Dynamic Positioning Committee

Marine Technology Society

Learning From Incidents

2016-2 – Complete loss of propulsion on a DP Class 2 vessel

This LFI was provided to the DP Committee by the Transportation Safety Board of Canada. The DP Committee thanks them for submitting the report. It is posted as received except for redacting the name of the vessel and name of the vessel operator. The names are not considered a useful component of incident reports and can discourage others from sharing incident reports. Document distribution details have also been redacted.

The report points to the loss of independence of the vessel's redundancy groups because of cross connections. A contributing factor was non-functional ground detection on the 24 volt system.

Cross connections are a factor in many DP incidents, report LFI 2015-1 is also about cross connections and loss of power. More information about cross connections in available in several DP Committee TECHOPS. These documents are available to download on our website

- TECHOP Cross Connections
  This TECHOP addresses cross connections between redundant groups in the DP system. Evidence from DP incident data confirms that cross connections in all parts of the DP system continue to be a very significant factor in DP incidents and are often the reason that failure effects exceed anticipated consequences and sometimes the worst case failure design intent.
- TECHOP - Control Power Supplies and Auto Changeovers
  This TECHOP is intended to highlight the vulnerabilities that are introduced into DP redundancy concepts by cross connections in control power supplies, including dual supplies and auto changeovers. Possible methods of eliminating or reducing the associated risks are suggested.

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Our file Notre référence

M16A0137

AUG 17 2016

Mr. Pete Fougere
Chairman
Dynamic Positioning Committee

Dear Mr. Fougere:

RE : Marine Safety Information Letter No. 05/16 – Complete loss of propulsion on a DP Class 2 vessel

On 28 May 2016, the platform supply vessel (PSV) [redacted] sustained a complete loss of propulsion while operating near a platform at the Thebaud natural gas field off Sable Island, Nova Scotia. At the time, the vessel was preparing to inspect a natural gas pipeline using a remotely operated vehicle (ROV) and was maintaining a position near the platform while in dynamic positioning (DP) mode. The winds were westerly at approximately 10 to 12 knots, and the current was south-southeasterly at 0.16 knots. Subsequent to the loss of propulsion, the vessel's stern made contact with one leg of the platform, and then the bow made contact with another leg of the platform.

When the vessel lost propulsion, a series of alarms sounded indicating that both main engines and all 4 thrusters had shut down. The engine room was notified immediately. The master took the vessel out of DP mode and attempted to manually control the vessel's movement through the use of rudders, but this was ineffective without the main engines or thrusters. The No. 1 auxiliary generator remained running, preventing a complete blackout of the vessel. Following the occurrence, the No. 1 main engine was restored and the [redacted] was manoeuvred away from the platform and outside the 500 metre safety zone, where all propulsion systems were restored. There were no injuries or pollution as a result of the vessel's contact with the platform (TSB Occurrence No. M16A0137).

The [redacted] is a DP Class 2 vessel. At the time of the occurrence, the 2 main engines were providing propulsion and the 2 shaft alternators were supplying the bow and stern thrusters to ensure the required redundancy. One auxiliary generator was online and supplying the non-propulsion electrical systems.

Information gathered by TSB investigators determined that:

- immediately prior to the loss of propulsion, a shutdown signal was simultaneously sent to both main engines and to the offline auxiliary generator No. 2 which was not running;
- a substantial ground fault was identified on the 24-volt control system for the engine room's automatic fire detection and extinguishing system. This system is supplied by the same 24-volt power supply that supplies the diesel control units (DCU) on main engine No. 2 and auxiliary generator No. 2;
- the shutdown signal was the result of a ground on the 24-volt power supply system connected to main engine No. 2;
- introducing a ground on main engine No. 2 caused that engine to shut down, but introducing a ground on main engine No. 1 did not cause that engine to shut down;
- the DCU on main engine No. 1 was not an original unit; and
- the DCU on main engine No. 2, which was an original unit, caused the No. 2 main engine to shut down when a ground fault was present.

To ensure independence and redundancy of the propulsion system, the DCU on main engine No. 1 is connected to a separate 24-volt power supply from the DCU on main engine No. 2. Therefore, a ground on the 24-volt power supply for the DCU on main engine No. 2 may create a shutdown signal for main engine No. 2, but not for main engine No. 1 due to the separate power supply.

However, the investigation found that the primary power supply for the DCUs on main engine No. 2 and auxiliary generator No. 2 was also the backup power supply for the DCUs on main engine No. 1 and auxiliary generator No. 1, and vice versa. Therefore, wiring from each of the 2 power supplies ran to each of the main engine and generator DCUs.

Additionally, the primary and backup power supply wires connected to the DCU on main engine No. 1 had been reversed. This meant that the DCUs on both main engines and auxiliary generator No. 2 had a common 24-volt power supply. It could not be determined whether this wiring arrangement occurred when the vessel was constructed or whether it had been introduced at some point later. This wiring arrangement allowed a ground in the 24-volt power supply system to simultaneously send a shutdown signal to both main engines and the offline auxiliary generator No. 2.[1]

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[1] Although subsequent testing was carried out to recreate this condition, the testing was unable to replicate the shutdown of both main engines.

The investigation also determined the following:

- the reversed wiring of main engine No. 1 to the primary and backup power supplies may have occurred when the new DCU was installed on main engine No. 1 in 2014;
- the ground fault detection system had loose connections preventing it from initially detecting ground faults in the 24-volt system.

The connection of both main engines to the same 24-volt power supply compromised the independence of the vessel's propulsion system, eliminating the redundancy required of a DP Class 2 vessel. The interconnection of both main engines allowed a single fault to shut down both main engines, resulting in the complete failure of the vessel's propulsion system. Correct connection of components is essential to maintain the required redundancy of DP Class 2 vessels.

This information is being provided so that you may take whatever measures are considered appropriate in the circumstances. The TSB would appreciate being advised of any such action. Moreover, an investigator may follow up with you at a later date. As the identified safety issue associated with this occurrence has been brought to your attention and consideration, it is anticipated that an investigation report will not be issued.

Yours sincerely,

Marc-André Poisson
Director of Investigations – Marine

cc. TC – Marine Safety and Security
[redacted]
DNV GL – Maritime
Lloyd's Register Canada Limited
[redacted]
International Marine Contractors Association (IMCA)
International Association of Classification Societies (IACS) Limited
American Bureau of Shipping

BACKGROUND INFORMATION

TSB Occurrence No. M16A0137

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TYPES OF TSB SAFETY COMMUNICATIONS

GENERAL

The purpose of a safety communication is to ensure that identified risks are communicated to those persons or organizations best able to effect change to convince them to take remedial action.

OCCURRENCE BULLETINS

An occurrence bulletin is a formal, written, safety communication used to inform regulatory or industry stakeholders of potential operational or technical concerns that were uncovered by the TSB's initial examination of the circumstances surrounding an occurrence. Bulletins contain only factual information.

SAFETY INFORMATION LETTERS

Safety information letters are generally concerned with safety deficiencies posing relatively low risks, and are used to inform regulatory or industry stakeholders of unsafe conditions that do not require immediate remedial action. Safety information letters are used to pass information for the purposes of safety promotion or to support or clarify issues that are being examined by a stakeholder.

SAFETY ADVISORY LETTERS

Safety advisory letters are concerned with safety deficiencies that pose low to medium risks, and used to inform regulatory or industry stakeholders of unsafe conditions. A safety advisory letter suggests remedial action to reduce risks to safety.

SAFETY CONCERNS

Safety concerns focus on an identified unsafe condition for which there is insufficient evidence to validate a systemic safety deficiency. However, the risks posed by this unsafe condition warrant highlighting. A safety concern provides a marker to the industry and the regulator that the Board has insufficient information to warrant further recommendations at this time; however, as more data and analysis become available, the Board will return to this unsafe condition if it is not readily redressed.

SAFETY RECOMMENDATIONS

The *Canadian Transportation Accident Investigation and Safety Board Act* (*CTAISB Act*) makes specific provision for the Board to make recommendations to correct identified safety deficiencies. Recommendations are used to address those systemic safety deficiencies posing the highest risks to the transportation system and, therefore, warranting the highest levels of regulatory and corporate attention.

RESPONSES TO TSB SAFETY COMMUNICATIONS

The *CTAISB Act* requires that federal ministers provide formal responses as to actions taken or planned in response to TSB recommendations. The Act does not mandate responses by other stakeholders to whom Board recommendations are issued. Notwithstanding, these stakeholders are requested to provide a response, and normally do so.

Although responses to other forms of safety communications are not requested or expected, the TSB often receives responses to safety advisory and safety information letters, and the substance of these responses are reflected in the Board's investigation report.