

STEM

M A G A Z I N E

***PETA* WANTS US TO
DISSECT THESE FROGS.**



Cutting Edge Learning

"Your Ideas" for a New Book-
Your participation is requested

\\255v

September 2021



INNOVATIVE FURNITURE SOLUTIONS FOR HIGH-TECH EDUCATIONAL ENVIRONMENTS

STEM BENCH

The new STEM Bench has been specifically crafted for the Technical Lab arena. Designed and manufactured to offer quality, value and durability for today's Higher Education lab environments. A great solution for artificial Intelligence Labs, mechanical and electrical engineering labs, and information technology labs.

Modular components to customize the bench to your unique needs:

- monitor arms
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MOBA ESPORTS TABLE



Varsity Esports programs are taking colleges and universities by storm and so is the new MOBA table design. These exciting new and innovative programs deserve an eye-catching environment and the MOBA table does just that. Just like the other school teams have their own stadiums and fields, the Esports team has their own arena. With a low-profile surround each student gaming athlete has their own defined area. The same surround panels are a great component to show off the school's team colors with hundreds of laminate options.



Welcome to Mahmoud E. Yousif and our newest readers at
the External Magnetic Field Propulsion Systems (ExMF-PS)
Foundation, Nairobi, Kenya

We believe that the key to success in seeing higher graduation rates, improved testing results, student inspiration, creativity, excitement and career satisfaction rests in the hands of the teacher.

The example and inspiration of individual educators carries tremendous weight on a daily basis, greatly impacting the quality and effectiveness of the classroom environment.

Our mission: Encourage curiosity, investigation, inspiration, creativity, and innovation; the foundations of every career passion.

Wayne Carley
Educator / Publisher
STEM Magazine
STEM for Woman Magazine
STEAM Magazine

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STEM Magazine is a monthly subscription non-profit education publication for educators, students, their parents and industry professionals.

Read monthly in 71 countries, STEM Magazines strive to encourage the educator to better understand the importance of STEM skills, their use in every school subject, the need and ease of integration into curriculum and the urgency for students to embrace STEM.

SynFrog

SAMANTHA SUITER

Inclusive Solutions

KIMBERLY A ASKEY / ORNL

A Modeler's Perspective

DR. RICHARD LARSON / MIT

Agile Best Practices

DR. MICHAELYN THOMAS

Slooh

Junior Water Prize Winner

XYLEM AND STOCKHOLM INTERNATIONAL WATER INSTITUTE

To understand STEM...

...you must DEFINE STEM, but you cannot define an acronym using the words it stands for; you must define the words the acronym represents.

Universities and organizations around the world continue to debate what a STEM career is. There is no doubt that “every career” uses STEM skills and this observation remains the focus of STEM Magazine.

Science: “The systematic accumulation of knowledge” (all subjects and careers fields)

Technology: “The practical application of science” (all subjects and careers)

Engineering: “The engineering method: a step by step process of solving problems and making decisions” (every subject and career)

Math: “The science of numbers and their operations, interrelations, combinations, generalizations, and abstractions” (every career will use some form[s])

For a moment, set aside any preconceived notions of what you think a STEM career is and use the above dictionary definitions to determine the skills used in any career field you choose.

These definitions are the “real” meaning of STEM and STEM careers.

Cutting-Edge and Cruelty-Free:

Meet SynFrog

By Samantha Suiter



What's green, wet, slimy, and hopping into science classrooms across the country? It's SynFrog—a hyper-realistic, dissectible frog model that's saving lives—and revolutionizing life science education.

By definition, STEM is at the cutting edge, yet hands-on dissection of animals in science classes hasn't evolved much in a century. SynFrog was “hatched” in 2019 when PETA partnered with SynDaver, the world's leading manufacturer of surgical training models. Now, SynFrog is available worldwide and can replace the use of frog cadavers completely in K–12 and college classroom dissection exercises. That's good news for frogs and students. Every year, some 3 million frogs are killed for classroom dissection, and a growing number of students don't want to take part in this. With SynFrog, they don't have to.

Fascinating Frogs

As an adjunct professor of biology for over a decade, I've discovered it's no longer necessary to use actual frogs for dissection to teach life science. We can learn much more about animals by studying them in their natural habitats than we can by participating in classroom dissection.

Frogs are fascinating. Tiny Brazilian torrent frogs, for example, conduct an elaborate routine that involves extending their legs and waving their feet to woo potential mates or warn other frogs of danger.

Clever mientien tree frogs living in Taipei, Taiwan, have figured out how to use our urban jungle to their advantage: They gather in roadside storm drains to amplify their calls, creating, as one scientist described it, a “mating megaphone.” Frogs are excellent listeners, too. Tiny Gardiner’s frogs, once assumed to be deaf because they don’t have ears, use their mouths to hear.

As we learn more about the benefits of keeping frogs in their natural habitat, innovative products like SynFrog curtail unnecessary dissection and prevent a reduction in frog populations.

It’s Not Easy Being Green

Many other frogs are bred and shipped to classrooms by dissection supply companies. These companies provide a wide variety of animal and fish species for dissection use in classrooms worldwide. Obviously, the ethics and morality of killing animals for general classroom study is questionable and continues to be challenged by many as unethical.



eth•ics /"θ iks/ n. pl

1. moral principles that govern a person's behavior or the conducting of an activity. “Medical ethics also enter into the question.”
2. the branch of knowledge that deals with moral principles.

Using animals as nothing more than teaching tools may be sending the wrong message to students and encouraging an unhealthy attitude toward the value of animal life. It is always our responsibility to lead by example in school, home, and the workplace.

Students Object to Dissection

Certainly, most students have compassion for animals and don't want to harm them. Studies indicate that as many as 25% of secondary students object to dissecting animals. This has far-reaching consequences. One study found that students opposed to dissection might avoid taking science classes because of it. As one student wrote, “When I found out that grade 12 biology consisted of dissecting a rat, I did not enroll myself into the course.”

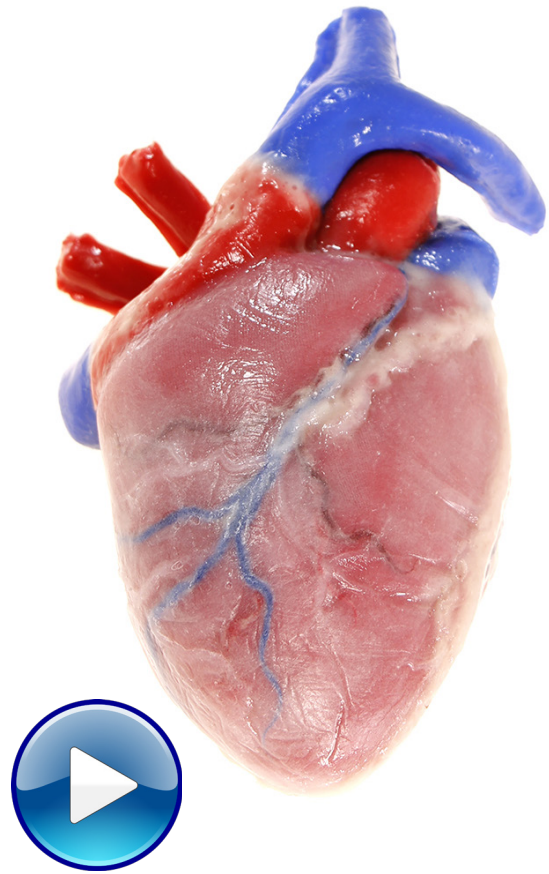
While many states have dissection-choice policies that allow students to complete alternate assignments instead of dissecting animals, the innovation of synthetic substitutes is appealing on many levels.

It is encouraging that not a single medical school in the U.S. requires students to use animals in dissection, and experimentation on live animals is neither required nor expected of students applying to medical school. Thanks to advanced synthetic methods and tools such as human-patient simulators; interactive computer programs; safe, human-based teaching methods; and clinical experience, a student can become a board-certified surgeon without harming a single animal. My daughter helps me introduce students and their teachers to SynFrog and other superior teaching methods through PETA's Teach-Kind program.

A Cut Above

Advanced, non-animal teaching methods such as SynFrog, as well as interactive software programs like The Digital Frog and the eMind tutorial series, have many advantages over dissecting dead animals. Peer-reviewed literature even confirms that students who use modern alternative dissection methods perform better in learning assessments than those who dissect animals.

As an educator, I know the importance of "hands-on" learning activities, but those that don't harm animals are the future of biology education. Additionally, dead frogs have monochromatic organs that are difficult to differentiate. Everything inside the animal is a dull, grayish yellow. SynFrog, on the other hand, is colorful and accurately represents living tissues.



The heart is deep red, the intestines are pale pink, and the reproductive system is yellow, with green speckled ovaries.

The organs are correctly situated inside the body cavity and can be removed and examined. The small intestine can even be unfolded and measured. Students are always wowed to discover that it's two and a half times the length of SynFrog's body, just as in a real frog!

SynFrog's creators didn't overlook any detail. The exterior skin is a moist layer of mucus covering the body. Underneath it is soft tissue representing a layer of muscle and a visible mesentery layer. Every organ that exists inside a real frog is replicated inside SynFrog, including the esophagus, trachea, lungs (with bronchial tubes and larynx), liver, gallbladder, stom-

ach, pancreas, intestines, kidneys, ureters, urinary bladder, ovaries, cloaca, circulatory system, and, of course, the heart.

There are even free supplemental teaching materials for SynFrog dissection available to download, as well as TeachKind's instructional video, which covers external and internal anatomy, classification, and comparative anatomy.

Kid-Tested, Frog-Approved

So, what doesn't SynFrog have? SynFrog is free from harmful chemicals used in the live preservation process to prevent them from decomposing before they reach the classroom. Dissection exposes students and educators to these chemicals, including formalin and formaldehyde, a preservative that's classified as a human carcinogen. Repeated exposure to even low levels of this chemical can cause respiratory difficulty, eczema, and skin sensitization.

But as any teacher knows, the most important question is, what do students think of it? If the reactions of students who dissected SynFrog at one middle school in Colorado are any indication, it gets the green light. Here's what a few of them had to say:

"My experience was so fun, it was easy to tell the organs apart, and there was really no mess. If it wasn't for the synthetic frog, I probably wouldn't have done the lesson."

"I'm so glad that I'm not using real frogs

because frogs need love too, not to be used for other stuff." "It's much better than old stinky gross dead frogs. We got a really cool experience and saw the organs better—with color it's much better than swamp green dead organs."

"I really liked that they were fake. I support frog rights. Frogs are cool."

Educators love it, too. Jessica Schultz, principal of Florida's J.W. Mitchell High School (the first school to use SynFrog) reported, "Kids are involved, they are in it, they are finger deep in frog guts, but it's all synthetic, so the smell isn't there, the stigma isn't there, they are not opting out. Every kid is engaged ... they are just all in on this."

Leaping Into the Future

Tomorrow's biologists, medical doctors, veterinarians, and leaders in science expect to learn from the most innovative methods available, without compromising their ethics. Now, thanks to SynFrog, they can. If you're a student or a teacher, please visit PETA.org/SynFrog to find out how SynFrog and other humane teaching methods can help your students leapfrog over the competition through relevant, repeatable, and responsible teaching methods.

PETA.org/SynFrog

Belinda Akpa: Engineering inclusive solutions

By Kimberly A Askey / ORNL



Belinda Akpa applies her diverse expertise and high-performance computing to accelerate the drug discovery process and increase the chances of success when candidate molecules go to clinical trials.

Credit: Carlos Jones/ORNL, U.S. Dept. of Energy

Belinda Akpa is a chemical engineer with a talent for tackling big challenges and fostering inclusivity and diversity in the next generation of scientists. She applies a problem-oriented approach that blends math, physics, chemistry, biology and computational modeling to accelerate solutions in areas including drug development and plant systems.

Her work at Oak Ridge National Laboratory is part of the Accelerating Therapeutics for Opportunities in Medicine, or ATOM, consortium and focuses on modeling the complex interactions between candidate molecules and the human body to improve outcomes when potential drugs go to clinical trials. The results from Akpa's systems models will integrate into ATOM's larger computational framework, which aims to shorten the drug discovery timeline from five years to less than one year. A collaboration of national laboratories, academia and industry, ATOM is working to speed treatments for cancer and COVID-19.

“We’re trying to design and optimize candidate molecules without actually making the chemical compound in a lab,” Akpa said. “With computational models, we can explore whether a particular molecule will shrink a tumor or restore healthy cardiac function.”

This is far from simple. To model drug delivery, Akpa must understand the chemistry of the molecule and the path it will follow. Can it make it past the liver, for instance, where contaminants are efficiently filtered from the bloodstream? After all, the drug’s target is not an isolated protein. It might be a receptor in a cell membrane within a cell that is in a tissue, which is part of an organ in the bigger system of the body.

“I think about my modeling as peeling back those layers and then reassembling them from the bottom up,” Akpa said. “I’m looking at what happens from the moment you take a pill or an injection to see if that drug will be delivered to the target in a high enough amount to have activity and at a low enough level to avoid toxic consequences in other tissues.”

Akpa’s systems pharmacology models help set **ATOM** apart from other AI-driven drug discovery methods. She will leverage ORNL’s high-performance computing capabilities, such as the Summit supercomputer, in her quest to get drugs to patients faster with a greater probability of success.

Diverse and inclusive science

Similar methods and models can be applied to a range of scientific questions in an approach that Akpa calls problem-oriented discovery. For her, the appeal of a national laboratory is the focus on interdisciplinary science.

“I love knowing that I can be thinking about cardiac function one day, and the next I’m thinking about the movements of plant cells for very different objectives,” Akpa said. “That is all unified once you start looking at the mathematical tools and the types of questions to be answered.”

Akpa also enjoys the academic environment and is a committed teacher. She holds a joint faculty appointment with the University of Tennessee’s Department of Chemical and Biomolecular Engineering, where she leads several research projects on plant physiology and stem cell signaling.

She previously taught and conducted research at North Carolina State University and the University of Illinois at Chicago, where she accrued multiple honors for teaching and mentoring. Sharing her joy in science and her driving curiosity has always been a motivator for Akpa, who wants to combat the illusion that science is an elite endeavor.

“Part of what keeps me going is knowing that everything I learn can be passed on to someone else to either build on

scientifically, or as an opportunity to share with students and younger people or the general public,” Akpa said. “I like making science accessible and helping people understand, ‘Hey, you can do it, too, if you want to; it’s nothing special about me.’”

Akpa is also passionate about ensuring that everyone has access to careers in science. As a senior member of the American Institute of Chemical Engineers, she is an active participant and leader of various diversity, equity, inclusion, and professional development activities that encourage current and future engineers to dream big and reach their career goals.

Answering the challenge

Akpa’s parents nurtured her early interest in science, seeing it as a path toward job security. Born in the West African country of Ghana, Akpa moved with her family to Northern Virginia when she was very young and grew up with an appreciation for cross-cultural communication as she helped bridge her parents’ world-view with American culture.

She brings this interest and experience to her science when working with interdisciplinary teams that “speak different science languages” and may have different approaches to knowledge discovery. She also expresses her love of cultural exploration through her hobbies, reading stories about cultural perspectives around the world and cooking diverse cuisines.

Her path could have taken many routes as she enjoyed math, physics, chemistry and biology in high school and considered medicine as a career. She chose to pursue chemical engineering during her undergraduate studies at the University of Cambridge, because she could combine all these disciplines, learn some programming and apply her skills to real-world problems.

She secured a doctorate at the same university, focusing her thesis on nuclear magnetic resonance, a non-invasive imaging technique with applications for medicine and many other fields. Akpa applied the technology to non-biological systems such as chemical reactors that turn raw materials into products with added value. It was during her first faculty appointment at the University of Illinois at Chicago that she began applying her engineering expertise to biology. She worked with an anesthesiologist who was trying to understand the mechanisms at play for a therapeutic he had identified that had the ability to reverse otherwise fatal drug overdoses.

“Those experiences translate to what I do now as these were very multidisciplinary problem-oriented environments,” Akpa said. “I have always loved solving puzzles. I like the logic and the ability to go down multiple dead ends and iteratively learn from the failures to find a solution.”

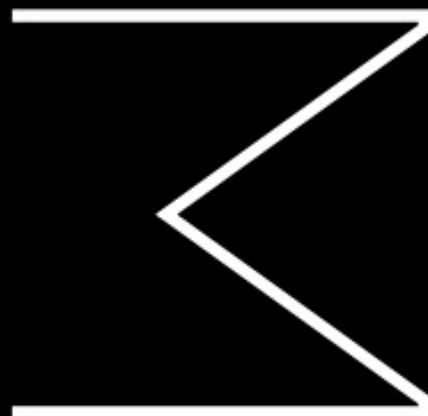
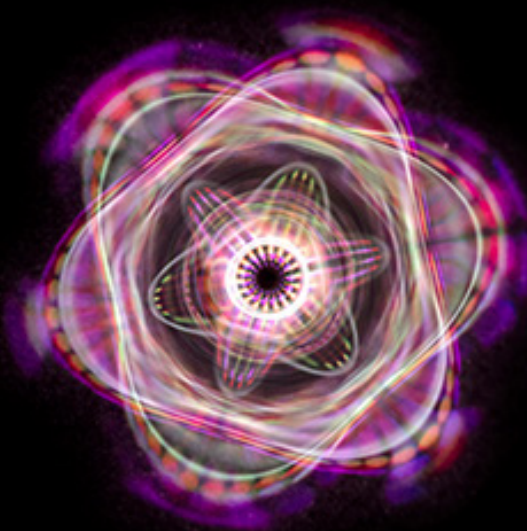
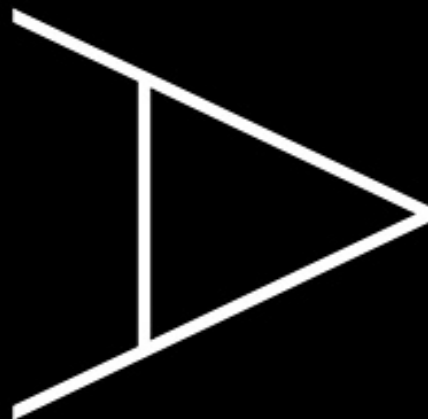
In her current research, Akpa draws on her extensive skillset and computational tools to speed solutions by using virtual models to identify the most promising candidates for physical experiments. It is difficult work that requires continual learning and innovation, but Akpa thrives on it.

“I’m a sucker for a challenge,” Akpa said. “You say something can’t be done, and I’ll say, ‘Oh, really? Are you sure about that?’”

UT-Battelle manages ORNL for DOE’s Office of Science, the single largest supporter of basic research in the physical sciences in the United States. The Office of Science is working to address some of the most pressing challenges of our time. For more information, please visit <https://energy.gov/science>.



Kimberly A Askey
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Experiencing the World with a Modeler's Perspective

Working Wonders with a Blank Sheet of Paper

By Richard C. Larson

"A sincere thank you for those many of you who have read some of my contributions to STEM Magazine. Very much appreciated. I'd like to share some news on a new topic in which you can play a key role! It's related to a new book that I am now writing titled: Experiencing the World with a Modeler's Perspective / Working Wonders with a Blank Sheet of Paper."



"THINK"

The book is aimed at adult college graduates who want to develop their STEM critical thinking skills within a modeling context, broadly interpreted. We are trying to encourage engagement and curiosity in the world around us, and to help others begin to develop a skill in thinking through problems from basic principles, starting with a blank sheet of paper.

Yes, Critical Thinking Skills development! It's not a math modeling textbook, nor does it involve computer programming — only using blank sheets of paper. It does not involve building physical things like robots, only filling up blank sheets of paper to help explain everyday things that at first appear difficult and often counter-intuitive.

The book will be a hard-cover book, and the reader will be encouraged to have their computer turned off while reading and doing. We want old-fashioned focused thinking. Our belief is that our societal increasing reliance on computers, with Google searches, Alexa inquiries, myriad databases, and chug-and-plug algorithms, has eroded our abilities to think through problems independently using clear thought, working from basic principles.

On many pages of the book the reader will be asked to think about a new problem situation and to write their initial thoughts on their blank sheet of paper. No computer needed.

Each such time they will see an icon  on the page representing a blank sheet of paper. In getting through the entire book, many sheets of paper will be needed!

How can you help? We offer two different ways. The first is to suggest everyday events and processes whose science is not straightforward, maybe even counterintuitive. You could propose such a process or event or situation and then offer your critical thinking explanation for it.

Examples:

- In many logistical systems, you can “speed service” by deliberately inserting delays.
- Simply moving certain chronically ill patients from one group to the next can increase the life expectancies of both groups.
- Most airline passengers may experience nearly full planes while airline management is worried about “not reaching the break-even 50% load factor.”
Please, send us your puzzling everyday situations for possible inclusion in the book, and please include your resolution to the problem.

Then, there is a second way you can help, closely related to the first. It’s often been said that the best way to learn is to teach. And how about teaching to young people who have had nearly zero experience with STEM thinking as applied to the world around us?? In the book, in addition to writing thoughts and explanations on blank sheets of paper, the reader will be asked to compose teaching notes – to (fictitious) curious and inquisitive teenage children! In the book, we have from time to time a child asking a parent a question that involves some critical thinking on the part of the parent and most likely creating a conceptual model for explaining.

Examples:

- “Hey, Dad. How come the more cars there are stopped at a red light when we arrive, the shorter our wait? I thought long lines meant long delays. Think of our last visit to Disneyworld!”
- “Mom, how come when it’s raining and we’re in the car, it always seems to rain faster on our windshield when you start driving, moving down the road?”
- “Dad, the daily ferry leaves for Martha’s Vineyard at 2:00 PM, and it’s only 30 minutes (on average) to drive to the ferry terminal, so why do you insist on leaving the house at 12:30 PM?”

In response to these “children’s” questions, we will ask the book’s reader to construct an illustrative dialogue between parent and child that will lead to a resolution to the problem described. That dialogue can then be shared with family and friends, including one’s own teenage sons and daughters.

This is the second way in which you can help: Submit your contributed idea for one of these puzzling children’s questions about our day-to-day lives, questions that require focused critical thinking, often using conceptual models of the situation that describe observed outcomes.

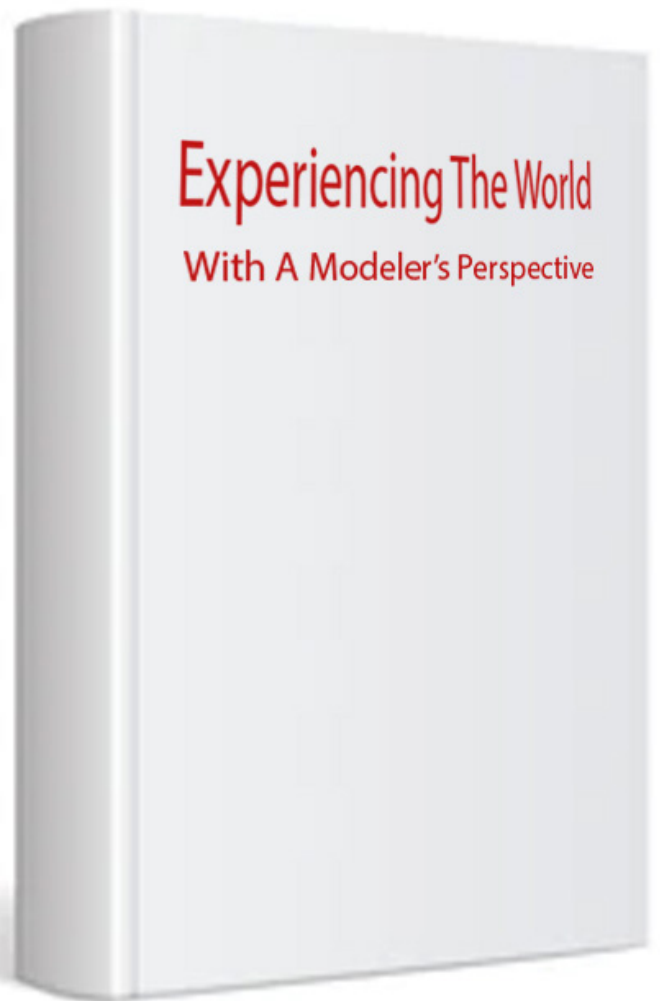
There you have it: You can submit ideas for the book in either of our two described ways. If I select your suggestion(s) to be included in the book, marked on a page using our blank sheet icon - , I will acknowledge your input in the book and send you a free hardback copy – when published.

Thanks for considering. Hope to hear from you by email.

Richard C. Larson

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Evolution

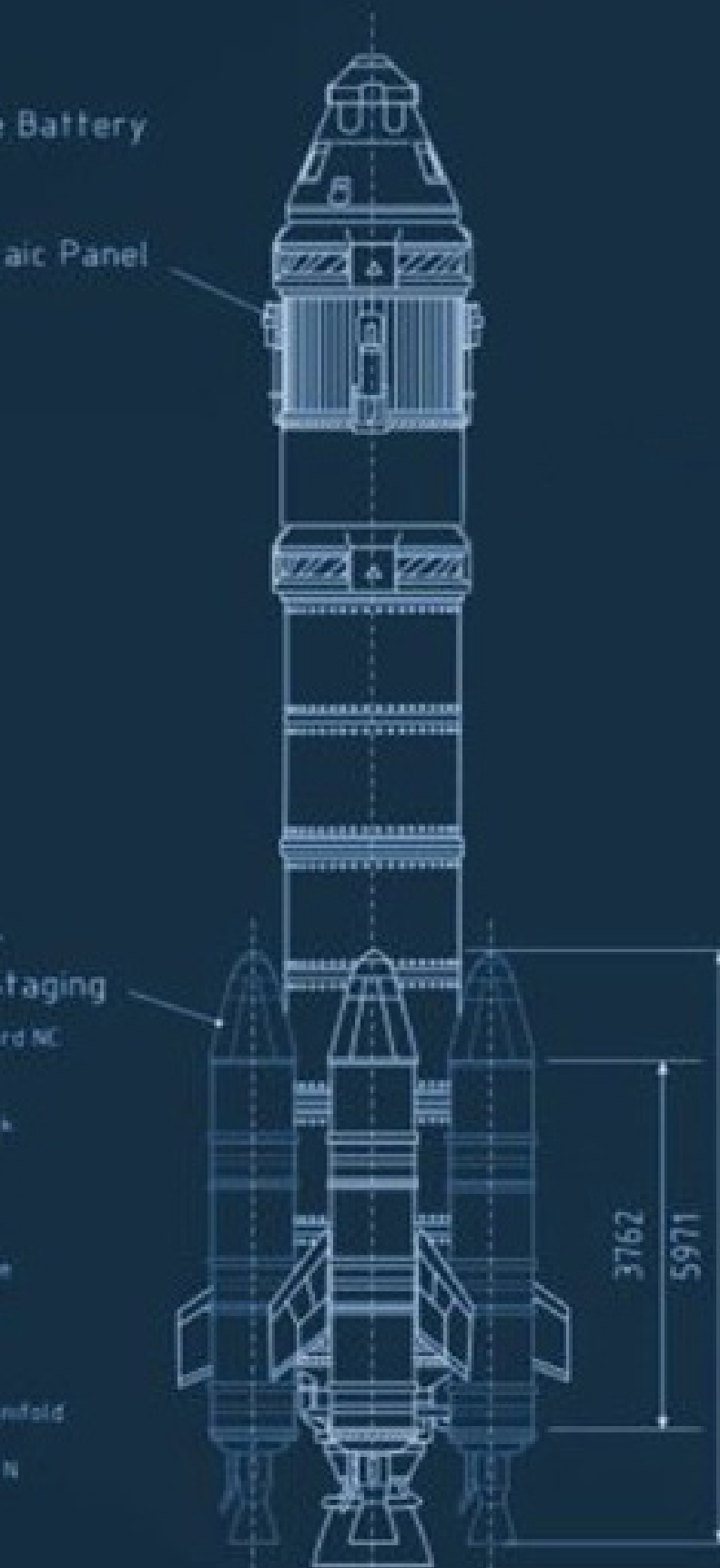
Lisa Marie Persaud



1st Stage

Stage	TWR (K)	Δv (km/s)	Time
1	2.10	279 m/s	12.9 s
2	2.07	322 m/s	15.0 s
3	2.04	380 m/s	17.8 s

Total Δv : 981 m/s



Leveraging agile best practices for engineering design optimization in the aerospace industry | [My top five strategies for agile implementation](#)

By Dr. Michaelyn Thomas

*S*ystems engineering is the trans-disciplinary cross-function of where all facets of engineering intersect. It focuses on managing complex engineered systems from the conceptualization phase through the end-of-life phase. Systems engineering is typically deployed to design, integrate, and implement complex systems such as research and development programs including artificial intelligence systems, space systems, aeronautical systems, robotics, and software design. For the management of complex systems, systems engineering is inherently intertwined into the program management workflow.

Program management is the collection of many related projects with designated project leaders, who tree up to the overarching program construct which is led by the program manager and the program management office.

Historically in the aerospace industry, complex engineered systems are program managed through traditional workflow processes. However, now more than ever, the systems engineering of complex systems must adapt quickly to the advancing

technological innovations to ensure the appropriate time-to-market strategy as well as the customer's competitive advantage. One way to accomplish this is by embracing and implementing agile program management best practices within the aerospace industry in efforts to reduce engineering complexity early on, and quickly, throughout the program lifecycle.

What does agile even mean?

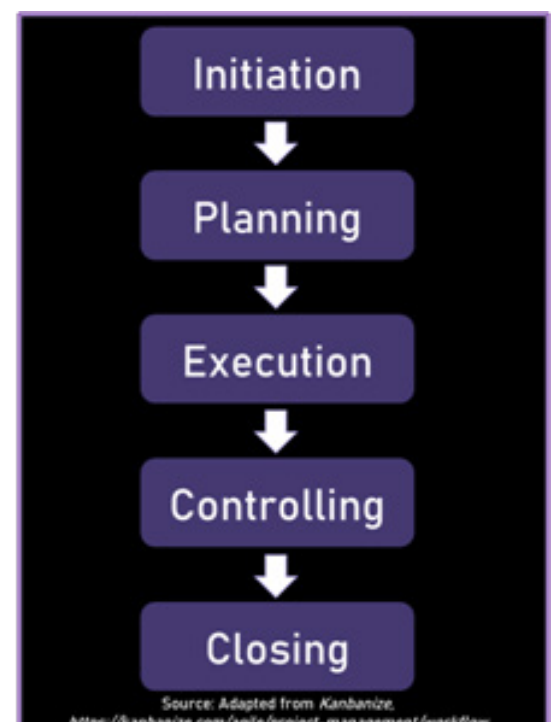
Agile is a way to program manage complex engineering designs by disrupting the traditional workflow. It prioritizes adaptability, high quality, and low cost through collaborative and iterative problem-solving. Agile is not doing what has been done before, only faster, but rather, it is a mindset and culture shift of how organizations manage complex programs. Agile can and should be implemented at the various project levels within the program because this will influence and shape the program management workflow. When all project leaders within any given program manage their work with an agile mindset, the program manager will be equipped to implement and push agile best practices from a systems level and holistic vantage point.

Typically, the agile style of program management would require a complete organizational culture change because it disrupts what has always been done before. In efforts to get a full understanding of agile program management, it is important to highlight the traditional way to manage complex engineered systems.



The traditional program management workflow is managed in a consecutive, linear manner where the next step in the process cannot commence until the previous has finished. According to Kanbanize, the main program management steps within the traditional workflow are

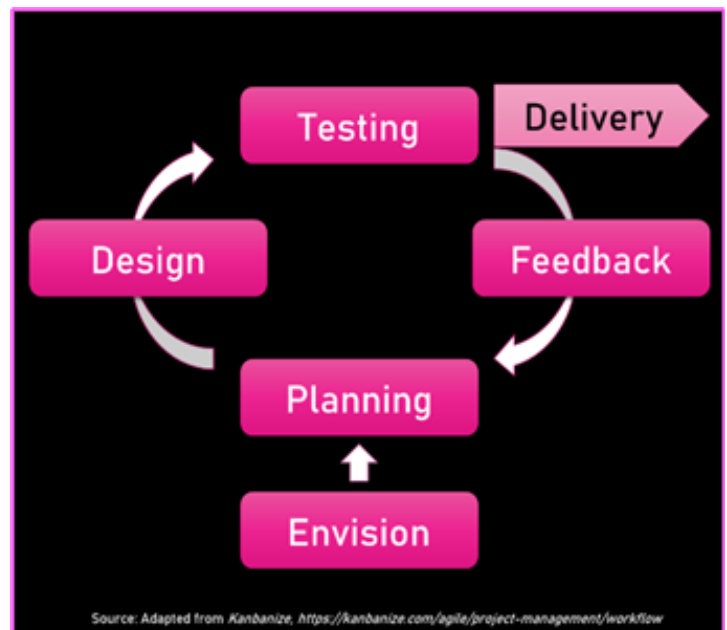
- 1) Initiation
- 2) Planning
- 3) Execution
- 4) Controlling
- 5) Closing



The traditional program management workflow is also known as the waterfall approach. While the traditional program management workflow is deemed effective, it presents challenges when managing dynamic, complex engineered systems because of the inability to adapt quickly to evolving requirements. It takes time to develop a new system, and innovation is a deep process where requirements can change. These changes are either driven by the customer or by the contractor based on the fast pace of new technology. Within the traditional program management framework, once a change in requirements is approved, the project teams of that program will ultimately need to go back, undo, and redo work which equates to high costs and delayed schedules for the program.

Conversely, Kanbanize depicts the agile program management workflow as more cyclical and emphasizes that program management teams must work cross-functionally and in parallel as opposed to linearly like the traditional workflow. The agile program management style focuses on -

- 1) the customer
- 2) empowered project teams
- 3) iteration
- 4) working on smaller work packages
- 5) collaboration and cross-functional work environments; and,
- 6) continuous improvement

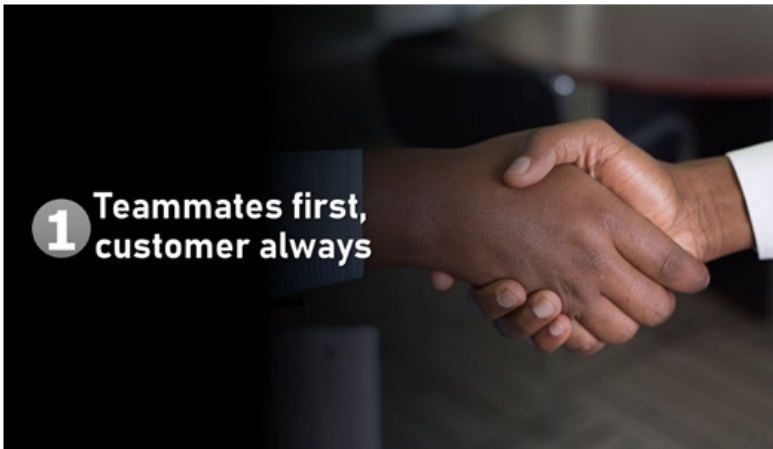


Essentially, the agile workflow process prioritizes increased visibility on how work is being managed, while providing the appropriate level of transparency to the customer. Agile has the ability to identify issues early which enables prompt corrective actions. This coupled with an iterative mindset enables sensible time-to-market and creates a strong competitive advantage by embracing value-based processes (agile) that successfully meet the customer's expectations.

My top five strategies for agile implementation

Agile program management generally requires a culture change which most likely will not happen overnight within any organization. However, it is key to understand what leaders and individual contributors can do to embrace agile best practices that will foster, accelerate, and embrace positive change as it relates to the development life cycle of complex engineered systems.

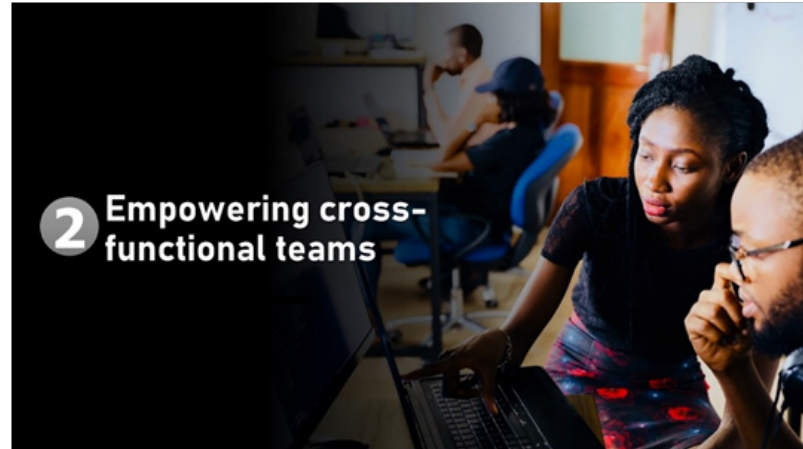
1. Teammates first, customer always



The cornerstone of the agile program management workflow is high team morale and employee empowerment, with an emphasis on meeting customer expectations. It is imperative to build complex programs around motivated and high performing teammates. Leaders must provide a work environment conducive to this, while trusting that their teams will get the job done.

The right people need to be placed in the right positions and given the space required for program success. Within an agile construct, it is the program manager's number one priority to empower, inspire, and motivate all teammates contributing to the program as opposed to employing heavy oversight and micromanagement. Program deliverables should be provided to the customer throughout the lifecycle in efforts to solicit customer feedback. This will also allow program teams to be highly responsive to customer requirements that may change.

2. Empowering cross-functional teams



This is a direct extension of item number 1, teammates first, customer always. When teammates are empowered, productivity increases, quality is prioritized, and the best engineering designs emerge. The agile mindset is grounded in the necessity for empowerment to be spread cross-functionally, by allowing diverse-skilled teams to self-organize—Leaders must give their program teams the right amount of autonomy to accomplish this. This allows for maximum collaboration and innovation (within budget, of course).

Tangible tactics that all program leadership teams should do immediately is:

- 1) set clear roles and responsibilities
- 2) employ teammates with diverse skill mixes—be on the lookout for underutilized talent
- 3) promote early and often communication and allow project teammates to “go ugly early”—create a safe space for teammates to bring issues and bad news for-

ward without fear of reprimand,

4) host daily 15 minute tag-ups by allowing key program teammates to have the floor to speak up about challenges and issues they are facing or anticipate facing.

Individual contributors should feel empowered to keeping their program leadership accountable to this.

3. Failure is ALWAYS an option



In the aerospace industry, people are ingrained to believe that failure cannot happen, and yes, this is very true for human safety and mission assurance. However, when speaking of “failure” within the agile framework, this is really about growth and learning for continuous improvement. Agile program management focuses on experimentation and evaluation coupled with rapid prototyping. Understanding “failed” outcomes as a result of experimentation, evaluation, and rapid prototyping leads to implementing sound solutions for execution.

This definition of “failure” requires a drastic culture change because not all tradi-

tional organizations have the in-house capability or resources for experimentation, evaluation, and rapid prototyping. However, in efforts to keep up in the evolving, fast-paced aerospace community, this mindset and practice is a must. Through continuous improvement, it is imperative for the teams to host after action reviews after each iteration to ensure lessons learned are captured.

4. Embrace changing requirements



Change is a part of the development complex design lifecycle, and the more programs can be adaptable to this inevitable phenomenon, the more likely programs will be better positioned in the marketplace. The ability to implement changing requirements quickly and efficiently will ultimately support the customer’s competitive advantage.

In an agile program management framework, programs must welcome evolving requirements even if received towards the end of the development lifecycle. Within the traditional program management workflow, it can be very challenging to accommodate requirement changes, espe-

cially late, due to the extensive processes and having to restart an already completed step in the traditional workflow structure.

Agile ensures that programs can adapt in fast-paced environments, no matter how late in the program lifecycle, with minimal delay. This is driven by project leaders working collectively on smaller work packages, iterating for continuous improvement, and delivering program milestones regularly and throughout the program lifecycle to customers.

5. Think “KISS”



“Keep it simple stupid”, also known as the KISS Model, is a United States Navy term coined in the 1960s. When applied within the agile program management framework, it really means to follow the customer’s requirements without over designing, by developing a solution that meets cost, schedule, and performance.

Do not deliver a Lamborghini when the customer requested a Toyota. Both are equally great vehicles, but one is much more affordable.

A program that has embraced the agile mindset aims to get just enough done to complete the program and meet the requested requirements and specifications. Any additional documentation, processes, or work that does not add value to the customer, organization, or enhance program deliverables, should be excluded.

Why is this important and what can you do to embrace agile?

Today’s engineer must go beyond the engineering because the market demands for this. The aerospace industry is going through a cultural and market shift where commercial applications are on the rise. Traditional government customers have a need for modularity, flexibility, affordability, and speed, with safety and mission assurance at the forefront. Agile program management aims to achieve this, and it benefits both the customer and contractor. Engineering specialists are still very relevant and needed. However, engineering generalists who have experience with cost, schedule, and systems thinking capabilities are high in demand across the aerospace industry. Diversity of skills within engineering teams and cross-functional teams are a must when building agile program management teams.

So, what can you do to embrace agile? If you are a manager, take a step back and identify what is driving complexity into your organizational processes and engineering designs. If you are an individual contributor, remember that you can lead from any chair.

Feel empowered to share with your leader your observations on engineering complexity and how the team can pivot towards optimization and increased efficiency. Lastly, ask many questions early and often. Center questions around, “is there a lower cost engineering solution?” or “is there a more streamlined process for effective problem-solving?”. If unsure, partner with your organizational support functions like finance and supply chain by leveraging their expertise on innovative cost solutions, as well as partnering with human resources to understand and recommend streamlined organizational processes.

Driving out engineering complexity, increasing efficiency, implementing new and innovative ways to problem-solving, and staying relevant in the dynamic aerospace industry, begins and ends with best practices and principles of agile program management. Diversity of skills and empowered project teams will reduce inefficiency and will ensure the emergence of out-of-this-world technology.



Dr. Michaelyn Thomas

Professionally, Dr. Michaelyn Thomas is a space expert, specializing in program management and business operations for complex space systems. She is on a mission to make rocket science affordable in efforts to create equitable access to space for new and existing satellite providers. Michaelyn also identifies as a finance subject matter expert, specializing in cost estimating, cost/price analysis, and comparative and competitive pricing for complex space systems; an organizational leadership subject matter expert, specializing in building strong and productive teams coupled with an equity, diversity, and inclusion mindset at the core of organizational structures; and as a space policy analyst, researching how the market drives and influences space systems development and implementation.

Scholastically, Michaelyn belongs to two academic honor societies—Tau Beta Pi (the engineering honor society) and Dobro Slovo (the national Russian honor society). She holds a doctorate degree in organizational leadership from University of La Verne; a master of science degree in space systems engineering from The Johns Hopkins University; a master of business administration (MBA) degree from University of Redlands; and a bachelor of arts degree in political science, public law with a minor degree in Russian language from California State University, Long Beach. She has three publications, including her doctoral dissertation, which is entitled, “Exploring the advancement of women in science, technology, engineering, and mathematics (STEM) executive management positions in the aerospace industry: Strategies identified by women that enable success”. Her most recent publication is entitled, “You don’t have to be a rocket scientist to work on rockets”, which appeared in the April 2021 issue of STEM Magazine.

Michaelyn is the founder of <https://spacedoutdoc.com/>, and there she shares thoughts, experiences, and research through storytelling in efforts to build community with a shared vision of women empowerment in the aerospace industry. She is also very passionate about community service, and she dedicates her spare time to inspire as many girls, women, and all underrepresented groups to pursue STEM education and STEM careers. She accomplishes this through community STEM activities, sponsorship, and serving as an executive mentor for the Patti Grace Smith Fellowship program.

e

Stage	Time
6	143.6 s
7	---

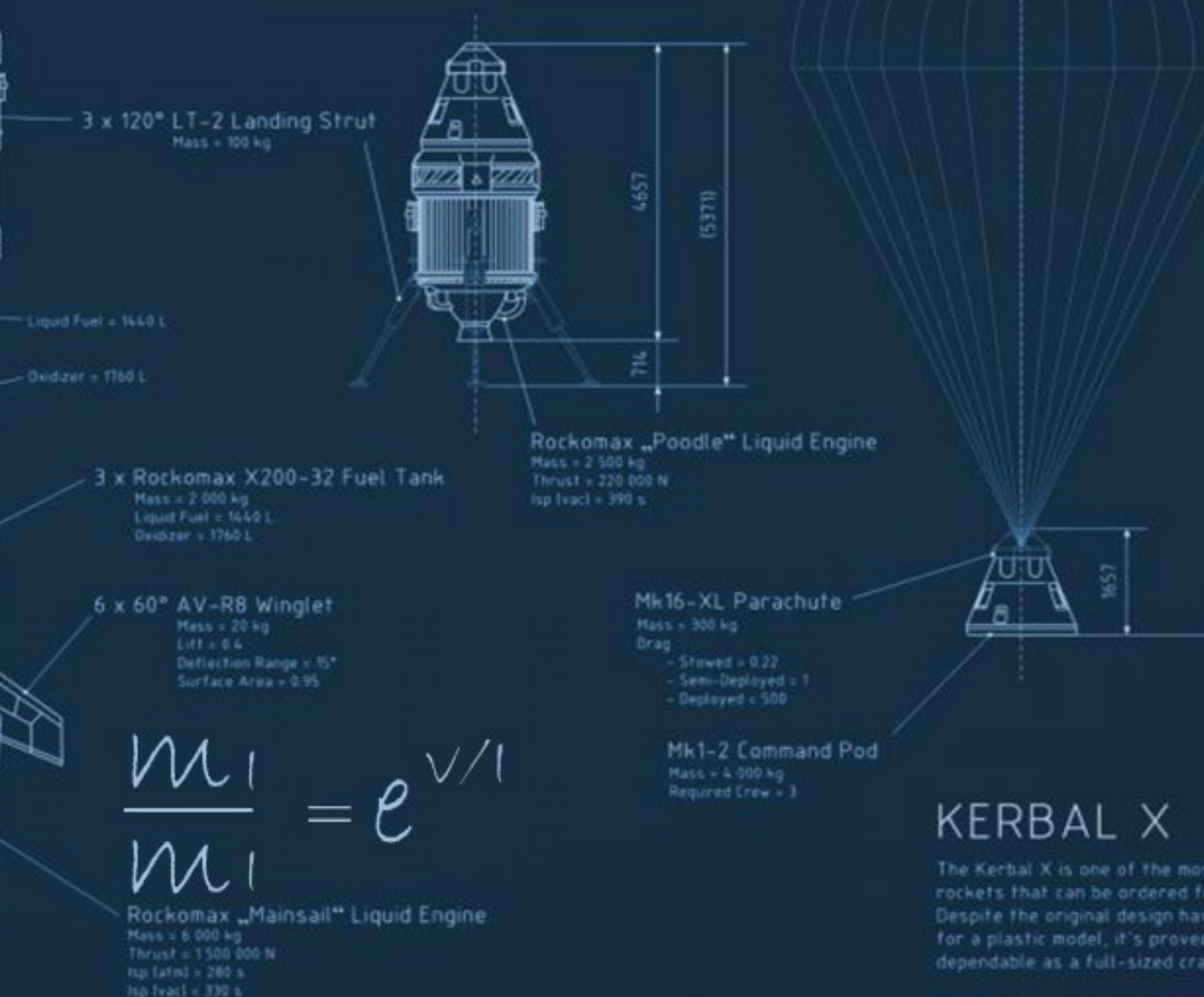
6th Stage

Stage	TWR (K)	Δv (vac)	Time
6	1.35	2523 m/s	2.191 s
7	---	---	---

8th Stage

Stage	TWR (K)	Δv (vac)	Time
8	---	---	---

ROCKET SCIENCE



KERBAL X

The Kerbal X is one of the most powerful rockets that can be ordered for Kerbin. Despite the original design having been created for a plastic model, it's proved itself as a dependable as a full-sized craft.

The X is capable of achieving orbit around Kerbin, and even features a variety of landing legs on its upper stages.



Slooh Launches New Grant to Help **One Million Students** Explore Space Using Its Robotic Telescopes

Teachers encouraged to apply by October 18, 2021 to receive Slooh license, professional development, and 40 student seats to bring the wonder of space to their classrooms

Slooh, the only organization offering live online telescope feeds of amazing astronomical events to students, is launching The Slooh Space Exploration Grant for the 2021-2022 school year. The grant is being provided with the goal of helping one million students nationwide experience the wonder of space from their classroom and home computers.

The rolling grant will provide one teacher per every accredited public school in the United States with access to the Slooh interface, robust professional development, and 40 student seats which will enable students to use robotic telescopes to view space phenomena, capture observational data, and engage in gamified learning.

“Space exploration is a powerful – and truly magnificent – way for students to build their scientific knowledge and practices, while tying celestial phenomena to STEAM concepts,” said Michael Paolucci, founder of Slooh. “Our new grant provides an equitable opportunity for students across the country to reap the benefits

of space exploration as they become well-informed citizens and 21st century thinkers.”

To apply for The Slooh Space Exploration Grant, teachers must complete a short application, including a brief response about how Slooh will support space exploration for students at their school. One teacher from every accredited public school in the United States will be eligible to receive the grant, which provides access to the Slooh interface and resources valued at \$750.

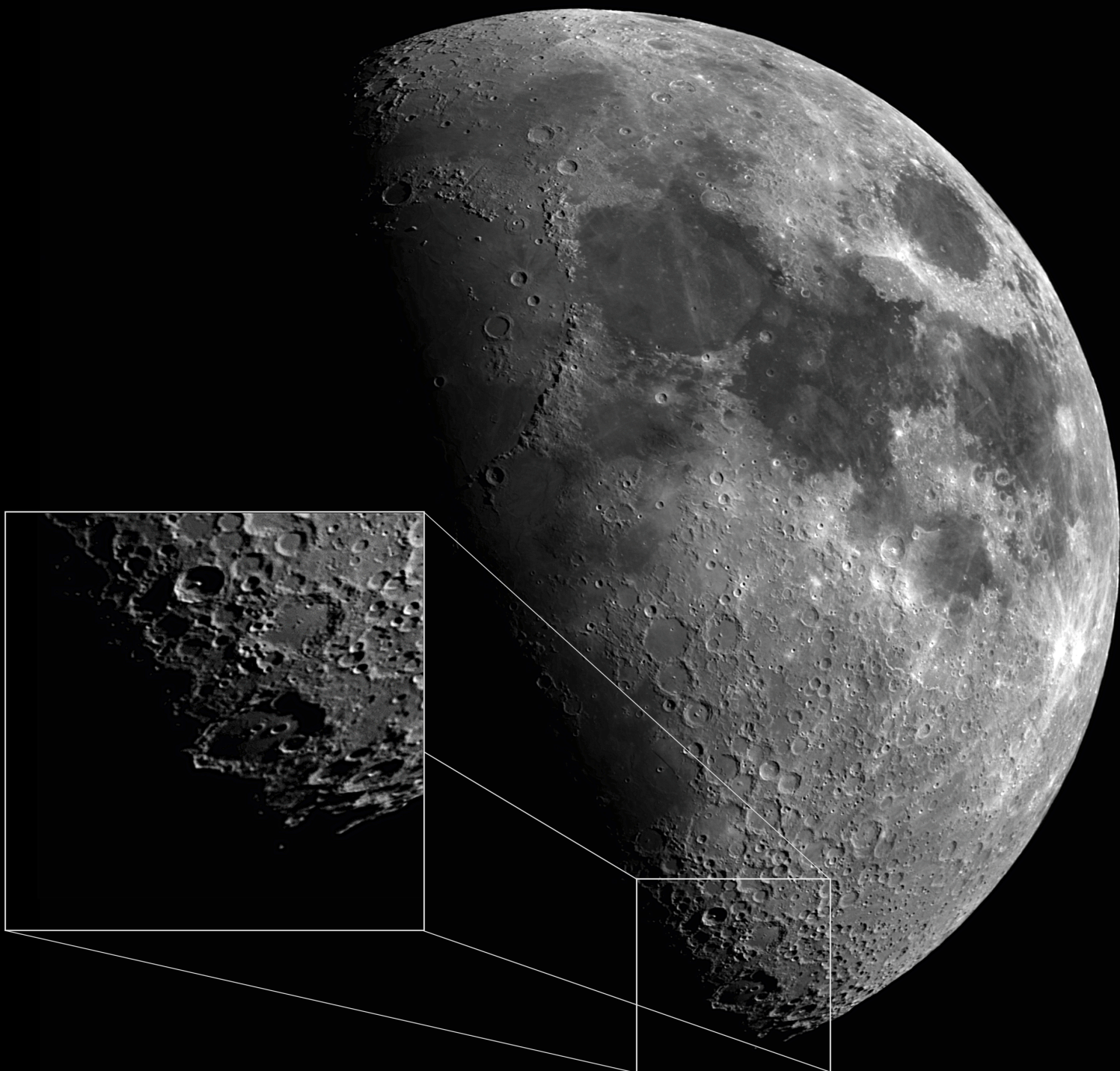
Applications for the first round of judging are due by **October 18, 2021**. Additional application rounds will be available throughout the school year.

<https://www.slooh.org>

With Slooh, students can view phenomena such as lunar changes, solar flares, asteroids, living and dying stars, and a variety of nebulae in real-time using Slooh’s patented Mission Interface and user-controlled network of robotic telescopes in

Age: 9-days past new

Phase: 60% (Waxing)



High-Res Waxing Gibbous Moon

Slooh T1 Half Metre Telescope

2014-06-06T21:14UTC



the Canary Islands and Chile, South America. Educators are supported by Slooh's astronomy team and receive robust professional development and product training to ensure that all students have access to celestial phenomena.

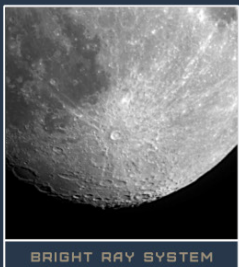
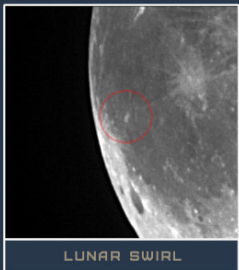
To learn more about Slooh and to **apply** for The Slooh Exploration Grant, visit [Slooh.org](https://www.slooh.org).

About Slooh

Funded in part by a National Science Foundation grant, Slooh brings the wonders of space exploration to upper elementary

through post-secondary students around the world.

For almost 20 years, the company has provided the ability to view space phenomena, capture observational data, and engage in gamified learning through its patented Mission Interface and user-controlled network of robotic telescopes in the Canary Islands and Chile. The company additionally provides robust professional development and access to astronomers to help educators drive student learning. To learn more about Slooh, visit [education.slooh.com](https://www.slooh.com).



La Dehesa

Slooh owns and operates four telescopes in one large clamshell dome, based in La Dehesa, Chile, at Pontificia Universidad Catolica de Chile. With a southerly latitude of 33 degrees, the observatory is ideally placed to capture southern hemisphere gems.



33°



33°

Xylem Expands Investment In Next Generation Of Water Innovators

Global water technology company, Xylem is expanding its investment in youth innovation to empower the next generation to solve the world's greatest water challenges. The diverse program, including over 60 events in 2021, builds on Xylem's 25 year sponsorship of the Stockholm Junior Water Prize with innovation competitions, in addition to community outreach initiatives and a global innovation incubator program.

The annual competition brings together students from 40 countries, and has enabled an estimated 125,000 youth innovators to bring forward solutions to urgent water challenges since the competition began in 1996.

"With water challenges intensifying by the day, we are investing in the next generation of water innovators," said Patrick Decker, Xylem's Chief Executive Officer.

"Young people have a leading role to play in putting water issues on the agenda – and solving them. They inspire us, and the world will gain from their passion and creativity. "We invest in platforms like the Stockholm Junior Water Prize and other initiatives that provide students with the opportunity to advocate and innovate for a sustainable water future," Decker added. "The talent of the students participating in the Stockholm Junior Water Prize is simply inspiring – and a great reminder of the energy and commitment, across generations, to solve the world's greatest water challenges."

xylem
Let's Solve Water



“Stockholm Junior Water Prize celebrates young people’s determination to be part of a better future,” said Torgny Holmgren, Executive Director at Stockholm International Water Institute. “The passion and ingenuity that all participants show is truly inspiring and an important contribution to the global water world. At SIWI, we are proud to host the Prize and organize this event in close partnership with Xylem.”

SJWP is one of 60 youth-oriented events Xylem invests in, around the world, under the banner of Xylem Ignite, its dedicated student development program targeting students worldwide. Since the program’s inception last year, Xylem Ignite has already engaged more than 6,600 students in creative water-oriented hackathons and sustainability events, including 650+ participants from 47 countries competing in the Xylem Global Student Innovation Challenge.

The challenges included: reducing the water footprint of everyday products; gamifying water quality education; predicting urban floods; and designing a water system for life on Mars. Participants can also apply to be a part of the Xylem Ignite Innovation Incubator. The Incubator program provides up to 12 months’ support for participants to scale up their innovations and advance them toward market readiness.

Through Xylem’s partnership with City Football Group and its global foundation program, Cityzens Giving, the Company

is empowering youth to use the power of football to provide vital water education to millions of fans around the world. And through Xylem’s corporate citizenship program, Xylem Watermark, the Company is building awareness of water challenges through youth-led community outreach initiatives that promote water, sanitation and hygiene (WASH) practices.

2021 Stockholm Junior Water Prize Winner

Eshani Jha from the USA has received the prestigious 2021 Stockholm Junior Water Prize for research on how to remove contaminants from water. HRH Crown Princess Victoria of Sweden, the official patron of the prize, announced the winner on during an award ceremony as part of World Water Week.



Eshani Jha is a student at Lynbrook High School in San José, California. She has done research on how to remove contam-

inants from freshwater in a simple and cost-effective way. The process involves replacing active carbon with biochar for use in efficient and cheap water filters.

“I am honored to receive this prize, particularly with so many excellent contributions from around the world,” said Jha. “I hope we can work together in the years to come, for a better water world. We really are the future of water-related science.”

Her invention targets certain classes of contaminants, particularly pesticides, emerging contaminants, and heavy metals. She explains that she has enhanced the biochar’s ability to act like a sponge for these contaminants, creating a “super sponge.” “I see a multitude of applications for this, and I also see great potential in targeting other contaminants too,” she said. “My ambition is that this should be a one-stop water filter.”

The Jury noted that: “Water contamination is a growing problem around the world, with new contaminants discovered and increasing concentrations of existing pollutants being recorded. The simplicity of this solution is that it addresses multiple, varied contaminants with a single device, and that device is potentially scalable to global use, with the added benefit of localized manufacture.”

About Xylem

Xylem (XYL) is a leading global water technology company committed to solving critical water and infrastructure challenges with innovation. Our more than 16,000 diverse employees delivered revenue of \$4.88 billion in 2020. We are creating a more sustainable world by enabling our customers to optimize water and resource management, and helping communities in more than 150 countries become water-secure. Join us at www.xylem.com.

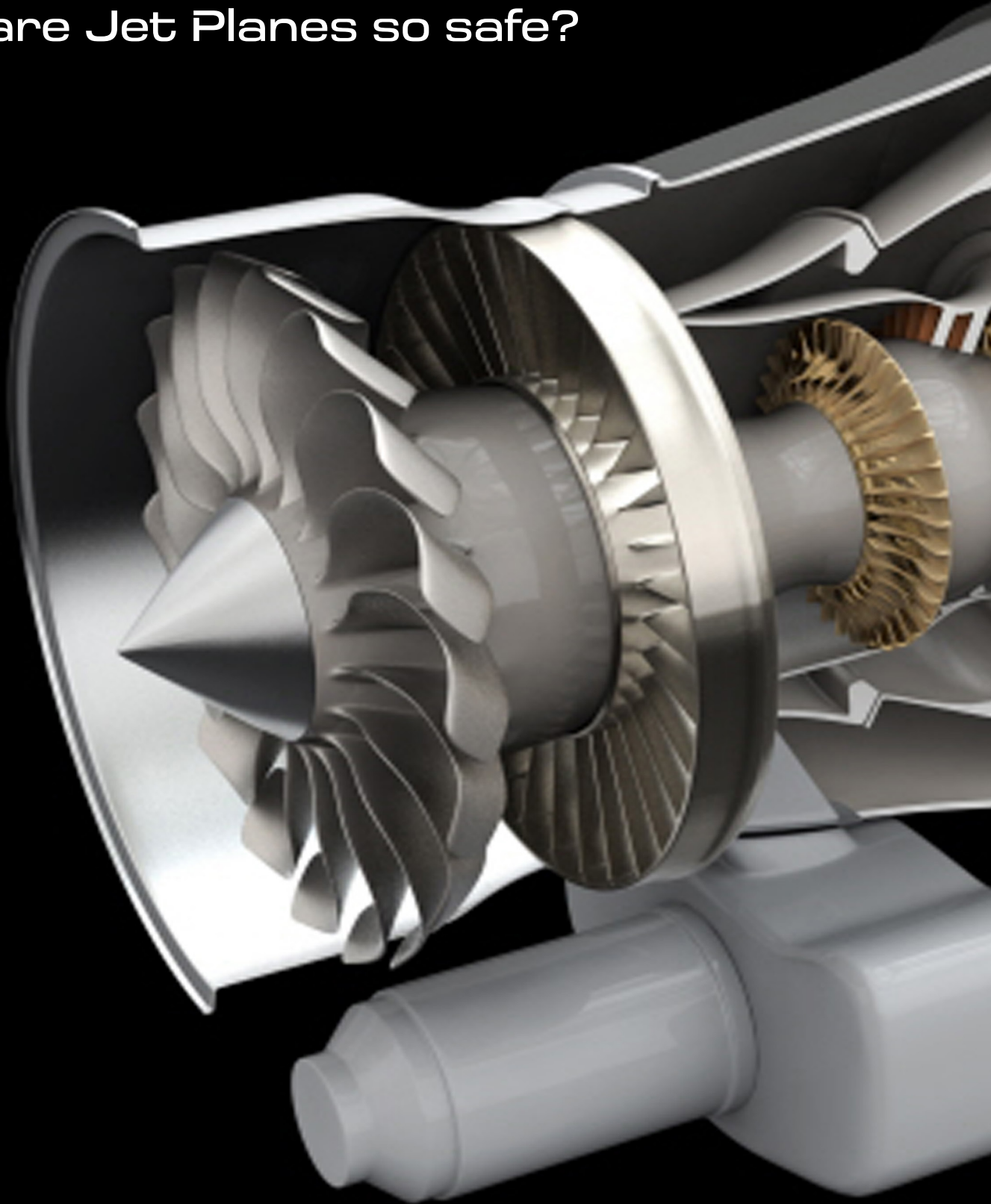
About SIWI

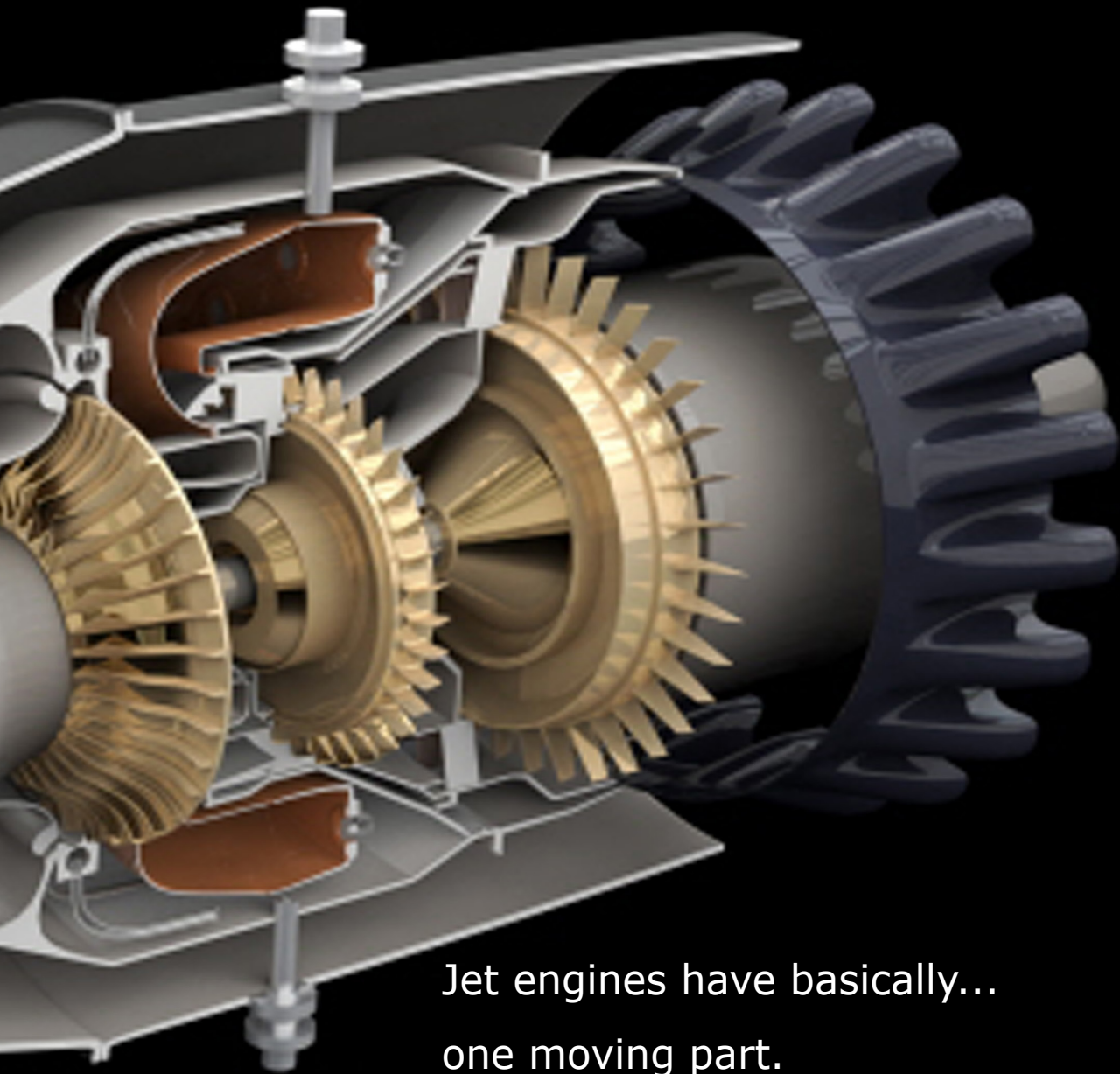
Stockholm International Water Institute, SIWI, is a world-leading expert on water governance, water diplomacy and cooperation over shared water resources. It is a not-for-profit foundation, advising governments, cities, and companies across the world. SIWI hosts UN programmes, organizes the leading global water event World Water Week and awards the prestigious Stockholm Water Prize and Stockholm Junior Water Prize.

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