

# Industry and Technology Hub

## IAU Centre for the Protection of the Dark & Quiet Sky from Satellite Constellation Interference (CPS)



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Co-Chair

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# The Optical/Infrared Astronomy Concern with Satellite Constellations

- Constellation projects of multiple satellites in Low-Earth Orbit (< 2,000 km altitude) are proliferating now, with tens of thousands of satellites proposed in regulatory filings from around the world
- Demand drivers for satellite constellations are critical services of high economic and social value, including broadband connectivity, earth imaging and weather observation
- Satellites in sunlight may be more visible when operating over regions otherwise in darkness, making them more detectable to the naked eye and to astronomical observation - however, the lower satellites operate, the less time they are in the sun
- Various mitigations have been tested and deployed since 2020, with promising results:
  - Darkening key spacecraft surfaces or shielding them from the sun's direct reflection;
  - Altering spacecraft orientation at key operational phases;
  - Sharing specific satellite location data to allow observatories to plan with satellite passes in mind.
- While results to date have not yet reached the proposed visibility target, this field of technology development is still relatively new and innovation efforts continue.

# The IAU Centre

- Further progress to identify and apply effective mitigations requires collaboration between the satellite and astronomical communities
- The International Astronomical Union (IAU) proposed a forum to formalize this collaboration and centralize technical work: The IAU Centre for the Protection of the Dark & Quiet Sky from Satellite Constellation Interference” (CPS)
- Established on April 1, 2022, the Centre aims to offer resources, collaboration and encouragement for voluntary engagement from both industry and astronomy
- Co-hosts of the Centre alongside IAU are:
  - NOIR-Lab, a U.S. center for ground-based optical astronomy funded by the National Science Foundation (NSF), and
  - the SKA Observatory (SKAO), a UK-based intergovernmental organization building the world’s most powerful network of radioastronomy telescopes
- 4 Hubs: Industry & Technology Hub, Satellite Hub, Community Engagement Hub and Policy Hub.

# Industry & Technology Hub: Building Collaboration between Satellite & Astronomy Communities

The “Industry Hub” aims to engage the technical insights of both satellite stakeholders and astronomers to build the tools and resources to develop solutions and voluntary adoption of mitigations

- Most space operators are committed to being good stewards of space, but require familiarization with the effect on astronomy, and tools to assess their project and to evaluate mitigations
- Operators are more likely to voluntarily adopt best practices that are well-defined, with performance-based metrics that leave room for customization and innovation for their particular project
- Mitigations are more likely to be incorporated if integrated early in the satellite project life-cycle, avoiding prohibitive delays and costs from retrofitting or change orders

# Industry & Technology Hub Objective: Connecting satellite & astronomy communities to find & deploy solutions

## OUTREACH

- Enlist satellite constellation operators, manufacturers, other stakeholders to participate and collaborate in finding and deploying mitigations

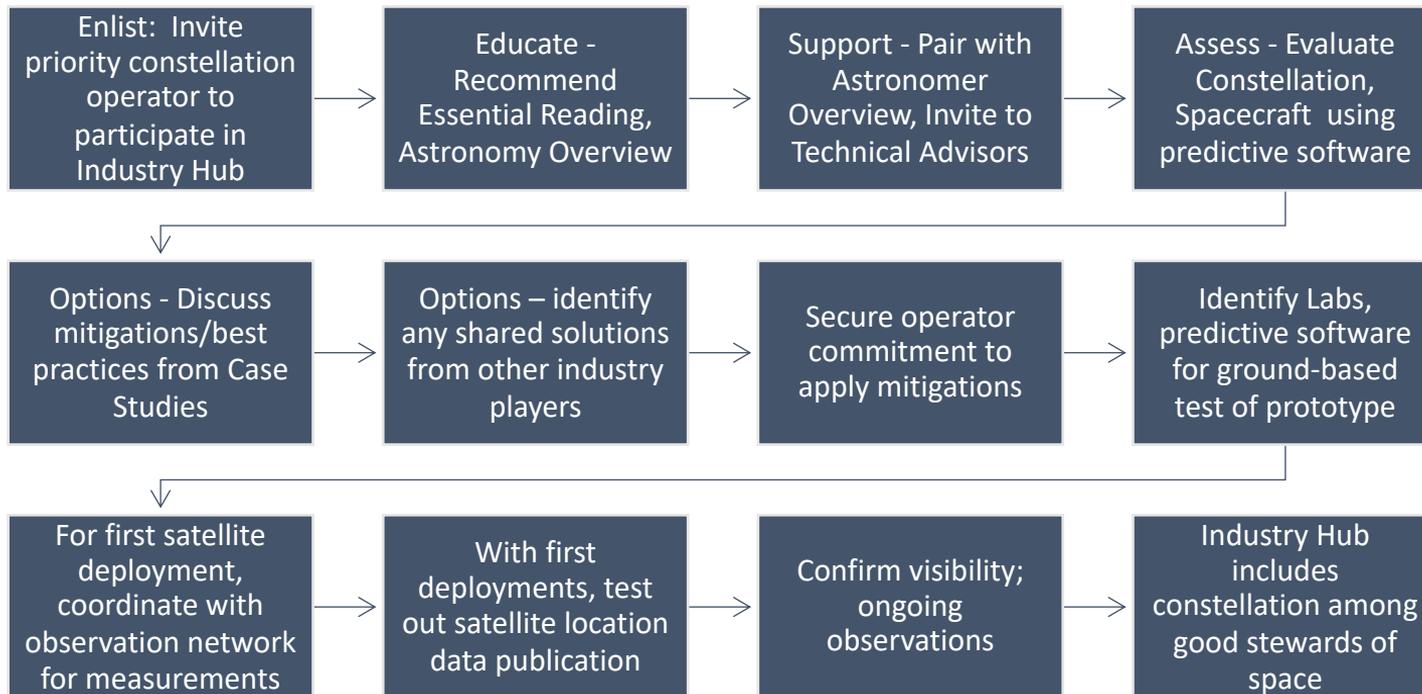
## RESOURCES

- Develop references to inform and to educate on astronomy's concerns, and share recommendations and best practices to date

## EXCHANGE

- Foster development and adoption of mitigation techniques; encourage sharing their efficacy and lessons learned, and encourage innovation in new approaches and tools (materials, test labs, simulation software, etc.)

# Notional I&T Hub onboarding process for New Satellite Constellation Operators



# Industry & Technology Hub: February 2023 Progress Report

- **OUTREACH:** Major LEO satellite constellation operators committed to participating; contacted all key constellation proponents. An additional 30+ Volunteers from industry, academic/research institutes offered their time.
- **MULTIPLIERS:** Engaging leading satellite trade groups & manufacturers to amplify outreach
- **PLANNING:** Workplan developed to shape the Hub and its activities. Feedback from early bilateral discussions are helping to scope the tools and resources companies need.
- **PROCESS:** Finalizing an on-boarding plan to prepare, support and encourage Hub participants to assess their plans and consider mitigations.
- **TOOLS:** Building reference library, essential reading lists, consolidated best practices and recommendations, and shared technical resources to educate and inform. Early work on marketplace for solutions - several operators already developing products, brightness models available to all.

# Ways to Support the I&T Hub in 2023

- Alert satellite operators you license to the collaboration within the IAU CPS and the tools & resources in the I&T Hub.
- Encourage inquiry & dialogue on the issue and specific solutions for a given constellation.
- Consider aiding the development of predictive tools for use before deployment, such as:
  - **Ground laboratories** that can test satellite prototypes using Bi-directional Reflectance Distribution Function (BRDF) measurements
  - **Modelling software** for satellite manufacturers that can assess visibility in design/test stage
  - Further **basic research on reflectivity of spacecraft materials** and designs
  - **Software applications** for the general astronomy community to identify, model, subtract, and mask satellite trails in images
  - **Reliable and consistent observations** to measure brightness and effectiveness of mitigations.
- Recommend that your satellite stakeholders participate in the Industry & Technology Hub

I&T Town Hall meeting (virtual)  
March 1, 2023  
1600-1730 UTC

Thank you for your kind attention!

IAU CPS Industry & Technology Hub

<https://cps.iau.org/>