Breaking points

English for engineering.

S Parmentier

In this course you are going to learn about :

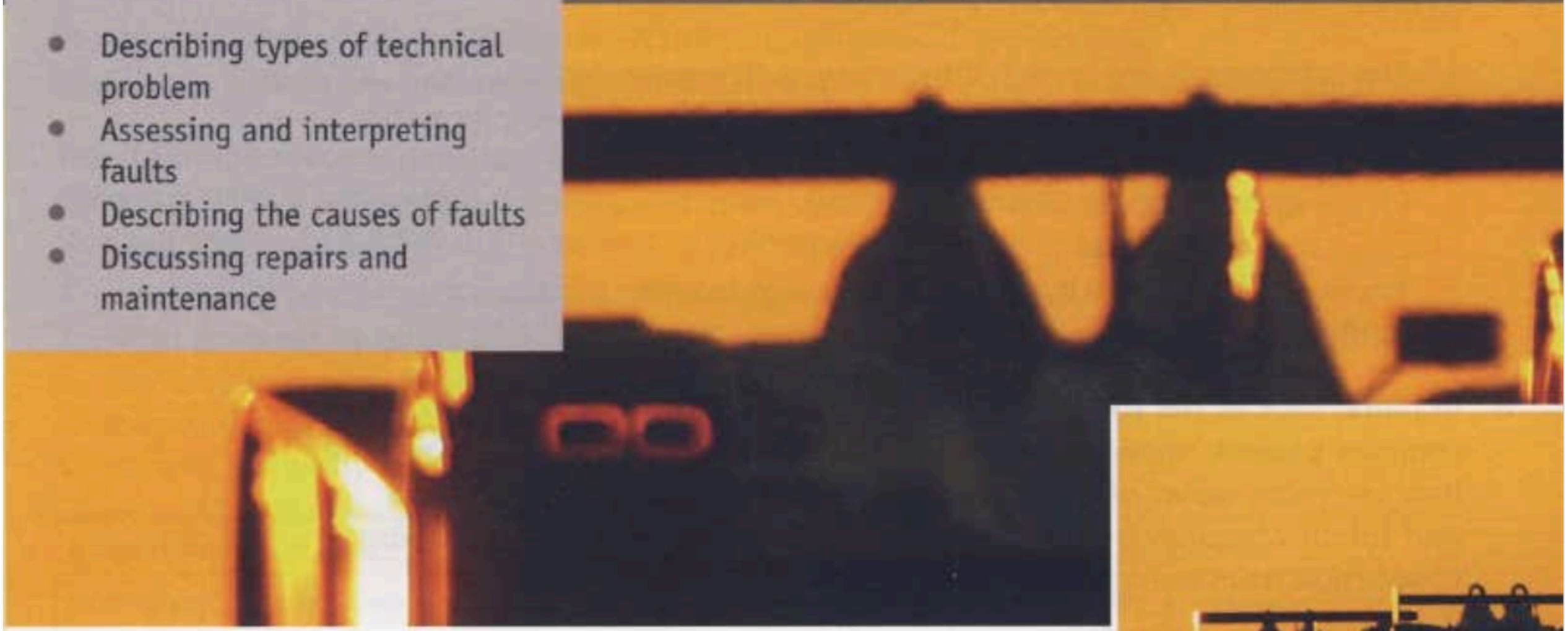
Describing types of technical problems
Assessing and interpreting faults
Describing the causes of faults
Describing repairs and maintenance

Do your exercises in your copybook, I will check by the end of the semester.

Your evaluation will be : some exercises will be used as evaluations (surprise !!)

UNIT 5 Breaking point

- Describing types of technical problem
- Assessing and interpreting faults
- Describing the causes of faults
- Discussing repairs and maintenance



Describing types of technical problem

Describing types of technical problem

1 **In pairs, discuss the technical challenges of endurance car races like the Le Mans 24 Hours sports car race.**

2 a ▶5.1 **Sabino, an engineer with a sports car racing team, is giving a talk to some of his team's sponsors at a test session. Listen to the talk and answer the following questions.**

1 What saying emphasises the importance of reliability?
2 What expression refers to things that can cause failures?
3 What expression describes damage caused by normal use?

b ▶5.1 **In the talk, Sabino names five engineering enemies. Complete the following list. Listen again and check your answers.**

1 h_____ = high temperatures
2 p_____ = loads from expanding gases or liquids
3 v_____ = continuous high-frequency movement or shaking
4 s_____ = sudden impacts
5 a_____ = damage to surfaces caused by friction

C **In pairs, suggest which engineering enemies in Exercise 2b can be the most problematic for each of the following car parts.**

1 chassis
2 engine
3 gearbox and clutch
4 suspension
5 brakes
6 tyres
7 wings
8 cooling system
9 nuts and bolts

3 a ▶5.2 **Listen to Sabino talking about some technical problems the team have had at the test and mark the following statements True (T) or False (F).**

1 Some liquid was lost from a pipe.
2 A car lost all its coolant with the engine still running.
3 A car's engine stopped on the circuit.
4 Some tyres were damaged.
5 A wheel nut fell off a car on the circuit.
6 A car's suspension was broken.

b **Complete the following extracts from the talk using the words in the box.**

bend	blocking	crack	jam	snap

1 *... you don't want anything _____ the airflow to the radiators.*
2 *... they had a wheel nut _____, it wouldn't turn.*
3 *... he didn't hit the barriers and _____ the suspension or _____ it completely.*
4 *... it didn't _____ the tub – the chassis.*

c **Complete more extracts from the talk using the correct form of a verb in box 1 and a word in box 2.**

1						
blow	clog	cut	leak	run	wear	~~work~~

2		
~~loose~~	up	out

1 *... a nut worked loose on a radiator pipe, which resulted in coolant liquid _____ _____.*
2 *... he switched off before the system had _____ _____ of coolant.*
3 *... the engine _____ _____ on one of the corners.*
4 *... the openings in the side pods always _____ _____ with dirt.*
5 *The tyres weren't close to _____ _____ ...*
6 *... the radiator problem didn't cause the engine to _____ _____.*

d ▶5.2 **Listen again and check your answers to Exercises 3b and 3c.**

e **Read the following comments made by race team technicians. Complete the following sentences using the correct form of words in Exercises 3b and 3c.**

1 There's smoke and flames pouring out of the engine. It's blown up .
2 There's a pool of oil under the car. Something's _____ .
3 This cylinder head bolt won't loosen. It's _____ .
4 The air filter's full of dirt. It's completely _____ .
5 This wing support's been moving about. The bolts have _____ .
6 Something's stopping the oil flow. The pipe might be _____ .
7 Are you sure that pushrod's straight? It looks as if it's _____ .
8 We'll need to change these brake pads. They're nearly _____ .
9 There's hardly any fuel left in the car. In another lap, we'll _____ .

4 **Read the technical facts about the Italian motor racing circuit, Monza, and summarise how the track is different from most others. In pairs, discuss the technical problems that racing cars could have at Monza as a result of the factors described in the text.**

The circuit is characterised by long straights and chicanes. This means the cars' engines are at full throttle for over 75% of the lap, a higher percentage than most other circuits.

The track requires heavier-than-average braking over a given lap, as the cars repeatedly decelerate at the end of some of the world's fastest straights for the slow chicanes.

The chicanes are lined by rugged kerbs. Riding over these hard is crucial for fast laps.

The long straights require small wings for minimum drag. This means lower downforce, resulting in lower grip on corners and under braking, and less stability over bumps.

The main high-speed corners Lesmo 1, Lesmo 2 and Parabolica are all right turns.

Parts of the circuit are surrounded by trees, which means leaves can be blown onto the track.

Assessing and interpreting faults

5 a **In pairs, discuss a technical problem you've experienced with a device, equipment or vehicle. Describe the fault, and how you tried to solve the problem.**

b **Read the training notes for telephone helpline staff working for a manufacturer of mining plant. In pairs, discuss what each point means.**

Problem-solving checklist

1 *User's observations:*
   - *nature of fault*
   - *circumstances of fault*
   - *external factors*
2 *Process of elimination*
3 *Identify the failure*
4 *Determine action and urgency*

6 a ▶5.3 **Mr Rooney, an engineer at a quarry firm, is talking to Al, a helpline consultant, about a technical problem with a diesel engine. Listen to the conversation and answer the following questions.**

1 What does the warning message say?
2 What external factor is discussed as a possible cause?
3 Why is this possible cause eliminated?
4 In what circumstances does the fault occur?
5 What does the consultant identify as the most likely cause?
6 What action is required, and how urgent is it?

b **Match the words in the box to their synonyms in the sentences (1–7).**

defect	defective	~~fault~~	faulty	intermittently	major	minor	properly	systematically

1 There's a **problem.** fault / _____
2 Perhaps something in the fuel injection system is **wrong.** _____ / _____
3 It's a **serious** problem. _____
4 It's a **slight** problem. _____
5 Is it working **correctly**? _____
6 The problem only occurs **from time to time.** _____
7 The problem doesn't occur **every time.** _____

C **Al made the following notes about three engine problems. Match the faults (1–3) to the possible causes (a–c).**

1 Starter motor sometimes works, sometimes doesn't. Engine is 9 years old.
2 Distribution belt failed. Engine blew. Belt replaced recently - almost new
3 New engine. Runs for 20 mins, then temp. gauge always goes into red, and engine cuts out (safety override)

a Cooling system problem. Fan? Water pump?
b Electrical contact problem. Loose connection?
c Manufacturing defect? Incorrect fitting? Not wear

d **In pairs, describe the problems in Exercise 6c using the following phrases.**

a faulty part	a sudden problem	a systematic problem	an installation problem	
an intermittent problem	caused by wear and tear	It's / It was ...	It's / It was probably	
Perhaps it's / it was ...	This is / was a ...			

e **Complete the following table using the phrases in the box from the conversation.**

I doubt it's	it can't be	it could be	it might be	~~it must be~~	it sounds like it's

1 It's certainly / it must be	
2 It's probably / _____	
3 It's possibly / _____ / _____	a problem with ...
4 It's probably not / _____	
5 It's certainly not / _____	

f ▶5.3 **Complete the following extracts from the conversation using phrases in Exercise 2e. Listen again and check your answers.**

1 *Obviously, it must be some sort of defect in the fuel injection system.*
2 *So _____ a software problem.*
3 *... maybe _____ a defective sensor.*
4 *Presumably, _____ anything too serious.*
5 *_____ water, then, if the fuel went in directly from a delivery.*
6 *_____ a faulty fuel pre-heater.*

7 a **In pairs, analyse the problem described below. Underline the words in the box that describe it.**

major	minor	sudden	systematic	intermittent

The problem

The driver of a dump truck, which operates in a quarry, has noticed that the truck's diesel engine is slightly down on power. The problem has become progressively worse over several weeks. Apart from the power loss, the engine is performing consistently, with no misfiring and no overheating. The degree of power loss remains constant throughout a given period of use, from starting the engine to turning it off. No increase in fuel consumption has been noted.

b **Read the notes and assess the possible causes of the problem in Exercise 7a using the words in Exercises 6d and 6e.**

Possible causes of the engine problem

- *water in the fuel supply*
- *a lubrication problem*
- *a clogged fuel filter*
- *a blockage in the exhaust system*
- *a compression leak from the piston cylinders*

Describing the causes of faults

8 **Look at the following strategies for preventing and dealing with technical problems in aviation. In pairs, discuss what is meant by the following terms and how they are used by engineers and pilots.**

1 checklists
2 standard procedures
3 back-up installations
4 planned maintenance

9 **a** **Read the article on the right and answer the following questions.**

1 How did the problem start?
2 What were the initial, unseen consequences?
3 What were the subsequent consequences?

b **Complete the sequence of events that followed the fuel leak on the Airbus A330 using the extracts (a–d).**

"We have a problem"

The true story of Air Transat Flight 236.

The chain of events began during routine maintenance work on an Air Transat Airbus A330. An incorrect hydraulic pipe was fitted to the right-hand engine. The component was oversized, leaving inadequate clearance with an adjacent fuel line. Subsequently, the two pipes rubbed together, causing the fuel line to wear progressively. The problem went undetected, until the night of August 24, 2001, at 35,000 feet above the Atlantic. With Flight 236 en route from Toronto to Lisbon, carrying 306 people, the fuel line ruptured, resulting in a major leak. Less than two hours later, the aircraft was completely out of fuel, gliding silently through the night sky …

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b Complete the sequence of events that followed the fuel leak on the Airbus A330 using the extracts (a–d).

04:38 The flight data recorder registered an abnormal increase in fuel consumption. At this stage, however, this slight anomaly was insufficient to cause warning lights to come on to alert the crew to any imminent danger.

04:58 _____

05:33 A warning message came up, alerting the crew to an imbalance between the amount of fuel in each wing tank. Initially, the problem was thought to be an instrument malfunction. But further analysis by the crew revealed that the amount of fuel remaining in the right tank was significantly below the planned quantity.

05:36 _____

05:45 As a precaution, the crew decided to divert to the nearest airport - the Lajes military airbase in the Azores.

06:13 _____

06:26 ENG 2 FAIL appeared, and the left engine cut out. Having completely run out of fuel, and with both engines now down, the Airbus A330 was gliding, descending at 2,000 feet per minute.

06:27 _____

06:46 With the airport in sight, the landing gear was lowered manually. The pilot then performed a series of spectacular zigzag manoeuvres to slow the plane down as much as possible. The aircraft touched down on the runway at 370 km/h – exceeding the standard approach speed by over 100 km/h. The pilot applied emergency braking, causing several tyres to blow out and catch fire. But the plane stopped safely, well before the end of the runway.

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a An alarm sounded, a red master warning lit up and the message ENG 1 FAIL came up on the screen. Seconds later, the right engine flamed out, due to insufficient fuel.

b During a routine instrument check, the crew noticed a disproportionate amount of oil had been used by each engine. Oil pressure and temperature readings for each engine were also irregular, but the levels were found to be within acceptable parameters.

c As the aircraft was now powerless and potentially uncontrollable, an emergency ram air turbine was deployed automatically to generate back-up electrical power for the fly-by-wire controls and instruments. However, with the main hydraulics shut down, the flaps and spoilers used to slow the plane before and after landing were inoperable. The co-pilot calculated the plane could remain airborne for 15–20 minutes, and that Lajes airbase was an estimated 20 minutes away.

d The crew decided to take action to correct the anomaly, opening a cross-feed valve to transfer fuel from the left tank to the right tank.

C Make opposites of the following words using the prefixes in the box.

ab- dis- im- in- (x4) ir- mal- over- un-

1 correct incorrect
2 undersized _____
3 adequate _____
4 detected _____
5 normal _____
6 sufficient _____
7 proportionate _____
8 regular _____
9 balance _____
10 function _____
11 operable _____

c **Make opposites of the following words using the prefixes in the box.**

ab-	dis-	im-	in- (x4)	ir-	mal-	over-	un-

1	correct	incorrect	7	proportionate	_____
2	undersized	_____	8	regular	_____
3	adequate	_____	9	balance	_____
4	detected	_____	10	function	_____
5	normal	_____	11	operable	_____
6	sufficient	_____			

d **Complete the following sentences using the words in Exercise 9c. Sometimes more than one word is possible.**

1 The temperature gauge was faulty. That's why it was giving _____ readings.
2 The shaft was thinner than it should have been, so its strength was _____ .
3 The power output from the motor varies. We don't understand why it's _____ .
4 The bolt's _____ . It's too big to fit into the hole.
5 The machine's not working as it should. There's some kind of _____ .
6 The braking force on both front wheels should be the same. There shouldn't be an _____ .
7 The fault was _____ . None of the maintenance technicians had noticed it.
8 The control panel isn't working, so you can't control the machine. It's totally _____ .

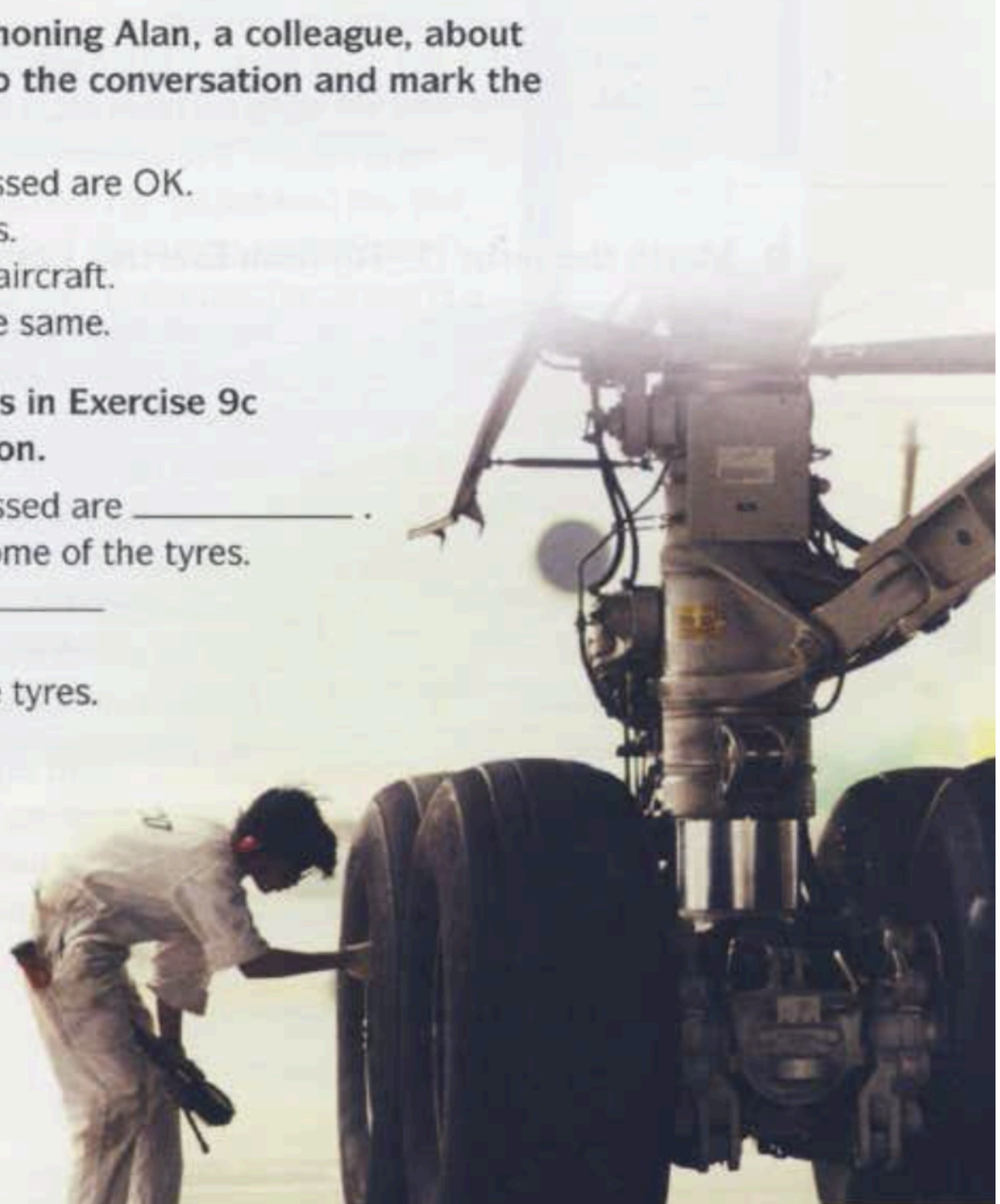
10 **a** ▶5.4 **Julia, an aircraft service technician, is phoning Alan, a colleague, about a problem with the tyres on a plane. Listen to the conversation and mark the statements True (T) or False (F).**

1 The tyre pressures on the block being discussed are OK.
2 There is too little air inside some of the tyres.
3 The tyre pressures are the same across the aircraft.
4 The degree of wear across all the tyres is the same.

b Complete the following sentences using words in Exercise 9c to make true sentences about the conversation.

1 The tyre pressures on the block being discussed are _____ .
2 There is _____ air pressure inside some of the tyres.
3 The tyre pressures on that block are _____ to the rest of the aircraft.
4 The wear rate is _____ across all the tyres.

c In pairs, discuss the possible causes of insufficient tyre pressure in general, and the specific problem Julia describes in Exercise 10a, and say why each general cause you discussed is likely or unlikely in this case.



Discussing repairs and maintenance

11 a In pairs, discuss the difference between repairs and maintenance and decide whether the following words relate to repairs, maintenance or both.

broken clogged defective faulty worn

b In pairs, compare car maintenance with aircraft maintenance. Which aspects are quite similar and which are very different?

12 a **Match the content sections (1–10) of an aircraft service manual to the descriptions (a–j).**

Contents

1	Opening and dismantling access panels	f
2	Topping up, draining and replacing coolants and lubricants	
3	Replacing filters	
4	Safely isolating electrical components	
5	Safely disconnecting and reconnecting electrical components	
6	Mechanical connections to be checked/ tightened at each service	
7	Parts susceptible to wear/damage, to be examined at each service	
8	Sensitive devices to be adjusted at each service	
9	Information on non-serviceable parts / sealed units	
10	Table of component life spans	

a Switching off the power supply
b Making sure certain parts haven't worked loose
c Changing parts that can become clogged
d Adding and changing fluids
e Equipment that needs to be set up precisely
~~f Taking something to pieces to allow maintenance~~
g Taking parts off and refitting them without danger
h Components that can't be repaired on site
i Details of how long parts are designed to last
j Making sure parts are still in good condition

b Match the verbs (1–10) from Exercise 12a to the definitions (a–j).

1	adjust	a	carry out planned maintenance
2	drain	b	change an old or damaged part
3	disconnect	c	check carefully
4	dismantle	d	empty a liquid
5	examine	e	add more fluid to fill a tank to the recommended level
6	replace	f	set up carefully by making small changes
7	reconnect	g	take apart assembled components
8	service	h	apply the correct torque, for example to loose bolts
9	tighten	i	establish a connection again
10	top up	j	remove or isolate from a circuit or network

13 a ▶5.5 A service technician is examining some machinery and talking to a colleague. What does he say about each point on the maintenance checklist?

Maintenance Checklist

1 Coolant level _____
2 Coolant condition _____
3 Coolant filter condition _____
4 Blade wear/damage _____
5 Blade alignment _____

b ▶5.5 Listen again. Do you think the technicians are working on an aircraft or on an industrial machine?

c In pairs, discuss what maintenance needs to be carried out on the machinery in Exercise 13a, describing the operations step by step.

14 a **You work for IPS, a producer of industrial packaging machinery. As a member of the global service team your role is to travel abroad dealing with serious technical problems at your clients' plants. Read the following email from a plant in Helsinki and summarise the problem.**

To: Chris McLean

Subject: Forklift damage to IPS15 Helsinki

Following our phone conversation this morning I confirm that a forklift truck has hit our IPS15 unit. The impact has made a large hole in the main panel on the side of the machine. Our technician who is trained to carry out routine adjustments on the machine has made an external visual inspection. He has advised me that the mechanisms for adjusting the precise alignment of the cutting blades have been damaged. Liquid lubricant is also leaking out from under the machine and a crackling sound can be heard inside the unit when it is switched on – presumably due to earthing/short-circuiting resulting from electrical damage.

I confirm my request for intervention by your service team.

b **In pairs, describe the sequence of steps you'll need to take to carry out repairs when you arrive in Finland, using the notes to help you.**

IPS15 Helsinki

- internal damage
- old parts
- electrical supply: on / off
- lubricant: in / out
- external panels
- alignment of cutting blades
- test
- new parts

15 **Think back to some repairs or maintenance you did, or had done for you, in the past, for example on a car, bike or domestic appliance. In pairs, explain what servicing or repairs were required, and the main steps involved in carrying them out.**