



NAMIC
NATIONAL ADDITIVE MANUFACTURING
INNOVATION CLUSTER

AM Summit Series

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THE PAN PACIFIC SINGAPORE



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Interview with keynote speakers – UL, EOS and 3D Matters

1. What are the inhibitors for SMEs in precision manufacturing industry in integrating AM as a rapid prototyping tool, and in select cases, as a cost effective method for complex part manufacturing?

Simin, UL: When considering integrating AM into an existing operation, manufacturers should fully explore *why* they are entering into AM as well as *how* they are going to implement it before doing so. Understanding the various impacts of AM on an operation - impacts to supply chain, safety, process, business, facility operations, staff, etc. – is critical to a successful and safe implementation.

Regarding specific inhibitors, many SMEs view the investment of necessary capital as a barrier to entry. By not making the proper investment, manufacturers risk compromising product quality as well as facility and staff. Specifically, investment in staff/technician AM training is often overlooked, but critical to long term success and safety.

Others would rather engage a service provider to make the part for them, especially in today's economic climate. Though appearing cost efficient on the surface, outsourcing their AM needs restricts the SMEs ability to learn and apply the practicalities of AM - such as support structure design, optimization, and part design optimization for weight reduction - thus limiting future innovation.

Finally, some SMEs also look to the larger manufacturers to adopt and optimize AM and related processes before they safely follow suit. This “follower” mindset often hinders the growth of AM in Singapore.

Jack, EOS: Most SMEs – and indeed companies of all sizes – are not grasping the full benefits that AM can bring to their production floor. A lot of customers we talk to today come from an environment that is dominated by conventional technologies and their boundaries. In this world, manufacturing drives the design whereas with AM customers have more freedom of design as design is driving manufacturing. Under these circumstances, AM cannot add value if a customer demands a conventional part just to be manufactured with AM. He needs to rethink the part by enabling e.g. complex or bionic structures, lightweight, functional integration.

In a nutshell, people are not grasping the full potential that AM can add and do not understand that they have to think differently and approach challenges differently. Once they have decided to go for AM, it is not enough to just buy a machine. Those operating the system or designing for AM need to be trained adequately in order to be successful based on this new technology. This is where "[Additive Minds](#)" can come into play if the customer is demanding that support.

Matthew, 3D Matters: As with the adoption of any new technology, there are a number of challenges for the precision engineering industry in integrating AM into its operations:

- **Upfront investment and material costs.** High-end industrial AM equipment is expensive, especially production quality metal printers that can run into millions of dollars. Metal powders can cost significantly more than "normal" metal and may have a direct impact on the final price to customers
- **Capabilities.** As AM is a new technology, each step of the process – parts design, material selection, machine operation and post-processing – requires new knowledge and skills. This means that companies either have to upskill their existing staff with or hire in new staff with the necessary skills for adoption of AM in their manufacturing process.
- **Regulatory and customer requirements:** As the precision manufacturing industry is subject to their customers' requirements, any changes in production technology may need end-user approval. The regulatory framework for AM printed parts is still developing, so at present there is still a bit of uncertainty as to what standards are required for AM design and printing

Despite these challenges, there are a growing number of SMEs already using AM for rapid prototyping and manufacturing end-use parts cost effectively. Internationally, leading industry players are already integrating AM into core operations for competitive advantage – for example, GE in the US has moved entire parts production over to AM and recently acquired 2 leading AM companies - Arcam and Concept Laser to bring the know how in-house

2. What are your suggestions in removing these inhibitors?

Simin, UL: NAMIC, as an initiative, can help SMEs break these barriers by supporting or funding AM applications that are suitable for commercialization and assisting SMEs investment in AM workforce training.

Jack, EOS: Companies in the AM space need to educate businesses as to the benefits of the technology and especially its potential to re-engineer manufacturing processes, to heighten flexibility, and to drive cost-efficiencies. Once organizations understand the full potential and benefits inherent in the technology, the inhibitors will vanish.

Matthew, 3D Matters: From our experience with companies who have successfully overcome these inhibitors, we would suggest the following:

- **Be Selective:** Not every part or product can or should be 3D printed, so SMEs can identify those that will benefit from AM. For example, parts or products that are obsolete (can no longer be purchased), complex, costly, have long lead times, or cannot be manufactured by traditional methods
- **Find Design Improvement Opportunities:** Identify which parts could potentially be re-designed to take advantage of what the new printers can do. This could include printing in 1 piece what used to be multiple parts, reducing weight or using different material grades to improve performance
- **Assess Quality and Costs:** Put the identified parts through a rigorous cost and testing program to be assured that parts can be printed cost effectively without any quality issues

- **In-house vs Outsourcing:** The last step is to decide whether AM is a technology to develop in-house or to find an outsourced partner to work with. As the capital cost of an industrial-grade metal printer is high, it is worthwhile to consider outsourcing unless there is a steady volume of high value parts and sufficient in-house capabilities to design the parts and operate the machine. Other examples of considerations would be the number and complexity of parts to be printed, and the number of new designs vs repeat orders.

Lastly, I would also suggest that SMEs participate in a good range of AM related conferences or networking events. There they can learn more about the latest technology developments and how other companies are successfully adopting AM in their operations. With all these steps, I am confident that SMEs will identify opportunities to take advantage of this exciting new technology.

3. What new opportunities for new lines of businesses using AM and how can tech start-ups venture into AM?

Simin, UL: There are multiple opportunities, but UL is monitoring the innovation occurring within AM design. Advancements in lightweight parts, mass customization, complex designs, and software that support AM simulation are exciting and driving innovation within the aerospace, medical and automotive industries.

Jack, EOS: It is ideal for producing parts that have either been innovated or updated for AM, for example parts which have better material properties when manufactured via AM or that are tougher, more resistant and lighter – or that have less movable parts which are prone to wear and tear. This kind of functional integration enables businesses to be more agile, more competitive, and to offer a higher value to its customers.

Tech start-ups can easily support this development by innovating new parts. This could be an entry point for them into the AM world that's beneficial to the tech start-ups as well as the AM industry and their customers.

Matthew, 3D Matters: AM is finally starting to move beyond the “hype” into real opportunities for many industries.

- **Technological and productivity advancements for heavy industries:** From the customers that we are working with, we see exciting opportunities for many “heavy” industries such as precision manufacturing, oil & gas, marine, aviation, engineering, construction and transportation. Many are using new AM-designed parts to improve productivity in manufacturing processes, reduce equipment downtime, upgrade obsolete equipment or reduce stocking time and costs
- **End-use production:** The main areas for growth in AM so far have been prototyping in materials such as nylon and resin, and we now see the “next wave” to be metal printing for end use production. In 2016, for the first time over 50% of 3D printed parts were for end use production. Judging by the releases of new printer technology this is going to only gather pace with exciting new metal printing technology being developed all the time.
- **Materials:** New materials are constantly being developed for AM, which opens up new possibilities for parts. As regulations in sectors such as medical and aviation start to adapt to the new technology, we expect that the adoption of such newly-developed materials will be very fast

In this fast-evolving landscape of opportunities, tech start-ups need to pick specific industry sectors and identify opportunities to add value to their customers – for example in design optimization, printer and material selection.

4. What new promotive measures including policy support are needed to promote AM?

Simin, UL: Education and training are critical to the future growth and success of AM. Access to AM equipment and facilities is necessary, but without a knowledgeable workforce, the industry will not innovate and grow as projected.

Jack, EOS: Singapore has made significant strides in promoting the AM industry. The formation of NAMIC last year, for example, is a testament to the government's efforts in supporting the industrial 3D printing infrastructure. The launch of the Jurong Innovation District in 2022 is also something EOS is looking forward to.

While targeted help from the government will be necessary for the promotion of AM, policy support alone is not going to be sufficient. Traditional mindsets around manufacturing within the industry will need to change, in order for industry players to be motivated to want to secure government funding. It is the triad of machine, material and build process that makes AM so compelling and more effective than the legacy methods of manufacturing, which are unable to match the same level of control, quality and detail as AM does – be it in the aerospace, medical/dental or tooling sectors.

With the government's continued investment at the enterprise- and sector-level, combined with efforts on the ground to educate and increase awareness about the benefits of AM, the manufacturing industry will be poised for an accelerated pace of transformation.

Matthew, 3D Matters: In some areas, Singapore is already world-class in supporting AM technology – for example, the range of research instructions undertaking R&D to support companies entering the market. Through organisations such as NAMIC, SPRING and EDB, the government is also making a strong push to develop this sector by making significant funding available to develop capabilities and conduct R&D.

However, there are 3 important areas that could benefit from additional support to promote adoption of AM:

- **Capital costs funding support:** This technology requires upfront capital investment of at least US\$1M for a metal printer and post-processing equipment and dedicated facilities, and is the single largest hurdle for SMEs to venture into AM. To complement the existing capability funding support, having capital funding support would be a significant boost to help SMEs seriously move into AM
- **Commercialization of R&D:** With this technology being new (and expensive), the path for new AM technology from R&D to commercially viable product that companies can use is longer and more expensive than typical. Having more funding support for R&D to commercial operations would be beneficial to make sure that Singapore gets the best technology into the market place as quickly as possible
- **Training availability.** Continuing to develop a range of courses from in-depth 2-3 year programs to short courses for workers keen to upgrade

5. Your comments on AM in Future of Manufacturing

Simin, UL: Rather than replacing traditional manufacturing, we believe AM will continue augment and complement manufacturing by advancing innovation, customization and, in some cases, personalization. AM is establishing itself as the preferred method to rethink redesign

components in which optimized weight and strength are critical success factors. Again, the aerospace, automotive and medical industries are already realizing the unique benefits of AM.

Jack, EOS: AM will re-engineer the future of manufacturing, it will even make up a large portion of the future of manufacturing – the exact portion will of course depend on the respective industry. At the moment, the future looks very bright and we cannot see any growth inhibitors at least for the next years: AM is definitely on a steep upward slope. One of the driving factors is Industry 4.0 – or the industrial Internet of Things – which is pushing companies toward digital manufacturing. AM will play an important role in this area.

To adapt to the needs of serial manufacturing, EOS is constantly working on the following topics: constantly increase the productivity of our systems; ensure that we offer high quality EOS systems, materials and processes for a repeatable part quality; step by step integration into existing manufacturing environments; offer worldwide technical services, trainings and “Additive Minds” offering to the customer

We will see two steps ahead of us in the near future: one is that customers will use AM more and more for serial applications resulting in building up factories that are exclusively based on AM. Here, more integration and automation will be key in the coming years.

A second development we will see is that AM will be integrated into existing manufacturing environments that today are dominated by quite a variety of conventional technologies. In order to derive the “best from both worlds” for the best part result, EOS works on the above as well (integration, automation) as well as intelligent data and part flow.

Matthew, 3D Matters: AM is now at an inflection point, and over the next 3-5 years will gather momentum to reshape the industrial landscape. Like what we saw with mobile phone technology, we will see print speeds and print sizes increasing exponentially as costs fall, and even more applications will become achievable. However, we believe AM will not completely replace traditional manufacturing; rather it will be a powerful “boost” – like Industry 4.0 – that will create new opportunities to SMEs industry in terms of speed, innovation and cost effectiveness.

6. Lastly, what would you say to your peers about NAMIC AM Series – Precision Engineering Summit?

Simin, UL: I hope everyone would take back some learning from the Summit, make more business contacts and collaborate on AM projects. NAMIC is a strong and capable organization to lead AM in Singapore, and UL will be around to support all AM activity to commercialisation.

Jack, EOS: NAMIC events are great platforms to connect with industry partners and thought leaders to discuss the adoption of AM technologies and how to enhance competitiveness in the rapidly evolving landscape of digital industrialization.

Singapore is not just a key market for EOS, but also an interesting ecosystem with unique demands for very low manufacturing tolerances, low volume and higher value for outputs, and is an ideal candidate to integrate additive manufacturing. With this upcoming Summit kick-starting the inaugural NAMIC AM Series, it is worthwhile to attend and understand the value proposition for integrating AM, as well as learning the cost effective translational research in Singapore and its commercial benefits for manufacturers and precision engineers.

Being at the Summit will also mean that businesses will get a chance to speak with government agencies and AM companies, which is a step towards improving efficiencies in AM integration.

Matthew, 3D Matters: We are honoured to be involved with this distinguished group of AM experts and enthusiasts who have been working so hard in the past few years to advance AM technologies in Singapore and the region. We continue to believe the future of AM in Singapore is one of collaboration and are happy to work with the Precision Manufacturing industry to unlock the potential of AM. Wishing everyone every success in discovering new opportunities and growth!

REGISTER

**Deadline to register: 18 January 2017
(limited seats available)**

For registration or other enquiries, please contact chloe.cai@sesallworld.com