism in a more feasible structure, an exponential growth in access to funds can also be expected. Enabling projects like the Space Elevator and missions like the Interstellar Probe comes with their ability and adaptability to integrate with the space industry's future needs. However, the financial challenges facing missions planned to explore our Heliosphere and beyond are exclusively higher, especially at early stages of research and development. A key solution for that can be associated with another trending keyword during this year's IAC as well, which is Inclusion in Space. The location of this year's event in itself is a step forward to address inclusivity in the space industry. In fact, inclusion in the space industry will not only lead to more ideas and perspectives of space exploration in our solar system and beyond, it will also participate in increasing access to funds by engaging governments to release contracts and launch national space programmes. Which will also naturally lead to the growth in private businesses developing space technologies, solutions and services. However, some challenges are expected to arise at early stages of this growth, for example commercial applications will take longer time to penetrate these new markets, where the space exploration race was not part of their economic positioning for a very long time. Thus, creating lack of awareness about space potential use cases like tourism or entertainment. These commercialization challenges will not only face new markets but rather exist in most projects or missions that haven't displayed their expected

Returns Of Investments (ROIs) clearly. Which is expected to be a concern at very early stages with most research investments focusing on the technical feasibility rather than the business ROIs. Some commercial applications however have paved the way with successful business models like Zero-Gravity flights, LEO Tourism, ISS site visits and soon to join the Orbital Reef project that was exclusively announced during the second day of IAC2021.

Orbital Reef is the first of its kind commercial space station by Blue Origin and Sierra in collaboration with NASA and RedWire. The project took commercial applications beyond the trending scheme of space tourism to enable space deeper space explorations missions and giving access to in space testing and manufacturing. Similarly, Interstellar missions have to work on getting their own breakthrough by empowering commercial applications of their missions.

In conclusion, a lot of work still needs to be done and the presence of Interstellar Technologies will have to go beyond ideas and dreams to Only explore! The industry already moved from commercializing space technologies into commercializing space missions. With this disruptiveness in the ecosystem, the interstellar dream can turn into reality faster than we think. ■



Figure 6. Orbital Reef Official Announcement, IAC2021



The Future is closer than we think