

How Can Simplicity Improve Diving Safety?

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About the author:

Terje Løvøy is a former commercial diver. He later became an Airline Captain and Vice President of SAS Flight Operations. He was also a US Federal Aviation Administration Examiner for the Boeing factory. Today he runs training workshops about procedure simplification to improve safety in high risk operations such as diving, shipping, oil and gas.

Introduction

This is an extract from a joint presentation with Andy Butler. First Andy Butler, Deputy Diving Manager & Dive System Operations, shared a case study from TechnipFMC. Andy's team used aviation inspired methods to change old and complex procedures into a new, more user-friendly and safer system.

Lovoy AS assisted TechnipFMC in this project. Jodi Lee and I trained TechnipFCM's staff to use the Lovoy methods.

This paper captures my part of our presentation at the Bergen International Diving Seminar. I will share lessons learned from TechnipFMC and many similar projects, to simplify and improve Safety Management Systems (SMS). Many reduced their procedures by more than 50% without losing anything of value.

From Diving to Flying

After several years in commercial diving I became an airline pilot. Some said I went from one extreme to the other, but I found many similarities. Both diving and flying puts us in high risk environments, but science and technology helps us manage the risks. Companies handling high risk must have a collection of procedures and checklists in their SMS. Our operations may be complex, but that does not mean we should explain them using difficult words and hard to understand sentences.

SMS' Lost Sight of the End-User

Many SMS' had become too big, too complex and lost sight of the end user. Use experience – not checklists, this was an unwritten rule I quickly

learned as young pilot. Older colleagues had experienced having to choose between experience or checklists.

Since voice recorders monitored us, we always read the checklists, but fast and superficially. Today, pilots read the checklists carefully – not because they have to, but because they want to. What changed? This question takes us back to 1988.



Are too Complex Checklists Safe?

I woke up one morning when the pilots of a B727 forgot the flaps and crashed close to my home in Texas. The warning system failed and the voice recorder showed superficial checklist reading. They answered what they expected to see and not the actual indication.

Every pilot knew they needed flaps, so a lack of knowledge was not the problem. Typical checklists at that time had too many non-critical items and we often read them too fast.

Ten years later, Swissair had an electrical inflight fire. Despite smoke and heat, the pilots circled

while reading the complex lists. This took too long; they crashed and lost all onboard.

Are too Long Checklists Risky?

What did we learn? Overly complex checklists compete with common sense and experience. So, we made shorter lists with a tighter focus on the most critical items. If unable to control the smoke or fire, the new lists quickly instructed us to land. This might have saved Swissair.

Not Room for Everything in the Checklists

Our new vision was to have a more risk based focus through concise simplicity. We believed there was a clear link between how user-friendly something was and how much we would use it. We accepted that there was not room for everything on the checklists. We reserved the checklists for the “killer items”.

Best Since Doctors Began Washing Hands

Other industries learned from aviation. As an example, Haukeland University Hospital in Norway reduced complications and mortality rates up to 42% by using aviation-inspired checklists. Norwegian TV2 called it the biggest breakthrough since doctors began washing their hands. Shipping, oil and gas are now also using these concepts.

From Flying to Diving

In 2013, TechnipFMC decided to use this experience from aviation and asked us to help improve their diving procedures. Like many other companies, they had problems with documents that were too long. Another problem was a mix-up of procedures and checklists. Consequently, the documents were not user-friendly. TechnipFMC ran a project resulting in new procedures and checklists that were much more operational and not mixed together.

What Was the Root Cause?

We ran 20 similar SMS improvement projects in shipping, oil and gas. When asked for the root cause, they all replied that the problem was too much information. After a while we started to doubt that the problem was too much information. Could the problem be how the information was presented? We found two other and much bigger problems. The first was windbag text.



Windbag Text

Procedures are like people, some talk a lot but say very little. We call them windbags, and this is not a compliment. You do not want inflated windbag text in your SMS.

Text is like math – we can present the same thing in a complicated or a simple way. Why write $\frac{12}{18}$ when we can write $\frac{2}{3}$?

Why write commence when we can write start? Is it not better to write stop than discontinue? We made a new simple word dictionary published at www.lovoy.info

Dictionary Example

Complex	Clear
Give consideration to	Consider
During the period of	During
A number of	Some
Give the recognition to	Recognize
Is concerned with	Concerns
Because of the fact that	Since

20 words

6 words

70 % reduction

Passive Text – Passive Mind

Windbag text uses a lot of passive sentences. Passive is a pest when you want to design a proactive safety system. We made a method called text washing, which can reduce the word count by more than 50%. Text washing can cut down the words, but this was not the end goal. Our goal was to be concise. This means saying what we need clearly with as few words as possible. We also developed easy to measure Key

Performance Indicators (KPIs) for proactive user-friendly text.

Spaghetti Structure

The second and biggest problem was spaghetti structure. This resulted in a tangled complex structure branching through our documents. It failed to present steps in the order we must do them.



The biggest spaghetti problem was between checklists and procedures. Most SMS' are like large icebergs. The checklists are the tip of the iceberg, they cannot hold the entire SMS. We needed to prioritize and permit items into the checklists based on their risk.

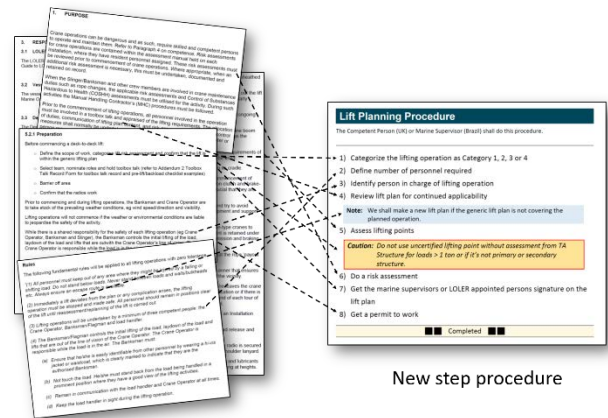
To find more information about a checklist item, we must be able to dive down below the surface into the procedures. Procedures have more details for training and standardization. This is where you go for more in-depth explanations about something you are uncertain about. Our biggest finding was that there was little to no link between the checklists and procedures. This had a large potential for improvement since we knew we needed to have workflow-based procedures in the same order as the checklists.

Cut the Spaghetti into Chunks

Chunking, it is a pedagogical concept that puts similar things together. For operational procedures, this means organizing things based on when we do them. The old procedures were chunked by academic topics without thinking about when we do the tasks. We therefore made new rules to help writers organize actions into workflows based on when we do them.

From Prose to Workflows

Most procedures were in prose text even though they described operative steps. With prose text, we mean regular sentences. It is better to write most procedures in proactive imperative steps. Most procedures also need an introduction using prose text. We must find the right balance between prose and step procedures. Today we have too much prose text.



Layout

The last element we looked at was layout. Pages cramped with text make it hard to find what you need. All the companies needed a clear visual layout that they could easily update themselves. I therefore made an advanced but easy to use Microsoft Word template with notes, cautions, warnings and other styles. This became known as the Lovoy template. It had layouts for regular prose text, proactive step procedures and checklists. The projects used the Lovoy template for paper and electronic documents.

Results

A combination of these methods allowed, for example, Teekay to reduce their navigation procedures and checklists from 48,939 to 17,235 words. That was a 65 % reduction, but the goal was not to reduce the word count. The goal was to have text that was easy to understand for both new and experienced workers.

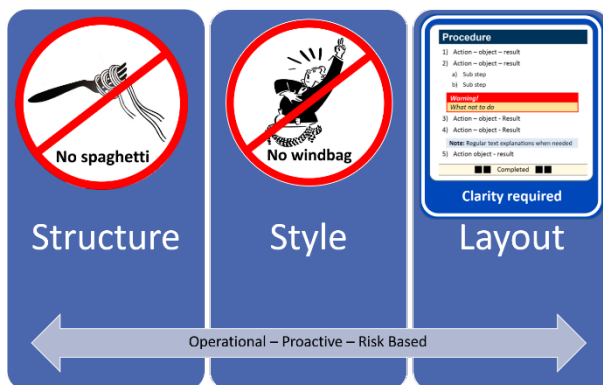
We got similar results with companies such as Eidesvik, KGJS, Bernhard Schulte, V.Ships and more. These have been in use for several years now, and have passed many forms of inspection.

User Feedback

Feedback from the end users showed that the new manuals were:

- Easy to read
- Easy to find what you needed
- Shorter and more concise
- Easier to learn
- Easier to use
- Safer
- More efficient

Surveys typically showed around 70% increased perceived usability.



Good Tools – Half the Job

The last question was – could we use internal writers? Could we train internal staff without inborn gifts as writers to solve the problems we found? Good tools were half the job, knowing how to use them was the other half. We made clear language writing rules and methods for how to untangle spaghetti structure. After training and practice, the companies' staff became very proficient.

Some thought the solution was to switch to a new SMS software system. This may have been a good idea, but it would not solve the writing problem. If you put inefficient text in, the same would come out. Those that washed and re-structured the text before they switched their systems had the best results.

New Technology and Training

I flew for 27 years, first in cockpits with mechanical instruments and later with data screens. New technology improved safety, but it also introduced new challenges. Flight training simulators were another tool that improved safety. It took a while before we understood how to use simulators efficiently.



Avoid Simulator Abuse

First, we used the simulator to train stick and rudder skills (technical skills). We abused and overloaded the trainees with multiple emergencies until they became saturated. We called this stress training.

Today we focus on building confidence so our pilots know they can handle, for example, a critical engine failure. We focus on both technical and non-technical skills. Non-technical skills include communication and coordination.

Simulator Training Procedures

Today most airlines use simulators to practice Line Oriented Flight Training (LOFT). LOFT is a carefully planned session run in real time. We practice normal procedures, communication and leadership. The trainees will get most of the information ahead of time so they can prepare and maximize their learning. The material includes procedures and a briefing of the session. We also practice some emergencies and unanticipated events, but the scenarios are realistic and solvable when using the procedures correctly.

The Way Forward

What is the way forward if you want to simplify your system? First, you need good content. You need the required facts for training, normal and emergency procedures. Next you must simplify and make it user-friendly without losing facts. Simplification can be a challenge. Without the right tools and knowledge of how to use them, you risk washing out the information you need.

Most support simplification, but few have specific methods for how to achieve it. Simplicity does not happen by itself – you must design it and this requires resources. Simplicity is abstract; it is easier to get funding for technical projects. To succeed we must put a value on simplicity.

You must invest in the training of your own people. With support from management, procedure improvement projects are low risk. They are low tech, do not require new software or hardware, but have huge potential.

Management Must Walk the Talk

There is a clear link between management involvement and the result. In oil and gas, the accountable management is often an oil company. The oil company should be able to identify and praise user-friendly procedures. They should be able to constructively critique overly complex procedures. If they want their suppliers to simplify, oil companies must lead by example and walk the talk when writing guidelines and specifications.



References

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Proactive Aviation Safety Systems, How other industries use aviation concepts, IUMI International Union of Marine Insurance, Terje Lovoy, Genova 2016.

Simplicity Improves Diving Safety, IMCA Making Waves, Terje Lovoy, London 2016.

Resources

[New Teekay Nav Procedures](#) (Video)

[User-Friendly Procedures are Used More](#) (Video)

[BSM Navigation Procedures](#) (Video)

[Simple Word Dictionary](#)