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INSTRUCTOR: Mr. John Berner

COURSE: Communications and Information Systems

UNIT: Communication Topics

TOPIC: Atmospheric Transmissions

OBJECTIVES:

On a written examination of 70 percent accuracy, students will be able to:

- Calculate the distance of line of sight transmissions
- Explain the changes in atmosphere due to the rising and setting of the sun
- Describe the difference between simplex and duplex communications
- Identify the different types of relay systems
- Explain the benefits of sub-audible tones
- Explain how trunked radio systems work, and why we use them
- Explain how atmospheric transmissions are used in any chosen profession

RESOURCES:

- Watergun
- Shield
- Two-way Radio
- PowerPoint Slides
- Computer and Projector Equipment
- Digital Projector

Atmospheric Transmissions

1. Preview

Definition of transmissions- the technical processes of conveying information from one location to another (part of the communication concept model)

Definition of atmosphere- gaseous envelope surrounding the earth

Communications Model- information that has been encoded is sent through a medium(atmosphere) with the intent of being received by another station

2. Content

2.1 Radio Waves

2.1.1 Depicted as ripples on the surface of water

2.1.2 Travel speed is 186,000 miles per second (speed of light)

2.1.3 Range is line-of-sight (in theory)

2.1.3.1 Refraction- bending signals on hilltops

- 2.1.3.2 Atmospheric Influence
- 2.1.3.3 Frequency Properties
 - 2.1.3.3.1 Higher Frequency, shorter antenna, less distance, better reflection
 - 2.1.3.3.2 Lower Frequency, longer antenna, more distance, better absorption
- 2.1.3.4 Calculating line-of-sight (refer to Power Point slide)
- 2.1.4 Capable of Carrying Information
 - 2.1.4.1 Voice
 - 2.1.4.2 Video
 - 2.1.4.3 Data
 - 2.1.4.4 Code
- 2.2 Communication Relay Systems
 - 2.2.1 Simplex Communications- using the same frequency while taking turns
 - 2.2.2 Mobile Relay- using two frequencies with the aid of a repeater for the purpose of reaching stations that are blocked by terrain
 - 2.2.3 Remote Base Station- using microwave and/or land line to activate remote broadcasting stations which may be a large distance away
 - 2.2.4 Mobile Extender- using a portable repeater, usually built into a vehicle that extends the range of a radio operated on foot
- 2.3 Sub-audible Tones
 - 2.3.1 Unable to be heard by the human ear- sound that is too high or too low on a sound spectrum to decipher the sound
 - 2.3.2 Receivers are sensitive to the sound- electronics can exceed our human abilities
 - 2.3.3 May be used to block unwanted noise or squelch- if a designated tone isn't heard, it ignores all other frequency modulations
 - 2.3.4 May be used to select a designated station- ignore radio chatter from others using the same frequency
- 2.4 Trunking
 - 2.4.1 Efficiency of frequency usage- large cities may use channels more at night than during the day
 - 2.4.2 Radios are programmed to stay in tuned with a handshake repeater, so they can adjust frequencies as needed
 - 2.4.3 Several agencies can use the same frequencies limiting the number that are licensed for use
 - 2.4.4 Cellular Phones use the same technology
- 2.5 Atmosphere Changes
 - 2.5.1 Lowest layers D and E are only present during the day and disappear at night- 25-90 miles up
 - 2.5.2 Highest layers F1 and F2 combine into one layer called F at night- 90-250 miles up
 - 2.5.3 Ducting- sending signals over long distances by using nature- 1000 feet in the air in coastal regions where warm moist air is trapped

between two layers of cool dry air

3. Impacts

- 3.1 Professions that are dependent on atmospheric transmissions
- 3.2 Science and space exploration
- 3.3 Growing population and demand for bandwidth
- 3.4 Computers and Networking
- 3.5 Digital phones with imaging

4. Review

- 4.1 What are the negative and positive impacts of using VHF and UHF bands?
- 4.2 How does trunking consolidate band usage?
- 4.3 When are band openings at their peak performance?
- 4.4 How do we send radio signals to opposite sides of the globe?
- 4.5 What methods do we use to block unwanted noise or squelch?
- 4.6 Why do we use duplexing in radio communications?

ACTIVITIES:

Water Gun Activity (May be done outdoors if there is more student involvement)

1. have a student hold up a barrier which symbolizes a hillside
2. firing a water gun at the barrier symbolizes a transmitted signal
3. activity should show how radio signals can get past the barrier, but not within close proximity behind

Duplex Transmission Activity

1. set up a radio that displays frequency change under a digital projector so that the class can view it
2. transmit by pushing the “push to talk” button and let the class see what happens in duplex operation