

THE INVENTION OF VARIABLE-PITCH PROPELLERS

Words

Write the letter of each definition with the word it defines. If you don't know the definition, use the context of the reading passage to help you. Look for the words in bold as you read the passage.

PARAGRAPH 1

Words	Definitions
1 propeller	A n., a device that causes an airplane or boat to move
2 sustained	B adj., rough; not smooth
3 coarse	C n., inability to change
4 prolonged	D adj., continuing for a long time, often in a negative sense
5 inflexibility	E adj., having the ability to continue for a long time

PARAGRAPH 2

Words	Definitions
6 variable	F v., to travel at a steady speed
7 pitch	G adj., able to change
8 blade	H n., a thin, flat part of a machine
9 rotation	I n., turning motion
10 cruise	J n., the angle or slope of something

PARAGRAPHS 2–4

Words	Definitions
11 reliably	K n., the development, design, and use of aircraft
12 handle	L n., a plan for making something
13 turbulence	M v., to manage; work well with
14 aviation	N n., strong, sudden movements in air
15 design	O adv., dependably

PARAGRAPH 5

Words	Definitions
16 confer	P n., a person who is very interested in something
17 enthusiast	Q n., interest; need to know
18 isolation	R v., to discuss; consult with somebody
19 curiosity	S n., the condition of being alone or separated from others
20 revolutionize ¹	T v., to change completely

¹BrE: revolutionise

Reading

The Invention of Variable-Pitch Propellers

- (1) Until the late 1920s, airplane **propellers** were made of a single piece of wood attached at the center¹ to the driveshaft of the engine. The tilt of the propeller, that is, how flatly it faced the wind, was fixed, which meant planes flew as if they had only one gear. If the plane had a fine propeller, it traveled the entire time as if in first gear, working well on takeoff and landing but working inefficiently during **sustained** flight. If the plane had a thick, **coarse** propeller, it traveled the entire time as if in high gear, working efficiently during sustained flight, but making takeoffs and landings dangerous and **prolonged**. This **inflexibility** meant that commercial uses of such aircraft were limited because the planes could not carry heavy loads either safely or efficiently.
- (2) In 1922, Wallace Rupert Turnbull patented his latest invention, the **Variable-Pitch** propeller. His propeller in effect gave airplanes gears. The propeller's **blades** were separate from each other, attached at the driveshaft in the center, and could be moved independently or together to chop the air at different angles. The propellers could be tilted at takeoff and landing to act as if in first gear, chopping less air with each **rotation**, and could be tilted when **cruising** to act as if in high gear, chopping more air with each rotation. With this Variable-Pitch propeller, planes could now take off and land more safely and **reliably**, carry varying weights, and **handle** greater variations in wind speed and **turbulence**.
- (3) Turnbull was born in New Brunswick in eastern Canada in 1876. He studied mechanical engineering at Cornell, then continued his post-graduate studies in Europe, and returned to work at the Edison labs in New Jersey. In 1902, just one year before the Wright brothers made their historic flight, Turnbull went back home, set up his own lab in a barn, and started running his own **aviation** experiments.
- (4) To begin, Turnbull needed a wind tunnel. He built a wind tunnel, the first in the world, out of packing materials. In it, he tested different **designs** for propellers and wings; his research is the basis for many of the successful designs still in use today. Alone in his barn, Turnbull designed and tested his Variable-Pitch propeller. It was tested successfully in flight in Borden, Ontario, on June 6, 1927.

¹BrE: centre

(5) Turnbull spent his life experimenting and designing for the new science of aviation in his barn in Rothesay. He sometimes **conferred** with fellow aviation **enthusiast** Alexander Graham Bell in Nova Scotia, but for the most part, he worked in **isolation**. Unlike most engineers, he chose not to work in a university laboratory or in a lab such as Edison's, where he would have been supported by like-minded engineers and physicists. Instead, he spent his adult life in a barn he equipped himself. Depending only on his intelligence, **curiosity**, and work ethic, he **revolutionized** flight. He is honored² in Canada as a pioneer in aviation and a genius in the study of aerodynamics.

Answer the questions about **The Invention of Variable-Pitch Propellers**.

Questions 1–5

Do the following statements agree with the information in the reading passage?

Write

TRUE if the statement agrees with the information.

FALSE if the statement contradicts the information.

NOT GIVEN if there is no information on this in the passage.

..... 1 A coarse propeller worked better during sustained flight than during landing.

..... 2 Variable-Pitch propellers caused problems because of their inflexibility.

..... 3 The blades of a Variable-Pitch propeller could be moved to different angles.

..... 4 A plane with a Variable-Pitch propeller was easier to handle in turbulence.

..... 5 Variable-Pitch propellers were expensive to manufacture.

²BrE: honoured

Questions 6–7*Choose the correct letter, **A**, **B**, **C**, or **D**.*

6 Wallace Rupert Turnbull designed his Variable-Pitch propeller
A at Cornell University.
B in Canada.
C at the home of Alexander Graham Bell.
D in Edison's lab.

7 Turnbull preferred to work
A with other inventors.
B in a university lab.
C with like-minded engineers.
D in isolation.

Word Families**A***Complete each sentence with the correct word from the word family chart. Make nouns plural where necessary. Use the correct form of verbs.*

noun	noun	adjective	adverb
enthusiasm	enthusiast	enthusiastic	enthusiastically

1 Aviation are very interested in flying.

2 The inventor worked to turn his idea into reality.

3 Turnbull's for aviation kept him searching for a better propeller design.

4 Turnbull was about aviation.

noun	adjective	adverb
inflexibility	inflexible	inflexibly

5 An inventor should not work

6 The successful inventor cannot be

7 The of early propellers made planes difficult to fly.

noun	verb	adjective
isolation	isolate	isolated

8 Inventors often prefer to work in

9 An inventor may need to herself in order to do her best work.

10 Turnbull set up his lab in an location.

noun	verb	adjective	adverb
reliance	rely	reliable	reliably

11 The Variable-Pitch propeller made planes more

12 A plane with a Variable-Pitch propeller flew more than earlier planes.

13 Early pilots could not on their planes to carry heavy loads.

14 His on the work of others caused some to question his research.

noun	verb	adjective
revolution	revolutionize	revolutionary

15 Turnbull's propeller was a invention.

16 New inventions the way we do things.

17 The invention of the Variable-Pitch propeller led to a in flight.

noun	verb	adjective	adverb
variable	vary	variable	variably

18 It might be more difficult to fly if the winds are

19 Planes carry different kinds of loads, and the size of the load

20 Planes carry heavy loads.

21 Researchers look at different in their studies.

Word Families**B**

Choose the correct word family member from the list below to complete each blank.

1 enthusiast	enthusiastic	enthusiastically
2 inflexibility	inflexible	inflexibly
3 rely	reliable	reliably
4 isolation	isolate	isolated
5 vary	variable	variably
6 revolution	revolutionize	revolutionary

Like most inventors, Wallace Rupert Turnbull was filled with curiosity about many things. He became 1..... about designing a propeller that would fly more efficiently, during takeoff and landing as well as while cruising. Propellers on early planes were 2....., that is, the angle could not be changed, so they did not fly efficiently under certain conditions. Because of this, pilots could not always 3..... on their planes to perform well. Turnbull worked in an 4..... barn in New Brunswick to develop a new kind of propeller. He could 5..... the angle, or pitch, of this propeller, which made it efficient under different conditions. Turnbull's invention led to a 6..... in flight.

Paraphrases

Read the sentence from the reading passage. Then, choose the sentence that has the same meaning.

- 1 *Although he sometimes conferred with fellow aviation enthusiast Alexander Graham Bell in Nova Scotia, for the most part, he worked in isolation.* (paragraph 5)
 - A Turnbull relied on the support of Bell to keep working on his inventions.
 - B Turnbull invited Bell to work with him in his barn because he didn't like to work alone.
 - C Turnbull occasionally discussed his work with Bell, but mostly he worked alone.

- 2 *Depending only on his intelligence, curiosity, and work ethic, he revolutionized flight.* (paragraph 5)
 - A Turnbull worked hard to learn all he could about flying.
 - B Turnbull was not able to get the support of other inventors working in aviation.
 - C Turnbull's hard work and deep interest in flying led him to completely change aviation.

Word Skill

PREFIX IN-

The prefix *in-* can make the meaning of a word negative.

Read the sentences. Write a definition for each underlined word.

- 1 Inventing involves trying out different ways of doing things, so it is important for an inventor to be flexible.

flexible:

- 2 Because the position of the propeller on early airplanes was inflexible, it was always set at the same angle.

inflexible:

Listening

Track
29

*Listen to the conversation. Choose **FOUR** letters, **A–G**.*

Which **FOUR** facts about the flight demonstration will the students include in their report?

- A** the name of the plane's designer
- B** the names of the passengers
- C** the number of passengers
- D** the size of the propeller
- E** the speed of rotation
- F** the length of the flight
- G** the weather conditions

Writing (Task 1)

The charts¹ below show basic information about different models of light sport aircraft and very light jets for aviation enthusiasts.

Summarize² the information by selecting and reporting the main information and making comparisons.

Write at least 150 words.

Light Sport Aircraft

Manufacturer	Cruise Speed	Passenger Capacity	Price
Airways	75 mph	0	\$39,000
Tiger, Inc.	115 mph	1	\$134,000
McGregor	130 mph	1	\$194,000

Very Light Jets

Manufacturer	Cruise Speed	Passenger Capacity	Price
Airways	300 mph	2	\$900,000
Tiger, Inc.	350 mph	4	\$2,250,000
McGregor	425 mph	6	\$3,650,000

Speaking

Talk about the following topics.

Do you prefer to work (study) with a group or in isolation? Why?

When you run into a problem with work (studies), do you confer with others or do you prefer to find your own solution?

What makes you feel enthusiastic about your work (studies)?

¹BrE: tables

²BrE: summarise