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 (depend 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**