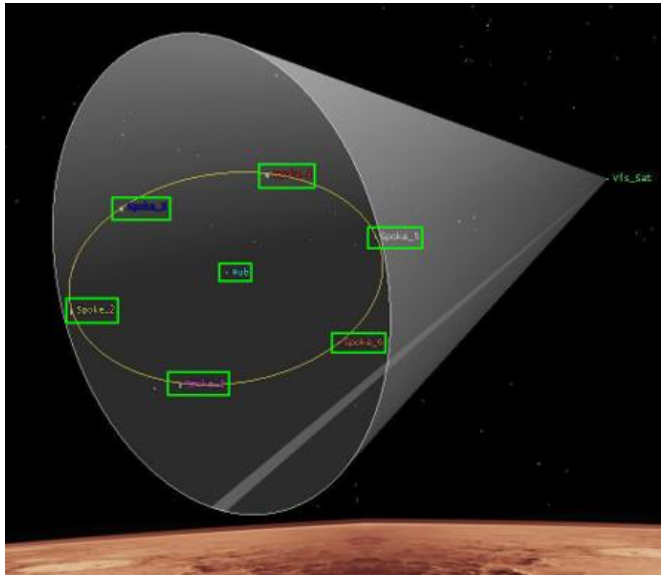
Midwest Region "Space Grant Short Talks"

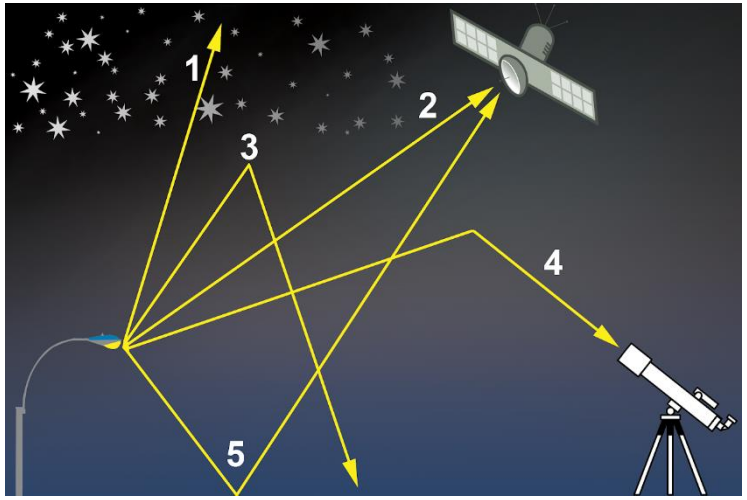
Make to Innovate: Use of hands-on learning in STEM Education

Matthew Nelson
IA State University



SmallSat Swarm Proximity Operations: Herding Cats Might be Easier!

Hank Pernicka
Missouri S&T



Measuring Light Pollution

Bryan Boulanger
Ohio Northern University

Thursday, Nov. 14, 2019. 2 to 3 p.m. Central Time. Link to join the Zoom videocon: https://umn.zoom.us/j/7261550823

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Matthew Nelson is an Assistant Teaching Professor in the Aerospace Engineering Department at Iowa State University. He serves as the Director of the Make to Innovate (M:2:I) program, the Assistant Director of the IA Space Grant Consortium, and founder/president of the Stratospheric Ballooning Association (SBA).
Matthew Nelson <mnelson@iastate.edu>

Make to Innovate: Use of hands-on learning in STEM education

The Make to Innovate (M:2:I) program at Iowa State University uses a flipped classroom to teach hands-on learning to engineering students. In this program students learn through Project Based Learning (PBL) to address real-world problems and work in a team environment. Over 8 years of operation we have learned some best practices for implementing such a program, including addressing growth from 50 students to over 250 students annually.

M:2:I Students working on projects in the M:2:I Lab in Howe Hall at Iowa State University

M:2:I sponsors

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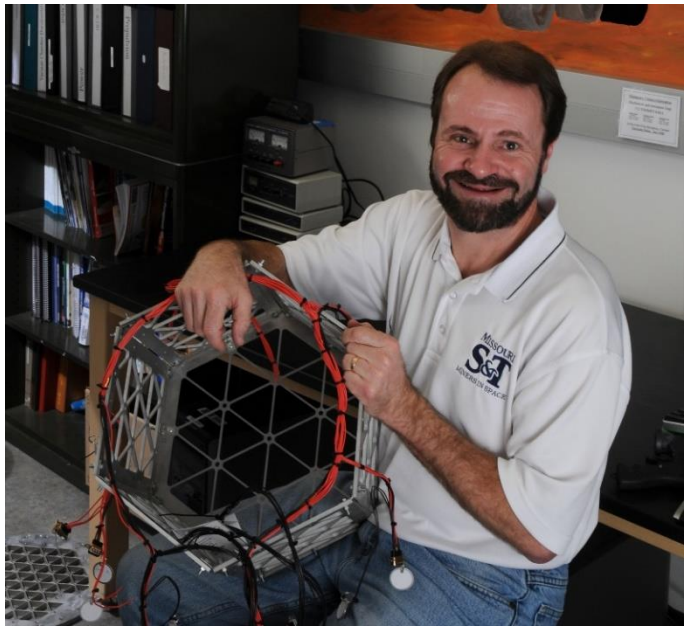

Hank Pernicka received his B.S., M.S, and Ph.D. degrees in Aeronautical and Astronautical Engineering from Purdue University. He is currently a Professor of Aerospace Engineering and Dean's Educator Scholar at the Missouri University of Science and Technology. Dr. Pernicka's general areas of research are astrodynamics and small spacecraft design. He is currently leading the Missouri S&T Satellite (M-SAT) research team, which placed first in AFRL's University Nanosatellite Program's Nano-satellite-8 competition and are current participants in the Nanosatellite-10 competition. He is also active in research areas including spacecraft mission design, libration point trajectory analysis, satellite attitude dynamics, and optimization.

Hank Pernicka <pernicka@mst.edu>

SmallSat Swarm Proximity Operations: Herding Cats Might be Easier!

As NASA considers future mission designs requiring swarms of spacecraft conducting cooperative formation flying in locations including cislunar space, libration orbits, and deep space, demands on GNC elements have become challenging. In such locations GPS/GNSS navigation is not possible. Tracking all members of the swarm using the DSN is also not feasible. Add to this the goal of using SmallSats/CubeSats to populate the swarm, SWaP (size, weight, and power) then becomes very difficult to manage.

Research at Missouri S&T is addressing some of these challenges. To minimize tasking the DSN, visual navigation techniques are being developed such that each member of the swarm knows the pose of the other members. Then only one member of the swarm is required to access the DSN. Natural formations (without control maneuvering) are sought that reduce required station keeping to maintain the swarm. Lastly, control options, suitable for small spacecraft platforms, are being developed that can be implemented allowing autonomous operations with minimal TT&C needed from terrestrial assets.

Complementing these efforts is the on-campus development of three smallsat missions that serve as technology demonstrations of close proximity operations supporting future swarm missions. These missions focus on GNC, micropropulsion, and SWaP elements of using small satellites to enhance deep space exploration.

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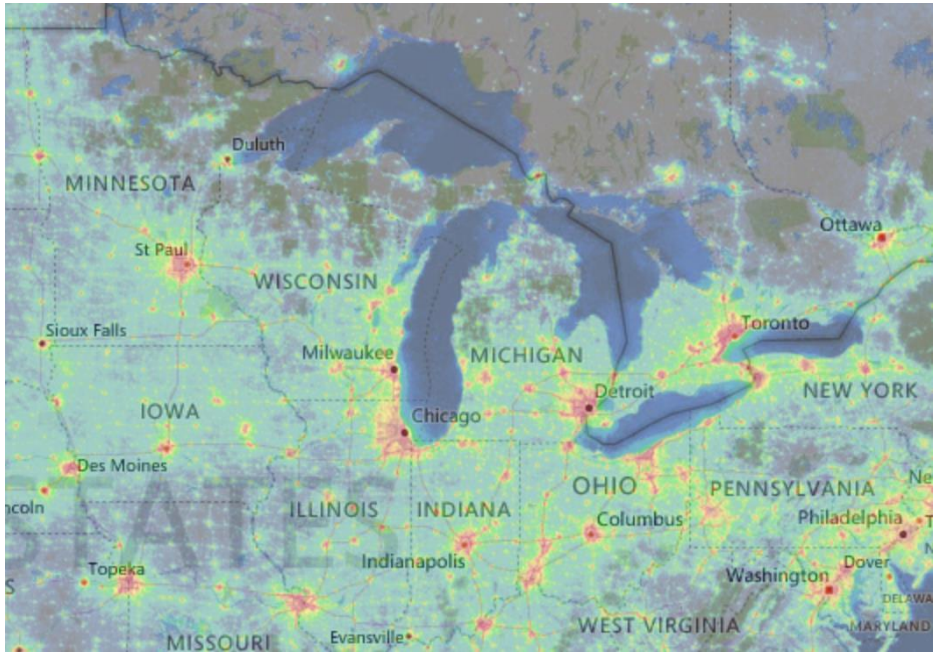
Dr. Bryan Boulanger is Chair of the Department of Civil and Environmental Engineering at Ohio Northern University. Bryan is a past recipient of the US EPA's Mission Award, a past US National Academy of Science Research Council Associate, and an International Dark Sky Association Delegate. Bryan's work focuses on developing tools and practices that decision-makers can use to reduce the impact of artificial lightscapes on surrounding natural resources and human experience. His work has been used to improve natural lightscapes in parks and communities across the US and Canada.

Boulanger Bryan <b-boulanger@onu.edu>

Measuring Light Pollution

Artificial light at night (ALAN) is demonstrated to reduce night sky visibility and harm ecosystem integrity. Approximately 80% of the world's population live under light-polluted night skies where the Milky Way is no longer visible. To find the best ways of confronting and ameliorating the problem of light pollution, we must first quantify the presence of ALAN on multiple spatial scales and model its behavior in the environment. This talk provides a quick overview of the remote sensing and ground based measurements used to quantify and characterize ALAN. The presented measurement methods contribute to outdoor lighting design, conservation, and public policy interventions whose goals are to mitigate light pollution to the greatest practical extent while providing reasonably for the legitimate human uses of ALAN.



Topic-Related Image: Upward radiance measured by the Visible Infrared Imaging Radiometer Suite (VIIRS) onboard the Suomi National Polar-Orbiting Partnership spacecraft. The 2019 VIIRS data shows the extent and magnitude of light pollution originating from sources across the Midwest.