



MAY 20 - MAY 22, 2019
PASADENA CALIFORNIA

Monday May 20 2019 Pre-conference Workshops

10:00 AM - Prioritizing Manufacturing 4.0 Investments and Implementations

Manufacturing 4.0 is not necessarily an equivalent to a fourth industrial revolution; it is simply an evolution of all the technical, organizational, cultural, and behavioral advancements since around 1750, with added emphasis on automation and synthetic intelligence.

Within this workshop, we will define the critical elements of this manufacturing evolution, and why it is natural to think the future of manufacturing sectors will be intractably altered. Together we will explore how certain trends, working in concert, will reshape the way manufacturing companies operate. Included in these converging trends will be:

- Dramatic improvements in factory flows and efficiencies that result from the convergence of robotics, artificial intelligence, and machine learning
- Enhanced intelligent decision-support systems that capitalize on the convergence of inexpensive and mass-produced sensors, wireless telemetry, cloud-computing, advanced algorithms, and augmented reality systems
- Accelerated application of autonomous material handling enabled by the convergence of autonomous systems, dynamic network modeling, and movement optimization models applied in factories and distribution centers, as well as in transportation of goods
- Enhanced end-to-end global supply chain management driven by a convergence of connected ERP systems and transparent supplier performance and risk monitoring tools
- Cost reductions in all of the above that allow these technologies and systems enhancements to be available to even the smallest of manufacturing companies

This workshop will define and describe manufacturing 4.0 and all its many, and sometimes complex, elements. Because no company has the capital to implement all elements of manufacturing 4.0 at once, prioritization methods must be applied. This workshop will present several methods for prioritizing various element investments so that little investment 'rework' will be needed as one progresses through a manufacturing 4.0 series of implementations.

Using a modern as well as historical look at manufacturing technologies, this workshop will address why 'convergences of technologies' is at the heart of manufacturing 4.0, and not necessarily any new bright-star technology.

Key learning objectives:

- Defining the expectation of manufacturing 4.0
- Specifying the elements and underlying technologies in a manufacturing 4.0 environment
- Demonstrating how convergence of technologies, and not the technologies themselves, will be what defines a successful manufacturing enterprise
- Learning a methodology to prioritize technology capital investments
- Learning an approach to alleviate the impending talent shortage that manufacturing 4.0 will create

Speakers

Alan G. Dunn, President, GDI Consulting & Training Company and Operations, Manufacturing, Supply Chain, Project Management, Cost Management, S, California Institute of Technology Caltech

12:30 PM - Lunch Break

1:45 PM - Going Beyond the Buzz: Blockchain Technology Bootcamp

Many of us are familiar with blockchain due to an increased interest in cryptocurrencies. Taking away the cryptos, blockchain is a promising new technology for advanced manufacturing industries. Potential advantages of blockchain technology include the ability to speed up many processes that currently take a lot of time, such as supply chain management, cyber security, communication optimization, automated dissemination of large data sets, and speedier and safer ways to sign contracts between partners and witnesses. This is particularly helpful for lengthy production processes of launch vehicles, satellites, and other spacecraft.

While blockchain is getting its feet on the ground in some industries (such as aviation), there is still a lot to learn about how the technology works, how it can be implemented and monetized, and how to maximize its advantages for the space industry.

Key learning objectives:

- What is blockchain technology and why do you need to know about it now?
- What are its potential applications and use cases in the space industry?
- What are the benefits of blockchain: from leadership to engineers to supply chain
- How to implement blockchain technology
- What are common pitfalls when implementing this technology into an organization?

4:30 PM - VIP Reception in Exhibition Hall

10:00 AM - The Future of Electric Propulsion: A Deep Dive into a Promising Propulsion Technology

Electric propulsion may have been around for more than 50 years, but it still has huge potential: it is being integrated in many cubesats and will also play a big role in the area of satellite servicing, (crewed) missions to the Moon (including the Lunar Orbital Platform-Gateway), and exploration missions that go deep into, or even beyond, our solar system.

The capabilities of electric propulsion become more apparent and are seen as a real game changer in future missions. This workshop highlights the history of electric propulsion, as well as some key challenges, areas of research, and a future outlook on what electric propulsion can bring to your space business.

Key learning objectives:

- The current standards and certifications for electric propulsion systems
- Standards and setup measurements to be mindful of when designing an electric propulsion device
- An understanding of electromagnetic interference and compatibility challenges and testing
- An overview of the different types of electric propulsion systems: hall-effect thrusters, gridded

ion engines, and highly efficient multistage plasma thrusters

- The importance of thrust and efficiency to ensure life qualification time and cost
- The future of electric propulsion: how will this technology develop in the coming decade?

12:30 PM - Lunch Break

1:45 PM - Systems Thinking: A Holistic Application to Space Systems

Systems thinking is a holistic approach to analysis that focuses on how a system's constituent parts interrelate over time and within the context of larger systems. The systems thinking approach contrasts with traditional analysis, which studies systems by breaking them down into their separate elements.

This approach offers new insights into space system context, complexity, component interrelationships, and emergent properties.

Key learning objectives:

- Learn the fundamental principles and concepts behind systems thinking
- Contrast systems thinking methods with more traditional engineering analyses
- Review case studies of systems thinking applied to space system conceptualization, design, testing, and deployment
- Practice applying systems thinking for problem solving
- Identify resources to further develop systems thinking skills and capabilities
- Explore future directions in the application of systems thinking to advanced space problems

Speakers

Dr. Rick Hefner, Program Director, California Institute of Technology, Caltech

4:30 PM - VIP Reception in Exhibition Hall

Tuesday May 21 2019 Conference: Creators, Cultivators & Collaborators

8:30 AM - Welcome Remarks

9:10 AM - Keynote: NASA

Speakers

Jim Bridenstine, Administrator, NASA

9:40 AM - Keynote: Commercial Spaceflight Federation

Speakers

Eric Stallmer, President, Commercial Spaceflight Federation

10:00 AM - Pushing the Pedal to the Metal: Accelerating Innovative Technology Development Through Creative Partnerships and Business Models

Across a variety of space organizations, a paradigm shift is taking place in terms of approach to procurement of innovative technologies to reduce lead times and cost. Within NASA, DoD, and intelligence communities the cultural approach to innovation is changing: organizations such as Defense Innovation Unit and AFWERX are examples of innovative consortiums within the DoD.

As we move to integration of new technologies and a younger generation, how should commercial industry, as well as civil and military organizations, move forward with new business models to create a culture of technology innovation? What implications does this have for the supply chain? What lessons in innovation can we learn from the way that successful startups develop products and secure capital?

This panel brings together leaders of new space initiatives within commercial organizations, the DoD, NASA, and start-ups to discuss the following topics:

- What are the benefits of new space initiatives into existing space structures?
- How to ensure these initiatives are feasible
- What overhaul or change does this require?
- What are the benefits and challenges of bringing in non-traditional space business into a conventional space or military organization?
- What are the implications on the supply chain?
- Can principles of commercial lean startup development help expedite innovation in the space sector?
- What issues are commercial startups tackling that could benefit aerospace industry primes?

Moderator

Ellen Chang, CEO, LightSpeed Innovations

Speakers

Col. Steve Butow, Director, Space Portfolio, Defense Innovation Unit

Tess Hatch, Investor, Bessemer Venture Partners

11:00 AM - Coffee Break in the Foyer

11:30 AM - Adapting to New Opportunities in the Launch Vehicle Industry: Outlining the Importance of Lowering Cost and Improving Flexibility

Due to the continuous slowdown in geostationary satellite orders as well as a continuous growing interest in small satellites and (crewed) missions to low-Earth orbit (LEO) and beyond, launch service providers are forced to offer flexible services at a lower cost to cater for the new business opportunities opening up in space, and to stay commercially viable.

Most of those new business opportunities are currently still under development: the first two satellite servicing vehicles aren't due to launch sometime in 2019 and 2020. A timeline for the early 2020s is currently set for crewed launches and the development of the Lunar Orbital Platform-Gateway and a variety of (potential) commercial space stations. The LEO (communications) constellations are still

under development and have not yet been launched. Meanwhile, a large number of small and large launch service providers are currently already operational or aiming to become operational within the next five years.

For US-based launch service providers, there are Air Force contracts to pick up besides the commercial business. However, while the Air Force has recently announced new Launch Service Agreements, the government wants to ensure it can rely on businesses that have strong commercial positions in this highly competitive environment.

Bringing together large and small launch service providers, as well as satellite operators and representatives from the new business areas in space, this panel discusses the following topics:

- How to diversify business in the launch industry – should launch service providers look into space transportation development?
- The growing need for access to space in areas outside of the GEO satellite industry
- The cost of launch: the implications of going cheap(er)

Speakers

Tim Ellis, CEO, Relativity Space

Michael S. Laidley, Vice President, Omega Program, Northrop Grumman Innovation Systems

Shane Fleming, Vice President, US Operations, Rocket Lab

12:30 PM - Lunch Break

1:30 PM - Ensuring Satellite Resiliency with New Communication Systems: From Laser to High-Frequency

The way we communicate in space and how we stay connected on Earth is experiencing a change: while we traditionally use radio frequency communication methods from satellites to ground stations, there is a growing interest in laser communication connections back to Earth, but also in the space environment. Meanwhile, the need for higher data rates also push for a shift in the use of frequency bands, with new bands such as high-power KA, KU, Q and V being developed.

These changes require new technologies and new issues need to be addressed. Bringing together satellite operators, satellite manufacturers, and component suppliers, this panel will discuss the following questions and topics:

- New technology requirements for different communication bands: from antennas to optimized ground systems
- New technology challenges when implementing new communication systems: from smaller spaces, to 'noise on the line' and radiation issues
- How can we leverage safely what is already out there?
- How to ensure communication system resiliency and security

Speakers

Peter J. Moosbrugger, PhD, Chief Technologist, Phased Array & RF Technologies, Ball Aerospace

2:45 PM - Afternoon Break for Refreshments, Exhibition Visit and Networking

3:15 PM - Spurring Investment, Cooperation and Advanced Technologies to Ensure LEO Commercialization in the 2020s

To get back to the Moon, a lot of development is still required in LEO, an area that is set to become more commercialized in the coming years. In 2018, NASA launched several public-private initiatives, such as the [Study for Commercialization of LEO](#), as well as the [Tipping Point Solicitations & Awards](#). [Euroconsult estimates](#) that government funding in exploration will grow to \$20 billion in 2027, of which 44 per cent will be spent on transportation, 26 per cent on orbital infrastructure, and 14 per cent on moon exploration. Government spending in this area is growing as several agencies are looking to partner with commercial organizations to ensure an affordable and efficient access to space.

There are several areas in LEO that will see increased commercialization efforts in the coming years, including [satellite servicing](#), commercial [space station development](#), a potential conversion of the International Space Station, and suborbital tourism. These efforts will continue certain points of discussion, such as policies, standards, business case development, and technology development. In order to get to LEO, we have to use the most optimized forms of technology to ensure a safe and sustainable ride.

In this session, leading commercial companies as well as agencies will discuss a range of topics where further technology development is taking place or required, including:

- Advanced robotics
- Propulsion systems
- On-orbit manufacturing
- In-space habitat development and safety

Moderator

Mike French, Senior Vice President, Commercial Space, Bryce Space and Technology

Speakers

Al Tadros, Vice President, Space Infrastructure and Civil Space, SSL, A Maxar Technology Company

Mike Lewis, Chief Innovation Officer, NanoRacks

Miki Sode, PhD, Commercial Innovation Program Manager, International Space Station National Laboratory (ISS NL)

4:30 PM - End of Space Tech Conference Day 1 - Drinks Reception in the Exhibition Hall Until 6:00PM

Wednesday May 22 2019 Conference: Future Mission Enablers

8:30 AM - Welcome Remarks

8:45 AM - Expanding Space Capabilities by Developing and Selecting Advanced Propulsion Systems for Next-Gen Applications

Propulsion systems remain a major topic of discussion and development for future satellites, refuelling and servicing missions, exploration missions, and interplanetary landings. Electric propulsion has clear benefits to certain types of travel, but other technologies, such as hybrid, nuclear, and chemical propulsion are still of interest to industry too.

Bringing together organizations working on a variety of propulsion systems for various missions, this panel will discuss the following topics:

- Developments regarding new propellants and their benefits to various applications
- Which type of propulsion system is most ideal for which application?
- Where are the gaps in technology development for propulsion systems?

Speakers

Beau Jarvis, CEO, Phase Four

Matthew Kuhns, Lead Mechanical Systems Engineer, Masten Space Systems

10:00 AM - Coffee Break in the Foyer

10:30 AM - Optimizing Mission Agility with Autonomous Systems: The Benefits and Challenges of Implementing Artificial Intelligence

Autonomous decision making by our future spacecraft is the key to ensuring that future missions go smoothly. As we aim to service satellites in low-Earth orbit (LEO) and geostationary orbit (GEO), look to increase the number of lunar exploration missions, intend to build a crewed Lunar Orbital Platform-Gateway, and eventually want to explore further, smooth operations control is mandatory.

As autonomous systems garner more interest and are increasingly implemented in certain industries, questions remain about their reliability and how to trust such systems.

Bringing together advanced robotics and autonomous systems experts, this panel discusses the following topics:

- The terminology of autonomy: the four stages of autonomous systems and where we are at
- Identification of use cases and how to set up a business case
- Risk-taking in autonomous system development
- Verification and validation testing for non-deterministic systems
- What to do when autonomous systems fail

Speakers

Dr. Blaine Levedahl, Director, US Government Programs, Olis Robotics

Christine Stevens, Principal Engineer, Space Programs Operations, Space Systems Group, The Aerospace Corporation

Gabriel Comi, Chief Architect, Artificial Intelligence and Autonomy Capability Center, Raytheon

12:15 PM - Lunch Break

1:15 PM - Designing the Factory of the Future: Implementing Digital Transformation in the Space System Manufacturing Value Chain to Optimize Efficiency

The way we manufacture components, subsystems, and systems is changing: the role of sensors, data analytics, augmented reality, and automation in the manufacturing environment is growing. According to research by consultancy Deloitte, the aerospace and defense industry [is well on its way](#) to becoming more digitized in the next five years. This development is down to a number of factors: production times need to be reduced to respond to customer demand, there is a growing shortage of a skilled workforce, and certain processes can be optimized with the use of new technologies.

Implementing these new approaches in the manufacturing chain isn't easy: it requires a strategy overhaul and incubating new technologies in the supply chain. Bringing together organizations that disrupt their existing ecosystems with new technologies, this panel discusses the following points:

- Industry 4.0 implementation challenges: from leadership to engineers
- What is the role of data analytics in the space supply chain and how can we leverage every single piece of information?
- The implementation of neural networks and blockchain technology to stay on top of supply chain developments
- A new way of engineering through augmented reality and software such as CAD
- The need for a skilled workforce to adapt those technologies

Speakers

Don Pedersen, Director of Software Development, Airbus North America

Jeff B. Juranek, Senior Project Leader, Corporate Chief Engineer's Office, The Aerospace Corporation

Nathan Eskue, Manager, Program Material Controls, Northrop Grumman Innovation Systems

Whitley Poyser, Digital Transformation Sr Leader, Lockheed Martin Space

2:30 PM - Afternoon Break for Refreshments, Exhibition Visit and Networking

2:45 PM - Taking Additive Manufacturing to the Next Level: Ensuring Quality Control for Future Spaceflight

Additive manufacturing (AM) has been around for a while, and as the technology matures due to enhanced machine capabilities and better knowledge about AM the aerospace industry is slowly moving away from prototyping to actual production of AM components. End users will use AM components and tools for spacecraft development, for on-orbit manufacturing and lightweighting. Often, it is an easier way to make complex structures.

As we move towards greater use of AM, there are still some issues in the space of additive manufacturing. Bringing together industry groups, manufacturers and end-users, this ideas-sharing session will highlight the following topics:

- Material selection – how to ensure you have the correct metal alloys or plastics for your mission
- Next steps in terms of qualification, standards, and policies

- Would we require new types of testing?
- How to ensure in-situ quality monitoring

Moderator

Dr. Mohsen Seifi, Director, Global Additive Manufacturing Programs, ASTM International

Speakers

Max Haot, CEO, Launcher

AndyT. Kieatiwong, Founder & CEO, Additive Rocket Corporation

Kevin Sheehan, Head of Additive Manufacturing, Siemens

4:00 PM - End of Space Tech Expo Conference 2019