

Client: Undersøkelseskommissjonen etter Utvik Seniors Forlis, Norway
Job reference: T30642 **UTVIK SENIOR**



Figure 1 (4/00A): General view of engine from forward port side.



Figure 2 (5/5): Engine forward starboard side, showing fracture of PTO housing mounting and engine casing mounting face, and upward bending of top cover plate.

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Figure 3 (5/11): Detail of figure 2, showing general direction of stud bending (arrowed).



Figure 4 (05/13): Detail of figure 2, showing upward bending of top cover plate.

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Figure 5 (5/17): Camshaft drive chain (timing chain).



Figure 6 (5/18): Detail of left-hand side of figure 5.

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Figure 7 (5/19): Detail of centre field of figure 5.



Figure 8 (5/20): Detail of right-hand side of figure 5.

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Figure 9 (8/00A): Aft starboard side of engine block showing damage to charge air distributor.



Figure 10 (8/1A): Detail of damage to charge air distributor.

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Figure 11 (08/22A): Damage to starboard side crank case door frame.



Figure 12 (08/16A): Exhaust flange connections - viewed from aft port side.

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Figure 13 (8/13A): Exhaust flange connections showing retained studs (2 outlined in lower flange and one arrowed in upper flange).

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Figure 14 (8/15A): Detail of retained studs in upper and lower exhaust manifold flanges.



Figure 15 (8/5A): Top aft starboard corner of engine block showing gauge mounting
• location.

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Figure 16 (8/3A): Engine valve stems and springs viewed forward from engine's aft end.

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Figure 17 (8/4A): Detail of aft end valve stems.



Figure 18 (8/12A): Starboard aft engine side showing missing cover plate at the figures right side (fracture direction of stud arrowed) and mounting flange upper left-hand side of
• figure.

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Figure 19 (8/10A): Detail of cam shaft drive cover location.

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Figure 20 (8/11A): Detail of mounting flange shown in figure 18.



Figure 21 (8/23A): Turbocharger showing exhaust gas side casing and shafting to charge air compressor side.

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Figure 22 (3/3A): Detail of turbocharger showing fractured rim of casting.



Figure 23 (3/2A): Detail of turbocharger showing fractured cover-plate.

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Figure 24 (N5055): Micrograph x50, specimen unetched. Section from turbocharger case mounting flange, showing graphitisation corrosion (left of field) and graphite morphology.



Figure 25 (N5056): Micrograph x100, specimen etched in Nital. Section from turbocharger case mounting flange, showing pearlitic matrix and graphite morphology.

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Figure 26 (N5057): Micrograph x50, specimen unetched. Section from turbocharger cover plate, showing graphitisation corrosion (left of field) and graphite morphology.



Figure 27 (N5058): Micrograph x200, specimen etched in Nital. Section from turbocharger cover plate, showing pearlitic matrix and graphite morphology.

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Figure 28 (04/16A): Engine front starboard side.

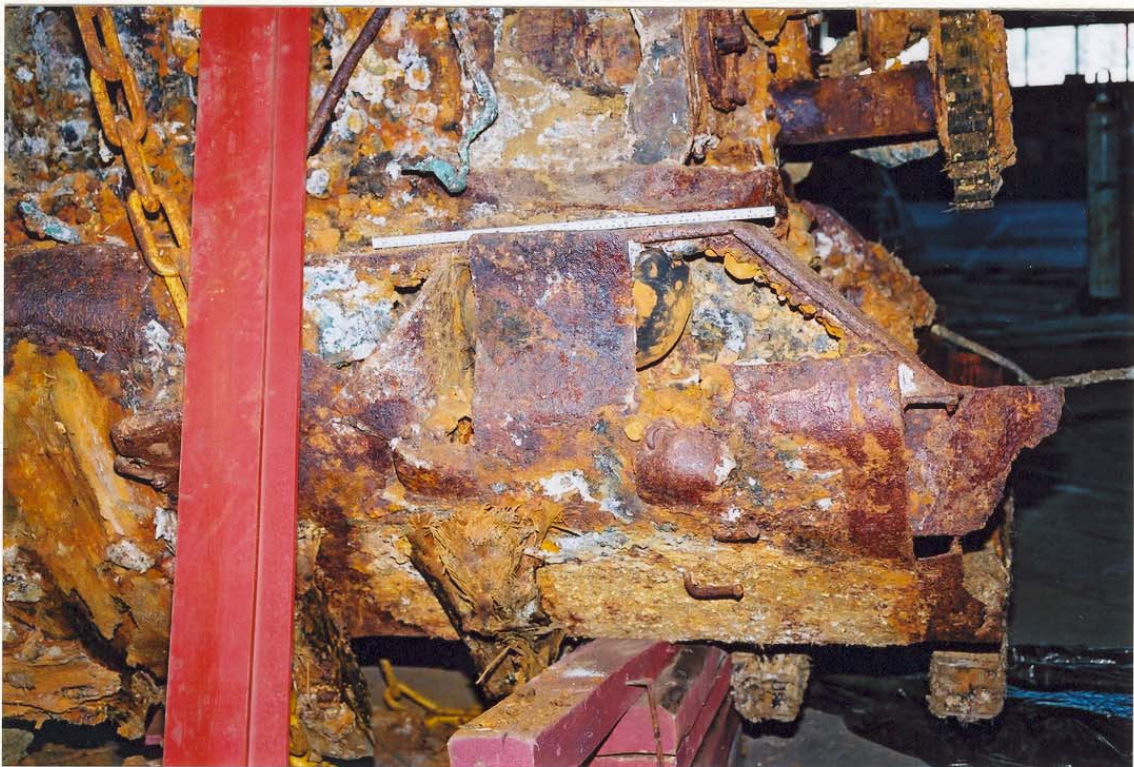


Figure 29 (02/19): Detail of front starboard side damage, showing pebble trapped behind upwardly bent foundation plate.

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Figure 30 (03/7A): Detail of trapped pebble and backwardly deformed stiffener plate.



Figure 31 (02/17): Detail of upwardly bent forward starboard side engine foundation plates.

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Figure 32 (03/14A): Engine starboard side showing upwardly bent foundation plates.



Figure 33 (03/13A): Engine starboard side showing upwardly bent foundation plates.

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Figure 34 (03/12A): Engine starboard side showing upward bending of foundation plates.



Figure 35 (04/24A): Detail of engine starboard side showing bent foundation plates and stiffener.

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Figure 36 (06/13A): Propeller blade number 3, showing damage to tip.



Figure 37 (06/17A): Second propeller blade number 2, showing damage to tip.

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Figure 38 (06/20A): Propeller blade number 1, showing tip bending damage and fracture in root.



Figure 39 (06/22A): Detail of fracture origin in propeller casting root.

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Figure 40 (06/23A): Detail of fracture in propeller casting root, showing fast brittle fracture chevron markings.

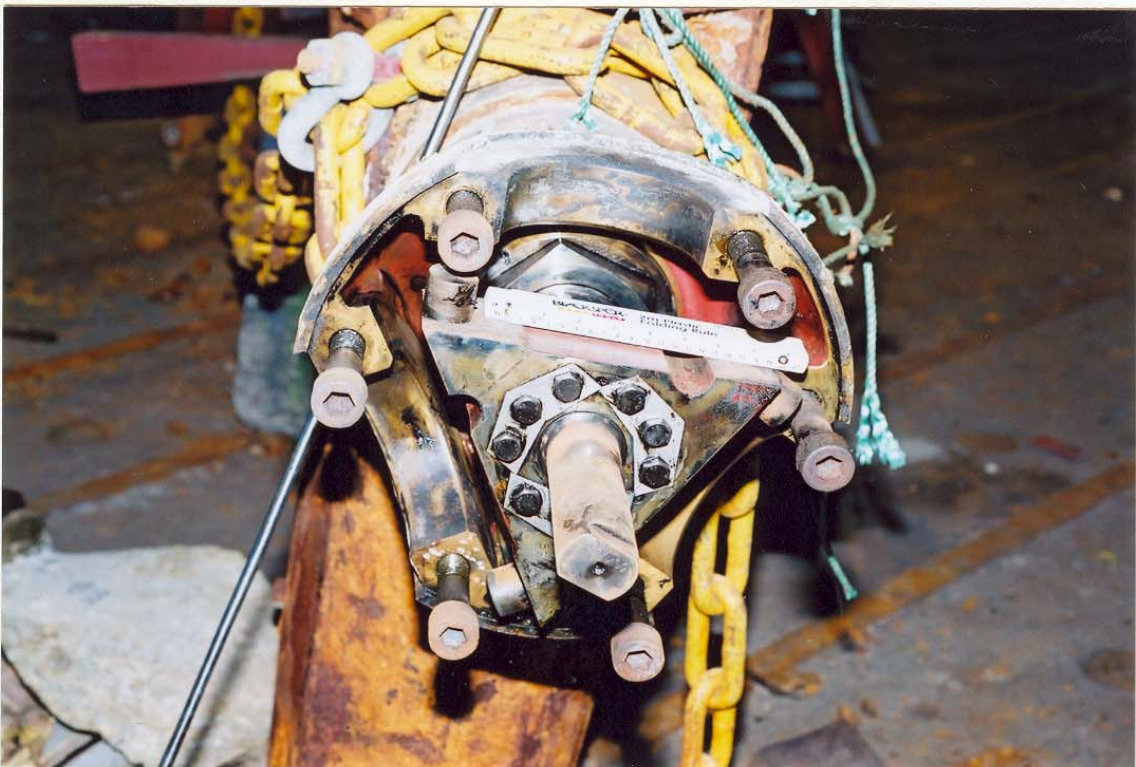


Figure 41 (02/9): Propeller cone internals.

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Figure 42 (06/12A): Detail of propeller cone internals, showing severe local mechanical contact damage (arrowed).



Figure 43 (01/8A): Aft end of keel showing bending damage.

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Figure 44 (6/00A): Rudder blade showing site of bending damage - piece removed during earlier examinations.



Figure 45 (06/5A): Detail of bent lower aft corner of rudder blade - piece removed during earlier examinations.

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Figure 46 (7/13A): Rudder stock and pilot motor - viewed from the port side.



Figure 47 (7/18A): Detail of fractured pilot motor hydraulic pipe connections.

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Figure 48 (7/23A): Detail of rudder stock to bolting flange weld sites.



Figure 49 (7/22A): Detail of rudder stock to bolting flange weld sites.

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Figure 50 (1/24A): Deck doubler plate and trawl winch service pipes.



Figure 51 (1/24+1): Deck doubler plate and trawl winch service pipes.

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Figure 52 (01/3A): V-belt drive pulley.

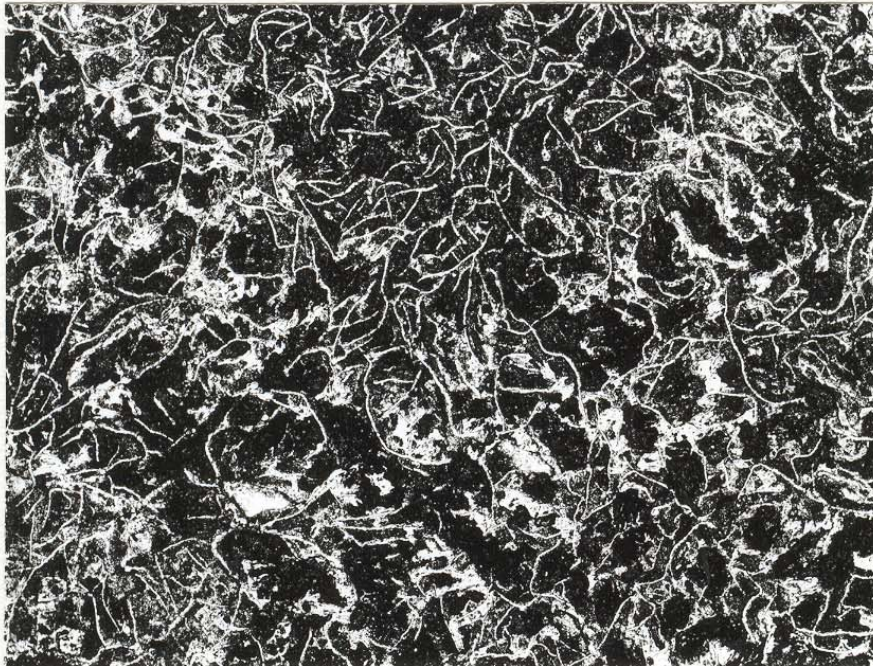


Figure 53 (N5095): Micrograph x100, specimen unetched. Section from drive pulley, showing extensive (total) graphitisation corrosion and prior flake graphite morphology.