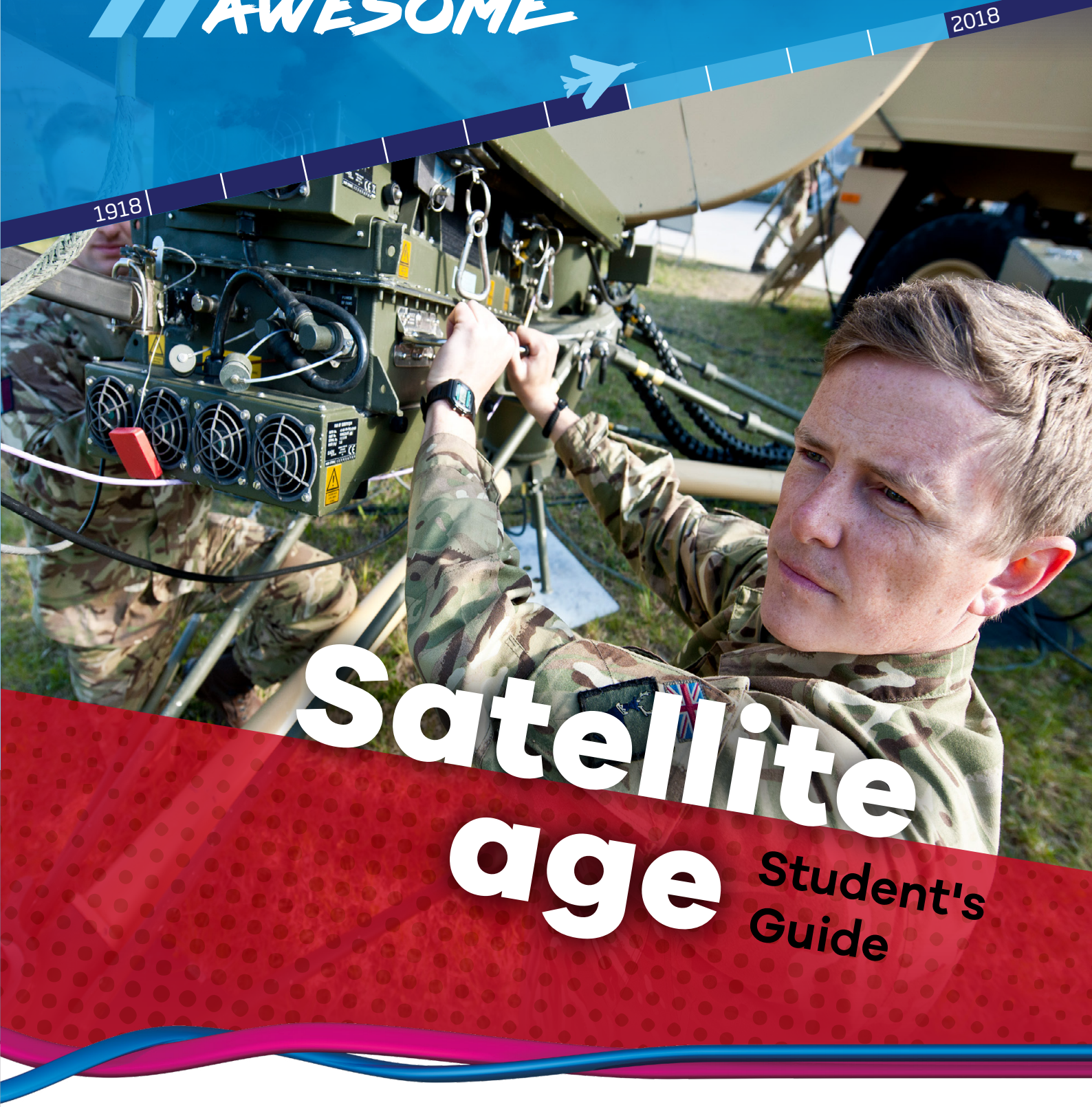
AIMING FOR AWESOME

1918 2018



Satellite age

Student's Guide

ROYAL ACADEMY OF ENGINEERING

RAF 100

2018. THE YEAR OF ENGINEERING

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

Skynet

In the 1960s, satellites became an increasingly important way for military to communicate with squadrons abroad. However, only two countries used satellites for signals and military intelligence: the USA and the Soviet Union.

Consequently, the UK created Skynet as its own military communications satellite. The Skynet satellite also provided secure and encrypted facilities for all three of the British armed forces.

The first Skynet satellite, Skynet 1A, was launched in November 1969 but was quickly replaced by Skynet 1B in 1970 following a fault. Unfortunately, Skynet 1B was placed in a geostationary transfer orbit and had to be abandoned in transfer orbit because of a failure of the Thiokol Star 37D apogee kick motor.

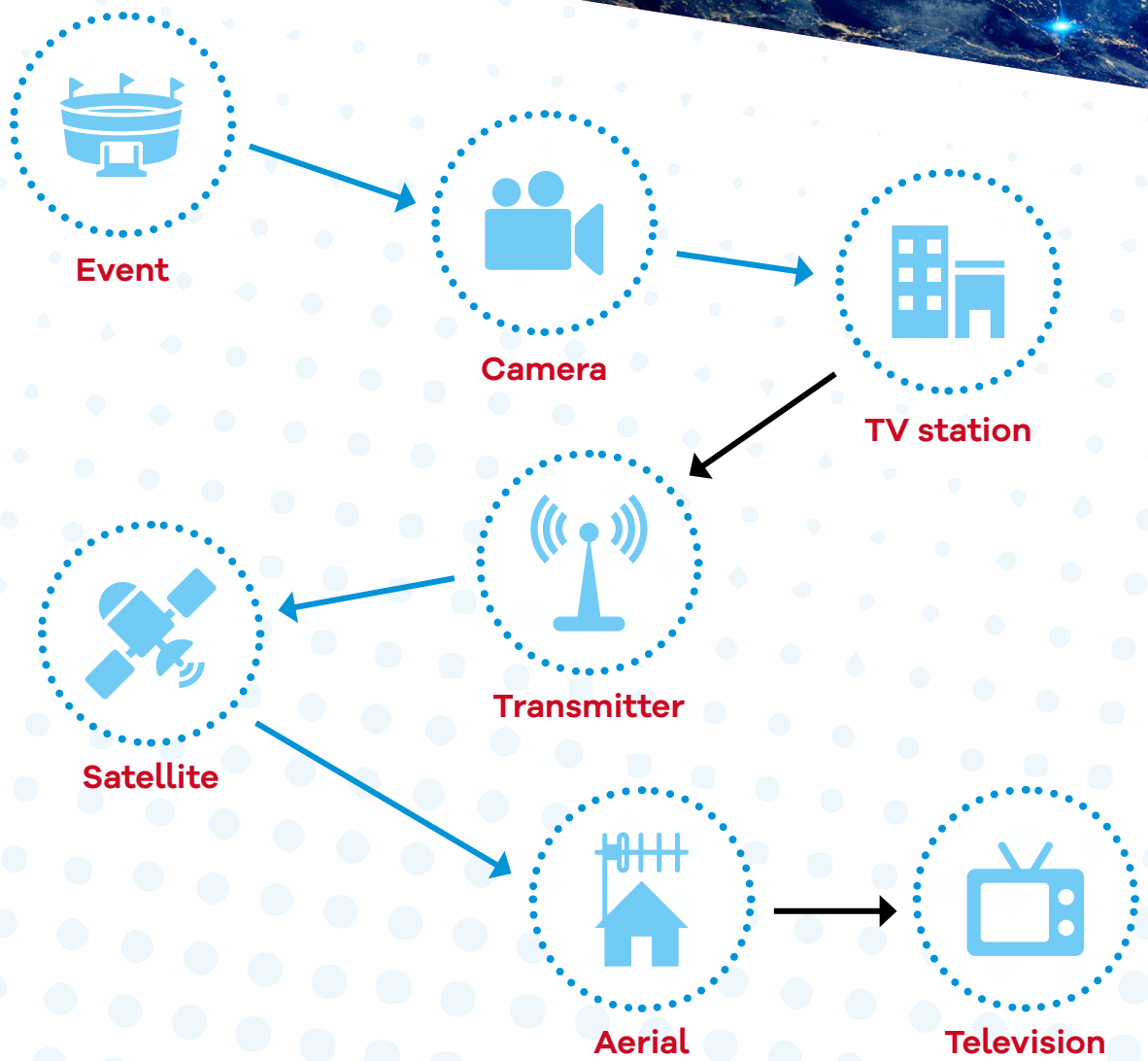
Despite the issues faced with Skynet 1A and 1B, engineers persisted with Skynet and launched Skynet 2A in January 1974 and Skynet 2B in November 1974. The Skynet 2 system was very successful for its time, and remained in service for several years beyond the timeframe originally planned.

Satellites

Satellites use radio waves and microwaves depending on the type of communication the satellite is being used for.

Microwaves are used for mobile phones while radio waves are used to transmit television and radio programmes.

Satellites are needed to allow communication over long distances. A signal is sent from a transmitter, such as a TV station, to a satellite. The satellite receives the signal and transmits a receiver, such as a TV dish.


Event
Camera
TV station
Transmitter
Satellite
Aerial
Television

TIME TO INVESTIGATE

Radio waves and microwaves are types of electromagnetic radiation, like light.

Light travels in straight lines and is reflected by shiny surfaces, like a mirror. Satellite dishes use reflection to receive a signal. The dish reflects the radio or microwave to a small receiver in front of the dish.

Key words

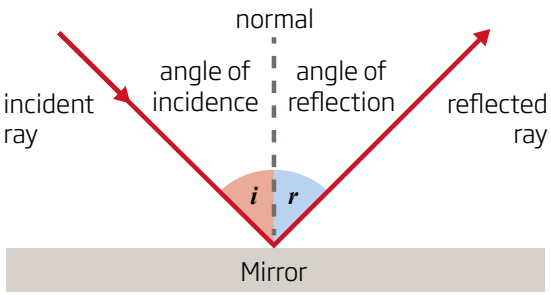
Angle of incidence: the angle between the normal and incident ray

Angle of reflection: the angle between the normal and reflected ray

Normal: a line drawn at 90° to the surface of the mirror

Incident ray: the light going towards the mirror

Reflected ray: the light coming away from the mirror



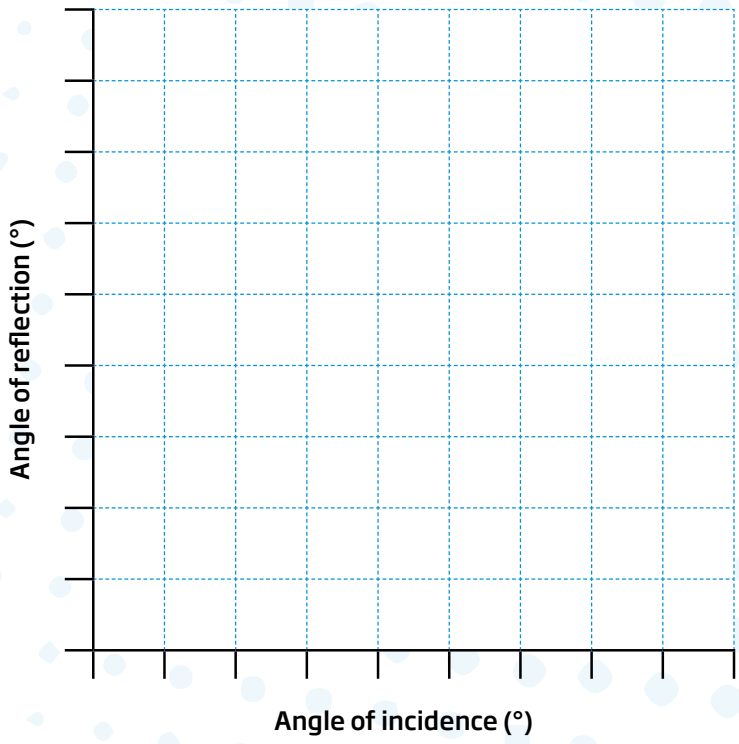
TIME TO INVESTIGATE

In this experiment, you will investigate the relationship between the angle on incidence and the angle of reflection.

1. Draw a line on the paper. Place the mirror on the line and support it so that it does not move.
2. Draw a line at 90° to the mirror; this is the normal line.
3. Shine the beam from the torch towards the mirror. Use the pencil to carefully mark two dots in the centre of the incidence and reflected rays.
4. Move the mirror to one side and use the ruler to join the dots to show the complete path of the ray. Add arrows so that you know what direction the ray travelled.
5. Use the protractor to measure the angle between the normal and the incident ray, and the normal and the reflected ray
6. Repeat three more time with different angles of incidence.

Angle of incidence	Angle of reflection

Complete the graph with your results



Complete the conclusion below:

From my experiment, I can see that the angle of incidence is ..... the angle of reflection.

I can tell this because .....

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ROYAL ACADEMY OF ENGINEERING

Royal Academy of Engineering

As the UK's national academy for engineering, we bring together the most successful and talented engineers for a shared purpose: to advance and promote excellence in engineering.

We have four strategic challenges:

Make the UK the leading nation for engineering innovation

Supporting the development of successful engineering innovation and businesses in the UK in order to create wealth, employment and benefit for the nation.

Address the engineering skills crisis

Meeting the UK's needs by inspiring a generation of young people from all backgrounds and equipping them with the high quality skills they need for a rewarding career in engineering.

Position engineering at the heart of society

Improving public awareness and recognition of the crucial role of engineers everywhere.

Lead the profession

Harnessing the expertise, energy and capacity of the profession to provide strategic direction for engineering and collaborate on solutions to engineering grand challenges.

RAF 100

The RAF 100 Youth & STEM programme has been 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 using our centenary celebrations to extend opportunity to all and to encourage greater diversity in this critical area of national skills shortages.

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