

- www.usda.gov/rus/educate/telchart.htm
The USDA's "Rus the Surfin' Squirrel" Web site informs students about utilities and contains a telecommunications word game.
- www.fi.edu/franklin/inventor/bell.html
This page from the Franklin Institute Online shows students how telecommunications pioneer Alexander Graham Bell invented the telephone while striving to assist deaf people, and chronicles the revolution and chronology of modern telecommunications.
- www.howstuffworks.com/
Students can use the topical index on this site to find many answers to their questions about telephones, fiber optics, radio waves and other technology that allows us to communicate with people all over the world.
- www.sciencenet.org.uk/Origins/telecom.html
These ScienceNet pages explain how many technological innovations, such as the fax machine, have taken years to develop.

Suggested Print Resources

- Brain, Marshall. *How Stuff Works*. John Wiley & Sons, Hoboken, NJ; 2001.
- Foltz Jones, Charlotte. *Accidents May Happen: Fifty Inventions Discovered By Mistake*. Random House Publishing, New York, NY; 1998.
- Gearhardt, Sarah. *The Telephone (Turning Point Inventions)*. Atheneum Press, New York, NY; 1999.
- Macaulay, David. *The New Way Things Work*. Houghton Mifflin, New York, NY; 1998.

TEACHER'S GUIDE

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Telecommunications

Grades 3-6

Journey to Mammoth Island, a whimsical place where investigating scientific principles is always an adventure. Olive, a young girl, assisted by the Island's mammoth population and a visiting inventor helps the locals discover why and how machines work. Science facts are clearly demonstrated, giving kids an opportunity to see how important everyday machines are linked together by the science that drives them. Students come to see that science is a way of organizing information about the world, explaining why things work the way they do and allowing us to predict what might happen in new situations.

This guide provides a brief synopsis of the program, background on the science concepts presented, discussion topics, additional activities, vocabulary and suggested print and Internet resources.



Program Summary

In *Telecommunications*, a visiting inventor investigating a stream of flying boulders discovers the Islanders' primitive communication system and decides to help them upgrade to one that is more efficient and less dangerous. The old system isn't quite cutting edge technology — rocks of different sizes represent letters of the alphabet, rather like Morse code. After some boulders miss their mark, the Islanders agree that it might be wise to find a better way of communicating.

The inventor tells them about telephones — devices that use electricity, light and radio waves to transmit sound messages. First, a microphone produces an electrical signal that rises and falls in the same way as the sound. Then a device called an amplifier boosts the signal current that travels through wires at incredible speed until it reaches a receiver, which converts the signal back into pure sound and out through a speaker. A network of phone lines crisscrosses every neighborhood that uses telephones to communicate!

Fiber optic systems make communicating over long distances even easier. Instead of phone lines made of copper wire to carry signals, cables made of many thousands of thin strands of glass are used to transmit information. A laser produces a beam of light that can carry a sound signal along the glass fiber. The beam carries the signal to a light detector, which translates the signal and sends it to a speaker where it can be heard.

There are many machines all around us that make our lives easier. Fax machines send images and words across phone lines. Cell phones make it possible to talk to anyone almost anywhere in the world! Everyone's town is broken up into small areas called 'cells.' Each cell has a base station that consists of a tower, an antenna and a small building containing radio equipment. The cell phones act as radios, transmitting and receiving signals sent from the closest base station.

Glossary

The following words are included for teacher reference and for use with students to extend the subject matter in the show.

amplifier — A device that takes a weak audio signal and turns it into a more powerful sound.

analog signals — Voice or video signals sent to or from a base station as a stream of changing radio waves.

digital signals — Voice or video signals that are transmitted and first interpreted as individual bits of binary information (using only the numbers 0 and 1).

effort — The force applied to get work done.

energy — The ability to do work.

exchange — A communications office that enables telephone customers to connect with other customers.

fax (facsimile) machine — An instrument that allows words, photographs and other images to be transmitted over telephone lines. (Facsimile means "likeness.")

force — A push or a pull on an object that causes a change in motion.

mobile phone — (Also called a 'cell phone.')

A cordless telecommunication system that relies on the transmission of radio waves from base stations within small sectors of a city called 'cells.'

(Continued)

Morse code — A method of transmitting messages by audible or visual signals.

machine — Any device that helps you do work.

mechanical advantage — The number of times a simple machine multiplies the effort force.

optical fibers — Long threads of glass that carry digital information over long distances.

power — A measure of how quickly work is done.

powerline — A cable used to carry electricity.

telecommunications — Communication at a distance beyond the range of hearing or eyesight.

telegraph — A communication device that uses electricity to send and receive information in the form of dots and dashes.

transmitter — A device in a telephone that amplifies and helps send sounds of the human voice electronically.

receiver — A device in a telephone that converts electric impulses of the human voice into sound.

work — To move or change something. Doing work takes energy. When you use force to make something move, you are doing work.

Pre-viewing Discussion

- How did people receive news and communicate with others before the development of the telephone?
- How would life today be different without telephones?

Follow-up Questions & Activities

- Challenge students to learn Morse code and transmit messages to one another for decoding in class.
- Explore the hobby of ham radio by bringing in a licensed amateur radio operator to talk to the class and tell students what ham radio operators do. A Web source to find a local hobbyist is www.arrl.org/hamradio.html.
- Ask students to research the differences between cell phones and regular phones and report back to the class.
- Have students research the investigations of Alexander Graham Bell and his contemporaries. Ask students to create a time line illustrating the development of the telephone, from the simple device introduced by Bell, to cell phones and Internet telephony.
- Students are so accustomed to electronic communications devices that it is difficult to imagine life without them. Ask students to imagine spending a week without the telephone and related technology, and have them write an essay illustrating how this would affect their daily lives.

Suggested Internet Resources

Periodically, Internet Resources are updated on our Web site at www.LibraryVideo.com

- www.opticalres.com/kidoptx.html#Lasers
"Optics for Kids!" explains how powerful lasers can carry huge amounts of information.

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