The Ultimate STEM Challenge

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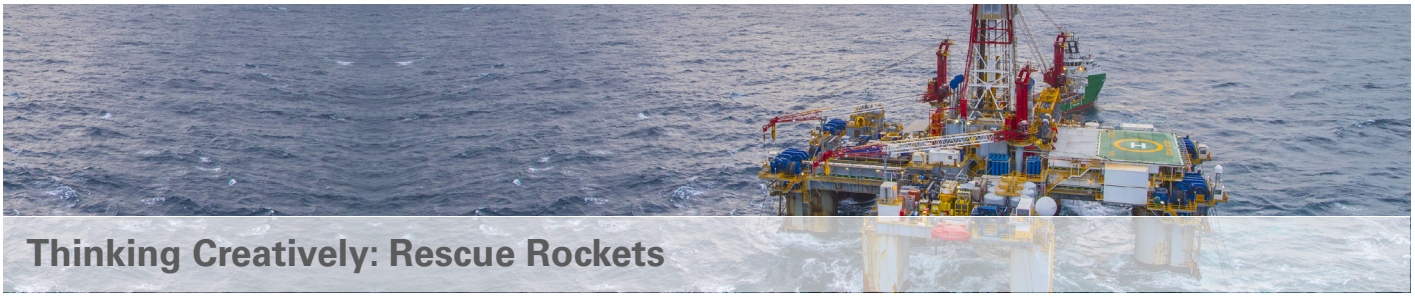

Thinking Creatively: Rescue Rockets

Student guide

Do an investigation to find the most efficient design for a water-powered rocket.

You may wish to explore some of the ideas and questions below to get started, but you can approach the challenge any way that you like.

Generate ideas

Get your challenge off to a great start by thinking about these key questions:

- What forces will act on the rocket as it moves through the air while the water propels it?
- What design factors might increase these forces?
- What design factors might decrease them?
- How can the rocket's design help make it stable during flight, as well as helping it reach as high as possible?

Think scientifically about air resistance

To make the most of this challenge you'll need to think about forces, friction, resistance (e.g. air resistance) and gravity.

Sketch the forces acting on a moving rocket. What force propels the rocket upwards? What forces will slow it down?

Think about the ideas you generated. How can your designs increase the forces you want, and decrease the forces you don't want?

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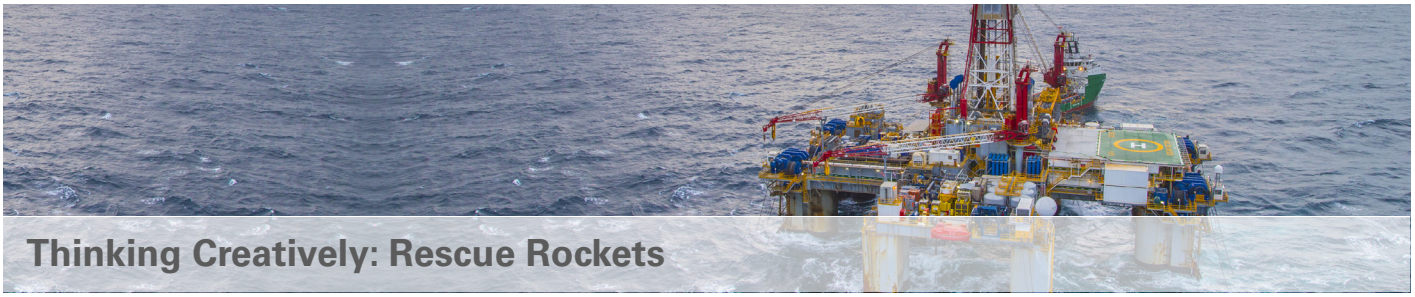

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Do your research

Search online to find out more and get inspired! Some independent research will make your design more unique and successful.

- Find out more about thrust and drag (your rocket won't generate lift like an aircraft, however).
- How high do distress flares travel?
- What lightweight lights (e.g. red LEDs) could you include in your design, to attract attention?
- How and where will you attach these to your rocket?
- How can you solve any stability problems, for example by adding a little weight to the nose?
- How does the high pressure water propel the rocket through the air?
- How are real rockets made streamlined and stable?

Complete the challenge

Be creative! Create and test different designs and shapes, adding your own streamlining and stabilisation designs. You could use a range of bottle shapes, and perhaps include a parachute to slow its descent.

In your team, decide:

- Who will be responsible for what?
- What do you need from school, and when? (Book equipment in advance.)

How will you measure how high your rocket can fly?

- Plan a test to compare different shapes and designs.
- Think about how you'll control any variables you don't want to test or vary, such as mass.
- Look for any sources of error, especially errors in timing.
- Think about how you can make your measurements more accurate, for example by getting every team member to time each flight and finding the average.
- Make sure your design ideas are different enough so you can measure any improvements or patterns.

Plan how you'll create and present evidence of your research, creativity, designs, investigation and results, for example using photos, video clips and written documents.

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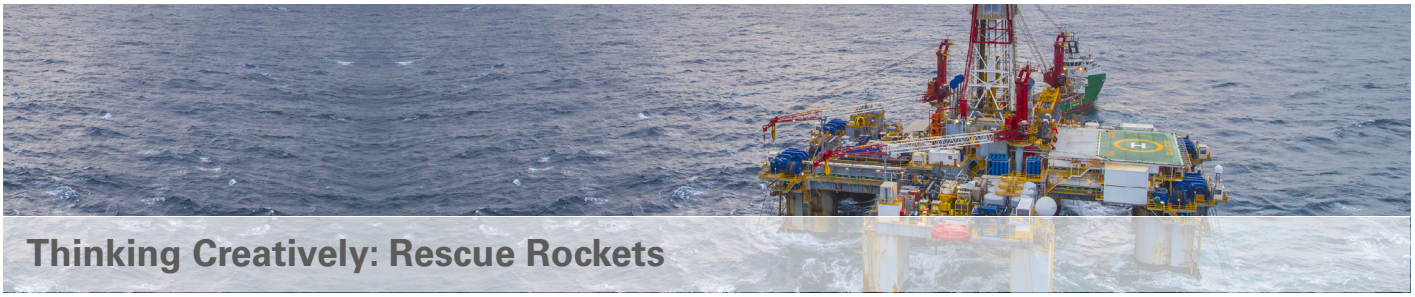

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Tips

- Limit your investigation to suit the time you have. For example, it might not be possible to test different water quantities as well as designs. Better to keep it simple and focused.
- Allow time to repeat your tests. This lets you check whether your results are reliable and refine your method.
- Your test should be reproducible. In other words, another scientist should be able to repeat it to check the results.
- Use the same quantity of water when testing designs, and the same design when testing different quantities of water or pressure.
- Adding mass at the nose can add stability by balancing the mass of the water at the other end. But too much mass may decrease your maximum altitude and flight time.
- Remember that your designs should also be practical so the water rocket would attract attention and help save lives in real life.