



# The Complex Picture

Managing the risks of complex integrated systems

DNV Energy  
DNV IT Global Services

# The Complex Picture



One hour in the office to fix a defect for one week of rig down time. A fair swap? The ratio of time to locate a fix a defect during the early phases compared to post delivery can be more than 100:1.

Software and systems used in the energy and maritime environments are becoming increasingly complex as they evolve to meet more demanding customer, regulatory and technological requirements. The energy and maritime industries are also facing greater product innovation with more software embedded systems forming part of the safety and business critical systems.

These new software intensive products can provide great benefits in terms of functionality, operability and maintainability. However with so much of a system's functionality defined by the software system, the consequence of a failure of the software system can be catastrophic.

Safe, predictable and profitable operation of these systems depends on:

- Development of reliable components.
- Successful integration of these components into systems.
- Good management and coordination of component and system requirements, development, procurement, testing, validation, integration, commissioning and operation.

Most system and software defects occur in the early phases of a project and without adequate control of the process these defects can remain undetected until the later stages of the project. Frequently these defects originate through poor system and component requirements. Research has also shown that it can be up to 100 times more expensive to fix these defects once the system's been delivered than to fix them in the earlier phases.

The extent and value of the software installed in a modern integrated system is rarely fully appreciated or controlled. The software is a critical component and owners and operators tend to have less control over the software production process than they do over the production of critical mechanical components.

Other industries have successfully managed the transition from mechanical, electrical and hydraulic systems to software intensive integrated systems, most notably the aerospace and automotive industries.

DNV ITGS has extensive experience working with these industries and with this experience we have identified software and

## SERVICES OFFERED

**Project management** – assuring on-time and on-budget delivery. DNV's combination of domain experience and extensive technical experience can be utilised to ensure smooth project delivery.

**System requirements and design management** – limiting the chance of introducing errors and managing the interface between the parties.

**Requirements management** – controlling adherence to the requirements throughout the project lifecycle.

**Project risk management** – DNV's experience in risk management is unparalleled. DNV's unique blend of in-depth domain knowledge and expertise in technical, safety and financial risk management can give an unparalleled picture of the risks associated with complex integrated systems.



Traditional mechanical control systems are being replaced by software based control systems. In a mechanical solution the quality can be controlled during all phases of the project using established procedures.

For software based systems, the hardware quality can be controlled but the functionality of the system is in software. It is possible to have full traceability of the mechanical components, but the same is not always true for the software.



The RP is intended to have an impact on how integrated systems are specified, developed, engineered and implemented. It introduces a different approach to managing projects targeted at controlling the risks.

systems development standards and best practices and brought them together with DNV Energy to produce a new DNV recommended practise, DNV RP- D201.

This RP is designed to help companies control an integration project by enabling them to express and control their requirements, control the sub-suppliers and adequately plan and implement the verification, validation and integration activities.

This RP divides the project into discrete phases and then defines activities that should be executed within each phase. These activities are also arranged by engineering discipline and allocated to project parties, e.g. owner, operator, system integrator, etc. This arrangement opens up the engineering processes allowing the progress to be tracked and managed.

This RP focuses on the functionality of the system. By decomposing the system into function it gives the project a clear overview of the interaction between the different components and highlights important components and interfaces. The key functions of the system are classified according to the consequence to the business, financial or safety goals if that function were to fail.

Classifying the importance of the function allows the RP to define an appropriate level of effort to the engineering of that function.

Successful application of this RP will help to reduce the overall project risk. By providing a clear oversight of the project, deliverables can be tracked and threats to the project schedule can be identified at an early stage and addressed. This RP ensures that all verification, validation and integration activities are planned, implemented and managed throughout the project, this enables system defects to be detected and rectified at the early stages of the project, helping to reduce expensive on-site and post-delivery warranty work.

Finally, this RP concentrates on engineering the correct requirements for the system and then managing these requirements throughout the projects lifetime. Strong requirements are key to removing the uncertainty and therefore the risks from integration projects.

**Supplier selection and monitoring** – helping our clients get the best value from the best suppliers.

**System testing and verification management** – DNV utilises state of the art techniques to identify system defects at an early stage.

**System validation management** – revealing the residual defects that cannot be detected outside the operational environment.

**Configuration management** - ensuring that the functionality is established and maintained throughout the life of the system.

**Experts on-board** – DNV's resources can be employed ad hoc during a project's lifecycle to provide expertise, coaching and project execution when it's needed most.

Det Norske Veritas AS  
NO-1322 Høvik, Norway  
Tel: +47 67 57 99 00  
Fax: +47 67 57 99 11

[www.dnv.com](http://www.dnv.com)

Det Norske Veritas Energy  
NO-1322 Høvik, Norway  
Tel: +47 67 57 99 00  
Fax: +47 67 57 99 11

Det Norske Veritas IT Global Services  
LE VISIUM, 22 avenue Aristide Briand  
94742 ARCUEIL Cedex, France  
Tel: +33 1 49 08 58 00  
Fax: +33 1 49 08 95 88

For more information, please contact either DNV IT Global Services or DNV Energy