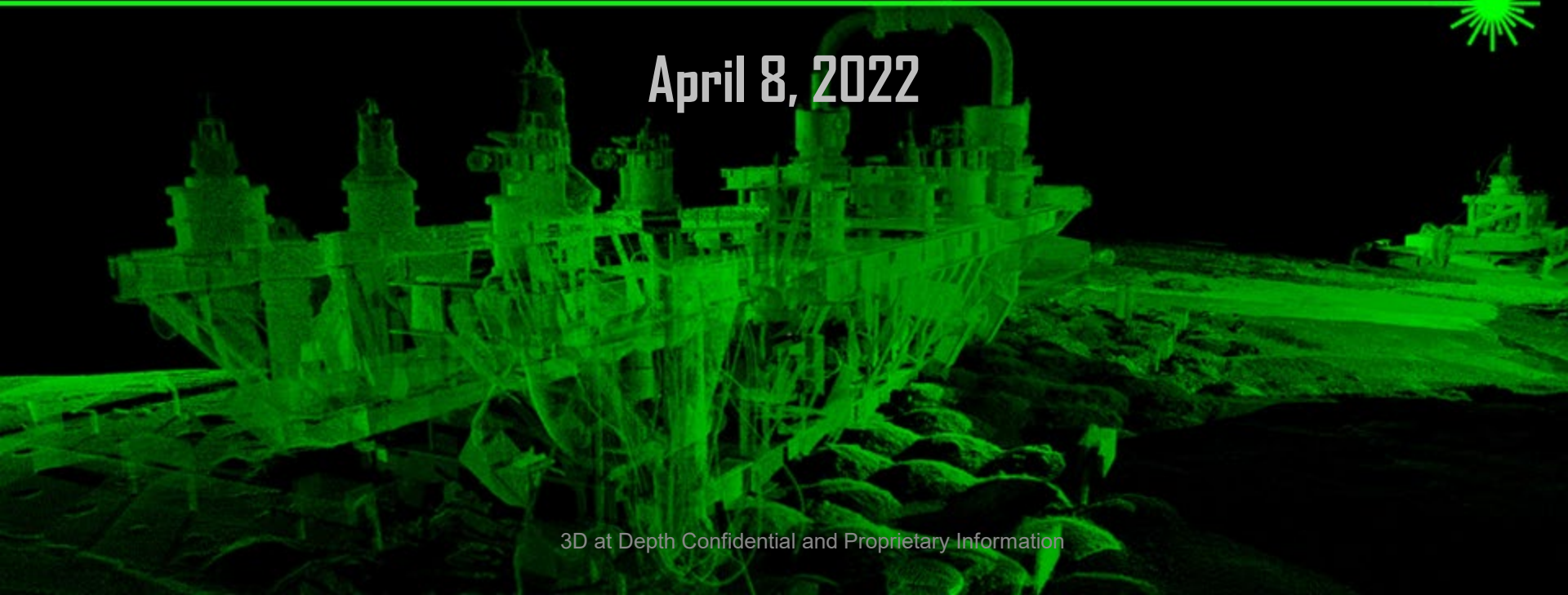




MBARI WIDE SWATH LIDAR G2 UPDATE

April 8, 2022

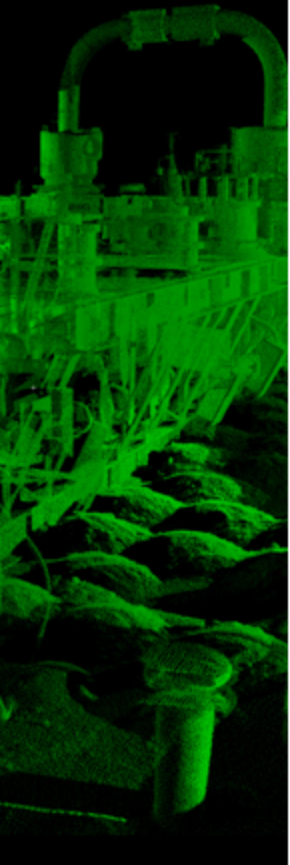




TOPICS



- Proprietary Information
- 350kHz PRF Data Capture Tests
- Curved window, motors, mirrors
- Flat window design
- LiDAR modeling
- PTP
- MBARI input and feedback





PROPRIETARY INFORMATION



NOTICE: This presentation contains 3D at Depth Confidential and Proprietary information.

In order to better describe some of the design decisions and options, this presentation contains details about the internal architecture and design decisions for 3D at Depth's current 3D laser scanning products. Therefore, this information should ONLY be shared with MBARI employees who need to read and evaluate the presentation. 3D at Depth appreciates our customers taking the appropriate safety measures when distributing this information internally.



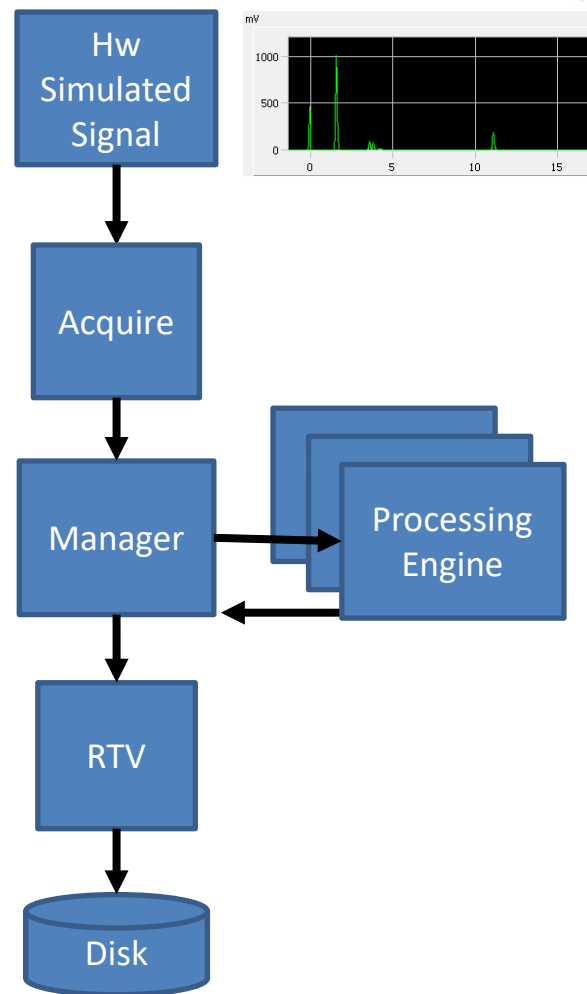


350KHZ DATA CAPTURE TESTS



- Simulated Data through system, direct data path (not going through A2D conversion process)
- Set PRF to 350,140 Hz (350 Khz goal)
- 1000x1000 point file
- Capture data at full speed, no skips, 2.857 seconds/file
- Processing takes 7.8 seconds (5 returns, continuous)
- $100 / 180 \text{ degrees} = 55\%$
- $3 / 5 \text{ returns} = 60\%$
- $7.8 / 2.85 \text{ processing to acquire time} * 0.55 \text{ (data clipping)} * 0.6 \text{ (number returns)} = 0.91 \text{ ratio}$

Simulation verifies real time data processing





350KHZ DATA CAPTURE TESTS



- This does show that we are not keeping up with data generation in real time, since we are still keeping 5 returns and all data, RawQ is completely full.
- Actual Data rate will be less, estimate at 17.4 MB/s for RIAAT / much less if we process into MBARI custom format which will be targeted for a slower connection (less than 100 Mbit/sec)
- $65 \text{ MB/s} * 0.55 \text{ (clipping data)} * 0.6 \text{ (number returns)} = 21.45 \text{ MB/s}$

Mar 31 23:04:37 sl4n-001.local InstaCloud: RawQ: 0%, ProcE: 85%, In: 12.11 MBytes/s, Out: 64.13 MBytes/s
Mar 31 23:04:38 sl4n-001.local InstaCloud: RawQ: 0%, ProcE: 86%, In: 12.22 MBytes/s, Out: 62.49 MBytes/s
Mar 31 23:04:39 sl4n-001.local InstaCloud: RawQ: 0%, ProcE: 86%, In: 12.33 MBytes/s, Out: 62.92 MBytes/s
Mar 31 23:04:40 sl4n-001.local InstaCloud: RawQ: 0%, ProcE: 86%, In: 12.39 MBytes/s, Out: 63.97 MBytes/s
Mar 31 23:04:41 sl4n-001.local InstaCloud: RawQ: 0%, ProcE: 83%, In: 12.41 MBytes/s, Out: 64.05 MBytes/s
Mar 31 23:04:42 sl4n-001.local InstaCloud: RawQ: 0%, ProcE: 83%, In: 11.38 MBytes/s, Out: 59.70 MBytes/s

Mar 31 22:17:45 sl4n-001.local EC: TPH: Progressing to cart /tmp/scans/sl4_15
Mar 31 22:17:45 sl4n-001.local EC: TPH: Progressing to cart /tmp/scans/sl4_16
Mar 31 22:17:45 sl4n-001.local EC: TPH: Progressing to cart /tmp/scans/sl4_17
Mar 31 22:17:45 sl4n-001.local EC: TPH: Progressing to cart /tmp/scans/sl4_18
Mar 31 22:17:45 sl4n-001.local EC: TPH: Progressing to cart /tmp/scans/sl4_19
Mar 31 22:17:45 sl4n-001.local EC: Laser Shots per Second: 349565
Mar 31 22:17:46 sl4n-001.local EC: TPH: Progressing to cart /tmp/scans/sl4_20
Mar 31 22:17:46 sl4n-001.local EC: TPH: Progressing to cart /tmp/scans/sl4_21
Mar 31 22:17:46 sl4n-001.local EC: TPH: Progressing to cart /tmp/scans/sl4_22
Mar 31 22:17:46 sl4n-001.local EC: TPH: Progressing to cart /tmp/scans/sl4_23
Mar 31 22:17:46 sl4n-001.local EC: Laser Shots per Second: 349647



WINDOWS, MOTORS, MIRRORS





CURVED WINDOW



- * Normal flat window vendor unable to provide the curved window
- * Normal AR coating vendor unable to AR coat the new window
- * Found a new vendor, but some risk
- * Finding motors, however will have to build up motor, bearing, and motor housing
- * Will require custom scan mirror and have not found a vendor for this yet

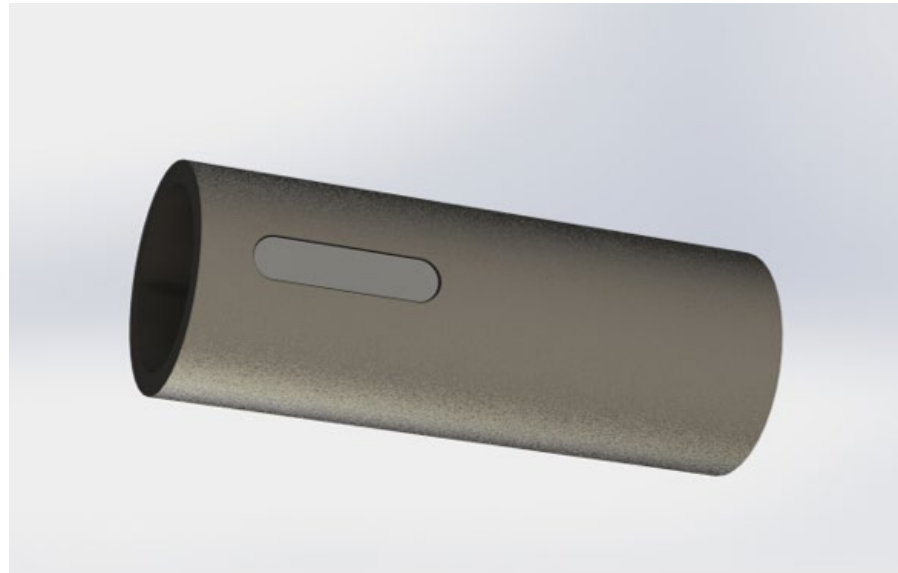




FLAT WINDOW



- ✱ This week started feasibility investigation for a flat window rotated 90° from curved window orientation
- ✱ Advantages:
 - ✱ Flat window – ease of manufacturing and AR coating
 - ✱ Believe this will require more standard spinning mirror and motor assemblies which reduces cost, lead time, and allows for multiple vendors
 - ✱ Stress is more distributed along window



LIDAR MODELING AND PTP





LIDAR MODELING AND PTP



LiDAR Modeling

- ✱ Performing LiDAR modeling for trading laser power, mirror size, and receiver performance for the 11m LOS range – ongoing

PTP Investigation

- ✱ Identified two options for generating PTP using Raspberry Pi4
 - ✱ Real time hat: <https://innoroute.com/realtimehat/>
 - ✱ Pi4 can also be used directly to measure/generate PTP
<https://github.com/raspberrypi/linux/issues/4151>
 - ✱ Favor the Pi4 directly, for flexibility and cost
 - ✱ Time Machines also has line of products, but they tend to cost more



MBARI FEEDBACK

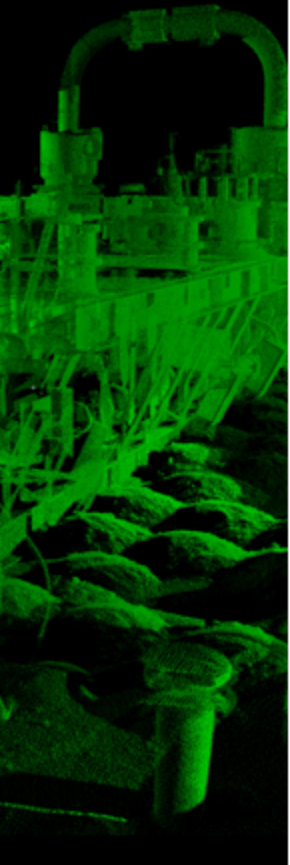




MBARI FEEDBACK FROM APRIL



- Flat window design will not fit as well in tube AUVs
- Final Phase 1 proposals due July 13th
- Feasibility study review and concept review ~ June 10th
- Next meeting May 4th. 10am.





MBARI FEEDBACK FROM MARCH



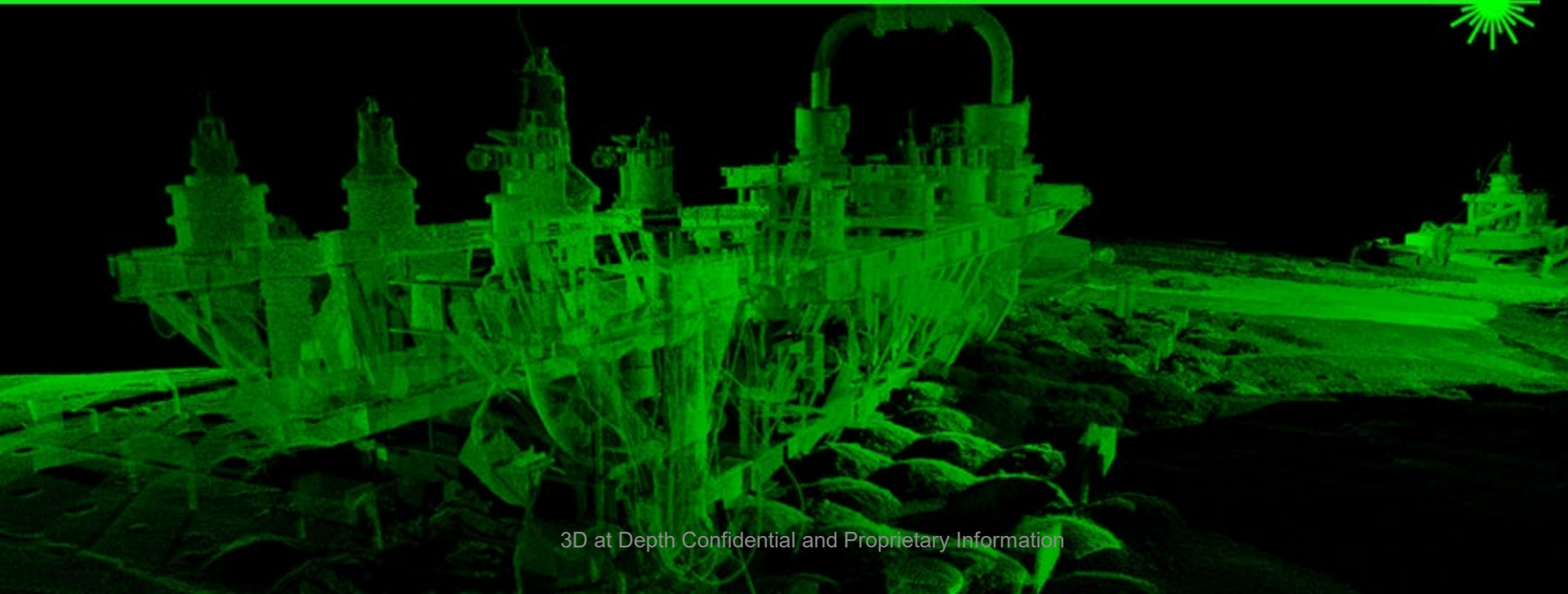
- Send step file of housing to Eric – Jeremy
- PPS to PTP conversion devices – send to Eric
- Eric send dimensions of MBARI pressure test vessel
- Move ahead with suggest Point Spacing design from slide 5

SW Topics

- Still need to decide 2 or 3 points
- Must be able to run on only 100Mb/s in case of network or vehicle issues
- Like the option to reduce number of returns or range bit resolution to reduce bandwidth requirements.
- Prefer to flag data as opposed to delete data. Can create our own definitions
- Add in the SW document that SL4 is Linux but RTV and 3D Collect are Windows based



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