SOOP Operational XBT Systems: Hardware and Data Systems

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Provide a brief review of the of the systems in use today with a few comments about satellite comms and metadata …again.

Hand Launched systems

Autolaunched systems

Real Time Transmissions

Hand Launched Systems have been the mainstay for thirty years

Simple, reliable. No need for anyone to redesign

Most common problem is breaking the wire, usu. at the base of the launcher. Easy fix.

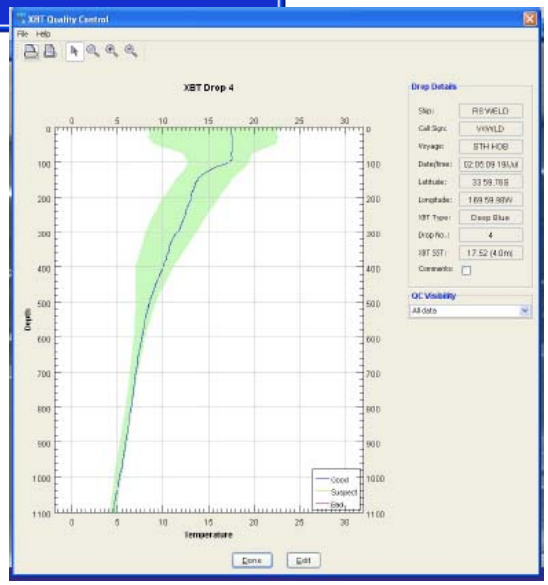
Sippican LM-3A Hand Launcher (ca $1000 USD)

The probes in use today are all manufactured by Lockheed Martin Sippican.

Model	Rated depth	Common applications
Deep Blue (T-7)	760m	Open ocean
T-4	460m	Naval and fisheries
Fast Deep	1000m	Open ocean, higher ship speeds
T-5	1800m	Open ocean, deeper depths

JCOMM Pool of Probes….

Data Acquisition Systems: Software drivers A to D cards etc

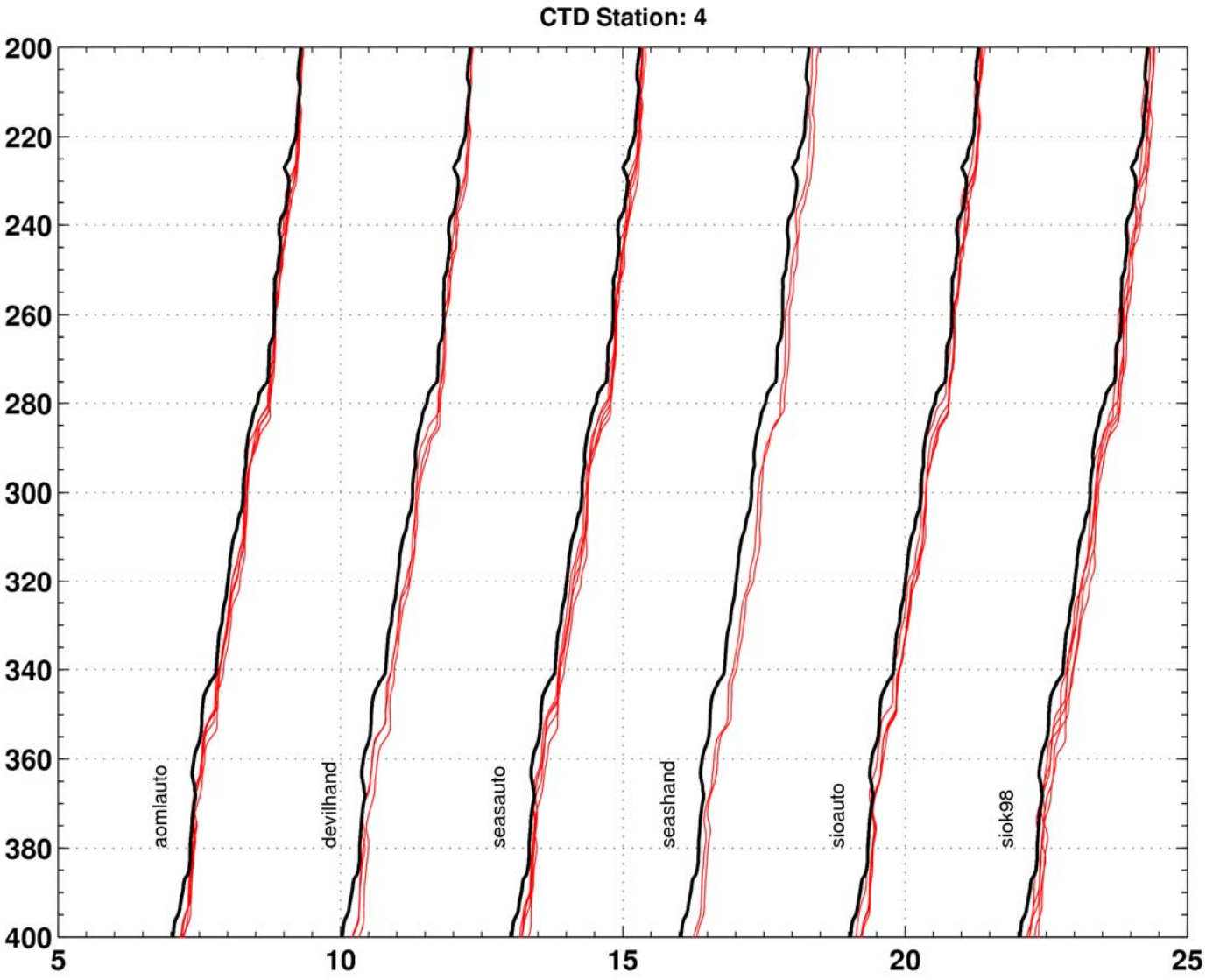


AMVER/SEAS (NOAA) usually with Sippican M-21 AtoD although Devil has recently been added.

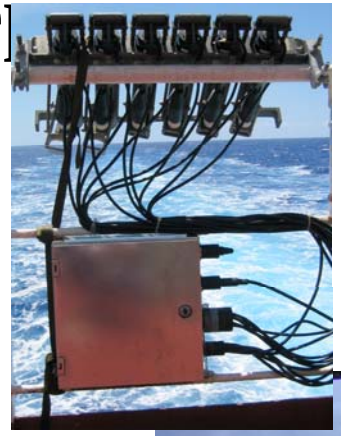
Devil
(CSIRO/Turo Technologies) original design of the complete Devil system included software and a redesigned AtoD card aka Devil

Sippican also provides software drivers for the MK-12 and MK-21 AtoD cards which are often used on research ships.

No real evidence for bias across systems, at least with respect to the large fall rate bias



Auto launchers allow for more intensive horizontal sampling and for the ship riders to get a bit of slee

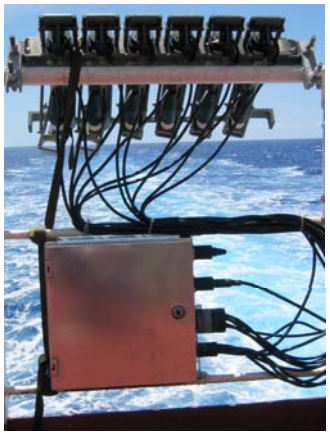


Scripps Autolauncher

AOML Autolauncher

Google Images quirk?

There has been talk of a combined or redesigned autolauncher in the past.



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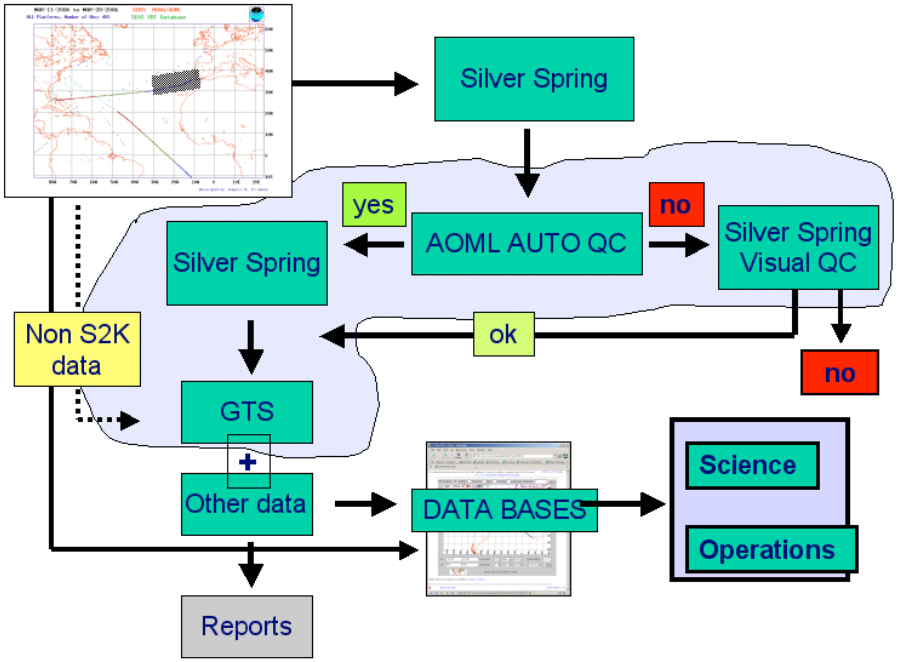
- Australia and Italy have both mentioned interest in a combined effort
- Not sure of the payoff in a complete redesign effort??
- Other national efforts could be supported by contracting SIO or AOML
- Complete redesign is expensive and only a few platforms are available

Real time communications is an essential part of the global climate observing system.

SOT/SOOP/NOAA can help if you would like to submit your data in real time!

climate.observation@noaa.gov



India recently began a successful collaboration with NOAA resulting in real time data being distributed with not much extra effort…Please follow their lead

There are several options for real time communications each with tradeoffs in terms of cost and data volume.

Iridium: Emerging as the comms of choice for many applications. Flexible protoc global coverage, allows high volumes, good price

narsat-C: Reliable and oven, already installed on st ships for safety reasons, h cost

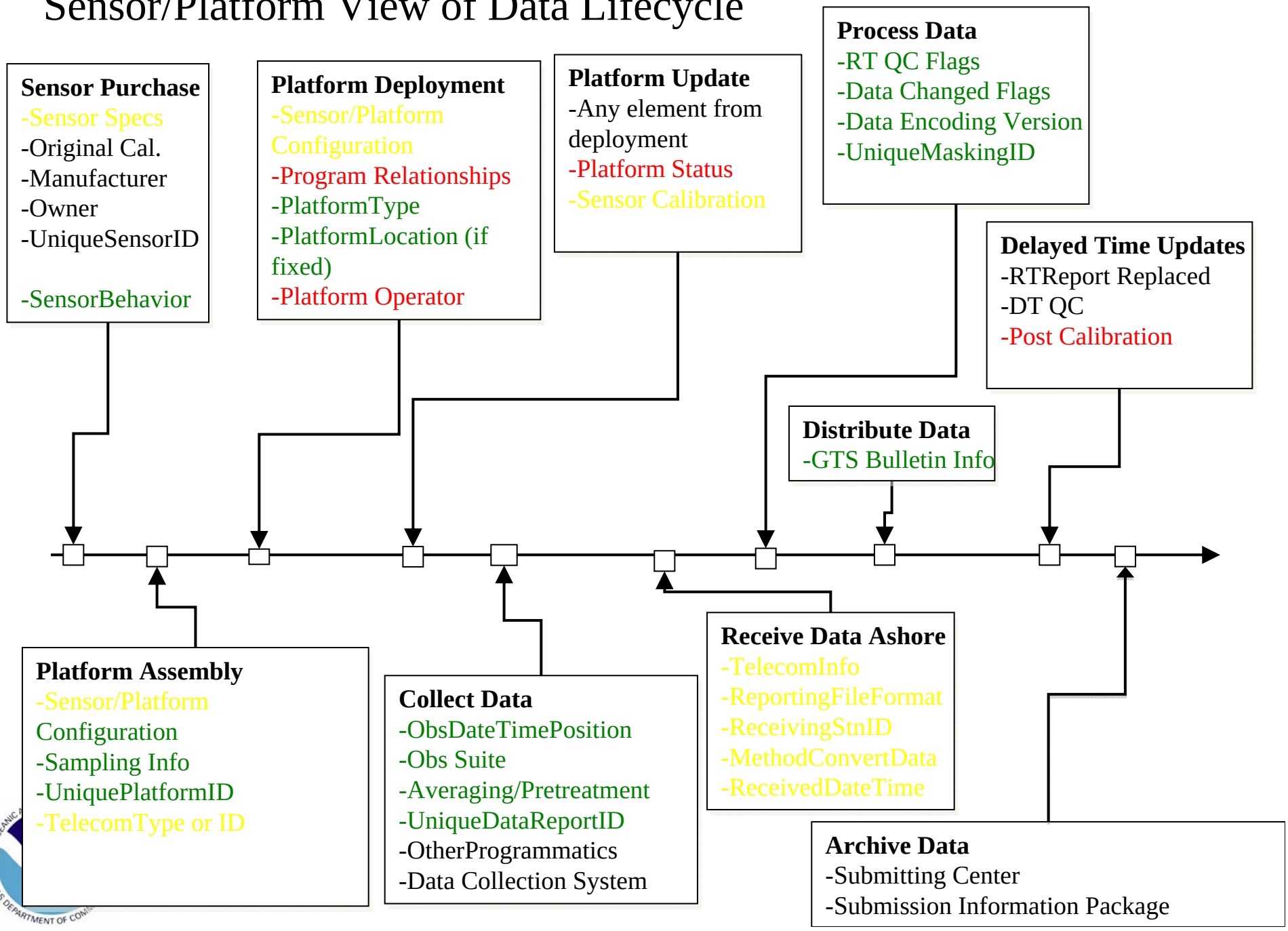
Increasing availability of broadband internet opens up a whole new world of options for communicating with equipment at sea.

comparable to Iridium, data timeliness satisfies XBT needs, oceanographic data and data management expertise on shore allows for tailored solutions.

Hardware systems are stable and straightforward, it's the data systems that need work.

- **Transmit more metadata from ship to shore, even at the expense of full resolution profiles**
- **Delayed mode metadata, if transmission is not an option**
- **Develop an Argo like exchange file format**
  - netCDF with CF conventions including all metadata
- **Document Quality control tests**
- **UNIQUE ID**
- **This is not just a BUFR issue**

Sensor/Platform View of Data Lifecycle



SOT-5 Document provides a complete list of what should be included in the future metadata collection scheme

- **Unique ID: Tag that is part of the GTS message that uniquely identifies the message and is retained with the data always.**
- **Call sign: ITU Call sign**
- **IMO Number**
- **Ship Name: Current ship name helpful to match ship identification in Lloyds registry as sometimes ship names change out of sync with Call sign.**
- **SOOP line number: e.g. AX10, PX05 etc**
- **SOOP transect number: Number identifying a single occupation by a single ship of a SOOP Line (i.e. incremented at the beginning of each occupation).**
- **Platform speed**
- **Platform direction**
- **Observation time: Some formats do not report seconds, others do**
- **Position of observations: Differing accuracies in reports, BUFR requirements (10^-3)**
- **Indicator for digitization: Devil BOM and Devil CSIRO only reports selected depths. The Devil software offers several options for digitization however, the method is not reported**
- **Total depth of water**
- **QC Indicator: Global indicator of depth measurements quality**
- **QC Indicator: Global indicator of temperature measurements quality**
- **Level by level QC flags for Temperature**
- **Height of XBT/XCTD launcher**
- **Program operating SOOP ship**
- **Launcher type**
- **Data acquisition software type and version**
- **Probe serial number**
- **Probe manufacturing date**
- **Drop number: sequential drop along the current transect.**

Highlights of the new metadata list

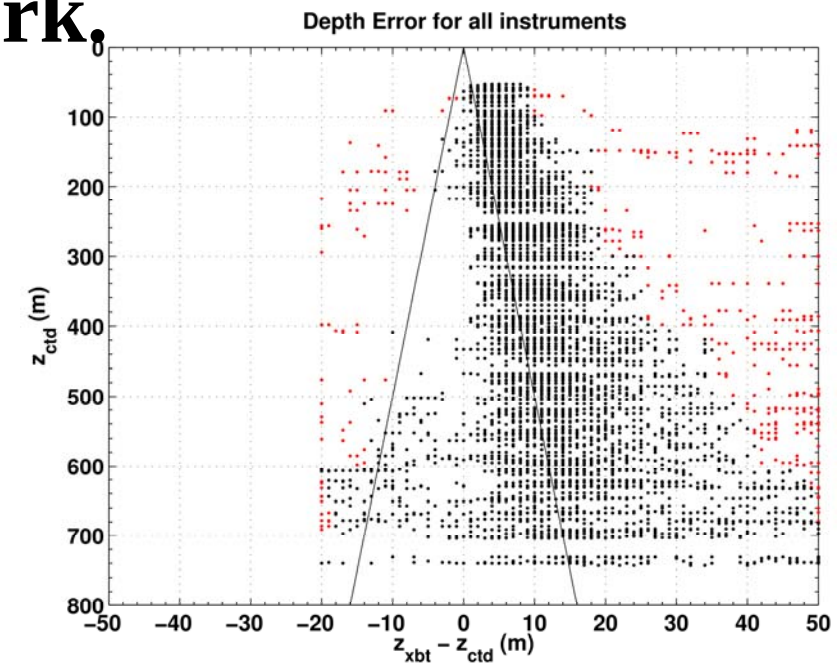
- **Unique ID: Create it as early as possible and transmit with the data (exclude JJVV from the process)**
- **Height/Location of the Launcher. How do we standardize? (ACTION) (Relative to deck, MSLL?)**
- **Programmatics**
  - Who are you? SEAS/SIO, SEAS/AOML, BOM, ENEA
  - What line? PX09 etc
  - What drop is this? (e.g. 4 of 127, or just 4)

How can we unambiguously describe QC? (Combination of netCDF/BUFR descriptors and a data management document on the web)

```
byte range_check_qc(time, depth, lat, lon) ;
  range_check_qc:long_name = ”Temperature range check qc test" ;
 range_check_qc:standard_name = "sea_water_temperature
  status_flag" ;  range_check_qc:_FillValue = -128b ;
  range_check_qc:valid_range = 0b, 2b-127b, 127b ;
 range_check_qc:flag_values = 0b, 1b, 2b ;
  range_check_qc:flag_meanings = "quality_good
  sensor_nonfunctional                    outside_valid_range" ;
  range_check_qc:reference = “www.gtspp.org/quality_manual
```

In summary, the XBT systems are relatively stable data management needs work,

- Admin message to transmit metadata to shore
- Enhanced delayed mode data file (netCDF/CF)
- Document QC Tests
- Data management manual ACTION.



Fall rate problem is the 800 lb gorilla in the room

Metadata Issues

Data management issues

Questions?