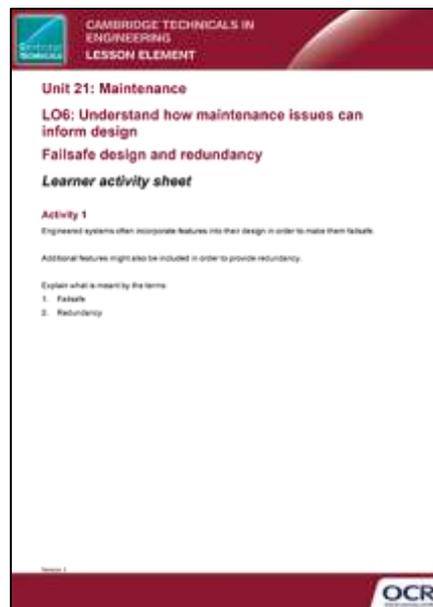# Unit 21: Maintenance

LO6: Understand how maintenance issues can inform design

Failsafe design and redundancy

Instructions and answers for teachers

These instructions should accompany the OCR resource 'Failsafe design and redundancy' *activity which supports Cambridge Technicals in Engineering Level 3.*

The Activity:

Learners have been tasked in Activity 1 to explain the terms failsafe and redundancy.

For Activity 2 learners are required to investigate the failsafe and redundant features of four systems.

This activity offers an opportunity for English skills development.

This activity offers an opportunity for maths skills development.

Suggested timings:

1 hour

Activity 1

Learners have been tasked in Activity 1 to explain the terms failsafe and redundancy. Typical responses are given below, although learners may provide alternatives.

1.	Failsafe	Failsafe refers to design features that allow a system to revert to a safe condition in the event of a failure or malfunction. Examples of failsafe mechanisms include dual-circuit brakes on a car and a safety gear on a lift (elevator).
2.	Redundancy	Redundancy is related to the inclusion of failsafe design features. It involves including extra and additional features into design to ensure correct operation in the event of parts of the system failing. An example of redundancy is an aircraft which can still fly should one engine fail.

Learners may note that failsafe design might be achieved through the inclusion of redundancy features into the design, hence the two are associated.

Activity 2

For Activity 2 learners are required to investigate the failsafe and redundant features of four systems. Typical solutions are given below although learners may find alternatives.

Learners should note that many features that are included to provide failsafe designs are achieved through redundancy (i.e. including additional components or systems). Hence, the two are closely associated with each other.

Aircraft	Car braking system
• Aircraft can continue to fly with one engine failed (failsafe + redundancy). • Multiple loading points of structural items (failsafe). • Pressure vessel e.g. fuel tanks, hydraulic tanks leak before breaking (failsafe). • Inclusion of crack arrestors on sections of fuselage (failsafe).	• Dual-circuit braking system (failsafe + redundancy).
Rollercoaster	**Lift (elevator)**
• Safety chain and pawl mechanicsm on hill climbs – arrests roller cosater in event of drive chain or power failure (failsafe). • Control system, zones and sensors monitoring roller coaster position (failsafe). • Multiple wheels securing roller coaster to track (failsafe + redundancy). • Two locking mecahncisms on safety harness (redundancy).	• Electromechanical brake reverts to 'brake on' in event of power failure (failsafe). • Multiple steel wire suspension ropes holding lift (elevator) car (redundancy). • Overspeed governor and safety gear (failsafe).

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