

R/V *Celtic Voyager*, engine failure 2015 - Lessons learnt

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Marine Institute Fleet

Celtic Explorer

- Launched 2002
- 65m
- DP equipped ,Multipurpose RV
- Ices 209
- Deepwater Multibeam
- 15 crew 20 scientists
- Endurance 35 days
- >320 days science per year
- Typical profile: ,110 days demersal fishing, 84 days pelagic acoustic research, 40 days ROV, 20 Days Oceanography, 20 Days Hydrographic, 50 days Charter



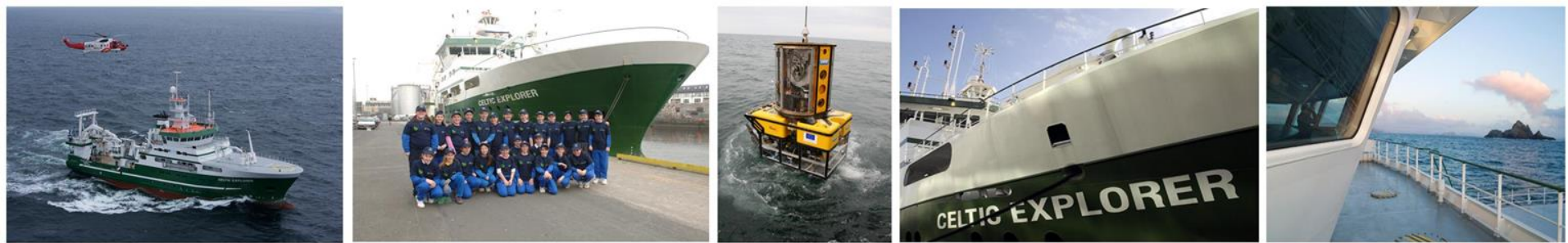


Marine Institute Fleet continued

Celtic Voyager

- Launched 1997
- 31.5
- Multipurpose RV
- EM2040 Multibeam
- 7 crew 8 scientists
- Endurance 14 days
- < 300 days science per year
- Typical profile: ,70 days Hydrography, 44 days UWTV surveys (Nephrops) ,50 days Student training, 40 days Ocenagraphy/Cetacean, 40 Days Geology/Research
- 65,000 hrs approx on engine...





Celtic Voyager engine failure 2015

During Day 2 of the 17th IRSO Celtic Voyager was completing Uwtv Survey west of the Aran Islands

- Vessel suffered a failure of its fuel pump and main engine shut down
- Attempts to restart unsuccessful
- Vessel taken under tow by Aran Islands Lifeboat
- Investigation revealed broken fuel pump drive shaft
- Fuel pump replaced, new drive shaft installed, all engine control and fuel systems investigated
- Engine restarted but went into overspeed (fuel pump shaft slipped)
- Shaft tightened, engine restarted manually and run
- Electronic control system reconnected and engine restarted
- Engine runs into immediate overspeed /runaway situation, suffers catastrophic failure with the lubricating oil dip stick being blown from the sump, the crankcase breather line failing, and rocker covers being blown off



Engine Damage

One cylinder head was heavily damaged. One of the valve spring collet holders had broken and this had allowed the valve to fall into the cylinder . When the cylinder head was removed it was found that the piston was heavily damaged, having seized in the upper part of the cylinder liner (firing ring). The piston had broken into two parts.

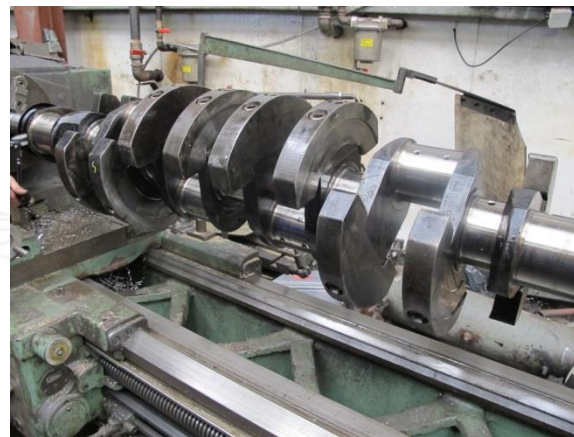
The crankshaft was removed for more detailed Examination and when the crankshaft was placed in the lathe it was found to be bent beyond the maker's acceptable limits. It was also found that there were "hard spots" and flat spots on the journals. The crankshaft was therefore found to be unfit for further service.

Aluminium debris was found in the inlet and exhaust trunking for the other cylinders on the B bank of the engine and that the turbo charger was damaged by the passage of debris.

Engine effectively written off.. Insurers deemed it beyond economic repair



Damage





Cause???

Independent engineering firm engaged to try and ascertain cause of engine failure
overspeed

Felt there was two issues

1: fuel pump shaft failure causing initial failure

2. Engine control system issues due to fault or contamination of flywheel pickups
masking engine speed thus increasing RPM and bypassing engine emergency speed cut
off (1720 rpm)

However it is possible that engine control/speed issue caused initial fuel pump failure
(initial overspeed stopped by breaking shaft....)



Options.....

Both vessels had extremely busy schedules so needed to get vessel back in service as soon as possible , three possible options were available as Wartsila no longer produce the original SACM Wartsilla engine

1. Replace engine with a wartsilla “short block” engine which is a partially built engine on a lead time of 9 weeks that would need additional parts including turbo chargers (lead time 5 months!!!) (6 month warranty)
2. Replace engine with a secondhand engine....
3. use a “Baudouin” 12M26.2 marine diesel which was a direct swap for the existing Wartsila 12UD25 in terms of engine mount and gearbox / PTO coupling dimensions could be made available 3 weeks from order (12 month warranty)

Option	Pro	Con
1: short block	Direct replacement so less engineering issues	Lead time too long, warranty shorter, still using original control system, twice as expensive as option 3, still needed components from original engine as no t complete
2. Secondhand SACM	Short lead time	No proper engine history, no confidence that class would approve/accept, unknown quantity, no warranty, old technology, Wartsila not interested in support
3: NEW Baudoin	Short lead time, brand new modern engine, 12 month warranty, new control system	Some additional engineering works LT/HT cooling, new engine installation, new supplier



Drydock for engine replacement and refit

- Needed board approval for Emergency Dry Dock and procurement of new main engine
- Vessel had to be towed “dead ship” on the instructions of the Marine Survey Office
<https://www.youtube.com/watch?v=wGkqhdqDL0o>
- Towed to Dept of Marine synchro lift and Yard in Killybegs Ireland
- 1st July vessel towed 2nd July alongside in Killybegs, work commences for hull cut
- 10th July lifted out, hull cut, generators removed, way clear for engine
- 22nd Engine Factory acceptance test in Cassis
- Tue 28th July engine collected
- Thursday 30th July engine arrives
- Friday 31st July Engine lifted into place, hull closed
- 13th August Vessel refloated
- Engine started 18th August
- 21st August alignment and sea trials completed
- 22nd August sailed on survey, back in service
- 23rd August first oil change whilst en route to Survey ground!!
- 72 days from failure to new engine.....!!



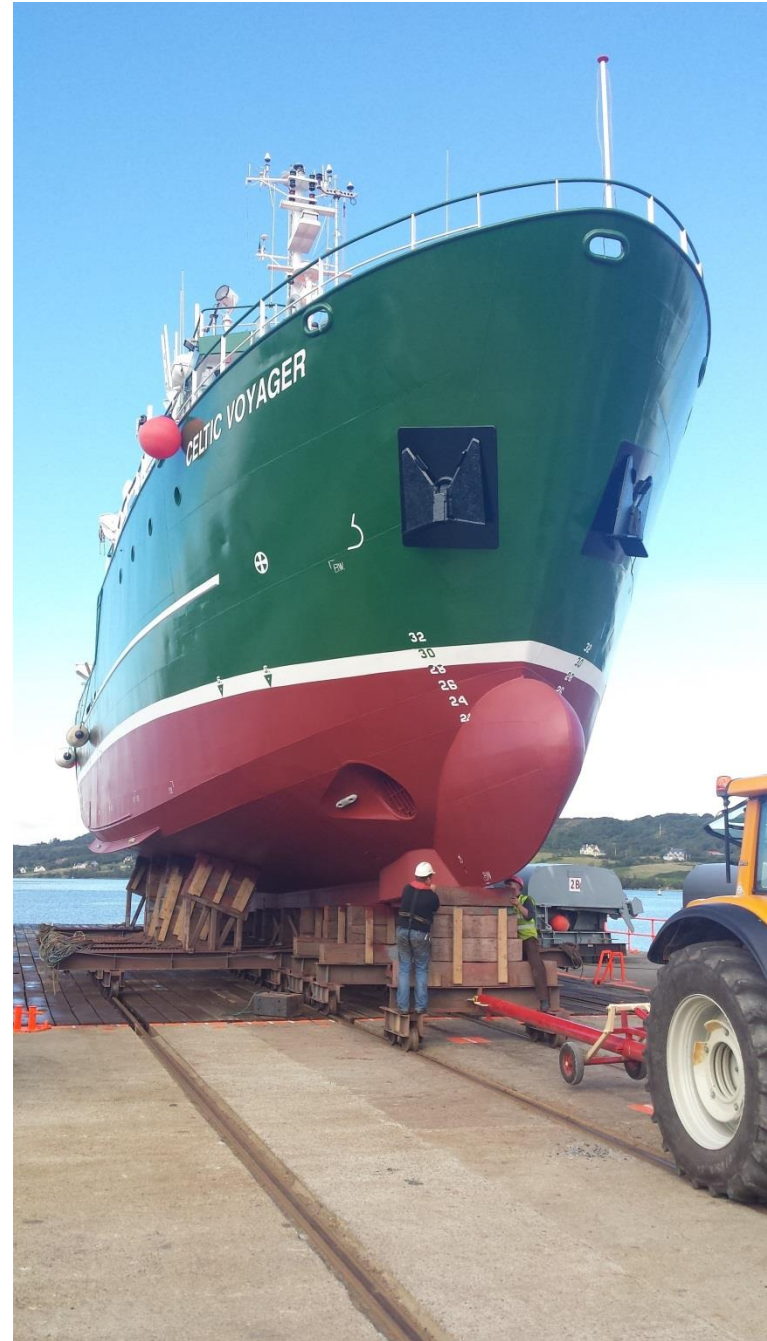


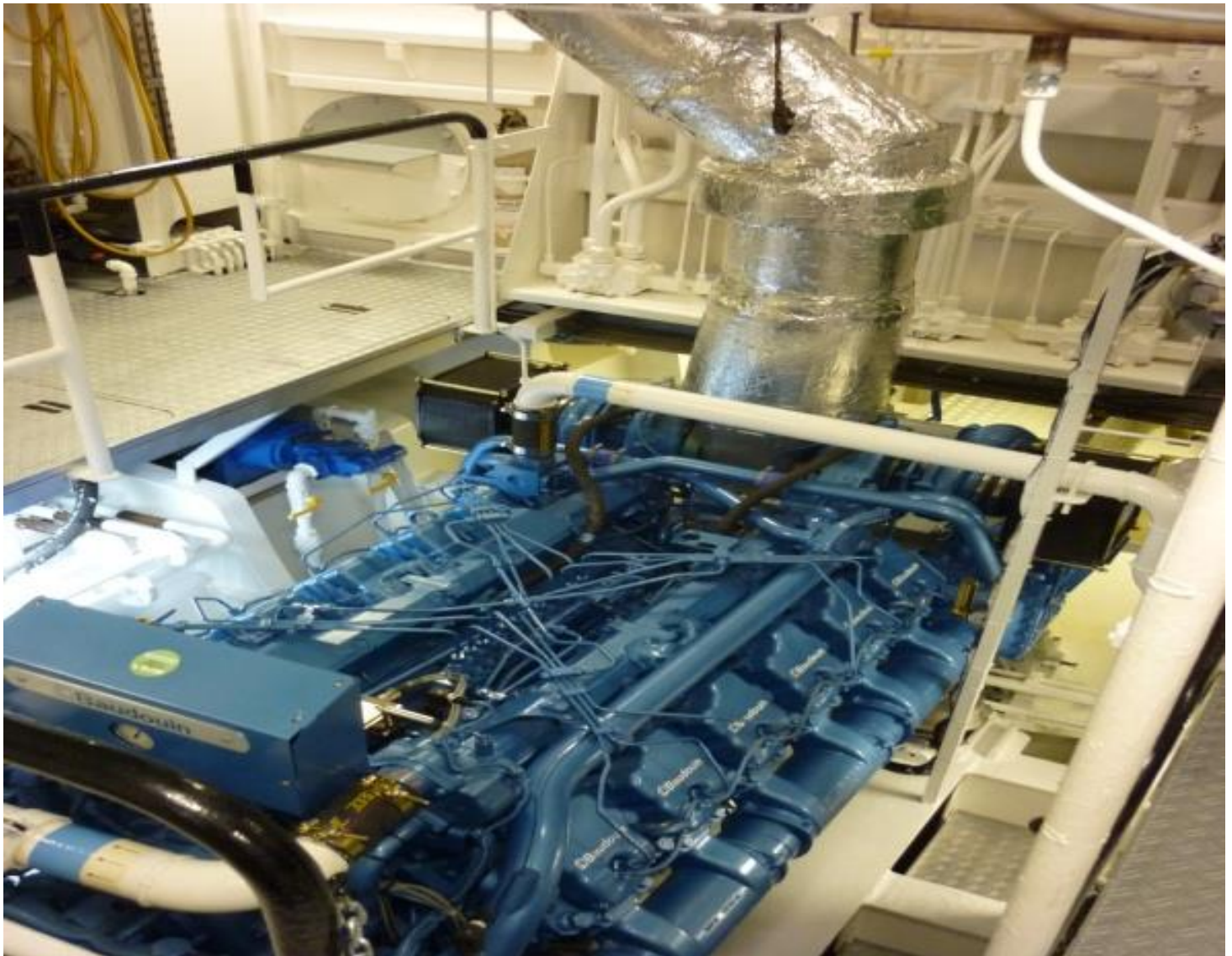




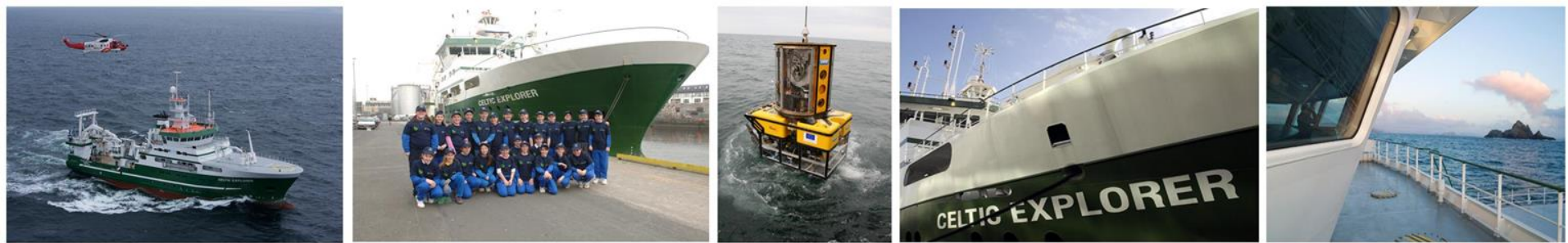












Issues

French factories close for August if missed end July slot would have another months wait

Work to rule in factory (forklift drivers) cause another delay

Minor issues at FAT required correction

Engine optimised for 1500RPM vs 1200 rpm on original requiring alterations

Vessel keel sump had to be cut to fit engine

Different cooling systems requiring new box coolers and extensive piping

French engine techs, Spanish propulsion tech and Irish Crew causes language barriers!!

50 – 80 hour oil change had to be worked into survey plan (not safe to do at sea)

Tricky to combine older BERG CPP and new control system

But...

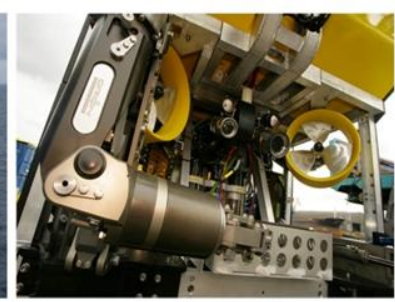
Vessel is faster, quieter and slightly more efficient with lower emissions and has a new engine with warranty!!



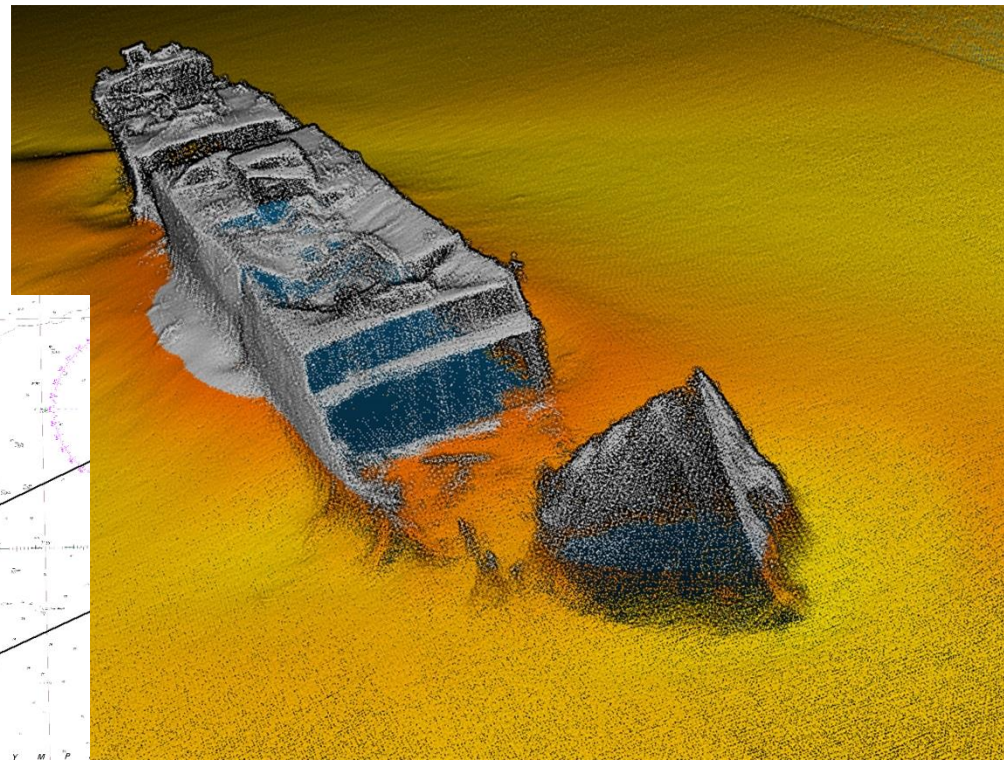
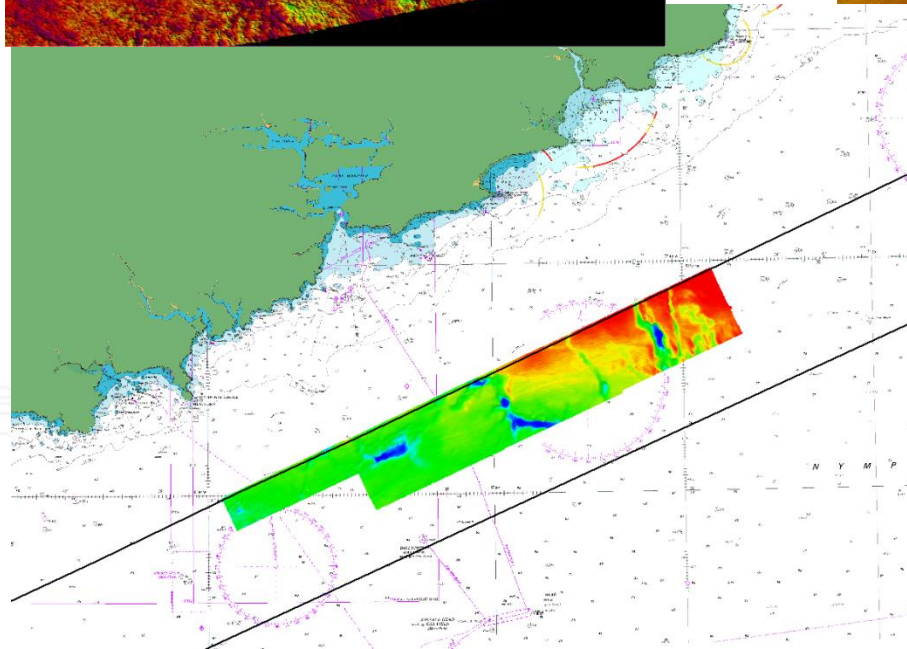
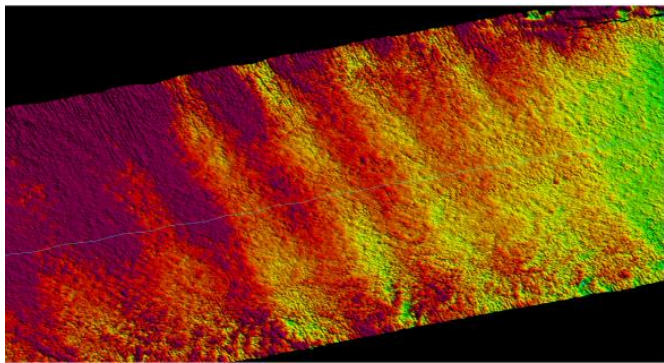
Additional work

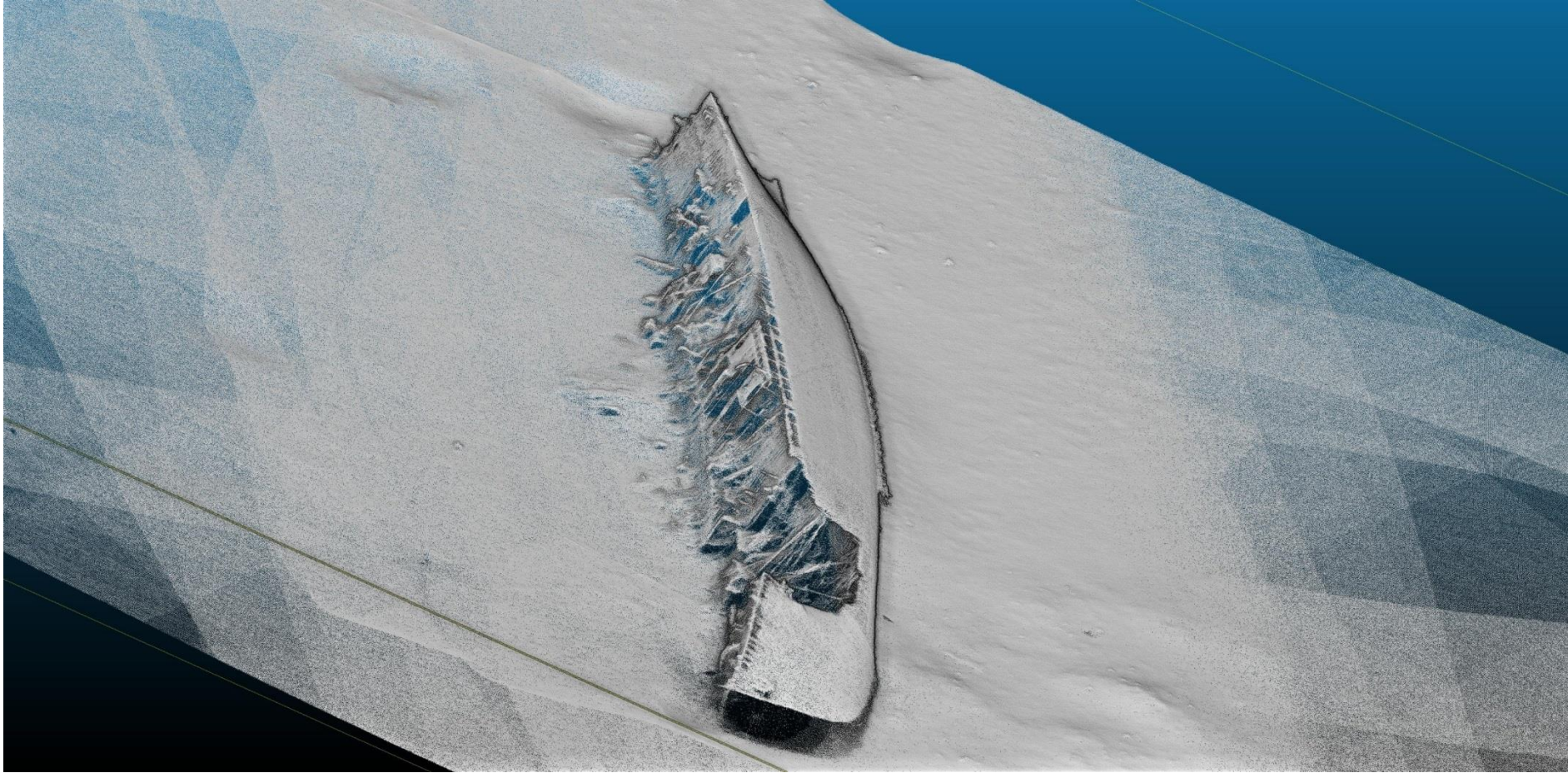
- Ships anchor chain damaged new EM2040 Multibeam in May 2015
- Decision made to relocate EM2040 (1rx and 1 tx) on trial basis to replace redundant EM1002 on aft retraction unit during engine replacement work
- EM3002 reduced to single head unit and relocated in bow position
- Vessel Broadband system upgraded and bandwidth expanded
- System performing extremely well in this location
- Normal refit works such as antifouling, inspections , anodes completed
- Vessel sandblasted below the waterline whilst waiting for engine
- Full repaint completed





Multibeam performance







Charter vessels/ rescheduling

- Tender issued for a charter RV to cover some survey work
- RV Prince madog (34M) contracted for a month to complete 23 days UWTV survey (France/Ireland) and an Oceanographic survey, CV ships crew used to assist permanent crew
- Ilv Granuaile (80m) contracted for mooring recovery work offshore west coast
- RV Song of the whale (20m) chartered for two PAM surveys
- 1 survey cancelled, some rescheduled , vessel finished on 23rd december 2015 and went straight into drydock for christmas....





Lessons Learned

- Cannot use Lifeboat???. Need to use commercial tug..(none available)
- Cannot rely on engine manufacturers to support old /out of production models
- Maybe have a replacement plan drafted in advance to speed up decision making process, need to acquire spare parts for out of production engines
- New engine was cheaper, faster for procurement , more efficient, came with a warranty
- Went on advice of class and insurers every step off the way
- Local yard that knows vessel/crew makes life very easy
- Have normal refit plans drafted well in advance...
- Need some slack in the vessel schedule to allow for the un expected /back up plan
- Have framework agreements/arrangements with vessels in your region to provide cover in the event of a major problem