



Case Study



The Future of Talent Acquisition & Innovation

NASA Crowdsources Systems Engineering



We live in a world of democratization of talent and resources. AirBnB crowdsources their **“hotel”** offerings by partnering with individual property owners as hotels, Kickstarter crowdsources cash infusion for product development at the earliest stages of conception, and platforms like Fiverr provide worldwide creative talent for just about any project you can imagine.

Leveraging the worldwide knowledge base that is available to us via the internet has never been easier. It could be argued that properly leveraging a crowdsourced approach for complicated work is almost necessary as we progress into the future. In an article titled Rethinking the On-Demand Workforce from the Harvard Business Review, the authors say, **“The half-life of skills is shrinking fast, and many jobs now come and go in a matter of years.”** According to the article, this is a major contributor to the growing skills gap and challenges to get highly technical projects done.

Crowdsourcing and democratizing skill are solutions as this challenge becomes more apparent, but the tricky part is connecting to the proper knowledge and focusing it on a specific project.

When it comes to engineering and more complicated skills work, contemporary crowdsourcing has often been less reliable than work in other fields. Freelance resources can certainly get you to a systems engineer, but more often than not, this work requires specific know-how and/or a team of brilliant minds, not just one.

According to Samantha I. Infeld, Ph.D, Project Manager from NASA Langley Research Center and lead in the Assist 2 Develop pilot project, **“Government organizations and some large corporations may have trouble generating truly different potential approaches or design ideas.”**

NASA Leverages Crowdsourcing

According to a NASA whitepaper, "[NASA's Center of Excellence for Collaborative Innovation \(CoECI\)](#) uses open innovation, or "crowdsourcing," to access the global public to find ideas, concepts, designs, or solutions that meet a previously unmet need possibly resulting in significant advances in performance."

The CoECI is NASA's first significant foray into leveraging talents outside their organization or contractors, although that network of talent is already vast.

In one specific instance, NASA was looking to innovate with systems engineering tools for creating space architectures, but the real challenge was to develop this architecture as a library of modeled parts in a systems modeling language (SysML). That's where Assist 2 Develop stepped in to help.



Why Crowdsourcing Is Different for (Model-Based Systems) Engineering

NASA adopted the use of Model-Based Systems Engineering (MBSE) back in 2009. The idea behind MBSE is that, under the right circumstances, it allows engineers to work successfully at greater degrees of complexity due to an increased formalization of how the technology works.

Developing a common thread of system models within a specific language (SysML) would not only provide faster development for their current project, but also provide a leading edge in future development.

“The primary goal was not to build a modeling library, but to capture different types of applications where we can compare and contrast their MBSE patterns,” Infeld says. **“If we saw some model library modules or graphics that we want to ingest into a NASA library, that would be an additional benefit. We wanted to see especially how they decompose functions to hardware, looking for an elegant way to do easy visualization.”**

The process of onboarding and acclimating engineers to a particular project is also much more complicated than a traditionally crowdsourced challenge. **“[We simply knew there wouldn’t be] as many entries as broader outreach challenges, such as designing a new phone app, but all of the entries [we received through Assist 2 Develop] were thorough and high-quality submissions, and from a variety of sources.”**

“To be honest, when I first heard about this pilot, my first reaction was to scratch my head thinking how all the pieces will come together,” says Deniz Eralp, a mentor who provided some guidance and insight to NASA and the submission teams for this pilot project. **“The project concept was highly attractive because every piece of it was quite inspirational on its own; space habitat as the problem domain, MBSE as the methodology, NASA – a pioneer organization - as the sponsor, and the global public as the innovator. But I think what really inspired me to participate in the pilot was not one of these alone, but the opportunity to see how the pieces could come together within their constraints. The space domain and expertise of global public, SysML and creativity of open innovation, space mission architecture and crowdsourced library of elements. These combinations seemed so contradictory and so intriguing at the same time.”**

The Challenges of Crowdsourcing

The challenge of crowdsourcing for projects in the world of engineering and design are also the benefits. These technical fields require a very specific skill set, which makes it challenging because the freelance world is so massive, but simplifies the process, because you know exactly what you need.

Using specific platforms that cater to certain types of freelancers and experts provides the ability to narrow the definition of need... meaning, fewer but higher-quality results. Assist 2 Develop fit that bill quite well, as it is a platform designed for mechanical engineers and CAD designers. What increased the challenge in NASA's case is that, while well versed in the world of engineering, the platform had no specific experience with systems engineering.

Common crowdsourcing platforms leverage massive lists of often unqualified users to spread the word about a project opportunity. A number of underqualified or even DIY engineers might apply to a NASA sponsored project alongside systems specialists that the organization is actually looking for - this is especially true for an organization that is as world-renown as NASA.

"We were actually a little concerned about the expansiveness pool of the folks who would be able or interested in responding," says Jon Holliday, a chief engineer at NASA that worked on this pilot project.

"First they had to know MBSE, a rather new technology AND an understanding of the complexity of a lunar habitat AND of course have the time and interest to compete, without assurance of anything monetarily in return."



Holliday, Infeld, and the Assist 2 Develop team actually found that those questions and concerns became motivators as they tested the water. **"There was a lot of value beyond the gates of NASA and our traditional suppliers, partners, etc.,"** Holliday says. **"So, although concerned a bit, the return of validating something we had no odds on was very cool!"**

How Assist 2 Develop Made It Happen

Because Assist 2 Develop had no experience with systems engineering, the team had to build the community from scratch, and generate positive results for NASA on the fly. The community was built using a framework developed by Assist 2 Develop and included an array of expert judges and mentors.

This framework also included a list of vendors that helped connect experts and provided tools to make things happen. [The International Council on Systems Engineering \(INCOSE\)](#), which is an organization that promotes the dissemination of information about systems engineering, and the [Systems Engineering Research Center \(SERC\)](#), which is a University-affiliate organization that provides access to the expertise of their network of experts in systems engineering, helped to provide insight and know-how in both systems engineering and the community that Assist 2 Develop built.

[Part of the pilot with NASA was focused on building a prize contest](#), where \$8,000 in cash was up for grabs, similar to a college grant program. The difference here was that the winning submission(s) would actually be used in future space exploration endeavors.

The submissions were tasked with developing a common library that would save system engineers a large amount of time, allow stakeholders to recognize common graphics, and quickly understand the architecture options.

Once challenge entries started rolling in, it drove internal conversation amongst the NASA engineers. The NASA MBSE Community of Practice had some discussions about different approaches to modeling libraries spurred by reviewing the challenge entries and communicating with the authors. The diversity of responses spanned the breadth of engineering knowledge, and [included one winner who was a student at MIT and another winner that was a systems engineer consultant from France](#). There was even a team from the University of Alcalá de Henares in Madrid, Spain that added value to NASA's project.



While NASA has done similar challenges in the past, their biggest issue came when trying to sift through the massive pile of entries. That's where the Assist 2 Develop-built community came into play. Mentors who were experts in the fields of engineering and systems design reviewed and gave insight and feedback to the top entries, which improved and narrowed the field of entries that NASA needed to consider. From University students to consultants to industry veterans, this collaborative experience meant that many different minds were involved in helping to bring the best possible options to NASA's doorstep. Assist 2 Develop is always aiming to make this growing community smarter over time, and expand the capabilities within the framework.

That means that not only the winners of the submission contest helped NASA with their development, but many other entries helped as well. **"We couldn't have done any of this in the amount of time this Assist 2 Develop challenge took, especially with difficulties in finding resources at the agency and competing with other mainline programs,"** Infeld says.

According to Eralp, **"Even the most specialized and expert organization can benefit from seeing, evaluating and ingesting from these diverse approaches. NASA's pilot, although with a relatively small scope, demonstrated that this is possible. Maybe it is a good time to start challenging some approaches and assumptions on MBSE within our own organizations."**



In fact, NASA's cost estimate to generate some concrete concepts of modeling libraries as its own internal effort was \$100,000. Utilizing Assist 2 Develop's challenge platform for this pilot created a 90% cost savings.

The future of highly-skilled work is certain to continue changing, and according to the Harvard Business Review, **"90% of 700 leaders interviewed (C suite and front line) believe platforms will be core to their ability to compete in the future."** Unfortunately, many business leaders **"have been reaching out and using platforms on an ad hoc basis instead of strategically."**

That means finding resources to gather knowledgeable and specific talent strategically is becoming more and more prevalent. Platforms that develop partnerships with both the businesses and talent, like Assist 2 Develop, are paving the way to consistent, quality work.

"The pilot project is one small step for a big pioneer like NASA," says Eralp. **"And it will be a giant leap for MBSE when the organizations adopt similar approaches, or devise further ways to establish links between their MBSE practice and the resources outside the organization."**

Assist 2 Develop already has a growing community, and they are built with a specific intent - to connect businesses and organizations to the highly-skilled engineering talent they require.

Want to learn more about how Assist 2 Develop is growing communities to make crowdsourcing engineering work easier? [Check out this podcast that walks through](#) how the founder, Bassanio Peters, is working to better the commune of engineers working together.

