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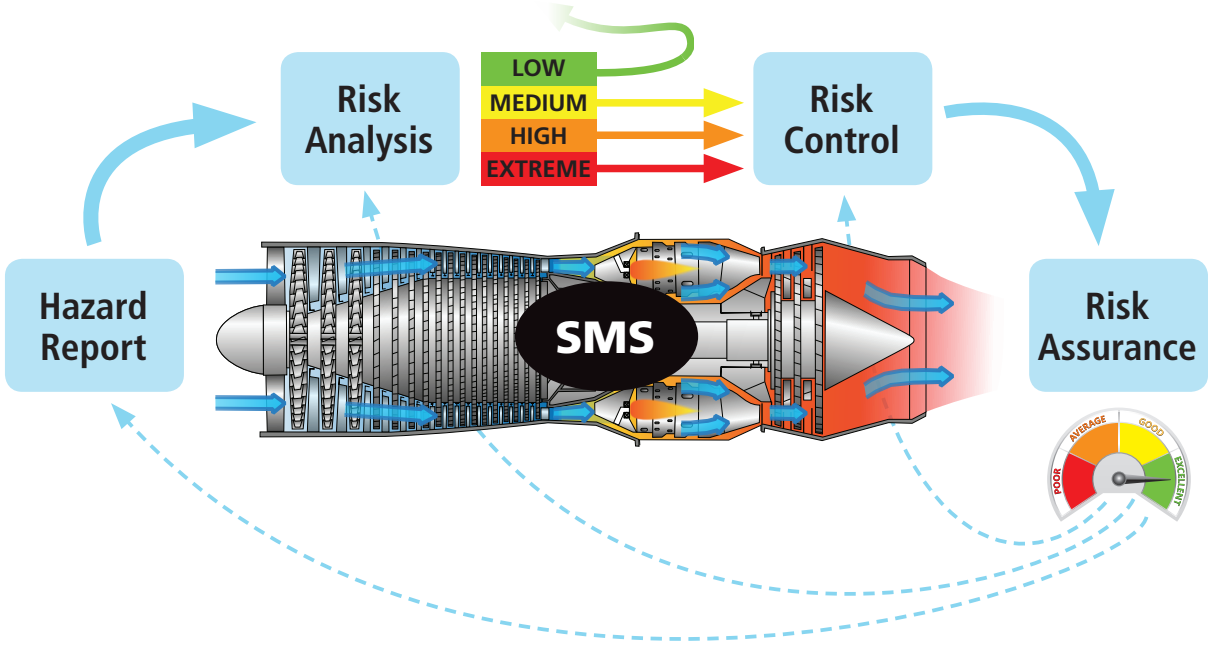

PHYLLIS UTTER/HAI

Figure 1. The SMS "engine" keeps the entire organization moving forward on safety.

Real-World SMS: Risk Assessment

By Bryan Smith and the USHST SMS Workgroup

Discussions of safety management systems (SMS) once mainly involved explanations and definitions for those who had never heard of the acronym. SMS has now, though, worked its way into the common vernacular — at least for commercial aviation.

These days, someone who has not heard of SMS is usually new to aviation, has no aviation background, or is involved in a nonoperational capacity. The key SMS question in the industry today is not "What?" or even "Why?" but a resounding "How?"

Answers to that question are neither as plentiful nor useful as we wish they were. Unfortunately, this has led to widespread grumbling about the value and effectiveness of SMS.

The International Helicopter Safety Team (IHST) believes that SMS is the right tool to improve safety in the helicopter industry and that poor SMS performance usually stems from poor implementation of the program. We hope to help our industry reap the benefits of modern safety management by answering the many questions we all have on how to effectively implement SMS in the dynamic and unique world of helicopters.

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In the last "Real-World SMS" article in ROTOR (Summer 2015, p. 58), we introduced an SMS model based on an engine (figure 1) and discussed how hazard reporting "feeds" the entire SMS process. In order to manage hazards and the resulting risks to your operation, you must first be aware of them.

Now that you have created a robust hazard identification and reporting system, you should have a stack of

Risk Assessment: The Essentials

A risk assessment matrix is a macro analysis of the risks incurred by your flight operation.

- The matrix rates hazards according to their likelihood and severity.
- Use criteria from your operating environment (for example, cost, time aircraft is out of service, number of times a week, type of injury incurred) to define the levels of risk in your matrix. This matrix is for you and your company. Make sure it reflects your real-world conditions.
- Defining the criteria should be a group activity — getting more people involved will increase buy-in.
- Encourage those making hazard reports to include their own assessment of the risk involved; you (and they) might learn something.
- Assign a number to each risk level and color-code the matrix to define high-, medium-, and low-risk potential. Quantifying the levels of risk will help you:
  - Target your biggest hazards in safety and training programs
  - "Bleed off" low-risk items
  - Explain risk to others
  - Track the progress of your safety program.

A flight risk assessment tool (FRAT) is a micro analysis of the risks incurred during a specific flight.

- A FRAT gathers information on four types of hazards: pilot and crew, aircraft, environment, and external pressures.
- Using a FRAT alerts pilots and crews to the compounding risks presented by multiple hazards on the same flight.
- FRATs should ask specific questions that can be easily completed by pilots and flight crews before each flight.
- A FRAT should not just measure risk but should also include ways to lower that risk.
- A free flight risk assessment tool is available at http://bit.ly/ehst-frat.

identified hazards. The question is what to do with this list. Give each hazard equal weight and try to fix them all at once? That approach is guaranteed to fail. Luckily, SMS incorporates a better idea.

The Need for Something New

The "safety" crowd has been crying wolf and declaring the sky is falling for as long as we can remember. Some hazards are overblown — remember the Y2K nonevent? And some people go to ridiculous lengths to eliminate all risk — a process that drains resources, time, and focus and is guaranteed to alienate your management, peers, and staff.

We need to do something that the corporate world fails to do and traditional safety programs largely miss. To manage risk effectively and efficiently, we need to assess it — a part of the safety management process that is simple, powerful, and often misunderstood.

In risk assessment, you methodically analyze the likelihood of a risk occurring and the significance of its impact. When we assess the risk associated with a hazard, we are acknowledging that not all hazards pose the same amount of risk or are worth the same level of effort to correct. Risk assessment enables us to target our safety efforts on where we can contribute the most to the overall safety of our operation.

Into the Matrix

The first step in risk assessment is to construct your risk matrix. Create a grid such as the one shown in figure 2 (available on p. 37 of the SMS Toolkit at http://bit.ly/sms-toolkit). You'll use this matrix to assess two factors about any hazard: *likelihood,* or the probability that the hazard will occur, and *severity,* the significance of the resulting problem.

Some hazards are potentially very dangerous but very unlikely; the ultimate risk is quite small. Being hit by a meteorite while flying around, for example, would likely be catastrophic, but the probability of that happening is so remote that there is little risk involved. Similarly, some hazards, such as bumping your head while climbing out of a helicopter, are very likely to happen but typically carry a low impact.

On one axis of your matrix, rank severity of a hazard from most to least severe, and on the other axis, rank the likelihood from most to least probable. Assign each block in the grid a number. Color-code your matrix so you can easily see what you have defined as high-, medium-, and low risk.

When you create your own risk assessment matrix, you can assign a low number to the high-severity, high-probability events and work your way up, or vice versa. Use red, yellow, or green to color-code your chart or use your favorite colors — it's up to you. What matters is that you and everyone in your organization uses the same matrix to assign severity and likelihood to risks, leading to a structured, consistent approach to risk management.

Put a Number on It

The next part of developing your matrix is to develop standard parameters for the categories in your matrix. While this may sound like a tedious process, this is an opportunity to customize your risk assessment for your operation and your real-world conditions. For example, what does *catastrophic,* the highest level of severity, mean for your organization? Fatality, total loss of aircraft, a dollar amount of costs incurred? Define the parameters for the other severity levels as well.

How about the probability scale? What does *occasional* mean? Once a month? Once a week? Again, there are no universal answers. It depends on what you and your organization decide is reasonable.

We recommend that you define the categories in a group setting, preferably using your organization's

safety committee. If your company is very small, make everyone an honorary committee member.

By defining the categories within a group setting, you create a set of shared definitions that will be used by everyone, leading to consistent risk assessment. You can also use this process as a way to engage management and staff in the SMS process. When the group has decided the difference between a critical and a marginal hazard, for example, you head off the perception that risk assessments are the subjective judgment of the safety manager.

Remember that stack of hazard reports on your desk? The next step is to use the severity and likelihood of each hazard to assign it to a risk category. For example, in the matrix in figure 2, a hazard of catastrophic severity that will likely occur frequently is assigned a 1, while hazards that pose a negligible risk and that are unlikely to occur are assigned a 20. Some hazards will be in the high-risk (or red) category, while others will be in the medium- (yellow) or low-risk (green) categories.

Using the Risk Assessment

Using a quantified approach to risk assessment has several benefits. First and foremost, the numbered categories help you to rank and thereby target your biggest safety challenges. Using the format of the matrix in figure 2, it's pretty clear that a hazard with a ranking of 1 poses a bigger risk to your organization than one with a ranking of 20.

Limited time and resources for your organization's safety, training, or new-equipment purchasing budgets? Concentrate on the high-risk hazards to get the biggest bang for your buck. Wondering what to address in your next safety meeting or in your training program this year? Need topics for the safety newsletter? The high-risk items provide the answer to all these questions.

Besides providing an objective, uniform way to assess risks, by using a risk assessment matrix, you will also be able to track performance as your safety program (hopefully) lowers the overall risk faced by your company. It will also help you create reports for your organization and can be especially useful to explain risk to those who do not fly.

Focusing on the most significant risk factors at your operation should help you mitigate those risks. It also will help you engage others in your safety program. When the boss understands that an issue is being addressed because it carries a high risk of catastrophic loss for the company, your request for funds to address the hazard has a better chance of being approved. For your line-level employees, they will be more ready to schedule a training session or change a procedure if they understand that you are not panicking about every possible hazard but instead focusing on ones entailing significant risk to them, their co-workers, customers, or livelihood.

In addition to the analysis of hazards that are reported or discovered through SMS processes, another great place to include a risk assessment is on the actual reporting form used by staff. Whether it is a safety report, hazard report, safety survey, or other form, asking the reporting individual to assess risk can yield very useful information. What that individual perceives as risk may be different than what the safety officer or management perceives as risk, and it is worth taking a bit of effort to find out why.

Risk Assessment vs. Flight Risk Assessment Tools

Remember that risk assessment is an analytical process. You need to be in the right environment and the right state of mind to conduct a proper assessment. This excludes people who are fatigued, hungry, sick, pressed for time, or otherwise stressed.

In law enforcement, pilots are often dispatched to a call when they hear coworkers screaming over the radio for help with a life-or-death crisis. Even if they had the time to use the risk assessment process at that moment, they would not do a good job of it. In many helicopter industry sectors, the pace and pressures of operations just prior to a flight work against people's ability to make sound analytical decisions.

This is where a flight risk assessment tool (FRAT) comes in. A FRAT is *not* the same as the matrix shown in figure 2.

The risk assessment matrix is a macro tool that is used to determine the acceptable risk parameters of hazards involved in any flight your organization may take. This type of risk analysis is best done as part of a discussion around a table, with your fellow members of the safety committee, ample time, and a cup of coffee.

The FRAT is a micro tool: its purpose is to identify the risk involved in a particular flight. A FRAT asks for specific information about four categories of hazards that can affect a flight (pilot and aircrew, aircraft, flight environment, and external pressures) and quantifies the risks involved.

Using a FRAT reminds us to review hazards and the ways they can compound each other to form an accident chain. For example, if the weather is bad *and* the pilot is fatigued

Figure 2. A sample risk assessment matrix.

	LIKELIHOOD				
SEVERITY	**Frequent**	**Probable**	**Occasional**	**Remote**	**Improbable**
I. Catastrophic	1	2	4	8	12
II. Critical	3	5	6	10	15
III. Marginal	7	9	11	14	17
IV. Negligible	13	16	18	19	20

from a long, busy shift with no rest *and* he hasn't logged a lot of recent flight time in that particular aircraft *and* … you get the idea. A FRAT compiles the risks presented by a flight and produces a total score for that flight.

Flight crews should be able to easily fill out a FRAT, even under the influence of the very risks we are concerned about. Furthermore, the FRAT should guide the crew on how to mitigate high risks to lower risk scores, if possible. For example, if nighttime conditions elevate the risk score, the FRAT should remind crews that using night-vision goggles is a way to mitigate or lower the risk. (A FRAT is really a risk identification and mitigation tool, but RIMT doesn't roll of the tongue as well as FRAT.)

After filling out a FRAT, a pilot should have a clear idea of the risk factors involved in a flight and, most importantly, how to mitigate those risks so that the flight can be concluded safely. To learn more about using a FRAT, visit the U.S. Helicopter Safety Team's FRAT fact sheet at http://bit.ly/ushst-frat.

The European Helicopter Safety Team has created an excellent example of a FRAT, which is available at http://bit.ly/ehst-frat. The tool includes versions customized for different mission profiles, such as fire fighting, helicopter air ambulance, maintenance, or training flights.

Assessment Leads to Control

Let's go back to figure 1, our SMS engine. We started by collecting hazard information, which is the "fuel" for the entire SMS process.

By using a risk matrix, we then determined the risk for each hazard. Some had high risk scores, others were low. As you can see in figure 1, the low-risk items are ported overboard with our risk assessment bleed valve while the high-risk stuff continues through the SMS engine. Thanks to our SMS program, we are not going to be distracted by the unimportant stuff!

Now we are ready to move on to the next step by taking those high-score risk issues and develop methods to control the risk. The risk assessment matrix that we created will help us through the process. Our goal is to lower risk, which is a function of probability and severity. We want to lower one or both of those factors. And because we put numbers to the risk categories, we can easily set defined goals and evaluate the performance of our risk controls.

Just as you can't fix what you don't know about, you can't control what you don't measure. Risk assessment is how we first measure hazards. It will also help us measure how (or if) our safety program is working to improve the level of safety in our organization. Essential steps in risk assessment appear in the box on p. 2.

We'll be back in a future issue of ROTOR with a detailed look at the process of risk control. Meanwhile, please check out the IHST website, ihst.org, for additional information on this and numerous other safety topics — everything we have is free for you to use. Fly safe.

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