

## Dead satellites are filling space with trash. That could affect Earth's magnetic field

### Level 2: Intermediate

#### 1 Warmer

a. Discuss these questions with a partner.

- What are satellites used for?
- Do you know what happens to satellites when they reach the end of their working life?

#### 2 Key words

a. Match the words from the wordpool to complete the definitions. Then, find and highlight them in the article so that you can read them in context.

compromise      currently      disposable      disrupt      intertwined  
perturb      rubbish      vast      ventures      wealth

1. put something at risk \_\_\_\_\_
2. intended to be used once and then thrown away \_\_\_\_\_
3. the amount of money and/or possessions a person has \_\_\_\_\_
4. at the moment \_\_\_\_\_
5. extremely large in area, size or amount \_\_\_\_\_
6. trash \_\_\_\_\_
7. make it difficult for something to continue in the normal or expected way  
\_\_\_\_\_
8. closely connected and difficult to separate \_\_\_\_\_
9. business activities or projects that involve risk \_\_\_\_\_
10. worry or upset someone \_\_\_\_\_

b. Complete the sentences with words from the previous activity. You might have to change the form of the word.

1. By sharing confidential information with a competitor, she \_\_\_\_\_ the company's future.
2. We should definitely use fewer \_\_\_\_\_ products if we want to protect our planet.
3. His successful investments over the last couple of years have led to considerable \_\_\_\_\_.
4. The author is \_\_\_\_\_ delivering talks every week.

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5. The library holds a \_\_\_\_\_ collection of books, newspapers and magazines.
6. These concepts are clearly \_\_\_\_\_ so it is impossible to analyse them in isolation.
7. They are considering selling their business to embark on new \_\_\_\_\_.
8. The news \_\_\_\_\_ everyone in the office, causing a tense atmosphere.

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- 1 A dead spacecraft the size of a lorry pulverises into dust and litter. This is what happens to internet service satellites during re-entry. When the full mega-constellation of satellites is in place in the 2030s, companies will do this every hour because satellite internet requires thousands of satellites to be constantly replaced. And it could compromise our atmosphere or even our magnetosphere.
- 2 Space entrepreneurs are betting on disposable satellites as key to a new means of wealth. There are currently nearly 10,000 active satellites and companies are working as fast as possible to get tens of thousands more into orbit – for a projected 1m in the next three to four decades.
- 3 Those satellites power internet services and may turn some billionaires into trillionaires – at the cost of covering the planet with toxic rubbish. The problem is that space, contrary to popular belief, isn't really a giant, self-cleaning void.
- 4 Space holds systems like the magnetosphere that keep us alive and supplied with oxygen by protecting our atmosphere. It is easy to assume that the magnetosphere is too vast and robust for humanity ever to have any impact on it, but I don't think that's true. I'm a plasma physicist and the author of recent research that found that the space debris generated by dead and dying commercial satellites could compromise our ionosphere or magnetosphere, also known as our planet's plasma environment.
- 5 This pollution is going to disrupt our delicate plasma environment one way or another. Yet few people are discussing this potential crisis – maybe because so much scientific research about space is intertwined with commercial space ventures, which are interested in avoiding these questions.
- 6 Soon, we will be putting at least an Eiffel Tower's-worth of metallic ash a year directly into the ionosphere. And all of that will stay there, indefinitely. How could we possibly think that burning rubbish in our atmosphere 24/7 is going to be fine? Although some study is being devoted to the phenomenon of satellite and rocket chemicals saturating the atmosphere with ozone-depleting alumina, no one else is studying the pollution of the magnetosphere except me.
- 7 Damaged spacecrafts are huge and consist entirely of aluminium and other highly conductive materials, which can create charging effects and act as a magnetic shield. If these conductive materials form a huge layer of debris, it could trap or deflect all or parts of our magnetic field. The Earth is a ball magnet that we're surrounding with fast-moving metal rubbish. The current debris in the ionosphere shows an apparent human-made electrostatic signature. If individual spacecrafts can perturb their environment with plasma wakes, imagine how 100,000 of them and their associated rubbish could perturb the magnetosphere. This could in turn weaken our atmosphere and put the planet at risk of losing habitability.
- 8 Low Earth orbit is being promoted as a destination for satellites and even space hotels. People like Elon Musk and Jeff Bezos state that space is the key to the future of humanity. But what if it is the opposite? What if space activities cause our planet's end?
- 9 Our magnetosphere keeps us alive. It defends us against an otherwise dangerous solar system, and any pollution of it should be studied and monitored. Space companies need to stop launching satellites if they can't provide studies that show that their pollution will not harm the stratosphere and magnetosphere. Until this pollution is studied further, we should all reconsider satellite internet.

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#### 3 Comprehension check

a. Are these sentences true (T) or false (F) according to the article? Correct any that are false.

1. Companies are working hard to start using satellites to provide internet services.
2. Companies are investing in a new type of satellite to make larger profits.
3. Many people think that space cannot deal with large quantities of rubbish.
4. The writer believes that commercial satellites alone can't damage our plasma environment.
5. The writer thinks researchers may have hidden interests.
6. Aluminium is potentially dangerous because it can affect the Earth's magnetic field.
7. The author believes the space industry will help us survive as a species.
8. Space pollution should be much more closely monitored than it currently is.

#### 4 Key language

a. Complete the sentences from the article with the correct prepositions.

1. When the full mega-constellation of satellites is \_\_\_\_\_ place in the 2030s, companies will do this every hour.
2. Companies are working as fast as possible to get tens of thousands more into orbit – for a projected 1m \_\_\_\_\_ the next three to four decades.
3. Those satellites power internet services and may turn some billionaires \_\_\_\_\_ trillionaires.
4. The problem is that space, contrary \_\_\_\_\_ popular belief, isn't really a giant, self-cleaning void.
5. It is easy to assume that the magnetosphere is too vast and robust for humanity to ever have any impact \_\_\_\_\_ it.
6. Yet few people are discussing this potential crisis – maybe because so much scientific research about space is intertwined with commercial space ventures, which are interested \_\_\_\_\_ avoiding these questions.
7. Soon, we will be putting \_\_\_\_\_ least an Eiffel Tower's-worth of metallic ash a year directly into the ionosphere.
8. Damaged spacecrafts are huge and consist entirely \_\_\_\_\_ aluminium and other highly conductive materials.

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#### 5 Discussion

**a. Discuss these statements.**

- 'Few people are discussing this potential crisis – maybe because so much scientific research about space is intertwined with commercial space ventures, which are interested in avoiding these questions.'
- 'People like Elon Musk and Jeff Bezos state that space is the key to the future of humanity. But what if it is the opposite? What if space activities cause our planet's end?'
- 'Space companies need to stop launching satellites if they can't provide studies that show that their pollution will not harm the stratosphere and magnetosphere. Until this pollution is studied further, we should all reconsider satellite internet.'

#### 6 In your own words

- a. With a partner, make a list of the pros and cons of employing disposable satellites.**
- b. Do some research online to check your ideas.**
- c. Prepare a presentation about disposable satellites, the pros, the cons and what may happen in the future.**