



ARRL Teachers Institute

Introduction to Wireless Technology

8:00am - 4:00pm Daily

Note: this is a tentative agenda and may be changed to accommodate optional activities and to best meet site and TI participants' needs.

Pre-Institute Tasks - Things to do *before* the Institute

- Install and test software on laptops
- Complete and submit pre-workshop survey
- Submit introduction biographies & snapshots

Optional Activities (depends on time, interest, and opportunity)

- Fox Hunt (Amateur Radio Direction Finding)
- Amateur Satellite FM Contact
- Amateur Satellite Telemetry Recording & Analysis
- ISS Packet Communication
- MAREA Demonstration
- Weather Satellite Imaging
- Amateur License Exam Administration
- Facilities Tours
- Ham Station Operation
- Participant Demonstrations and Presentations

Breaks

- Lunch - roughly noon to 1:15 pm daily.
- Restroom and stretch breaks approximately every hour, but stand, stretch, and use the restroom as needed!

Monday / Day 1

I. Introductions & logistics

II. The Educational Context for Wireless Technology

- A. The Relevance of Wireless Technology
- B. “What do we teach?” (Connections to benchmarks & science literacy)

III. Basic Electronics

- A. Basic Principles of Electronics and Radio Wave Propagation (magnet and tube demo)
- B. Elements of Electricity: Resistance, Voltage, and Current
- C. Circuit Basics
- D. Electronic Components (measuring and operation)
 - 1. Resistors (calculating serial and parallel resistance)
 - 2. Capacitors (calculating serial and parallel capacitance)
 - 3. Inductors
 - 4. Diodes
 - 5. Transistors
- E. Digital multimeter operation and safety
- F. “It’s the Law!” - Ohm’s & Kirchhoff's Laws

IV. Soldering 101 (The 24-hour digital clock)

- A. Terminology
- B. Technique (The art and science of soldering)
- C. Solder the 24-hour clock kit (finish as homework, if necessary)

V. Brainstorming - Classroom connections & implementation

Tuesday / Day 2

I. Day 1 Review

II. “Smoke Test” of 24-hour clocks (if needed)

III. Laptop setup

IV. Understanding Signals - The Science of Wireless Technology

- A. PropScope set up and operation
- B. Analog Signals - Wave fundamentals & propagation
- C. Modulation / Demodulation Board
- D. The 5 Building Blocks of Wireless Technology

V. Digital Signal Processing (DSP) Fundamentals

- A. Analog-to-Digital and Digital-to-Analog conversion
- B. Digital (pulsed) Signals
- C. Infrared - TV Remote signaling and decoding
- D. RF - Radio Frequency Identification (RFID) - optional

VI. Radio in the Classroom

- A. Satellite operations - voice, telemetry, & weather
- B. ARISS (Amateur Radio on the International Space Station)
- C. Ham radio - contacts, QSL cards, School Club Roundup
- D. Emergency preparation, communication, community service
- E. Remote sensing and control, the MAREA concept
- F. Radiosport - Radio Direction Finding (Fox Hunting)

VII. Career Opportunities for Students

VIII. Working with your local ham radio club

IX. Brainstorming - classroom connections & implementation

Wednesday / Day 3

I. Day 2 Review

II. Introduction to “What’s a Microcontroller?”

III. The Board of Education (BOE) and BASIC Stamp

IV. The BASIC Stamp Editor

V. Programming fundamentals

- A. Flowcharting
- B. Pseudocode
- C. Comments & Documentation
- D. The PBasic Command Set
- E. Syntax
- F. Constants, Variables, and Memory
- G. Flow Control
- H. Subroutines

VI. Applications

- A. Digital inputs & outputs (lights on / lights off)
- B. Frequency and sound
- C. Sensor input
- D. RFID applications (optional)

VII. Brainstorming - classroom connections & implementation

Thursday / Day 4

I. Day 3 Review

II. Robot component setup

III. Assemble the robot

IV. Motion and servos

- A. Standard versus continuous servos and how they work
- B. Adjusting the servos
- C. Measuring servo efficiency and torque

V. Controlling motion and robot navigation

- A. Motor control: dead reckoning
- B. Sensor control: navigating by touch (avoid, using metal “feelers”)
- C. Sensor control: line following using reflected IR
- D. Project: navigating the maze

VI. Brainstorming - Classroom connections & implementation

Friday / Day 5

Note: anything that was not completed on Days 1-4 will “flow” to Day 5 for completion.

- I. Day 4 Review**
- II. Advanced robot projects**
 - A. Infrared detection and ranging - avoid
 - B. Infrared detection and ranging - follow (the Conga Line)
- III. Looking ahead to TI-2**
- IV. ETP grants - what's available, what we're looking for**
- V. Complete and submit workshop expense reports**
- VI. Completion certificates and group pictures**
- VII. Post-Institute Survey**
- VIII. Packing and preparation for shipping & departure**
- IX. Brainstorming - classroom connections & implementation**
- X. Participant action plans**
- XI. Program critique and good-byes**