

Data Telemetry and Power

Objective is to provide an overview of available options associated benefits/limitations.

**** Every locations has unique requirements**

Factors defining Telemetry method:

- **Fishing activity**
- **Surface traffic**
- **Range**
- **Hydrographic conditions**
- **Bathymetry**
- **Interference sources**

Tools and possibilities for Interfacing w/ Nortek



Nortek External Power Supplies



4x

50 Wh

Small AA: alkaline/Lithium Ion



165 Wh

Lithium PulsePlus



2x

540 Wh

Large D: Alkaline



1200 Wh

Lithium metal hydride



Doin' it yerself Power Supplies

Considerations:

Minimum voltage 8.5 V

Maximum voltage 18 V

Stiff vs. soft

DC-DC converters min 1.5-2 amp supply

**Direct draw of transducers means
Range directly proportional to available
Power (2-3 dB)**

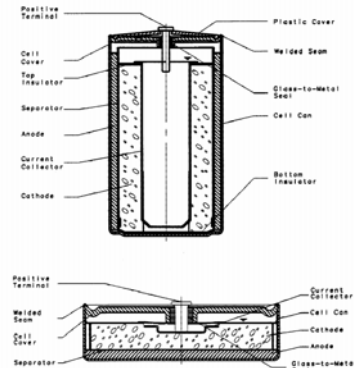
Pulses Plus

Hybrid combines bobbin type Li/SOCL₂ with a capacitor

High energy density that allows for loads periodic high current draw or pulses



Same operating life with smaller size for use in GPSlice buoys. Oceantronics' original battery pack (left) used 380 alkaline D cells (54 kg). The new battery pack (right) uses 32 lithium thionyl chloride D cells and four hybrid layered capacitors (3.2 kg).





Charge Systems

Solar panel

Regulator

Battery Bank

Panel Orientation

- **Fixed: orient South**
Vertical angle = Latitude

- **Buoy: figure 2-4X panel requirement**
Vertical or on top of buoy



"Standard Kit"

Specifying a Solar Charge System

Battery Bank

Plan for 30 days of no sun (ref. UK)

Sealed gel-cells (little to no "gassing")

Regulator

Avoid damaging batteries

Disconnect panels if batteries reached max

Disconnect load if batteries drop below critical voltage

Specifying a Solar Charge System

Panels

**Estimate lowest Peak Power: Winter
In UK 1-2 hours/day in Jan&Feb (available from
manufacturers)**

**Power consumption per day:
AWAC 1 wave burst/hour => 10 Wh/day
Worst case is 1 hour so 10 Watt panel (buoy 20-
40 W)**

**On land be careful of shading: 1/10 coverage
leads to 1/4 power output loss**

**Types:
Aluminum frame
thin SS (2X price)
Flexible (lower power, more expensive)**

Siemens/Shell/BP



Cabled systems

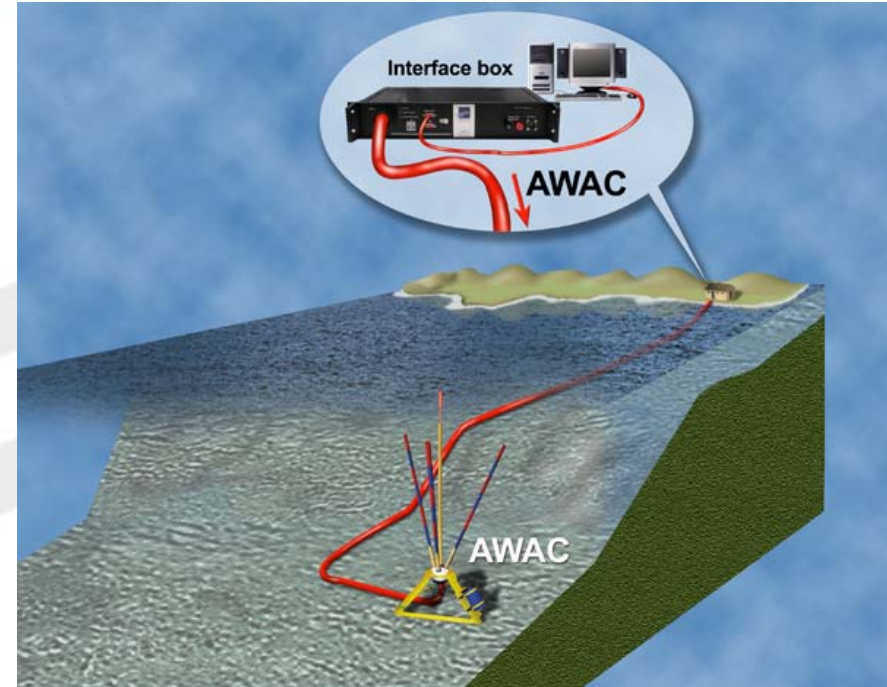
What:

- Armored cables
- communications
- power supply

Why:

- Dependable comms
- Power
- Limited servicing
- High band width (raw data, upgrades)

**Considerations: cable breaks \$\$\$,
backup battery, segments**



Offshore Cable

Offshore cable:

8 leads (RS 422)

double jacket

armored

molded connectors

Sync line for NIP on land

\$10/meter

Considerations:

- **Use higher voltage (48V) DC-DC converter and backup battery**
- **Weight the cable**
- **Sements (200-500m)**
- **Strain relief**
- **Finding breaks (time domain reflectometer)**



Cabled Communications

RS 232: Short distances (<50m)

- **Reference to ground**
- **High sensitivity to external noise**

RS 422: Longer distances (<5km)

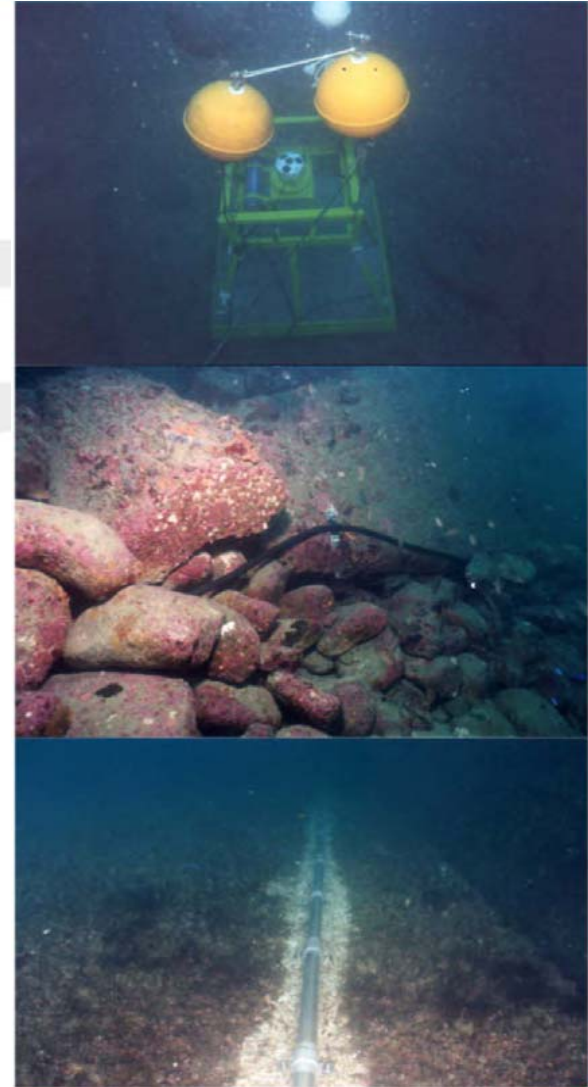
- **Reference to differential**
- **Lower noise sensitivity**

Instrument requirements:

- **Different internal harness**
- **Cable**
- **Converter at PC**

RS485:

- **Not full duplex**
- **Less expensive cables**





AWAC Interface Box

**Modem: GSM,
RF, land**

**Lightning
Protection**



AWAC



Modem

**Backup
Power**

From AWAC

**Network
Power**

Available Comms:

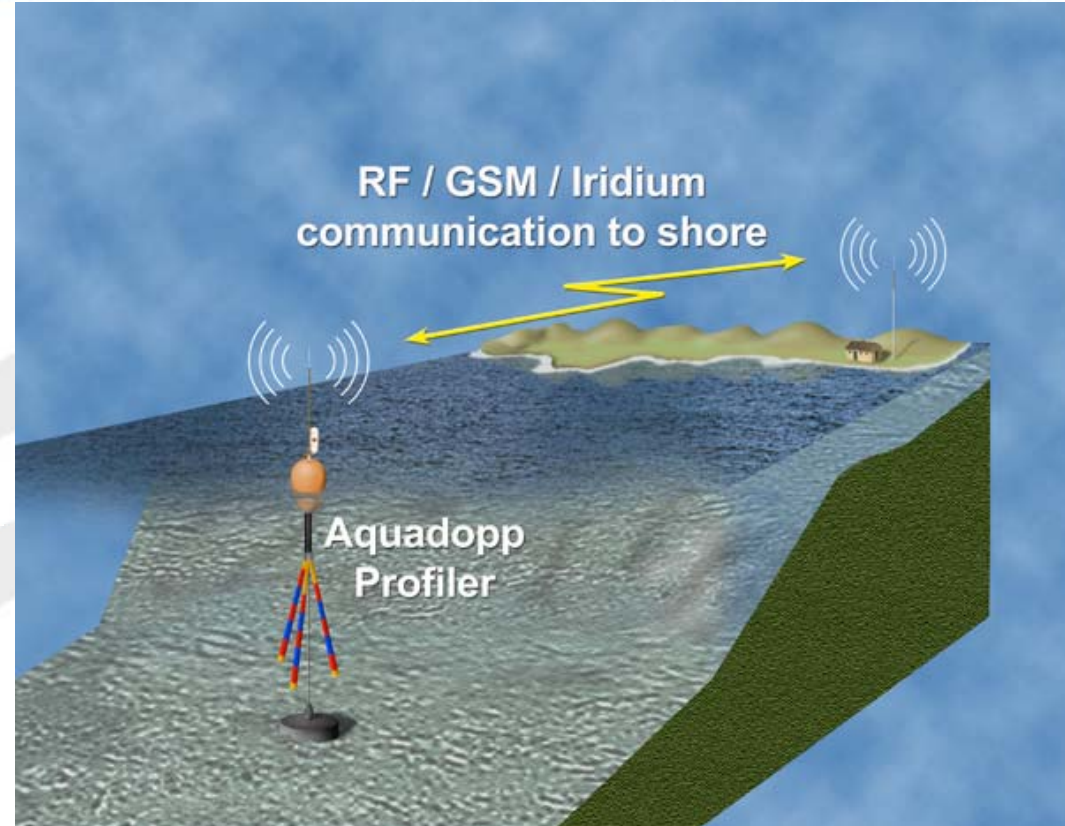
- RF modems
- Wireless LAN
- GSM
- Satelite

Why:

- surface currents & profiles
- relatively inexpensive
- solar power
- Comms have good range
- Serviceable by boat

Considerations:

- exposure (shipping, ice, vandilism, fishing)
- compass calibration





RF Modems

What:

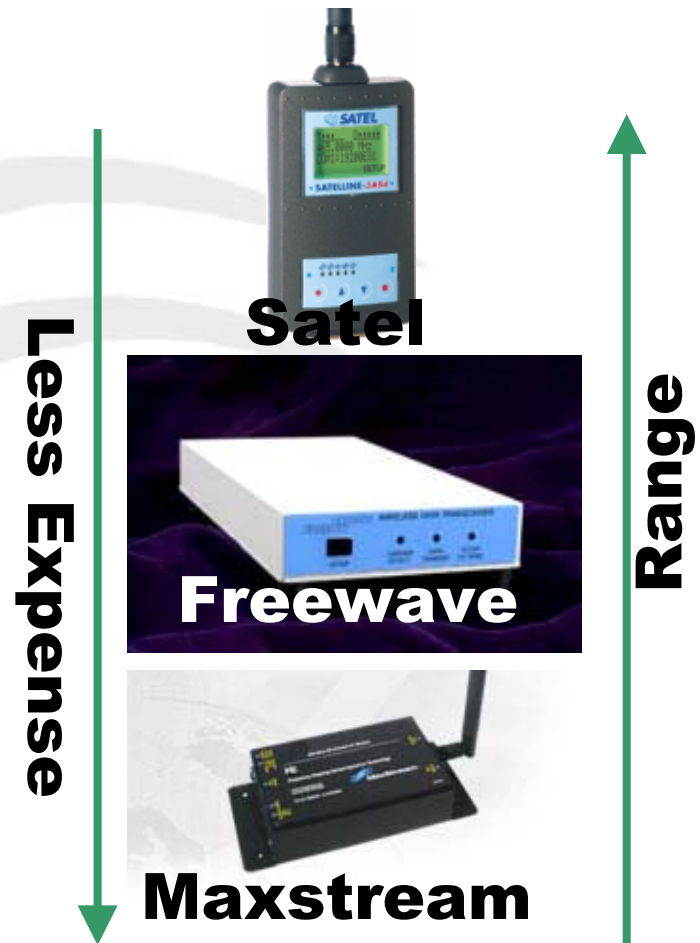
- 900 MHz license free band
- Frequency hopping
- spread spectrum
- Different power levels

Why:

- Good Range
- Reasonably good bandwidth
- Inexpensive

Considerations:

- Power vs. range requirements
- Antenna selection
- Buffer size
- Configurable baud rates
- Sleep mode power consumption





Antennae

Antenna Gain (fixed vs. buoy)

covers 900MHz supports freq hopping

Antenna cable length

Fresnel zone/line of sight

Data rate (doubling => 30%)

6 dB change power => factor 2 range

**Height is everything!!
10m 5x range than 2m**

Vertical separation from other antennae

**Yagi/Parabolic:
path study/accurate compass**



Test modes

St. Petersburg, FL



802.11

Bluetooth and WiFi

Bluetooth range limited to 100 m but low power

WiFi more power but greater range

High bandwidth

No cost per transmission

***Range is antenna limited**

Cisco ethernet receivers (32 km)

Zip code to Denver, CO



GSMICDMA

Established network - Coverage dependent

Dependable

Reoccurring costs

GSM used in Taiwan - No experience with CDMA

2-way communications

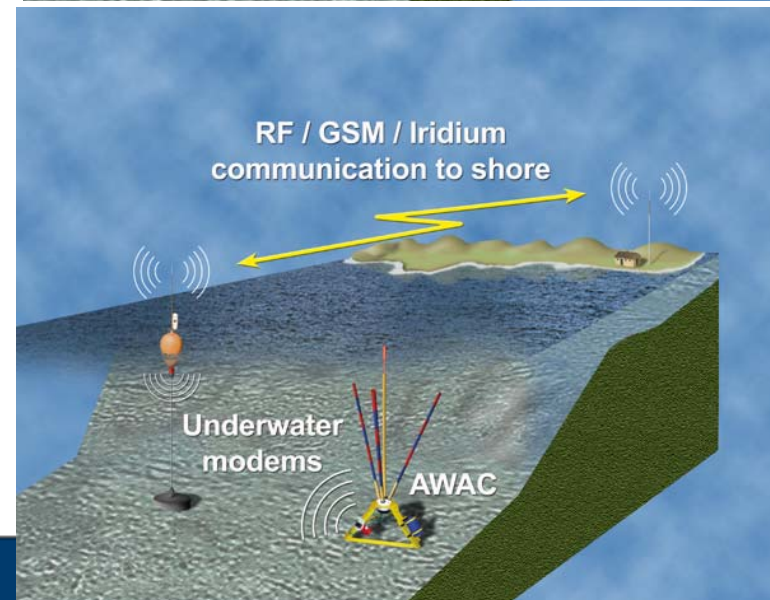
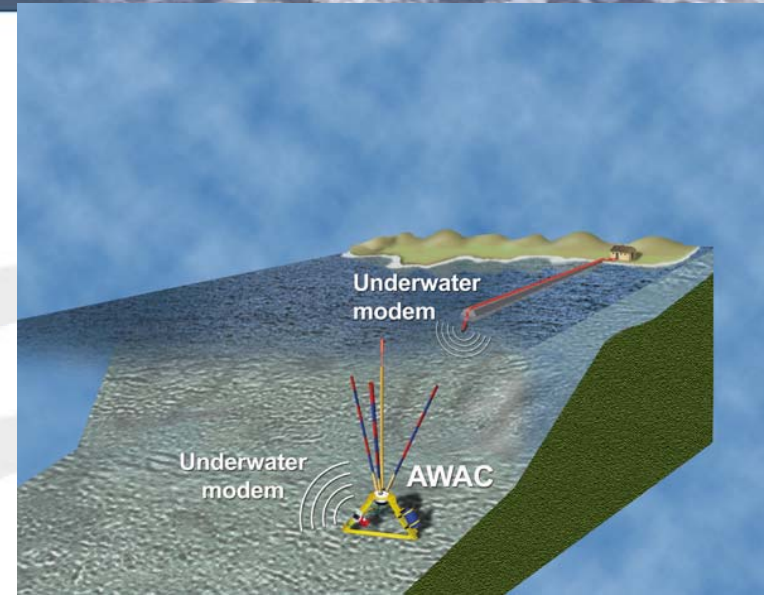
Acoustic Modems

What:

- Paired acoustic instruments
- Frequency hopping
- Spread spectrum
- Linkquest, Benthos, Sonardyne, Applied Acoustics

Why:

- bathymetry
- high risk cable
- cable breaks expensive
- Buoy risk



Considerations:

- Vertical / horizontal transmission
- Test modes – verify channel
- Optimum location 1/3 from bottom

Challenges:

- Background noise sources:
- Sea State, shipping
- low bandwidth
- regular service schedule
- depth/range => aspect ratio
- Two way challenging - retries

168 : principles of underwater sound for engineers

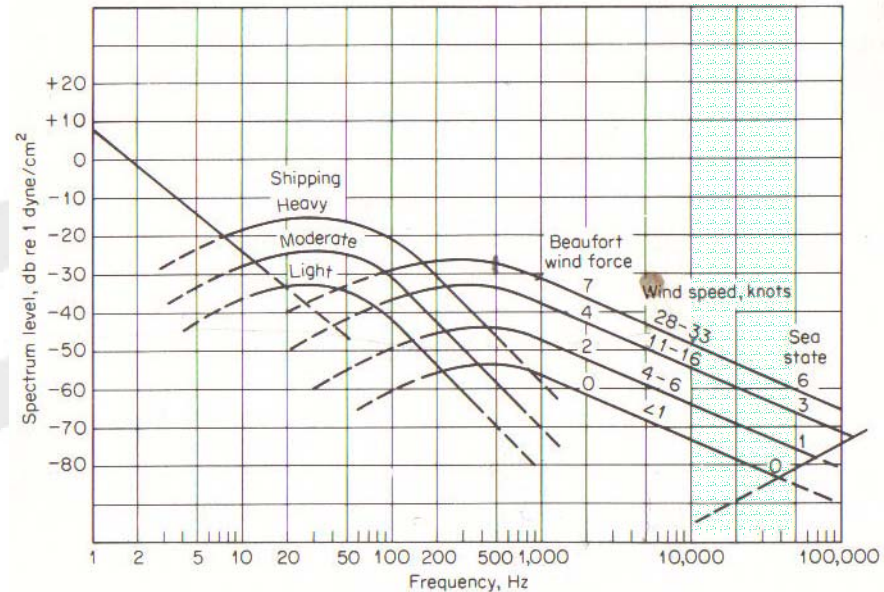


FIG. 7.5. Average deep-water ambient-noise spectra.



Satellite Comms

Argos:

Established - since 1978 dedicated to environment

Over 7,000 transmitters

full global coverage

401.65 MHz (clean band)

2 way transmission

Max message size 32 bytes / 1 kbyte max per day

High cost

Data packaged and controlled

Orbcomm: 30 low Earth orbit satellites

Geared at asset tracking / remote monitoring

8 kbytes per message - max 50 kbytes/day

\$2 per day regardless of data volume

noisy part of spectrum (138-150MHz)

Data delivery in the form of an email - unprocessed format

Quake Global leader (San Diego)



Satellite Comms cont.

Inmarsat:

Origins from maritime communications (phone, fax)
64 kbit/s to more than 250,000 ships/vehicles/aircraft
B-GAN ("coming soon") with 432 kbit/s

Iridium:

1.5 GHz – relatively clean
Two-way w/ mobil can initiate communication
max through put greater than 1 Mbyte/day
Data rates of 2.4kbps
Data is not processed nor packaged for end user

Considerations:

Coverage

Data rates

Power consumption / power management

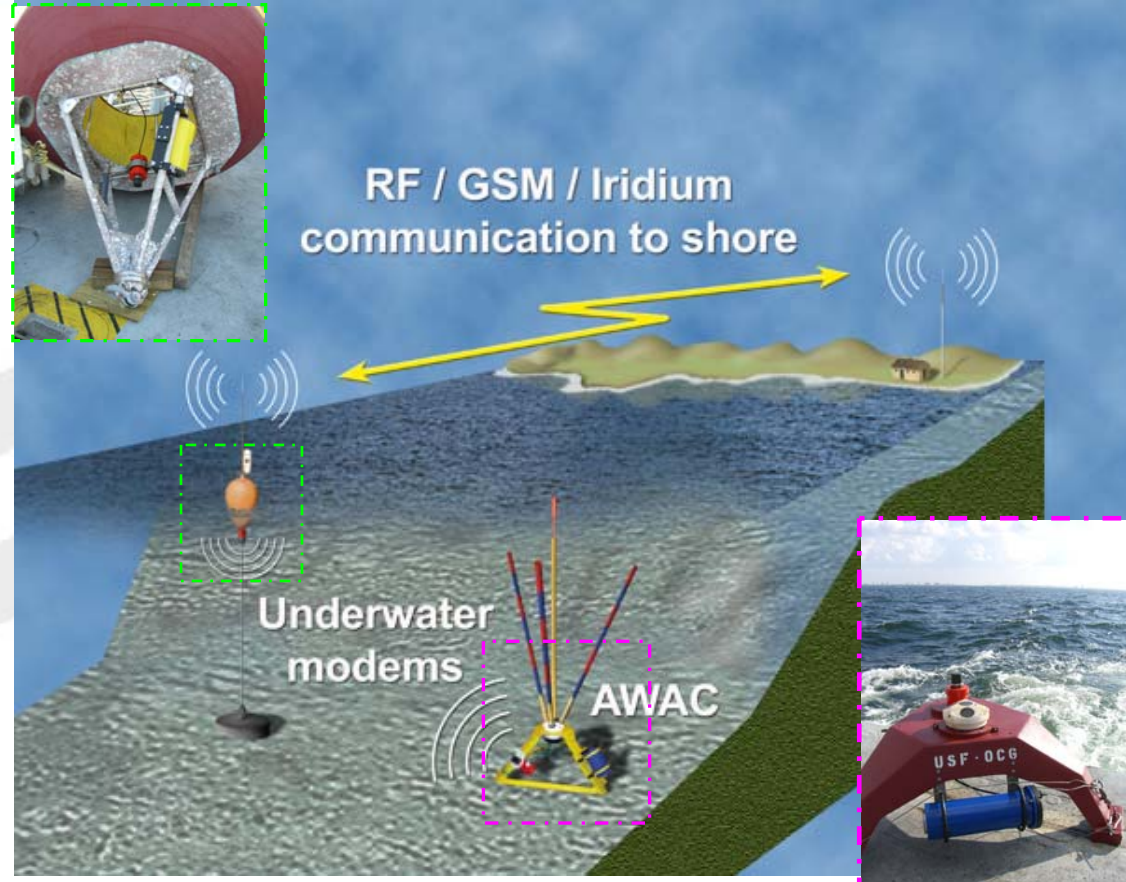
Data handling by end-user

Combined Systems

Takes advantage of best mode for each step

Complexity of system means only as robust of weakest link

Polled mode more difficult - better if one way





Paradopp System Integration

System Integrators Manual

Operational Modes: Command Mode, Power Down, Data Collection

Paradopp platform allows for wide variety of controllers

Initiating contact: Hard and Soft Breaks ... Why

Two character commands:	Start	ST, AD, SD, SR
	Stop	Break
	Interrogate	II
	Baud Rate	BR
	Configuration	GC, GH, GA

Configure with instrument software first

Controller to control instrument: powering up&down, measurment, clock

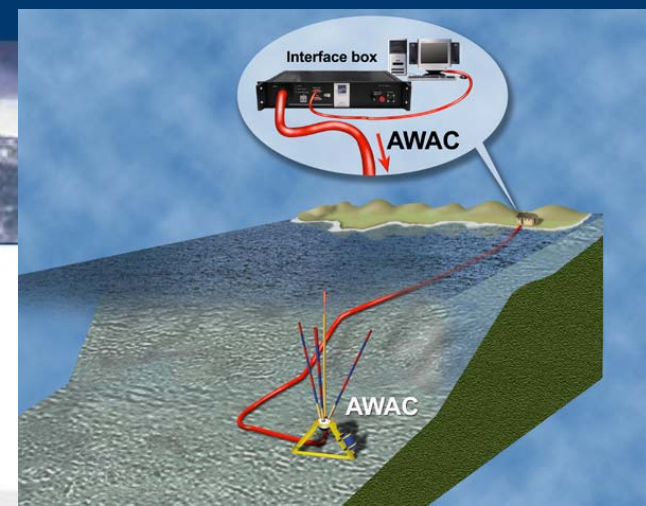


Example of Controller Controlled

- 1. Send a break to the instrument**
- 2. Set in command mode (within 10 seconds)**
- 3. Start measurement (different variants)**
- 4. Send break after data received**
- 5. Power Down**



Dial-up Example



- 1. Configure Instrument with standard software**
- 2. Start instrument with defined schedule and log to recorder**
- 3. Connect instrument to dedicated telemetry system**
- 4. Schedule software to 'dial-up' instrument (e.g. Modem)**
- 5. Inquire status (II), Time to next measurement(OM) & time remaining if measuring(OA)**
- 6. Read recorder with file pointer specification (RD)**
- 7. Return instrument back to measurement mode (RM)**

Module libraries

Software modules for system integration

- **PdCommX** – ActiveX control for Win32 (Labview, Visual Basic, Delphi etc...)
- **PdCommXCE** – ActiveX control for WinCE (PDAs and embedded computers)
- **PdWaveBase** – Wave data processing library (DLL) for Win32, WinCE and Linux
- **Direct Serial command interface described in**
 - Paradopp interface manual
 - NIP interface manual

