

GATE KEEPER

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Achieving Incident Free Project Execution Through The Use Of Effective Decision Support Tools (DST's)

A Decision Support Tool (DST) is an operational barrier used to achieve desired and predictable project outcomes as part of an overall integrated risk management strategy.

GATE develops and implements DST's to mitigate high risk exposure associated with project execution. When effectively developed and implemented, a DST can help the user to:

- **Set up** an activity to achieve a high degree of safety prior to execution.
- **Operate** during the activity in the safest way possible.
- **Support** the operator in making better and more effective decisions when conditions during activity execution change.

By helping the user to make better decisions during stressful situations, there will be less reliance on the individual experience level of each user.

In its most simple form, a DST should comprise two sections:

1. Configuration & Setup
2. Operating Guidelines

DST Configuration Section

The objective of the Configuration Section is to identify the safe and advisory configurations of each activity for the particular operation being performed. Table 1 shows the basic dynamics of a Configuration Section, which explained in more detail below.

- **"Condition" row:** This row contains the two important columns for this section: Best Setup Condition Column (green column) and Advisory Condition Column (blue column).
- **"Notification Protocol" row:** This row explains whether the user should or should not notify a certain predefined group of people based on the user's current condition.
- **"Action to Perform Based on Condition" row:** This row explains what the user should do for each activity within the specific column.
- **Category Area:** The rest of this section is dedicated to organizing individual aspects/activities of the operation into categories of similar concepts.

To set up the Configuration Section:

1. For each aspect/activity described in the categories, the safest setup for that particular activity is identified, typically determined through research and/or from experience in the activity, and is placed in the "Best Setup" condition column (the green column).
2. Any configuration deviating from the best setup is placed in the "Advisory" condition column (the blue column).

Each item should be verified prior to the execution of the related activity. The Configuration Section is not meant to prevent work from starting; however, if it is difficult or impossible to setup the activity according to the configurations in the green column, it is advisable to notify all parties and ensure that a risk assessment is performed to see how this variation may affect activity outcome.

DST Operating Guidelines Section

The Operating Guidelines Section provides actions that should be taken if certain failure scenarios impact the process or operation, causing a condition that represents a higher threat level. The Operating Guidelines Section uses the same fundamental dynamics as the Configuration Section, with some minor differences, including:

- In this section, there are 4 different conditions: "Safe" condition and three different threat levels of escalating severity.
- The actions to take for each threat level depend on the activity itself.
- The rest of the document, as above, is dedicated to aspects of the activity that may change or failures that may occur during the execution stage.

Table 2 shows the basic dynamics of an Operating Guidelines Section.

Configuration Section			
Condition	Best Setup	Advisory	
Notification Protocol	NO	YES	
Action to Perform Based on Condition	Proceed with Activity	Assess Risk Based on Deviation from the Safest Setup	
Category 1	Description of Particular Aspect of Operation	Safest Configuration of a Particular Aspect of the Activity	Any Other Configuration

Table 1: Configuration Section: Safest Setup – To Be Verified Before Activity

Operating Guidelines Section				
Condition	Safe	Threat Level 1	Threat Level 2	Threat Level 3
Notification Protocol	NO	YES	YES	YES
Action to Perform Based on Condition	Cont. with Activity	Action 1	Action 2	Action 3
Category 1	Description of Particular Aspect of Operation	Particular Aspect is within Defined Safe Guidelines	Failure Scenario 1	Failure Scenario 2
			Failure Scenario 3	

Table 2: Operating Guidelines Section



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Dynamic Positioning Example

This example shows how several operational barriers need to be put in place to account for the failure modes of a single, but important, piece of equipment: The Dynamic Positioning (DP) system's gyrocompasses. To start, here are a couple of quick facts about gyrocompasses (gyros):

- Gyros are used by the DP system and the Global Positioning Systems (GPS's) for accurate heading information.
- Gyros can fail internally due to a design flaw or externally due to the loss of power supplies or communications systems.
- Loss of all gyros will lead to an immediate loss of vessel position, since the DP system will no longer know the vessel's position.

The importance of gyrocompasses to the stability of a vessel's DP system is well known. Therefore, vessel systems are typically designed with multiple gyrocompasses and several power supplies to provide redundancy and prevent a total loss of all gyros.

The gyrocompass configuration for this example consists of two gyrocompasses, each having a primary and secondary power supply. The primary supply is the ship's main Low Voltage (LV) system, while the secondary supply comes from two Uninterruptable Power Supplies (UPS's), which can be thought of as big batteries. The gyrocompass power distribution table would look like this:

Gyrocompass Power Distribution		
	Primary Supply	Secondary Supply
Gyro 1	LV Supply 1	UPS 1
Gyro 2	LV Supply 2	UPS 2

An effective DST must include an analysis of all of the interconnecting vessel systems. Therefore, we need to "zoom out" from the power supplies, and look for any configuration issues that could defeat the dual redundant gyrocompass setup.

This example vessel has a power distribution network that is split between portside (red) and starboard side (green). Each network has a Low Voltage (LV) and a High Voltage (HV) distribution. Two generators which are supplied from two different fuel oil tanks feed these power distribution systems.

Identifying Failure Points

With all of this information, we then look for any aspect within these interconnecting systems that could defeat the dual redundant gyrocompass setup. This system analysis leads to Table 3.

Gyrocompass Power Distribution			
Gyros	Primary Supply	Secondary Supply	
Gyro 1	LV Supply 1	UPS 1	
Gyro 2	LV Supply 2	UPS 2	
Low Voltage (LV) Power Distribution			
LV Supplies	Primary Supply	Secondary Supply	
LV Supply 1	HV Supply 1	HV Emergency	1
LV Supply 2	HV Supply 2		
UPS 1 Charger	HV Supply 1	Auto-Changeover Between HV Supplies	2
UPS 2 Charger	HV Supply 2		
High Voltage (HV) Power Distribution			
HV Supplies	Primary Supply	Secondary Supply	
HV Supply 1	Generator 1	HV Supply 2	3
HV Supply 2	Generator 2	HV Supply 1	
HV Emergency	HV Supply 1	HV Supply 2	4
Generator Fuel Supply			
Generators	Primary Supply	Secondary Supply	
Generator 1	Port Fuel Tank	Sbd Fuel Tank	5
Generator 2	Sbd Fuel Tank	Port Fuel Tank	

Table 3: Failure Points

Configuration Barriers

Once the key potential failure points have been identified, configuration barriers must be created in order to help manage the risk potential. As shown above, the five key failure points have been mitigated with five relatively simple configuration changes shown in Table 4.

Operational Barriers

After the vessel has been checked against the safest setup for the gyrocompasses, the operation can begin with greater confidence in the stability of the DP system. This being said, remember that during the operation, things may still fail.

Table 5 shows examples of line items that can be put in place to signal problems and possibly prevent the loss of all of the gyros. With this DST, the crew will be able to recognize the situation, and know exactly what to do after certain failure scenarios occur that cause a condition representing a higher threat level.

Key Takeaways

DST's can be designed to serve as effective operational barriers, especially when dealing with complex systems and high risk operations. For DST's that are created for offshore, high risk operations, configuration barriers can help manage the impacts of previously undetected design flaws while operational barriers help to improve the crew's confidence in making decisions during time-critical situations. Having this easy-to-use, industry-tested tool, reduces the need to rely on individual crew members' personal experience.

Configuration Barriers			
Condition		Best Setup	Advisory
Notification Officers		NO	YES
Action		Proceed with Operation	Inform and Risk Assess
Gyros	Gyro Selection	Both gyros selected	Either gyro unavailable
	LV Power System	LV Power Supplies	1 Shared secondary supply is disconnected Shared secondary supply is connected
UPS Supply Auto-Changeover		2 Set to manual	Set to automatic
HV Power System	Main HV Supplies	3 Bus tiebreakers open	Bus tiebreakers
	Emergency HV Supply	4 Single main HV supply	Dual supplied
Fuel	Fuel System Segregation	5 Cross-over valves closed	Segregation compromised

Table 4: Configuration Section for Gyrocompass Power Distribution



From discovery to abandonment, upstream to downstream, GATE provides a systems approach to oil and gas facilities through our engineering, commissioning and marine services. Our goal is to provide solutions that allow our clients to make sure their projects work right the first time.

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Table 5: Operating Guidelines Section for Gyrocompass Power Distribution

Operational Barriers					
Condition		GREEN	ADVISORY	YELLOW	RED
Notification Officers		NO	YES	YES	YES
Action		Continue Operation	Inform and Risk Assess	Prepare to Stop	Cease Operations
Sensors	Gyros	2 gyro's selected	Any alarm	One gyro remaining	Loss of all gyro's
	LV Power	LV	No alarms	Any alarm	Loss of one LV system
UPS's		No alarms	Any alarm	Running on batteries	