SunrIde Proposal 2020/21

About Us

SunrIde (Sheffield Universities Nova Rocket Innovation Design Engineering) is a team of students from 1st-year undergraduates to PhD students, from various Science and Engineering departments of the University of Sheffield and Sheffield Hallam University. The team was formed in 2017 with an objective of bringing together engineering skills and innovation for amateur rocketry.

We are a passionate team of students striving for excellence through engineering innovation with the intention of acquiring hands-on rocketry and space technologies experience and developing our engineering acumen. We aspire to build a platform for students of all levels of expertise to learn and have hands-on experience in rocketry and its adjacent technologies. We aim at achieving that by integrating students' projects into our rockets designs and payloads, collaborating with other universities and companies across the UK, and providing teaching materials and activities in all forms to students thriving to learn about rocketry.

Achieving such goals requires building a fluid team spirit. Therefore, what makes us productive and special as a team is that we provide a fair chance to exchange knowledge, time, and experience between all students and from alumni to current members. Following our belief of providing the best environment to get a dynamic work ethic and the best out of individuals, we arrange socials, take part in conferences and events to encourage our members to bond and communicate better.

The Sheffield Space Initiative (SSI) was founded in 2017 to further engage in the science and engineering challenges involved in the exploration of Space, its a highly cross-disciplinary group of projects that are now developing a real heritage of success for Sheffield and our STEM students in particular. It aims to share knowledge and experience of this exciting industry through research-led teaching methods. SSI has now also forged partnerships with other institutions in the UK, Europe, Asia, Australia and America.

Achievements

Ground-breaking agendas: Team SunrIde takes pride in being the first officially recognized UK team in history to participate in the world's largest international university rocket engineering competition, Spaceport America Cup. One of our goals is to have a team in the University of Sheffield participate every year in the annual Spaceport America Cup.

Rocket Amy 2018

Rocket Amy was a high-power rocket that aimed to reach 10,000ft altitude in Spaceport America Cup with 4 kilograms payload carrying capacity and a solid COTS motor.

James Barrowman Award: SunrIde is the award winner for the Best Flight Dynamics. We received the James Barrowman award at the Spaceport America Cup 2018 for achieving the most accurate altitude prediction with an altitude accuracy of 99.83%' under 10,000ft. This is a substantial achievement being the first and only team from the UK to ever participate and receive an award in the world's largest Intercollegiate competition.

Rocket Helen 2019

Helen was a sounding rocket made of carbon fibre with aluminium nose tip competing in Spaceport America Cup 2019 in the 30,000 ft. apogee category with a COTS Solid motor. The use of unique bio-resin in the place of epoxy resin displayed the team's aim to reduce environmental impact in manufacturing processes. The rocket also carried a scientific payload on-board to conduct vibrational analysis on interior components, which aids with future vibrational studies for sounding rockets in the university.

Breaking a national open altitude record: United Kingdom Rocketry Association has confirmed that SunrIde's rocket, Helen (named after astronaut Helen Sharman, an alumna of The University of Sheffield), that was launched in Spaceport America 2019 which recorded an apogee of 36,274 ft and speeds up to Mach 2.67, officially holds the number#1 spot in the UK after breaking the previous record was set back in October 2000 by Project MARS. This was our second rocket and our second time breaking records!

UNITED KINGDOM ROCKETRY ASSOCIATION (UKRA)

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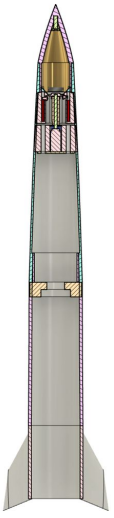
UK Open Altitude Records

Open rocketry altitude records are those in which multiple numbers of rocket motors may be employed including use in both clustered rockets and multi-stage rockets

	Altitude (feet / metres)	Name *Group*	Motor / Total Impulse	Airframe Diameter	Rocket mass	Date	Location	Altitude verification method
1	36274ft *10540m*	Team SunrIde	N5800 *20146 Ns* Ceseroni	125mm	33.5kg GLOW	June 2019	Spaceport America, USA	Perfectflite Stratologger x2
2	34579ft *10540m*	MARS	O-10000 *22000 Ns* Kosdon	104mm		October 2000	Black Rock Desert USA	IAX-96 Altimeter /Accelerometer BSR ALTACC Altimeter /Accelerometer AED R-DAS Flight Computer
6 miles high (31680 feet) / 9.6 kilometres								
3	25400ft *7697m*	MARS	O-3000 *32000 Ns* Amateur	102mm		September 2002	Black Rock Desert USA	AED R-DAS Flight Computer 1 AED R-DAS Flight Computer 2 G-Wiz LC Deluxe Altimeter/Accelerometer GPS Data Logger

SunrIde Jr. 2020



SunrIde Jr. is an amateur mid-power rocket with a solid 2 grain motor. It is expected to reach an altitude of 1350 m. For the payload, it carries a camera and a microphone from the Arduino Nano 33BLE to measure the speed of the rocket with the Doppler Effect. We are competing in the UKSEDS National Rocketry Competition in July 2020 with a design report of SunrIde Jr. as the competition went online due to COVID19.

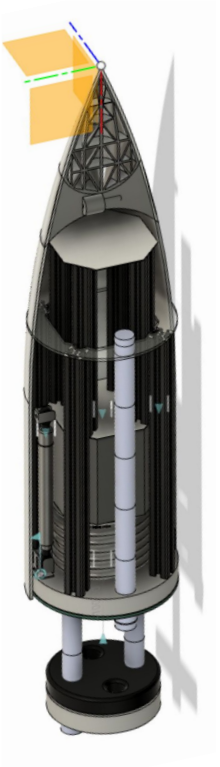
About UKSEDS:
Teams are challenged with designing and submitting a brief technical report of a mid-power rocket with the primary goal of reaching the greatest apogee possible. Motor selection is limited to ensure a fair competition between teams.

Current Projects

Rocket Vesna

As a tribute to Helen's survival and nearly perfect conditions after recovery, Vesna (named after Vesna Vulovic) was a direct upgrade to her proving reliability and reusability of her system.

Despite our intention to redesign our rocket to fit the new mission criteria, we have chosen to retain the aft body of Helen, for the structural rigidity and optimal aerodynamic performance she demonstrated. Setting that in mind, the main mission was to create a system that can adopt and launch a satellite payload at apogee, while maintaining a reliable data acquisition system to allow us to have a detailed post launch study.



These conditions made Vesna the main attraction as a platform for testing and designing innovative systems. This opened to us the door to directly collaborate with another SSI project called SunSat. Providing us with a 10cm 3U cubeSat that tests a new technology for measuring high G forces while ascending, and atmospheric conditions as it descends.

Accommodating such payload required us to build a wider forebody that can safely withstand the forces acting on the rocket, and be able to mechanically eject the payload and drogue chutes at apogee, without the use of pyrotechnics. A final year student dedicated his thesis to solve the stability and rigidity of the coupling between the different sized bodies and proper transfer of energy. By designing custom particle dampers that run through the structure, and around the launching mechanism.

The fairing system was designed to be a scalable mechanism that can be implemented into larger scale rockets, without detaching any parts for reusability, and most importantly maintaining a low outer profile that can accommodate pressure and temperature sensors with minimal aerodynamic change to the simplified simulated profile. This should result in a fast and stable descent of a singular body under the drogue and fairing flaps, before ejecting the main chutes, minimizing any damage caused by the fall.

Once the current conditions allow us, we intend to manufacture most of the components ourselves with the help of the University of Sheffield Advanced Manufacturing Research Centre (AMRC). We intend to finish the manufacture early this year, allowing us to test the new systems before launch and adapt the design if needed.

Sheffield's Shot 2 Space - Rocket

Sheffield Shot 2 Space is a collaborative effort between the Universities of Sheffield, Sheffield Hallam, and Kingston. A multi-year long project was set up and set sale on september 2019 to create a platform for academics and senior students to pour their knowledge and projects into becoming the first UK universities to reach the Karman Line.

Over the course of the academic year 2019/2020 an early test version was agreed upon and designed to be manufactured and hopefully launched in July 2021. Spanning over 6m height and a radius of about 25 cm, Gagarin is a hybrid engine fueled rocket that is expected to reach 35 - 50 km high, with a similar fairing system to Vesna. It should be able to facilitate 4U satellites and a static payload.

Rocket Sunfire

Project SunFire is a dissertation level project aimed towards students with final year projects and academics, to create a bipropellant liquid rocket engine that will be used to power the rocket competing in Spaceport America Cup in summer 2021.

Formerly, SunrIde has focused on designing and manufacturing the rocket body and avionics, while outsourcing propulsion units from manufacturers such as Cesaroni. Students will now take on the challenge of designing, manufacturing, testing and finally implementing a propulsion unit.

The low thrust output engine will use a pressure-fed system to supply fuel and oxidiser to the engine and will implement regenerative cooling to achieve high temperatures during combustion. This opens the opportunity for students to engage not only in conceptual design but also consider thermodynamics, subsonic and supersonic flows from a practical perspective.

SunFire will be the foundation on which a working propulsion unit will be created for further work and advancements. Future students and academics can build on this to improve the design and efficiency of the engine and engineer based on SunFire's Success for new mission requirements.

SunrIde Society

1. Mission statement

The Broad range of ages and academic levels within the SunrIde Project allows our members to gain insight into various academic fields outside of their own specific course of study. Communication across years from Masters to First year students allows for an exploration of peers projects and academic environments. We aspire to continue to expand our collaboration with similar projects in universities across the UK, organize and take part in conferences and events to empower the next generation of rocket scientists and engineers through early and intensive engagement in this rapidly evolving field and community of UK Space Technology.

2. Learning Sessions

Interactive learning sessions and webinars by experts, and SunrIde alumnus will be offered for our society members. We aim at giving them a sturdy basis in rocketry and the programs involved with it, to start their research, proceed to designing and manufacturing rockets.

Some of the society's learning sessions and webinars are:

OpenRocket:

Aims at explaining the interface of the program, modelling a simple rocket, showing different kinds of nosecones and motors classifications, explaining the stability constraints, forces, centre of gravity and pressure and their relations, plotting the forces vs time.

Avionics of Rockets:

Covers the avionics used for the recovery system (Stratologger, Eggtimer TRS, in-house arduino, etc.), collecting flight data (GPS, IMU, altimeter, etc.) , cameras, switches, telemetry and redundancy.

Autodesk Fusion 360:

Introducing the basics of engineering sketching, creating bodies and components, assemblies, mesh manipulation, simple simulation, and generative design.

Physics of Rockets:

Explains atmospheric conditions and their effects on launches, shock waves, forces a rocket undergoes, nose cone shapes and their relation to supersonic and subsonic flights, fins airfoils, angles of attack, and stability margins.

CFD and FEA:

Introducing the basics of CFD with 2 main examples; a simple case of 2D flow over an airfoil and then then a more advanced case study of a rocket in supersonic, compressible flow, and doing the relevant FEA for it on Fusion 360.

3. Rocketry Conference

An annual conference for students interested in rocketry, where they meet academics and professionals from across the country to network, share knowledge and aspirations. It will involve talks by partnering teams from other universities, a careers fair of our partnering companies, discussions and networking events with professionals, and a Rocketry Varsity. The Rocketry Varsity will include questions competition, competitive activities like folding parachutes, coding competition, and many more that Rocketeers will enjoy.

4. UKSEDS National Rocketry Championship

Chosen society members will get to participate in UKSEDS National Rocketry Championships to gain the relevant experience to join SunrIde team in the following year. This competition will help providing students who have had no or limited experience in the field of rocketry to get a hands-on experience designing, building and launching a mid-power model rocket. They will also gain report writing skills as they will be required to submit a brief technical report detailing their design and build.

5. Workshops

Members should complete the iForge training to learn about manufacturing and the safety regulations of using the tools and machines in the iForge. We will hold many workshops to get students more familiar with the processes of manufacturing rockets and using machines like the CNC, laser cutters, and 3D printers.

6. Socials

Throughout the academic year a number of socials will be provided open to all members. These activities range from hikes and nights out unrelated to the technical work, and trips around the UK visiting thematically relevant conferences and networking events. Diversifying our members social events allows for team building outside of the purely technical aspect of the project results in more effective and productive work as a team.

7. Memberships

Basic Membership: (5 GBP)	**Elite Membership: (10 GBP)**	**Non-members:**
Socials Learning sessions Rocketry Conference will be for additional (4 GBP) Workshops will be additional (3 GBP)	Socials Learning sessions Rocketry conference Workshops and training UKSEDS National Rocketry Competition Research and FYP integration opportunities	Socials (varying fee) Learning sessions (5 GBP) Rocketry Conference (14 GBP) Workshops: (5 GBP)

Partnership

Manufacturing

SunrIde's projects and ambitions are growing bigger each year. Therefore, we need to raise awareness around the UK and within universities to collaborate, as we cannot attain our ambitious goals without help. We need expertise in the manufacturing sector to help build the rockets. Building rockets is difficult because we do not have all the necessary tools at our display. We would need to collaborate with companies and universities that have the vital tools and facilities that we need to assemble the rockets.

Funding

Building rockets is expensive, as we all know from the current state of the space industry. We are passionate about rockets and want to allow students to be a part of the rocket industry to give them a head start with their careers. We would be grateful for any funding we receive, and we would be delighted to negotiate how we would promote your funding.

Collaboration

Our aim is to collaborate with companies and other universities so that they can be a part of history. We want you to be a part of this journey over the next few years and we are willing to collaborate in any such ways with you. This could involve; promotional events, conferences, giving speeches, sharing workspace and labs, and integrating projects.

Marketing

The plan is to broadcast on the news and promote ourselves and what we are doing. Television is one of the ways we are going to do this, along with; radio shows, articles and other media sources.
Promotion and awareness will also help us excel. We would be thrilled to give talks at events to raise awareness of what we are doing. We would love to collaborate with media companies to help us achieve this

Conclusion

To sum up, SunrIde aspires to expand and go above and beyond to demonstrate what students are capable of. Throughout the challenges, projects, and competitions we push to lay before us the advanced technologies and manufacturing routes of rocketry, their engines, and various functional payloads. Curiosity is what drives us, and there are no limits to what a group of passionate challenging students can do.