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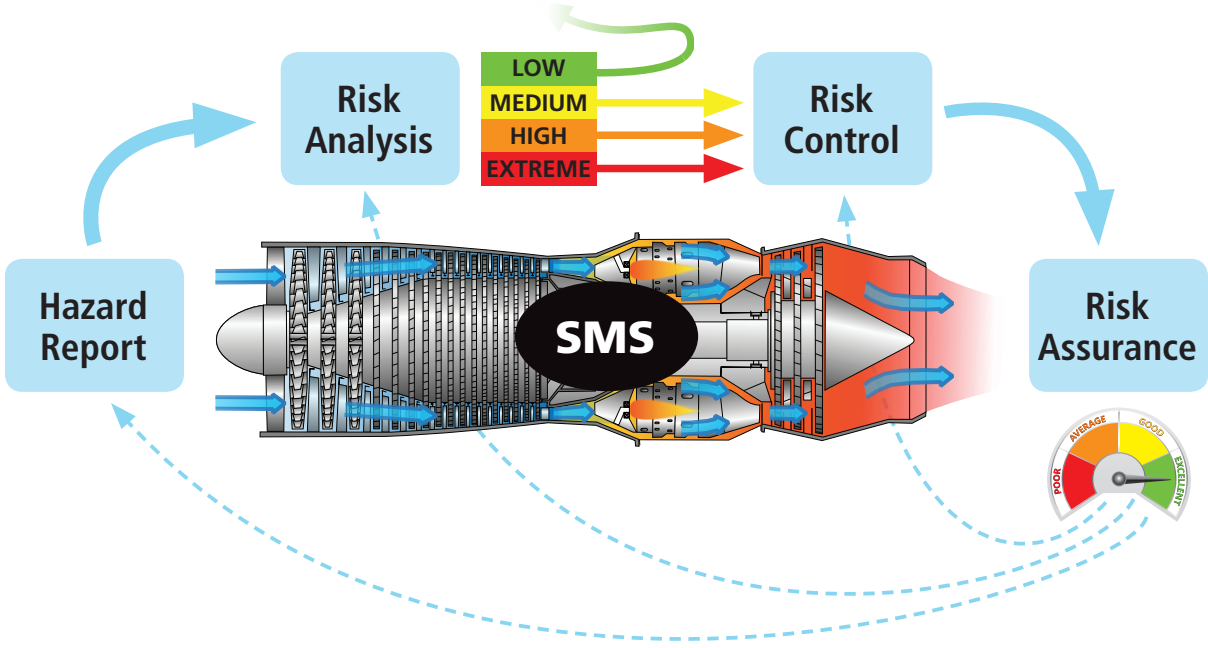

PHYLLIS UTTER/HAI

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

Real-World SMS: Risk Assurance

By Bryan Smith and the USHST SMS Workgroup

Discussions about safety management systems (SMS) often include reassuring statements such as, "You probably have many of these SMS components in place already." For the most part, this is true. Standard operating procedures usually require SMS fixtures such as a parts inventory and tool control or incident reports.

So if you already have some SMS elements in place, how will a formal SMS program make a difference in your operational safety? It is those missing pieces of SMS that are usually the key elements in taking all of those parts and making a functional, efficient, and effective safety system.

Consider a hangar floor full of various aircraft parts. Individually, they function perfectly as designed. You may even have an engine together and running on a test stand. But it is not until they all are put together and turned into a flyable aircraft that those parts deliver the services you purchased them for.

A modern SMS takes a traditional safety program and creates a system that enables those separate pieces to deliver measurable reductions in risk.

Measure Results and Modify as Necessary

One critical piece to the safety puzzle that most traditional programs are missing is safety assurance. Is all of the time and money you spend on safety working? How do you know? Too often, a safety measure is simply put in place and assumed to be working. We can do better — and to be effective in our efforts to improve safety, we have to do more.

This series of ROTOR articles was designed to help operators effectively implement SMS in the real world. Our first article (Summer 2015, p. 58) introduced a simple SMS model (figure 1). That article discussed how hazard reporting and data collection feeds the SMS engine.

In the second article (Winter 2016, p. 88), we looked at how we analyze risks to determine the severity and likelihood of each risk, with the goal of focusing our efforts on hazards that pose the most risk to our operations. The third article (Summer 2016, p. 62) covered the art of designing ways to

control and mitigate risks.

Now, in the fourth and final article of the series, we will look at the next step in the SMS process: risk assurance. This is where we measure the results of our risk controls: Were they effective in reducing risk? Do they need to be adjusted? Let's look at how you can use risk assurance to ensure that your safety program is working.

SMS in Action

Let's say we have determined that bird strikes are a hazard at our operation. The first step in responding to that hazardous condition is to assess the level of risk it presents.

Remember the matrix you used for your risk assessment? Hopefully it had both colors and numbers such as the sample in figure 2 from the IHST SMS Toolkit. It is not important if the red section is paired with higher or lower numbers — we just need a way to distinguish the low-risk hazards from the higher risk ones. In our matrix, a Category 1 hazard presents the highest risk to our operation, and a Category 20 presents the lowest risk. The numerical risk value is based on both the *likelihood* of a hazard leading to an incident and the likely *severity* of the resulting incident or accident.

Our safety committee evaluates the likelihood of a bird strike and determines that they are probable. In addition, the committee believes that a bird strike could create a critical-level accident. The resulting score: bird strikes represent a Category 5 risk.

In other words, the safety committee has determined that a bird strike is likely to occur, and when it does, it is likely to result in an accident that will result in serious damage and/or injury. Sounds like some risk control is required in order to improve the safety of the aircraft and crew.

After conducting some hazard analysis (as explained in our Summer 2016 article), the committee decides to equip all flight crews with helmets and to require crew members in the front seats to have a visor down at all times. These risk controls are aimed at lowering the severity of a bird strike.

In addition, the committee found a large percentage of bird strikes appeared to be near a specific geographical area, a nature preserve. Hoping to reduce the likelihood of a strike, they implement new training for staff designed to help them plan flights that avoid this high-risk area as often as possible.

Create Metrics

So far, our safety committee has defined the hazard — bird strikes — and rated the level of risk it posed to our operation: Category 5. Next, the committee identified several approaches to lessen the severity and likelihood of bird strikes. Now it's time to create metrics around our risk controls.

Metrics are important because they provide context for our risk controls. Metrics tell us where we begin, where we want to go, when we reach our target, and whether our efforts are or are not working.

For example, we note that there were four bird strikes in the last six months. Only 10 percent of our flight crews have helmets with a visor system. This is our starting line.

The committee sets two follow-up dates with associated objectives to help us reach our goal.

The first objective is that within 90 days, all training is complete, helmet bids are received, and a purchase plan is in place. When implementing a new risk control, it's a good idea to create a 90-day phase-in period. The majority of new ideas fail within three months, so building in an early evaluation will enable you to spot implementation issues and possibly tweak strategies.

Next, the committee sets a longer-term objective: after nine months, there will be a 50 percent reduction in the number of bird strikes and 80 percent of crews will have helmets and be wearing them. This longer term objective is nine months out because the committee wants six months of data after the initial 90-day set-up phase.

Why not set an objective of 100 percent for both crew compliance and bird-strike reduction? Remember, these are objectives, not goals. The goal is 100 percent, but in the real world we understand that often it takes time to get there. Stay realistic and keep the objectives achievable.

Measure Implementation and Risk

At our follow-up dates, it is time to hook up the gauges and check the performance of our SMS engine. We want to measure two specific indicators: implementation and risk.

First, how well was the proposed risk control implemented? We all know that some risk control ideas do not materialize as planned, if they even make it off the paper at all. That idea that sounded so great in the conference room sometimes does not work so well in the cockpit.

So how did we do? Were the helmets purchased? Have flight crews been avoiding the nature preserve as planned? Did they all get trained?

The answers should be more than just yes or no. Just as you created metrics for your objectives, express your progress in numbers as well. How many helmets were purchased? What percentage of training was completed? How many times have crews still flown over the nature preserve?

Second, we want to reevaluate the risk score. Has there been a shift in either the likelihood or severity? If so, what is the score now? Again, we want a number. Safety performance needs to be a fact, not an opinion.

Let's say that after six months of utilizing new flight-planning procedures designed to avoid the nature preserve, we had two bird strikes. This is 50 percent less than the number of strikes in the six months before the new procedures.

Looking at our risk matrix (figure 2), we see that we can lower our likelihood category to occasional, or remote, depending on the definitions set for each category by your committee (see Winter 2016, p. 88 for more information on category definitions). Simply reducing the likelihood of a bird strike lessened the risk. If we continue to implement this new procedure, we may see the number of strikes decrease even further in the following six months, changing that risk score even more.

If we have been successful in purchasing and using helmets with

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

visors, the severity element of our risk score will be lowered as well. Let's say that regular use of helmets and visors lowers the severity of a bird strike to marginal.

Safety by the Numbers

By implementing our risk control plan, we have lowered the risk posed to our operation by bird strikes from a Category 5 (probable and critical) to a Category 11 (occasional and marginal). We now have a definite, quantified answer when asked about the benefits of implementing the risk controls.

When questioned about the increased fuel costs from using alternate flight routes or additional funds for helmets, the best answer a safety officer working outside of the SMS process could give is often "Yes, it seems to be working." This is a subjective statement that could easily be argued against.

With the benefit of the data-driven SMS process, we have a much better answer when flight crews question the necessity of doing additional work or adjusting to new equipment. Now our answer is "Yes, it is working. Our incident rate has decreased 50 percent, and the severity of a bird strike — the risk of one turning into a critical incident — has been decreased from a high to moderate risk level. Overall, the risk score associated with this hazard has improved 54.5 percent."

Your results may not be a 100 percent reduction of the risk. In fact, in the real world, they probably won't. We can lower the likelihood of a bird strike and lessen its severity, but without taking birds out of the air, there isn't a way to eliminate the risk. But SMS is not about eliminating risk. It's about analyzing hazards, targeting the ones that pose the most risk, and employing data-driven strategies to decrease the risk.

Focus on What Works

You devil's advocates out there have noticed that this is a best-case scenario; in the real world, things do not always go according to plan. You are right.

How often have you encountered safety training, equipment, or procedures that simply do not work? For most, several examples come to mind. It's bad enough that they don't accomplish their purpose of making us safer. Even worse, those lame-duck items linger around, dragging down our operations and adding work to an already busy day for no discernable reason.

Why is it so difficult to abandon them? Often it is because of fear. Safety policies and procedures, once established, become unquestioned gospel. Few of us are willing to get rid of them unless we are 100 percent certain that eliminating the element in question will not lead to disaster down the road.

We all have ineffective safety "stuff" in our operations. SMS can help us fix that. Remember, one way in which SMS is a different approach to safety is its emphasis on metrics and data. We use a numeric score in our risk assessment matrix so we can keep focused on the hazards that pose serious risk to our operations and not be sidetracked by those that don't. When we plan risk controls, we use metrics to create a baseline of where we started and metrics to define what success looks like. During our risk assessment, we measure progress numerically, so we can keep controls that work and adjust or eliminate those that don't.

Real-World Implementation

Unfortunately, in the real world, risk controls are not always successful. But because our risk controls are based on metrics that can be analyzed, we can go back and see what part of the implementation plan did or didn't work. Let's look at the four different scenarios (figure 3) that can occur when you implement a risk control in an effort to improve a risk score.

Effective Implementation, Improved Risk Score

This scenario is the best case possible: your implementation plan was carried out successfully, and your objectives were met. The result is an improved risk score.

Continue to measure the performance of your risk control and tweak the implementation plan as necessary. We need to ensure the risk control continues to perform as expected, and to try to reduce risk even more if possible. Also, data is generally not considered valid until you have about two years' worth. Continuing to monitor performance will help confirm the improvement was not just coincidence.

Poor Implementation, No Improvement in Risk Score

Sometimes, when we look at the implementation portion of a risk control, we see that the risk control was not implemented as planned. There are numerous reasons why this could happen: lack of funding, poor training, uncooperative staff, incompatibility with real-world operations, and so on. As a result, the targeted risk score is not improving. Instead, it is the same or even worse.

It is time to tell your safety committee that the plan is not working because of poor implementation. Some plans are great on paper, but difficult or impossible to implement.

Don't be in love with the plan, be in love with results. The team needs to determine what is stalling the process and either fix it or design a new implementation plan.

Figure 3. Assessing risk control performance.

		IMPLEMENTATION PERFORMANCE	
		GOOD	POOR
RISK SCORE PERFORMANCE	Better	Continue risk control; measure and adjust results as needed to meet objective	Risk control ineffective; consider new hazard factor to target and measure
	Same or Worse	Risk control ineffective; consider new hazard factor to target and measure	Adjust implementation plan to increase effectiveness

Poor Implementation, Improved Risk Score

Another possible result is that the risk score has improved despite the lack of implementation. This usually indicates that your planned risk control has little influence on the targeted hazard. For example, let's say that bird strikes have decreased even though aircrews are still flying the same routes over the nature preserve.

When this happens, you should go back to the safety committee and look at all of the hazard elements uncovered in your analysis (see the Summer 2016 article for more information on hazard analysis). Is there another one that may have a more powerful effect on risk? Is there a different way to attack the same element? For example, a different altitude or different route around the preserve?

Effective Implementation, No Improvement in Risk Score

The fourth option is a risk control that was implemented as designed and yet, the risk score for the hazard has not improved. Again, this happens when we target an element of the hazard that does not have a major influence on the overall risk. In our case, it may be that flying over the nature preserve did not really influence the risk of a bird strike.

As in the "Poor Implementation, Improved Risk Score" scenario above, it is time to change the plan. Go back to the safety committee and brainstorm what else influences the risk level and redesign your implementation plan.

Keep Only What Works

Whatever the reason, unless you have positive performance in both implementation and risk, stop what you are doing. Something needs to be fixed. Do not continue simply because the plan was given the "safety" stamp of approval.

It may seem embarrassing when our plans do not work out. However, it is important to let everybody know that a poorly performing risk control will not be tolerated. This sends a message that any safety-related equipment, policies, and procedures are there because they actually work, not to satisfy the requirement that a box be checked on an arbitrary safety checklist. By emphasizing your interest in effective safety measures, you will reinforce confidence in those risk controls that do survive the performance test.

The End?

Here we are at the end of our process to control the risk of bird strikes … or are we?

That's a trick question, really, because safety is an ongoing process — a journey, not a destination. Conducting 100 days of accident- and incident-free operations does not mean that the 101st day is risk-free.

One of the strengths of SMS is that it recognizes that managing safety is a continuing process. All of the performance information from our risk assurance efforts — both good and bad — should be analyzed and harvested for data to be fed back into the front of our SMS engine. It is all useful hazard information that can be used to improve our future risk analysis, risk control, and risk assurance efforts.

Remember, performance markers are the objectives we set to help us achieve our goals. They are bricks in the road to a safer workplace. Regular checks on this data lets us know where we are on that pathway, and what we need to adjust to keep us on the road.

Nothing is sacred but the goal of conducting our operations as safely as practical. Anything that does not help us meet that goal is subject to change. Empower yourself with the facts needed to make the necessary decisions.

Safety officers are often asked, "Does all this work on safety actually make us safer?" The question cannot be answered without defining what *safer* is. It is not necessarily the absence of accidents — that may mean we are just lucky. And many years of accident data show that having a collection of safety documents and policies or posters on the wall does not make us safer.

Safer is a quantitatively verified reduction in the likelihood or severity of an identified hazard at your operation. There is no reason to settle for anything less.

Bryan Smith is a member of the U.S. Helicopter Safety Team (USHST) — part of the International Helicopter Safety Team — and serves on the USHST SMS Workgroup. He is also the safety program manager for the Airborne Law Enforcement Association (ALEA). Bryan is a full-time pilot for a sheriff's office in central Florida, where he flies a variety of public-safety missions.

1920 Ballenger Avenue, Alexandria, VA 22314-2898
703-683-4646 | rotor@rotor.org
www.rotor.org