

# Standard Operating Procedure (SOP) 8: Site Installation and Maintenance Equipment Checklist, Version 2.0

## Weather and Climate Monitoring Protocol *Arctic (ARCN), Central Alaska (CAKN), and Southeast Alaska (SEAN) Inventory and Monitoring Networks*

### Change History

Previous Version #	Revision Date	Revised By	Changes	Justification	New Version #
1.00 (CAKN SOP 9)	12/19/2006	P. Sousanes	Minor edits: added park to radio and digital to camera in equipment list.	Incorporated peer review comments	1.01
1.00 (CAKN SOP 10)	12/19/2006	P. Sousanes	Removed SOP 10a and added link to manual instead	Redundant info available elsewhere	1.01
1.01 (CAKN SOP 9, 10)	March 2017	P. Sousanes K. Hill, M. Bower, B. Johnson	Combined field equipment list for both an installation and a maintenance trip in single SOP, removed details of installation replaced with links to installation manuals.	Reorganized and focused on the critical tools and equipment needed for annual maintenance trips, with links to installation manuals.	2.0

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### Overview

This SOP provides a comprehensive list of equipment and tools that are required for every site visit to a network weather station. It is important to go through the checklist before every field trip. The

instructions for installing a new weather station are available from the Campbell Scientific website: [Tripod Installation Manual or Tower Installation Manual](#) (<https://s.campbellsci.com/documents/us/technical-papers/siting.pdf>). A siting guide is also available: [Weather Station Siting and Installation Tools](#) (<https://s.campbellsci.com/documents/us/technical-papers/siting.pdf>). Figure SOP 8-1 is an example of a tripod tower configuration and figure SOP 8-2 is an example of a tower configuration.



Figure SOP 8-1. Network weather station (tripod configuration) with electric fence.



Figure SOP 8-2. Network weather station (tower configuration) with electric fence.

## Site Visit Packing Checklists

This is a comprehensive list of all equipment necessary for standard tower and tripod installations as well as the equipment needed for annual maintenance trips. A back up of almost every sensor and piece of equipment is needed for each annual maintenance visit to account for unanticipated equipment failures. Given minor differences in station configuration, packing lists should be refined prior to each trip by comparing the following lists with the station equipment inventories. Finally, previous annual maintenance data sheets should be reviewed for any documented maintenance supply or equipment needs (see SOP 9). On a case-by-case basis, individual components may be excluded from annual maintenance trips for convenience or to save weight (e.g., batteries and a solar panel may not be needed if transmitted battery voltage remains sufficient). However, it is expensive and time consuming to access each weather station, so staff should be prepared for all contingencies to avoid the need for multiple visits.

### Communications and Data Processing

- Datalogger with extended temperature testing

- GOES transmitter labeled with platform ID and TX time
- Transmitter surge suppressor
- Communications cable (to connect transmitter to datalogger)
- GOES transmitter power cable (with plugs for transmitter and datalogger)
- GPS antenna with mounting hardware
- GPS antenna cable
- GPS pipe mount with mounting hardware
- GOES antenna (Yagi or omnidirectional) with mounting hardware
- GOES antenna cable (coax)
- Extra Yagi antenna tines (if using Yagi)
- Clinometer and compass for antenna alignment (Yagi only)
- NEMA enclosure with mounting hardware
- Enclosure supplies – desiccant, putty, grommets, etc.

### **Power System**

- Solar charging regulator
- Enclosure grounding kit: black wire, green wire, lightning rod mount, copper ground rod nut
- Grounding rod
- Primary battery cable (for external battery connection to datalogger)
- Jumpers for connecting batteries in series
- 50-100 watt solar panel with wires attached and mounting hardware
- Two or three 12-volt (55-100 Ah) deep cycle batteries (charged)
- Battery box
- 2 ratchet straps ( optional, to secure battery box)

### **Sensors**

- Temp/RH sensor with radiation shield
- Secondary AT sensor (if needed for temperatures < -40°F)
- Soil temperature sensor (X 3) with aluminum conduit and bushings
- Anemometer with mounting hardware
- Rain gauge with mounting hardware
- Solar radiation sensor with leveling base and mounting hardware
- Snow depth sensors with mounting hardware and target (if needed)
- Barometric pressure sensor (some stations)

### **Tower Installations:**

- UT 10 or suitable tower
- Mast with set bolt
- Bell reducer and 1” x 16” nipple for atop mast
- Suitable footing and attachment hardware

- Cross arm (1 ½” x 6’) and mounting bracket and hardware
- Guy wires and attachment hardware
- Helical soil anchors (3), *and/or*
- Rock anchors (3-7)

### **Tripod Installations:**

- CM110 or suitable tripod
  - Tripod legs
  - Mast – 2 pipes and bolt
  - Guy wires and attachment hardware
- Lightning rod
- 1 or 2 cross arm(s) (1 ½” x 6’; 1 ½” x 4’) and mounting bracket and hardware
- 6 Rebar pegs for tripod legs, *and/or*
- Rock anchors (6)

### **General Supplies:**

- Tarp
- Shop towels
- Cable ties
- Bailing wire
- P-cord
- Duct tape
- Electrical tape
- Putty
- Mastic tape
- WD-40 (Note: This is a hazardous item – cannot transport on commercial airlines)
- Dielectric grease
- Flagging
- Strapping tape
- 2 ratchet straps
- Silicone caulk
- Enclosure supplies – desiccant, putty, grommets
- Bungee for holding enclosure open while working

### **Extra Hardware:**

- U-bolts (various sizes as back up for enclosure, solar panel, crossbar mounts, and radiation shield mounts)
- Unistrut/U-Bolt attachments for solar panels
- Nuts, flat washers, lock washers and bolts
- Ground rod nut
- 1/8” steel aircraft cable

- Ferrules (6), thimbles (3), turnbuckles (3), and shackles (6)
- Tipping bucket rim clamps
- Nu-rails (1" x 1" and ¾" x 1")
- Hose clamps (2" and 3")

**Hand tools:**

- Hand mallet (5 lb)
- Small saw
- Loppers
- Swaging tool for guy wire and ferrules
- Spade shovel
- Philips and flat head screw driver
- Small CSI screw drivers
- Utility knife
- Allen wrenches
- Nut drivers
- 2 crescent wrenches
- Sockets, drivers; including 3/8, 5/8, 7/16, 1/2, 9/16 in
- Ratcheting ½" wrench
- Open-end wrenches: 1/2, 7/16, 9/16 in
- Torpedo level
- Measuring tape (standard and metric)
- RoboGrip pliers

**Electrical tools/supplies:**

- Wire stripper/crimper and various electrical connectors
- Wire cutters
- Linesman pliers
- Multimeter
- UV-rated wire for power supply wiring
- Battery terminal connectors
- Miscellaneous wire connectors
- Transmitter fuses (7.5A)
- Datalogger internal lithium-ion battery (3.6 V, TL-2902)

**Computer:**

- Laptop computer or suitable alternative with software for direct logger and transmitter communications
- RS-232 data cable, USB data cable, and AC power charger
- Electronic files:

- latest datalogger operating system version
- datalogger programs
- equipment and sensor manuals
- firmware updates
- Complete set of SOPs

**Data sheets and reference material:**

- Clipboard with:
  - Station site visit worksheets
  - Flight/float/backcountry plans
  - Project Aviation Safety Plan
  - Research permit
  - Wiring diagrams
- Rite-in-the-rain notebook
- Sharpies, mechanical pencils

**Personal communication and navigation:**

- Park radio and two extra batteries or clamshell with 16 AAs (for parks with radio communications)
- Satellite phone with extra battery
- PLB and/or InReach
- GPS Unit
- Camera
- Compass

**Personal protective equipment:**

- Warm clothing
- Waterproof jacket and pants
- Gloves
- Leatherman
- Water/Food
- Sunscreen
- Personal medications
- Flight gear (Nomex, helmet, leather/Nomex gloves, inflatable vest)
- Bug spray/head net
- Bear spray
- Watch (or some way to keep track of time)