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## **TESTING AND DATA COLLECTION**

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### **Data Driven Verification: Closing the Loop**

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## Abstract

Traditionally, verification of equipment and systems on board vessels has been carried out by deploying surveyors to perform onboard witnessing and verification. Today, development of digital technology and increased possibilities in connectivity between vessel and shore provides the possibility to change the traditional methods, and leverage data and data centricity to enhance the conventional verification and validation efforts undertaken by industry stakeholders.

These technologies, such as KM's DPDS, have been existing for quite a few years in the market. At MTS 2019 the experience from three pilots on various vessels were shared. Since then, the DDV (Data Driven Verification) concept has considerably matured during the past years thanks to industry partners and leading vessel owners, such as TechnipFMC, who are implementing the DNV DDV notation with great success.

## Abbreviation / Definition

DDV	Data Driven Verification
DNV	Det Norske Veritas
DPDS	Dynamic Positioning Digital Survey
DSA	Digital Survey Application
KM	Kongsberg Maritime

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## Introduction

During the presentation we will share experience of closing the loop of digitally implementing a DDV technology and class notation, preparing, executing, and verifying data driven trials entirely by use of digital body of evidence.

The presentation will also discuss benefits and challenges for the involved parties when moving from traditional on-site witnessed trials to DPDS. The presentation will also cover the DPDS and DDV methods considering industry DP assurance requirements and standards.

A short comparison of traditional trials and DPDS with the focus on requirements, training and competence of involved parties will be presented. The presentation also demonstrates how the KM DPDS methodology is correctly testing DP System components, and how adequate verification is in place. DPDS is a KM product for data-driven verification by DSA.

## Data Driven Verification by (DDV) & Digital Survey Application (DSA)

A wide range of data-driven verification methods are expected to emerge from the vast development within digitalization, data analytics and data connectivity. Verification of DDV methods is essential in order to ensure that the evidence generated is genuine, trustworthy, and of sufficiently high quality. When this is proven, the evidence collected may be used as basis for independent assessment towards specified acceptance criteria.

The Class guideline [1] set requirements to several methods for data-driven verification, one of these being use of Digital survey applications.

A DSA application enables trained crew to perform vessel specific FMEA programs testing, based on approved digital configuration of these programs supported by a digital system, which ensures that a data-based body of evidence is harvested in the correct tamper free manner. The result is a digital data set (e.g., time series) representing the testing performed and the vessel and DP system behaviour, which is then verified by a surveyor using dashboards in a digital playback application.

The vessel operator plans the test onshore and provide access to the system to the parties involved. The surveyor will evaluate the plan and approve / reject for execution. The crew on board the vessel executes the tests following test methodology, and the timestamped test results are stored in the DSA application. Tests can be repeated numerous times with each attempt recorded. Full trackability of executed tests is available in the application. The surveyor can then perform the verification. Vessel operator has full visibility and control of the application. However, any changes to the tests or functionality are subject to class approval.

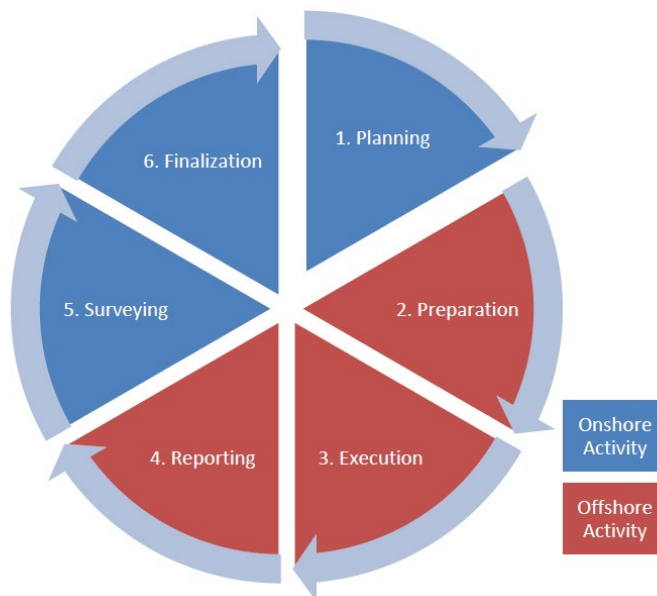


Figure 1. KM DPDS Process.

## Principal DSA Process

Figure 2 below illustrates the process from making the FMEA and FMEA test documents, class approval, implementation, and configuration of the FMEA test document into the DSA application, crew performing test by use of the DSA and thereby generating system response data (the body of evidence required by class/IMO) which is gathered by the onboard data historian, and secure access is provided to the surveyor. The surveyor performs independent verification on the tamper-free data (the body of evidence) and uses the data to perform an office annual DP survey and maintain the vessel DP class notation.

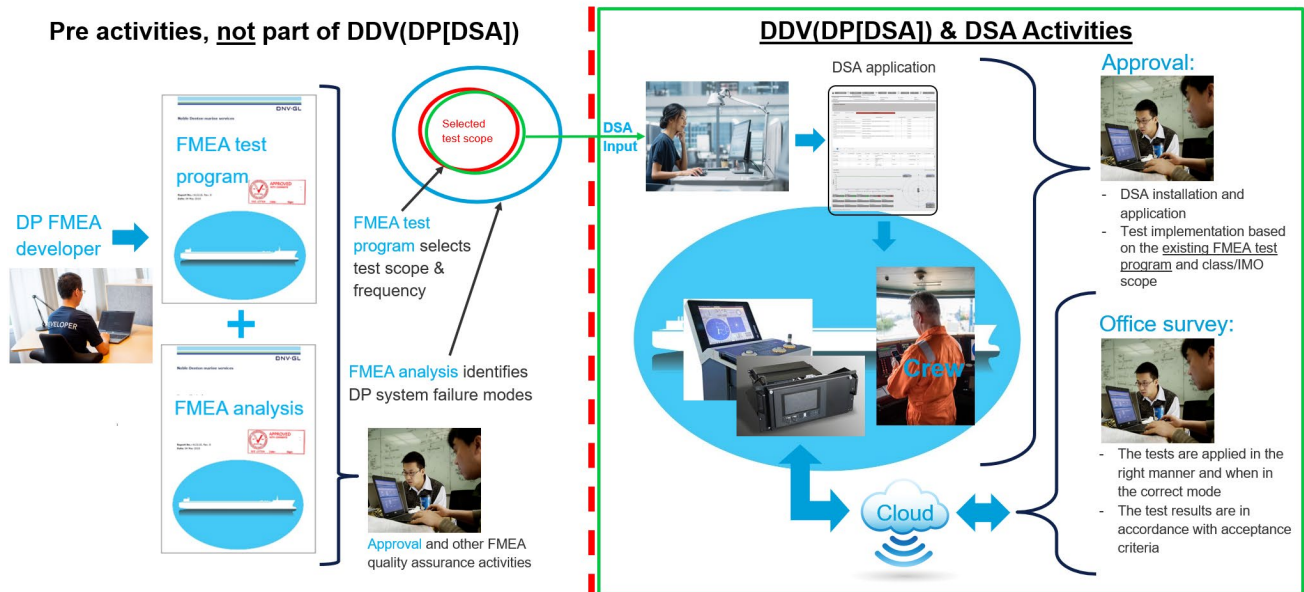


Figure 2. The DSA is a tool for execution, verification, and documentation of DP annual trials. DDV(DP[DSA]) is the DNV class notation for Data-Driven Verification of the DP system by use of a Digital survey Application.

The interaction between DSA and the target system, and the generated target system/DSA verification data, shall be carried over an API or other digital interface using documented methods and data structures. Specific competence is required to complete surveying tasks due to digital nature of evidence.

## The annual DP trials

Although the annual DP trials process is well understood and requirements are clearly defined, there is a gap in the industry related to execution methods. Where tightly controlled methods such as data driven verification managed with DPDS application provide equivalent or better outcome in comparison with traditional method, there are other methods being implied that are debated as questionable in industry fora. As example, full annual trial verification based on email exchange between the crew and 3<sup>rd</sup> party verifier could be considered as a step in a wrong direction. There is time and place for emails / photos / screenshots / reports / etc. however annual assessment of vessel's suitability for DP operations should not be based on carefully selected evidence submitted in form of email attachment or as an upload to an online database.

Traditionally, class surveyor would focus attention on tests within class scope for annual trials program and the “industry” tests would be witnessed by an independent witness as per the definitions within IMCA M190 [2]. Tests for class and “industry” scope would often be completed separately. The DDV methodology is bridging the two aspects demonstrating full transparency.

## Main learnings

The development and pilot testing of DSA has been ongoing for several years and a lot of learnings have been gathered through several pilot projects, and also some commercial projects. Some of the most important findings are related to:

**Technology:** The technology seems to be fit for purpose and the experiences made is that it the technology is able to support the objectives and intentions laid down in the DNV requirements for data driven verification (DDV) by use of digital survey applications (DSA), see [1].

**Data coverage:** The solution is dependent on the DSA to be able to harvest a sufficient wide range of data generated by representative tests.

**Competence:** The experience with the system to date has demonstrated that for both traditional and data driven trials the Crew competence in DP systems, DP assurance and DP FMEA testing is of paramount importance. The use of the DSA application by the crew requires additional familiarisation / training that can be delivered by the competent (vendor trained) person or vendor.

As the verification requires specific skills and different perspective, it is very important that the person verifying the tests has sufficient competence in use of the DSA application and data driven verification based on the collected body of evidence.

### DSA FMEA test program implementation:

The pilot testing performed has demonstrated that the quality (accuracy and level of detail) needed in the DSA implementation (including system set-up, test purpose, test method, and expected result) must be high to ensure the quality, efficiency and independent verification purposes. In general, the experience made so far is that the DSA implementation must have much higher quality than what is typically found in the paper based FMEAs used for the first DSA implementation. The main reason for this is twofold:

- To provide sufficient guidance to the crew to ensure that the tests are performed correctly and consistently to gather the correct and intended data for each test
- To ensure that the verifier can understand what has been done, for which purpose, and be able to verify this by use of the harvested data

In addition, it is anticipated that a high-quality test program will:

- increase the competence of the crew performing the testing (testing ownership)
- increase the transparency between vessel operator / class / client
- provide opportunity to review completed tests for learning purposes
- reduce the risk of vessels operating outside of client accepted ASOG
- reduce the need for communication between owner and class/OEMs/client in the test and verification processes
- reduce the risk of the office surveyor/verifier not accepting the submitted data and potentially requiring the crew to retest and submit again, due to e.g., wrongly performed tests or lack of correct data
- allow to complete some tests during standby time and incorporate some testing with other trials such as field arrival

## Conclusion

Verification through the use of DDV, providing a tamper free digital body of evidence and verification functionality, delivered by the use of the KM DPDS application provides equivalent or better outcome for DP annual trials and industry DP assurance.

The introduction of DDV methodology has demonstrated a positive impact on crew competence and improved the crew understanding of the DP system behaviour in fault conditions. This improves operational safety in case of an actual DP event.

There are distinct differences between DDV, and some existing “remote trial” solutions.

It has become clear to the authors that differences between various methods needs to be better understood and more emphasized. This will help the industry to ensure equivalent, or better, DP assurance processes when new methods are introduced.

## References

- [1] DNV AS (2020) “Class guideline DNVGL-CG-0557: Data-driven verification”
- [2] IMCA (2020) “M 190 Guidance for Developing and Conducting DP Annual Trials Programmes”