

AIMING FOR
AWESOME

2018

1918



Ejection seat

Teacher's
Guide



Royal Academy
of Engineering

THIS IS
ENGINEERING

ROYAL
AIR FORCE
Youth STEM

The aim of this resource is to give students the opportunity to investigate the impact of science, technology, engineering and mathematics (STEM) on ejection seats.



Curriculum links

England

Activity	Key Stage	Subject	National Curriculum
Time to make	KS2	Science	Forces - explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object.
Time to make	KS2	Design and technology	Design Make Evaluate

Scotland

Activity	Subject	Topic	Experiences and outcomes
Time to make	Technologies	Craft, Design, Engineering and Graphics	TCH 2-09a, TCH 3-09a
Time to make	Sciences	Forces	SCN 2-07a

Wales

Activity	Key Stage	Subject	National Curriculum
Time to make	KS2	Science	How things work: forces of different kinds, the ways in which forces can affect movement.
Time to make	KS2	Design and technology	Designing Making

Northern Ireland

Activity	Key Stage	Subject	National Curriculum
Time to make	KS2	<i>The world around us</i>	Strand 2: Movement and energy: The causes and effect of energy, forces and movement.
Time to make	KS3	<i>Science and technology: science</i>	Develop a range of practical skills, including the safe use of science equipment Learn about: forces and energy.

Preparation

- » Ensure all materials and equipment needed are available well in advance of the session. See the resource list below for essential materials and components.
- » A full risk assessment should be conducted prior to the session.
- » Ensure the plastic bottles being used fit the bottle rocket launcher. If using the Rokit bottle rocket launcher, then plastic fizzy drink bottles are recommended. Rokit is not suitable for any other type of bottle.
- » This session is expected to last 60 minutes.
- » Ensure technology is available to project the relevant video materials.

This resource has been linked to the Engineering Habits of Mind (EHoM). For more information about the EHoM please see the information sheet provided or www.raeng.org.uk/ltbae.

Resource list

For this activity, you will need the following per group:

- » Various materials for building an ejection seat, for example: paper, string
- » Plastic fizzy drinks bottle, 1 litre or 1.5 litre in size. You should test the bottles fit before the session.

You will also need a bottle rocket launcher and foot pump.

The following specific components may not be readily available in schools and other educational establishments. Therefore, it may be necessary to order these items.

Description	Product code	Pack size	Supplier
Bottle rocket launcher	281-104	1	www.mindsetonline.co.uk
Air pump unit	202-011	1	www.mindsetonline.co.uk

Emergency exit

The first use of an ejection seat in a practical application by a British pilot involved the Armstrong Whitworth A.W.52 flying wing experimental aircraft in May 1949.

In aircraft, an ejection seat is a system designed to rescue the pilot or other crew of an aircraft in an emergency. In most designs, the aircraft canopy comes off and the seat is propelled out of the aircraft by an explosive charge or rocket motor, carrying the pilot with it. Once clear of the aircraft, the ejection seat deploys a parachute. In two-seat aircraft, the seats are ejected at different angles to avoid a collision.

Before ejection seats, pilots would have to remove the aircraft canopy manually to climb and jump out.



TIME TO THINK

Ejection seats can save lives. However, they are not used in commercial passenger aircraft.

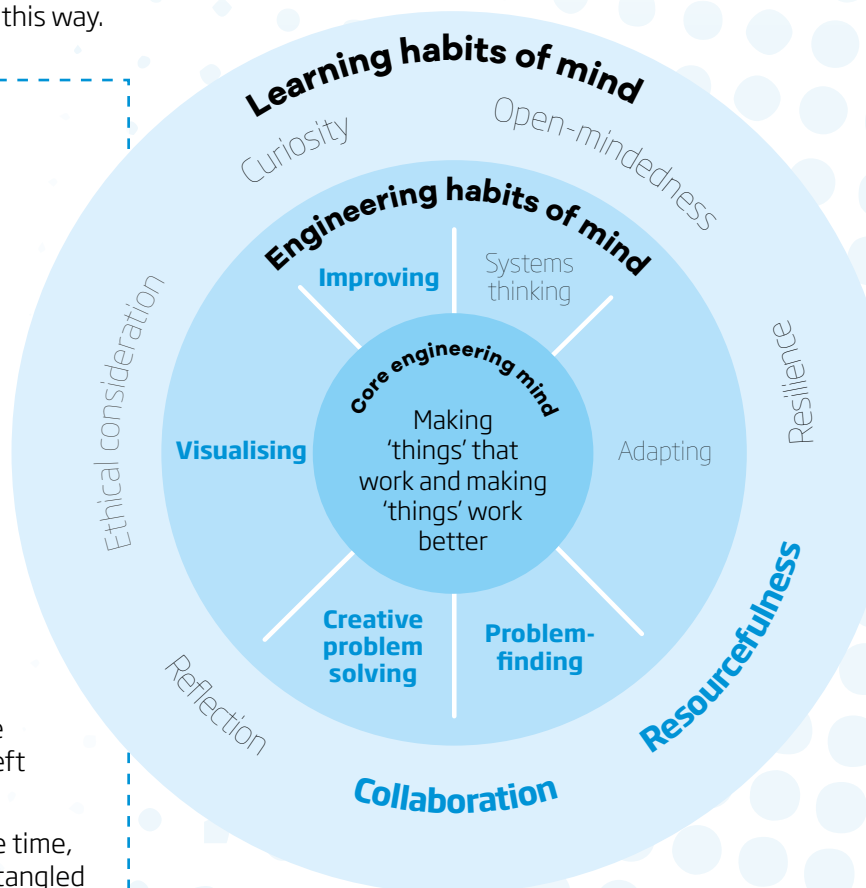
In pairs, discuss why ejection seats are not used in this way.

Guidance provided to STEM activity leader

You could run this discussion in many ways, for example using the *think, pair, share* technique or concentric circles depending on the class and student relationships.

Students might suggest some of the following points:

- » The force required to deploy the aircraft canopy.
- » Who decides when to eject? Can passengers accidentally pull the ejection mid-flight or would the pilot have to turn on an ejection activation switch or automatically eject them?
- » If the canopy is removed, the aircraft will be depressurised and the passengers will be left with no oxygen.
- » With many passengers ejecting at the same time, there is a high chance of parachutes being tangled or collisions of ejection seats.
- » Most passengers have never been trained or had parachuting experience.





Crown copyright

TIME TO MAKE

Design an ejection seat for an RAF pilot on a bottle rocket.

Your RAF pilot should be attached to a bottle so that when the rocket is launched, the pilot detaches from the rocket and deploys a parachute to land safely.

Guidance provided to STEM activity leader

For this activity, students should design and make their ejection seats in the classroom.

Once students have completed their prototypes, move to a large open space such as the school field or playground to launch the bottle rockets.

Follow the instructions for launching the bottle rocket kit and complete a full risk assessment before carrying out this activity.



MoD/Crown copyright



Royal Academy of Engineering

The Royal Academy of Engineering is harnessing the power of engineering to build a sustainable society and an inclusive economy that works for everyone.

In collaboration with our Fellows and partners, we're growing talent and developing skills for the future, driving innovation and building global partnerships, and influencing policy and engaging the public.

Together we're working to tackle the greatest challenges of our age.

What we do

Talent & diversity

We're growing talent by training, supporting, mentoring and funding the most talented and creative researchers, innovators and leaders from across the engineering profession.

We're developing skills for the future by identifying the challenges of an ever-changing world and developing the skills and approaches we need to build a resilient and diverse engineering profession.

Innovation

We're driving innovation by investing in some of the country's most creative and exciting engineering ideas and businesses.

We're building global partnerships that bring the world's best engineers from industry, entrepreneurship and academia together to collaborate on creative innovations that address the greatest global challenges of our age.

Policy & engagement

We're influencing policy through the National Engineering Policy Centre – providing independent expert support to policymakers on issues of importance.

We're engaging the public by opening their eyes to the wonders of engineering and inspiring young people to become the next generation of engineers.



The RAF Youth STEM programme is designed to engage and inspire young people by building their interest in engineering and technical career pathways.

From cyber specialists to aerospace, aviation, electronics, and mechanical disciplines, the RAF is committed to widening participation in STEM, extending opportunities to all, and encouraging greater diversity in this critical area of national skills shortages.

Royal Academy of Engineering
Prince Philip House
3 Carlton House Terrace
London SW1Y 5DG

Tel: +44 (0)20 7766 0600
www.raeng.org.uk
Registered charity number 293074