Forum Highlights

NASA's far-out space concepts

Imagine a rover on the surface of Venus, propelled by the slow movement of the planet's thick atmosphere; or a submarine exploring the depths of a hydrocarbon lake on Saturn's moon Titan; or maybe a lander hopping from site to site on Neptune's moon Triton; or how about a gram-sized spacecraft accelerating to 160 million kph and whizzing past an intriguing planet discovered in the solar system closest to ours.

NASA sets aside a small fraction of its $19 billion annual budget to fund studies of radical-sounding concepts like these. Panelists discussed some of the NASA Innovative Advanced Concepts program's projects.

Mason Peck, a Cornell University associate professor involved with the NIAC-supported interstellar Breakthrough Starshot Project, said NIAC is extremely valuable for those with big but high-risk visions, AIAA's Ben Iannotta reported.

He and the Breakthrough team are trying to figure out how to squeeze a spacecraft's critical elements, especially a communications package, onto what looks like a computer chip. They'll then accelerate this toward Proxima b, a recently discovered planet more than 4 light years away, by focusing laser light onto a sail.

The big question: "Can you make something small enough that also survives? We're talking about a 1 gram satellite," Peck said.

Closer to home, there is the second planet from our sun. "Venus is a fascinating planet," said Jonathan Sauder of the NASA-funded Jet Propulsion Laboratory. He wants to figure out how to navigate a rover across its surface despite pressures that would crush a nuclear submarine and temperatures that would melt lead.

At Venus' average temperature of 462 degrees Celsius, even electronics built to U.S. military specifications could not survive, because they're designed for a maximum of 125 C.

"The longest we've been able to have an object survive on Venus is two hours," he said.

So, game over? Not quite. Sauder has been studying how to make a rover operate almost entirely mechanically. On the top of the rover would be a turbine through which Venus' slow-moving, thick atmosphere would flow and propel the rover.

— Ben Iannotta | beni@aiaa.org

"I was taught the job is never finished until you've got all the data, you've analyzed the data, and you've answered all the questions."

– Delma Freeman, former director of NASA's Langley Research Center

"It's a period of delicious chaos ... it's like a combination of the first day of school and the French revolution."

– Dorothy Robyn, independent consultant and writer, on presidential transitions

Wild ideas for stopping climate change

AIAA

▲ **Rutgers University's Martin Bunzl** was among panelists who said efforts to stop climate change are inadequate.

If humanity wants to get serious about eradicating human-caused climate change, it's going to have to actively intervene in the functioning of the atmosphere.

Exactly how is the question. Perhaps sulfur dioxide could be dispersed in the stratosphere to reflect solar radiation. Or carbon dioxide could be captured from the air on a vast scale. Or maybe giant sunshades could be erected in space to cool Earth.

Such geoengineering might sound extreme, but according to some scientists, active intervention is the only way to stave off a planetary warming of more than 1.5 to 2 degrees Celsius, the threshold beyond which increases in sea level could be severe.

"It is a controversial topic," said Marty Bradley, a technical fellow at Boeing and the session moderator for "Geoengineering to Mitigate Climate Change — Is There a Role for Aerospace?"

Douglas MacMartin, a geoengineering theorist at CalTech, believes that adopting renewable energy and improving efficiency would not be enough to stop profound climate change.

MacMartin said it would be possible to cool the planet rapidly, by "dumping crap" in the stratosphere in what's called solar geoengineering or sometimes solar radiation management. The idea would be to mimic the effect of the 1991 eruption of Mount Pinatubo in the Philippines, which spewed tons of sulfur dioxide into the stratosphere and cooled the planet by half a degree Celsius.

MacMartin cautioned against jumping quickly to solar geoengineering, because it could have consequences that scientists do not yet understand.

— Ben Iannotta | beni@aiaa.org

In January, over 3,700 attendees representing government, academia and industry gathered at the 2017 AIAA SciTech Forum in Grapevine, Texas.

Younger workforce is aerospace's future

Despite its bright future, the aerospace industry faces challenges in attracting and retaining younger talent.

One challenge is the low retirement rate in the aerospace industry because job movement is key for young professionals, said Graham Warwick, technology managing editor at Aviation Week & Space Technology, during a panel discussion on the aerospace industry's workforce requirements.

"It's a means to an end for them, to develop skills and advance," he said.

Warwick cited an industry workforce study that showed aerospace is still a desirable field and noted it's important for leaders to understand and address the expectations of younger employees.

In regards to progressing in today's world of rapid innovation, Curt Carlson, founder and CEO of The Practice of Innovation, said, "You need to have an environment that's open, transparent and where intense learning takes place all the time."

Representing young professionals on the panel, Ben Marchionna, lead systems integration and test engineer at SkySpecs, said he doesn't necessarily believe millennials require a purpose to energize them.

"Ultimately … millennials get excited by this idea of getting a group of really motivated people together and solving some insurmountable challenge, particularly when everyone else thinks it can't be done," he said. "They get really excited about that — and this is what's it's all about for millennials."

Jaiwon Shin, associate administrator for NASA's Aeronautics Research Mission Directorate, said one of the major opportunities at hand is bringing together all of the "seemingly disparate technologies, like autonomy, electric power management systems and communications."

Shin echoed his fellow panelists' belief that it's important to communicate to the younger generation that aviation and the aerospace industry are not dying or boring.

"I think it's just a matter of packaging things right," he said, adding that it's important for the younger generation to understand the aerospace industry is growing and could change society in a "very transformational way."

— Lawrence Garrett | lawrenceg@aiaa.org

> "Every day, every night, the robots are placing [items] and doing work."
>
> **– Dava Newman,** deputy NASA administrator, on robots working aboard the International Space Station

> "We can no longer ignore AFC (Adaptive Flow Control)."
>
> **– Israel J. Wygnanski,** University of Arizona

> "You need to have an environment that's open, transparent and where intense learning takes place all the time."
>
> **– Curt Carlson,** founder and CEO of The Practice of Innovation

Robots strike out on their own

Machines are capable of doing more with less input from humans and will soon be able to assemble other structures or machines, inevitably opening up new possibilities for aerospace.

"We're at the dawn of what a lot of people call an autonomy revolution," Danette Allen, senior technologist for intelligent flight systems at NASA's Langley Research Center, said during a panel discussion about how autonomous machines will enhance aerospace capabililites. "When we talk about these systems that learn, when we talk about these systems that adapt, we are changing the way we talk about the way humans interact with these machines."

▼ **Danette Allen,** senior technologist for intelligent flight systems at NASA's Langley Research Center, said autonomy is altering aerospace.

AIAA

"A lot of this stuff is spinning in from our mobile devices, speech recognition … from gaming, we've got gesture recognition," said Rob High, IBM Fellow and vice president and chief technology officer of IBM Watson. "It is our firm belief that cognitive computing will have its greatest value and most disruptive benefit when we use it to amplify human cognition."

In regards to the impact on aerospace, MIT's Neil Gershenfeld said automation and robotics could lead to self-assembling structures. He added that future space explorers could use automation to build habitats.

"An ensemble of little robots can build scalable big structures," he explained. "To make large-scale space structures, you can flat-pack them and have a little ensemble of assemblers with the flat-pack structure that then scales to a big thing."

— Hannah Thoreson | hannaht@aiaa.org