

### VEX IQ STEM CAREER READINESS ONLINE CHALLENGE

### AEROSPACE ENGINEERING

PLASMATIC PROTONS 1565F MAYA GRACE



### WHO AM I AND WHAT STEM CAREER APPEALS TO ME THE MOST?

Hello, my name is Maya, I'm 13 and I'm a member of UK Vex Robotics Team 1565F Plasmatic Protons .

The STEM career that appeals to me the most is Aerospace Engineering specifically Astronautical Engineering. My dream is to be sitting at mission control at a rocket launch! I've always been fascinated by Space Exploration and STEM in general and eagerly look forward to investigating ideas beyond classroom lessons. When I was five years old I made a water powered rocket and that was the start of my fascination with science and engineering. Aerospace Engineering is the branch of engineering concerned with the design, construction and science of aircraft and spacecraft. It is broken into two major and overlapping branches: Aeronautical Engineering and Astronautical engineering. The former deals with craft that stay within Earth's atmosphere, and the latter deals with craft that operate outside of Earth's atmosphere



The Space X Starship SN8 sitting on its launchpad



# WHY AM I INTERESTED IN AEROSPACE?

I was first interested by spaceflight and aerospace engineering when I heard of SpaceX in 2017. I remember watching a rocket booster land after its gone to space I was amazed and decided I wanted to be apart of this community. In 2018 I watched the Falcon Heavy launch into space and the two boosters land, I had a huge smile on my face the whole time. I couldn't get over how far spaceflight had gone in a few years. I sent the picture of the two boosters landing simultaneously to all my friends and told them about how incredible it was.

#### 6 February 2018 16:46

Edit

This is the screenshot of the boosters of the falcon heavy landing which I sent to all my friends!





That was also the day I changed my home screen on my phone to Starman in the Tesla Roadster in space, Its been like that ever since. I could only talk about the launch for the rest of the week, my friends tried and failed to get me to talk about anything else!



The Falcon heavy which was launched on 6th February 2018



# ...WELL ACTUALLY IT IS

### WHAT IS AEROSPACE ENGINEERING AND HOW WILL IT CHANGE?

Aerospace engineering is the study of designing and building machines that fly. It is one of the newest branches of engineering, it began in the 19th century with the first experiments in powered flight. As an aerospace engineer you can design aircraft, spacecraft, satellites and missiles. Or research and test different technology.

Aerospace is one of the most rapidly changing careers because with every advancement of technology opens up lots of new ideas and designs that could work in a real world situation. Furthermore because we are trying to accomplish things in places that man has never been we encounter problems that we don't have the answer to. By finding the answers to those questions we might also discover more more efficient ways for existing processes. Innovation is always happening in aerospace engineering therefore aerospace engineering is always evolving and because there is so much more to be discovered.

In the next 10 years I think that aerospace engineering will merge with other careers and technology. I think it will combine with elements of medicine and biology first. This is because missions going to the moon and later on to Mars will need to get there safely. Cryosleep is an amazing example of the medicine/biology and aerospace fields working together.



The R-7 rocket that launched the first ever artificial Earth satellite Sputnik.

## **O WHAT IT TAKES TO BE AN AEROSPACE ENGINEER**

I decided to look into the skills you need to have my dream job which is a Propulsion Engineer at Space X.

#### CREW DRAGON PROPULSION ENGINEER

A Dragon Propulsion Engineer is responsible for the continued development of propulsion and fluid systems of the most advanced manned spacecraft in the world. These systems currently deliver cargo and crew safely to and from International Space Station, but further iterations and new designs will likely be necessary to extend humankind's reach to the moon, Mars, and beyond.

#### **RESPONSIBILITIES:**

- Develop (design, analyze, build, and test) propulsion engines, fluid components (e.g., valves, instrumentation, etc.), tanks/pressure vessels, and/or fluid systems for the Dragon spacecraft
- Own critical spacecraft propulsion hardware/systems, as every engineer at SpaceX assumes profound responsibility for their hardware
- Interface with our world-class production team to ensure designs are successfully translated into the fleet of Dragon spacecraft that is revolutionizing access to space

#### BASIC QUALIFICATIONS:

- Bachelor's degree in aeronautical/astronautical, aerospace or mechanical engineering
- 1+ years of professional or internship experience with design (CAD) and analysis (structural and fluids)

# This is a screenshot from the job specification on the Space X website.

#### PREFERRED SKILLS AND EXPERIENCE:

- Master's degree in aeronautical/astronautical, aerospace or mechanical engineering
- Strong understanding of spacecraft and/or launch vehicle propulsion systems and fluid components
- Experienced in NX 8.5 or other CAD packages (PTC Creo, CATIA) with a solid understanding and application of geometric dimensioning and tolerancing (GD&T) per ASME Y14.5-1994
- Proficient in basic principles of compressible and incompressible flow, thermodynamics, thermochemistry, mechanics, materials, and electrical circuits
- Professional or project experience with FEMAP, ANSYS, or similar finite element analysis (FEA) software tools, as well as good understanding of fatigue, fracture, and crack propagation
- Knowledge of metallic and fluid system manufacturing techniques, processes, equipment, and other processes such as machining, electron beam welding, orbital tube welding, tube bending, structural assembly, etc.
- Good understanding and experience working with aerospace materials (metals, plastics, composites)
- · Solid understanding of test methods/setups and data acquisition systems
- Ability to perform trade studies using first principals and engineering fundamentals to make clear recommendations even with partial information
- · Passion for advancing the commercial space industry and human spaceflight
- Able to work well in an integrated collaborative team environment, including frequent interactions with technicians, other engineers, and managers
- Highly self-motivated with strong organizational and written/oral communication skills able to
  prioritize and execute tasks in a high-pressure environment with the ongoing drive for
  continuous improvement in all aspects of work

## **O WHAT IT TAKES TO BE AN AEROSPACE ENGINEER**

As well as researching my dream job I also researched other jobs in the same field. These are the most common requirements .

- A Bachelor's (some require Masters) degree in aerospace engineering
- Experience working with CAD
- Can work well in a collaborative team environment
- Highly self motivated with organisation and communication skills
- Can work in a high pressure environment
- Passion for advancements in the Space Industry
- Critical thinking
- Computational thinking (Advanced problem solving)
- Advanced programming in Python, C++ and MATLAB.



Some of my first code from VEX IQ last year working towards C!

Also a common thread throughout many of the articles I read was the importance of maths as this underpins many of the core subjects in aerospace engineering and the physics required

## HOW IS INVOLVEMENT IN COMPETITIVE ROBOTICS IS PREPARING ME FOR THIS FIELD?

My involvement in competitive robotics is preparing me for this field because it gives me experience in a wide range of skills:

- Working in a team to maximise our productivity by listening to everyone's ideas.
- Working with CAD to design my robot has introduced me to CAD software.
- Working under pressure e.g. having to fix the robot that you accidently dropped in the middle of the competition!
- Learning to code the robot has given me a basis to learn other programming languages
- Collaboration when working with other teams to form an alliance
- Problem solving by finding strategies to maximise efficiency
- Appreciation of the iterative design process through having to keep an engineering notebook



Our team winning the energy award last season at Nationals

# **DR ANITA SENGUPTA**



Dr Anita Sengupta is an aerospace engineer she started her career working on the launch vehicles and communications satellites at Boeing. Next she worked at she helped develop the ion engines that powered the Dawn spacecraft to reach Vesta and Ceres that launched in 2006. She then created the supersonic parachute system that was the landing system for the Curiosity Rover which went to mars in 2012. Then she led the development of the Cold Atom Laboratory it is a laser-cooling quantum physics facility which is now on board the International Space Station. She was also the senior executive on the hyperloop project which is a maglev train in a vacuum. Now she is leading the development of terrestrial and space based transportation technologies as an entrepreneur and research professor.

I saw Dr Anita Sengupta speak at the Ri (The Royal Institution) on The Hyperloop: The future of green highspeed transportation. It was a really interesting dive into what our future could look like and the vast amount of opportunities for aerospace engineers in the future. This really inspired me to keep on learning and expanding my knowledge on aerospace engineering because it shows that anything is possible even in a field where we don't have that much knowledge.



The Dawn spacecraft was launched on a Delta II-Heavy rocket in September 2007

# **BIBLIOGRAPHY AND CITATIONS**

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