

Components:

1. Multibeam Sonar: Norbit WBMS, 0.9 x 1.9 degree, 400 kHz, 5-210 degree swath, 24 vdc, 40 watts
 1. https://norbit.com/media/PS-120005-24_WBMS-bathy_Pn_12003-AACDB4_A4.pdf
2. INS: IxBlue C3, 0.2% DT, 12 watts
 1. <https://www.ixblue.com/sites/default/files/2020-02/phins-compact-series-datasheet-.pdf>
3. Depth: OEM Impact Subsea ISD4000 OEM, 0.01% FS, emulating Parosci
 1. <https://www.impactsubsea.co.uk/isd4000/>
4. GPS: DGI/108185, Daniel's Ublox8n board with a antenna switch, 1 PPS out and serial out

AUV Function

- Controls power
 - Powers on/off INS, Sonar, Sonar DAQ
- Sends mode change commands to DVL to switch between PD6/PD13, ext. trigger/Free-run modes, depending on if Sonar is running (former)
- Sends discrete signal to DGI/GPS board to switch GPS antenna
- Drives the bus
 - Uses on-board, low power AHRS, depth, GPS for transits
 - When available, uses INS data published over LCM, or reads INS directly
 - Runs missions from waypoints translated from MB System planner
- Sends LBL ranges to INS when available

INS function

- Publishes position, depth, orientation in UDP packets on Ethernet
- Reads GPS on Serial 1, when available
 - 1 PPS, ZDA time
- Reads Depth on Serial 2
 - Impact Subsea, Parosci format
- Reads speed in PD6 (or PD0) from two DVLs on Serial 3 and Serial 4
- Reads LBL ranges from AUV over Ethernet, when available
- Mounted in the main vehicle hull
- 24 volts, 12 watts, split between IMU and board stack

Sonar DAQ

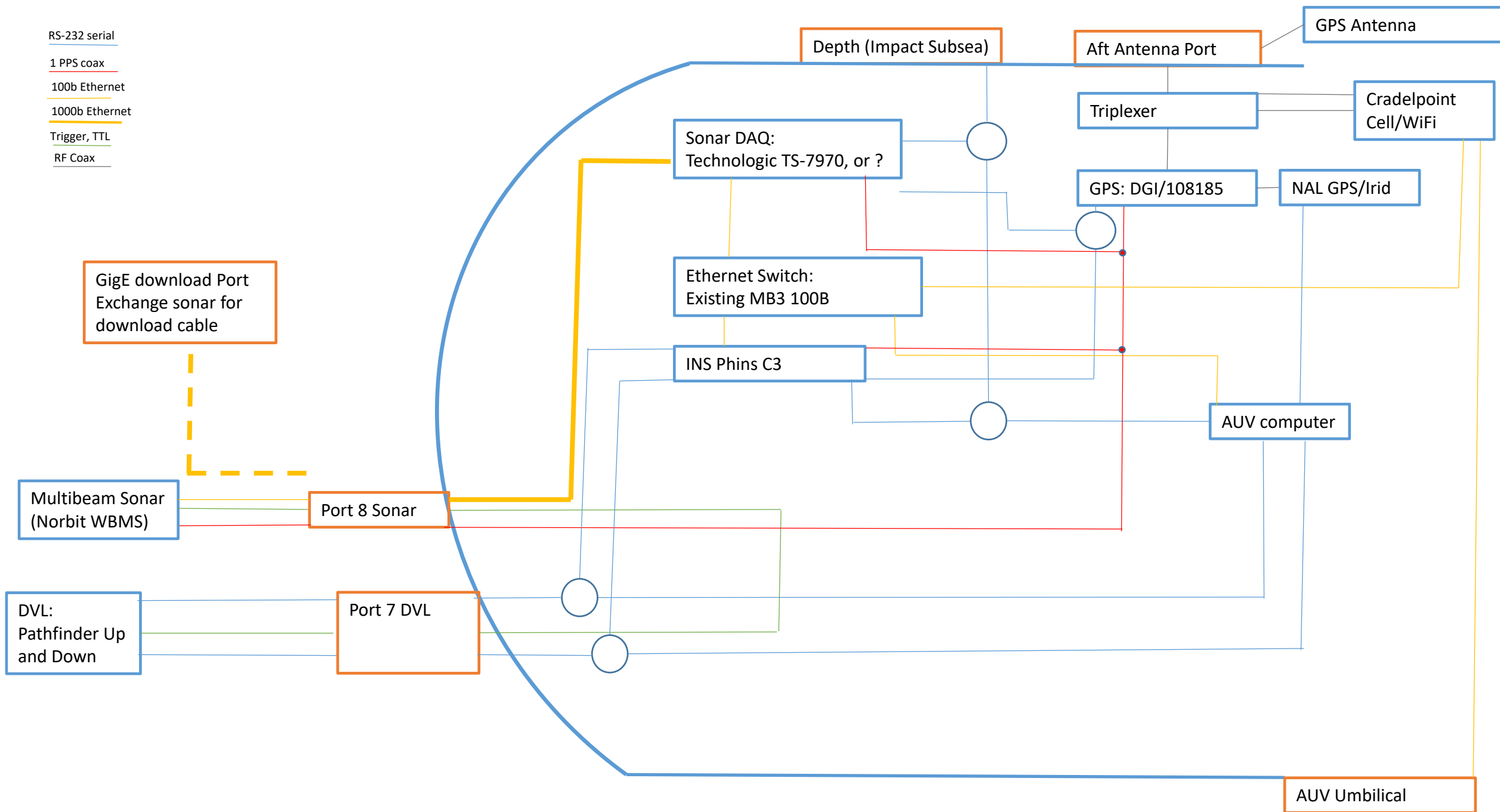
- Runs Norbit's program to read and write in S7K format sonar data on Ethernet 1 port
- Runs a new software program
 - log INS (Ethernet 2) and Depth (serial 1) at about 25 Hz.
 - Re-send INS data sub-sampled at 2.5 hz to AUV in LCM format over Ethernet
 - Sends setup config message to sonar after power up
- Sync computer time to GPS time using 1 PPS (serial 2) and ZDA (serial 3)
- Run NTP time server, broadcasting to sonar via TCP/IP on Ethernet 1
- Large mass storage (>TB) on SATA II
- Two Ethernet ports: GigE download and comms
- Backseat Computer is mounted in the main vehicle PV
- Technologic **TS-7970-2G-4GF-Q10S-RTC-CP-WIFI-E**(3 watts), or NanoX-BT Com-Express (10+watts) or other WHOI computer

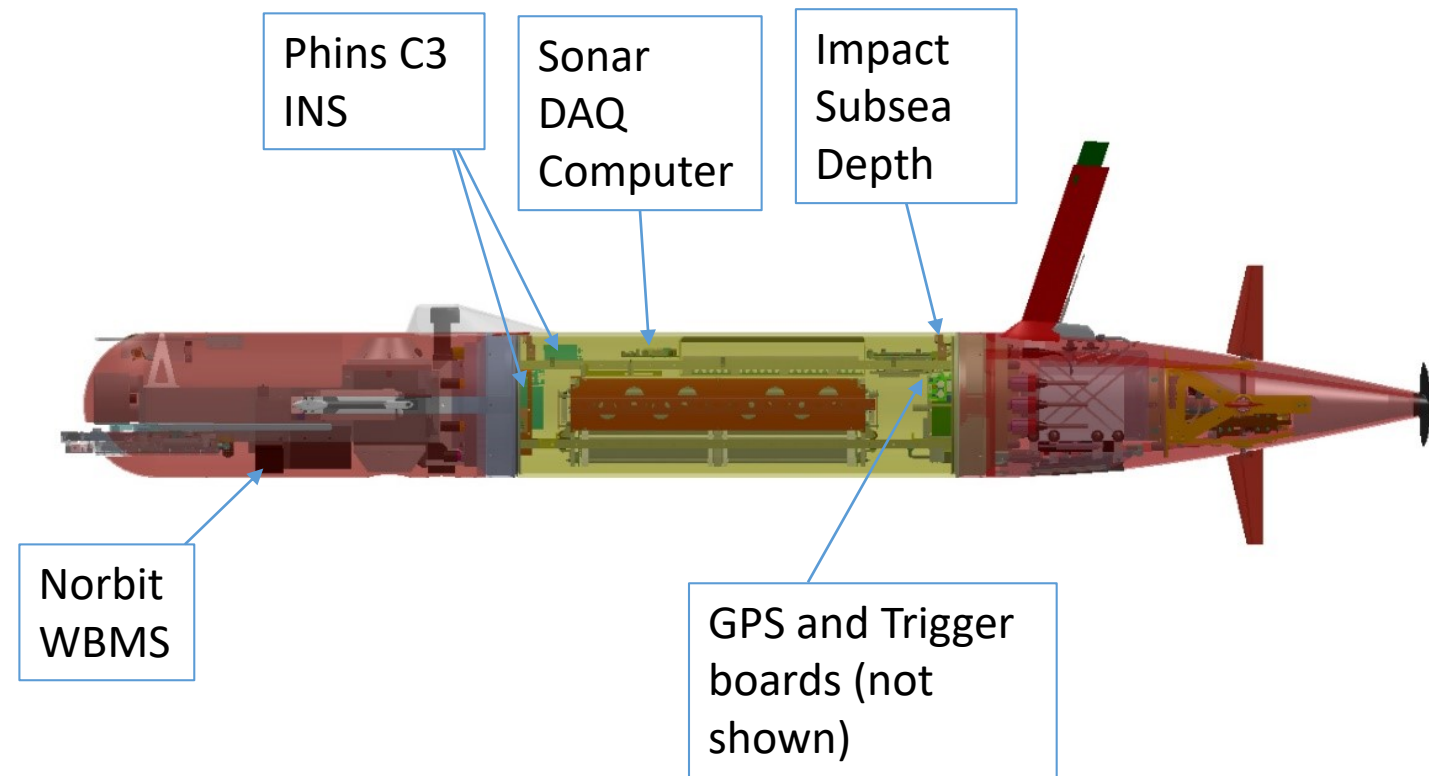
Sonar Function

- After power up, sonar accepts configuration parameters from DAQ on TCP/IP Port 2209 and NTP time
- Listens to 1 PPS on pin 7/8 to discipline internal clock
- Runs at fixed rate, e.g. 3 Hz
- Sends trigger out on pin 5, with 100ms transmit delay
- Sends a stream of Bathy data out TCP/IP Port 2210

Depth, DVL, GPS, Trigger

- Impact Subsea Depth outputs depth to Sonar DAQ, INS and AUV through a passive serial splitters in a standard format, probably Parosci standard
- Two DVLs (Up and Down Pathfinder 600 kHz) sending PD6/PD13 format speed data to the AUV and INS through a passive serial splitter. Down DVL fires on external trigger and Up DVL fires on slightly delayed trigger from trigger delay board
- DGI/108185 board directs the GPS signal to NAL or an on-board Ublox 8n with a switch controlled by AUV. 108185 outputs 1 PPS trigger and serial ZDA message to the Sonar DAQ and INS through a serial splitter. AUV controls the GPS switch with a discrete on the NAL LCB based on

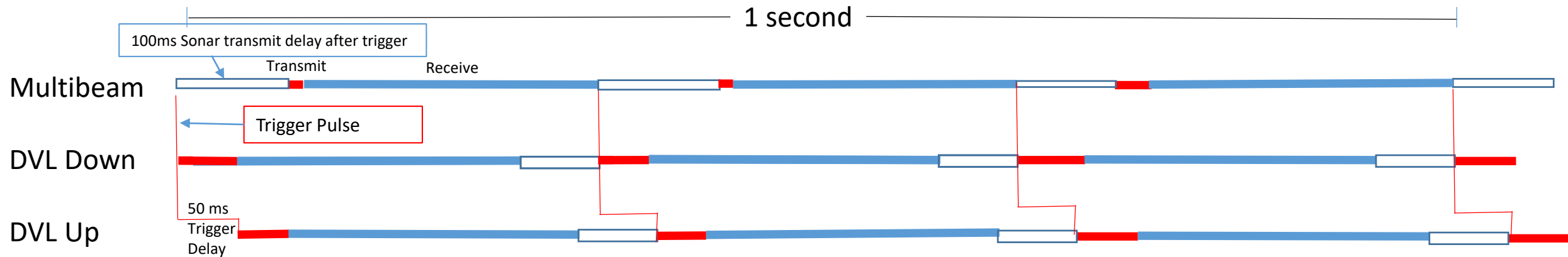




Potential Issues:

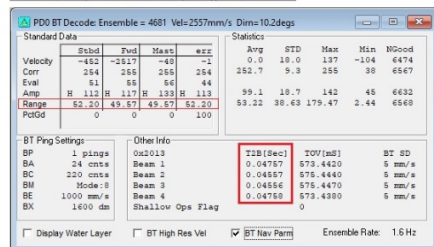
- Are passive serial splitters on depth and DVL a problem?
 - Find some active splitters or can a NMEA repeater be used?
- DVLs step on one another with 50ms lag
 - Trigger them together and suffer the double hit to the power bus
- How powerful computer is required for Sonar DAQ?
 - Start with the low power and upgrade if necessary
 - Adding Water column, backscatter or snippets might need more
- Can we do all the tasks on the Sonar DAQ with one program (plus the Norbit logger)? - log INS, Depth at high rate, send sonar setup config at boot-up then re-publish position at 2.5 Hz in an LCM message and host NTP server?

Trigger Schedule



- Sonar runs on a fixed rate (3 Hz): *Trigger Mode 1, Set_rate 3*
- Trigger out from sonar has a 100 ms transmit delay after trigger *set_trigger_mode and set_trigger_delay ref*
- Single trigger line into the DVL housing and into the Down DVL, then additional 50ms delay to Up DVL
 - This might also be possible using the Down DVL's trigger out, though these pins aren't currently wired out of the OEM case
- Pathfinder Deep Pings take ~50ms at a 50m range, and ~80 ms at 90m range

Phased-Array DVL BMS - Deep Pings ~ 50 meters



Phased-Array DVL BMS - Deep Pings ~ 90 meters

