Environmental Sample Processor: Contextual Sensors

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Supported Instruments

- Can => internal environmental sensors within esp core's housing
  - Temperature, humidity, pressure, voltage, amperage
  - Updates every 5 minutes as long as esp application runs

- CTD => Seabird 16+ interfaced as com sensor 1
  - Temperature, sea pressure, conductivity, etc.
  - Linux Serial port: /dev/tts/8
  - Connected on housing port J#?

- ISUS => MBARI (Ken Johnson's Lab) interfaced as com sensor 2
  - Concentration of nitrates and bisulfides
  - Linux Serial port: /dev/tts/9
  - Connected on housing port J#?

- TBD = Something new can yet be interfaced as com sensor 3

Internal Environmental sensors

- can is short for Sleepy.queryCan --> forces immediate sampling
  - can.temperature => internal temp. at top of can in degrees C
  - can.humidity => humidity in % of saturation
  - can.pressure => internal pressure in psia
  - can.voltage => instantaneous battery voltage
  - can.current => instantaneous battery load in amps
  - can.avgCurrent => averaged battery load in amps
  - can.waterAlarm => percent “wet” (0..100) usually < 1
  - Wattage is merely Sleepy.can.current*Sleepy.can.voltage
- Sleepy.can accesses most recent sample
  - Typically updated every 5 minutes
  - Recorded in binary real.log file
    dumplog @object.is String #will list Can environmental samples
- Sleepy.canPollInterval = desired update rate for Sleepy.can
  Sleepy.canPollInterval = Delay.new “7:00” #change rate to 7 min.
  - Set to zero to disable can environmental sampling entirely
    - Zero is the default for MFBs lacking Sleepy board.

Seabird CTD

- Seabird 16+ CTD with
  - support for fluorometer and transmissometer
  - Trouble with latest firmware to be addressed this summer
  - Generates file CTD-tts-8.hex
- puts CTD.status # shows instrument status
- CTD.pumpmode = mode, where mode is either:
  - :off, :beforeSample, or :duringSample
- s = CTD.sample => returns sample object
  - s.temperature => sea temperature in degrees C
  - s.conductivity => conductivity in S/m
  - s.pressure => pressure in decibars
  - s.transmissometer => % optical transmission
  - s.beamAttenuation => extinction coefficient in 1/m
  - s.sampleTime => time at which this sample was started
  - s.dataTime => time at which this sample was finished
  - s.depth => depth in meters (derived from pressure)
  - s.salinity => salinity in mythical PSUs
- More documentation in lib/instrument/ctd.rb

MBARI

MBARI's ISUS

- ISUS = In-Situ Ultraviolet Spectrometer
  - Stores raw spectra in ISUS-tts-9.dat
  - Stores errors in ISUS-tts-9.err
  - Requires externally calibrated temp., salinity & depth
- puts ISUS.status # shows instrument status
- ISUS.species = 2 or 3 #three to include bisufide
- ISUS.fit = 217..240 #spectral fit window in nm (tweak for species)
- ISUS.fromCTD temp, salinity, depth #update ISUS from CTD
- s=ISUS.sample => sample with most recent values fromCTD
  - s.no3 => Nitrate concentration in uM/L
  - s.br => Bromide in uM/L
  - s.hs => Bisulfide in uM/L (only valid if species>2 and fit tweaked)
  - s.sampleTime => when sample was requested
  - s.dataTime => when sample was recorded
- More documentation in lib/instrument/isus.rb

Polling Contextual Sensors

- Trickier than it would first seem
  - ISUS must synchronize with CTD to receive timely updates
  - Sample rate quickens automatically during DWSM sampling
    - So, ESP requests each CTD sample individually
  - Multiple threads mustn't access instruments simultaneously
  - The Can's internal sensor polling is controlled separately

- Code is in Polling object in mission/skeleton.rb and dwsm4km.rb
  - Polling.start #starts SensorPolling with new parameters
  - Polling.finish #stops polling and properly closes instrument files
  - Polling.pause   #stops until resumed
  - Polling.resume #resumes previous polling schedule if paused

- Instrument at esp prompt shows last sampled state of Instruments
  - CTD, ISUS, Can show last sampled state of each respective one

Parameters controlling Contextual Sensor Polling

- A bunch of $global variables determine instruments' configuration and polling rate(s)
- These may be assigned anytime before Polling.start
  - But, usually they get set once in phasecfg.rb
  - Missions with ":until=>time" automatically invoke Polling.start
- CTD
  - $ctdPumpMode=:duringSample #may be :beforeSample or :off
  - $ctdInterval=Delay.new "5:00" #sample CTD every 5 minutes
  - $ctdPeriod=Delay.new "1:00:00" #upload CTD data every hour
  - $samplingCTDinterval=Delay.new "2:30" #2x while DWSM works
  - $samplingCTDperiod=Delay.new "30:00"
- ISUS
  - $isusSpecies = 2 #ignore sulfides by default (3 to include them)
  - $isusFit =217.240 #because Luke says it should be so :-)
- ISUS polling rate is CTD sampling rate + 10 minutes
  - ISUS auto-sampling cannot be disabled