



The **risk analysis** segment of an SMS is where the work gets done. It is here where hazards, potential hazards, incidents and accidents are analyzed with the intent to lower the risk to ALARP (As Low As Reasonably Practical). The risk analysis will fall into 3 categories.

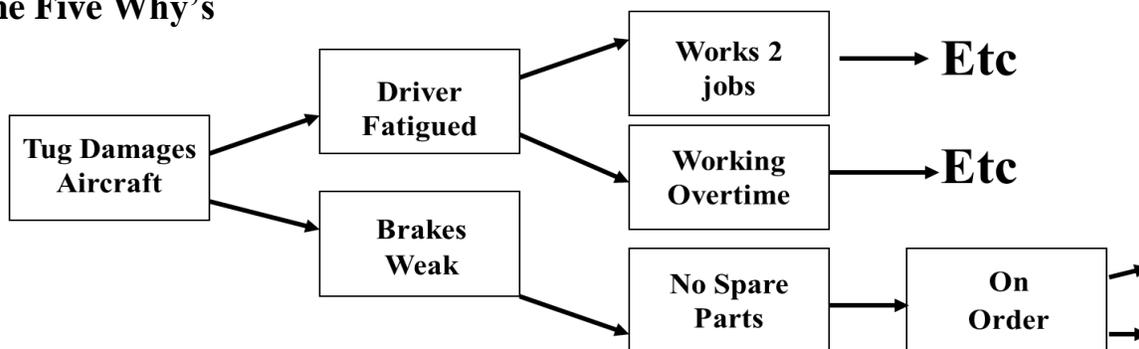
1. **Reactive.** The error has occurred and the analysis will work to answer the following questions: What happened? Why did it happen? What were the contributing factors in

this occurrence? What were the root causes? And finally the most important: What can we do to help ensure that it doesn't happen again? For decades, reactive has been the most common form of analysis carried out. I spent seven years in the TSB/C doing exactly that.

2. **Proactive.** A hazard has been identified and now you have to analyze it to determine just how much of a danger the hazard is. This will be the most common form of analysis in a successful SMS.
3. **Predictive.** There are no hazards that have been identified, but, a new endeavor calls for predicting what hazards there could be if the organization goes ahead with the endeavor. A hazard is simply "anything that could cause us grief." You are looking for what could go wrong with what we are planning on doing.

There is no one risk analysis tool that will ideally cover all three categories of risk so let's start with a very simple one.

a) The Five Why's

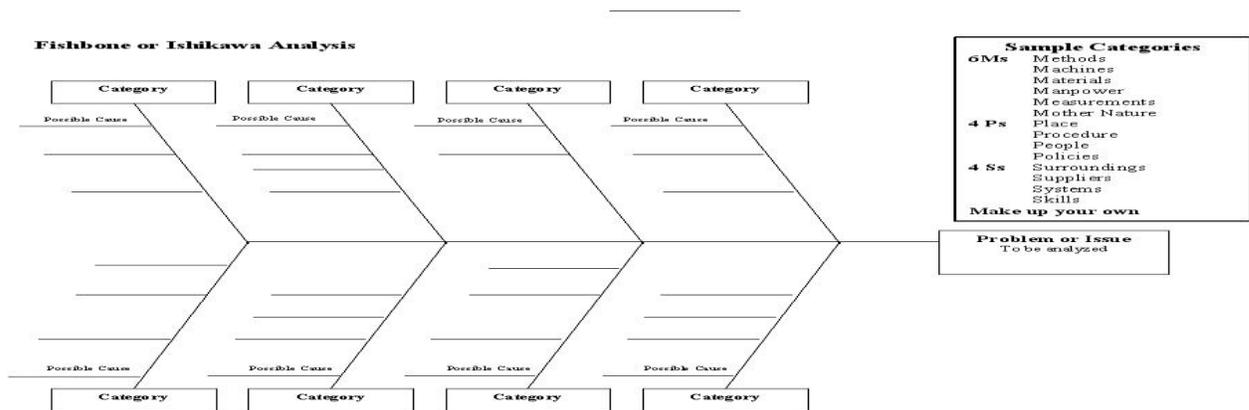


- Useful for **reactive** incidents only
- Simple to use
- Will help get to root cause(s)
- Easy to miss multiple contributing factors

b) The MEDA (Maintenance Error Decision Aid) SEDA (Safety Error Decision Aid)

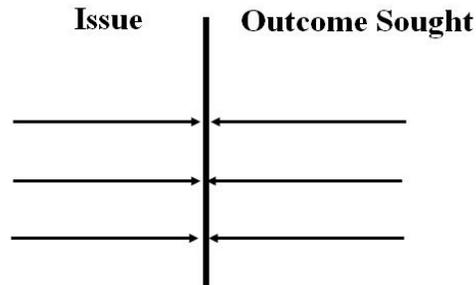
- MEDA is a **Reactive** tool to find root cause contributing factors and produce corrective actions for maintenance errors made mainly at major airlines
- This six page form was developed by Boeing to assist airlines in investigating their maintenance errors
- It is not copyrighted and can and should be adapted to suit you
- SEDA was adapted from MEDA by System Safety Services for smaller companies
- SEDA contains all of the Dirty Dozen contributing factors to human error
- SEDA is five pages in size and also can and should be adapted to suit.
- SEDA can be seen and downloaded from our website (www.system-safety.com) under Articles, SEDA
- Both are excellent tools to lead you to root cause contributing factors and corrective actions to prevent a reoccurrence.
- Both should have some training to obtain maximum benefit from them. If you own a Boeing product the MEDA training is free, or at least used to be.

c) The Fishbone (Ishikawa) Analysis



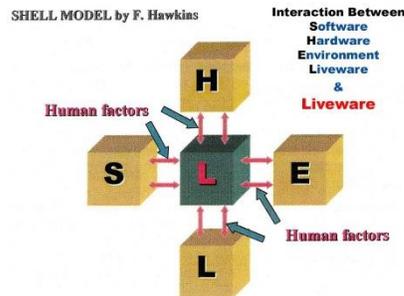
- Usually used for **proactive** and **predictive**
- Simple to use
- Will help determine root causes
- Great for brainstorming
- Will require training to gain maximum benefit

d) The Force Field Analysis



- Is usually **Predictive**
- Very simple to use
- Helps identify potential problems and solutions
- Great for brainstorming

e) The SHELL Analysis



- Can be used for **Reactive, Proactive** and even **Predictive**
- Popular, as it places the contributing factors into categories
- Makes it easier to determine multiple root causes
- Will require training

f) GAR (Green Amber Red) Analysis

- Is a **Proactive** tool to assess or analyze a pending situation
- **G** (Green) normal or low risk
- **A** (Amber) Guarded, Medium risk
- **R** (Red) High risk, May require backup
- Requires prior determination as to what constitutes each of the colours
- Requires some training on how and when to apply
- Used by police and in some cases military
- After 9/11, Homeland Security added a Blue between the Green and Amber and an Orange between the Amber and Red for possible terrorist attacks

g) Go, No-Go Analysis

- Is an excellent **Proactive** tool to determine risk
- Requires development of a form and trained personnel to use it

- A go/no-go number has to be established with rules that this number cannot be ignored
- For example:

• An Air Ambulance is about to dispatch on a night VFR Flight.	
• Score each prior to take off (10 (Bad) to 1(Good))	
1. Task Mission Complexity	_____
2. Crew Experience/Selection	_____
3. Crew Fitness	_____
4. Environment (Weather, Equipment)	_____
5. Planning	_____
6. Supervisory Control	_____
Total	_____ Go ___ No-Go ___
All Criteria must be determined <u>before hand</u>.	

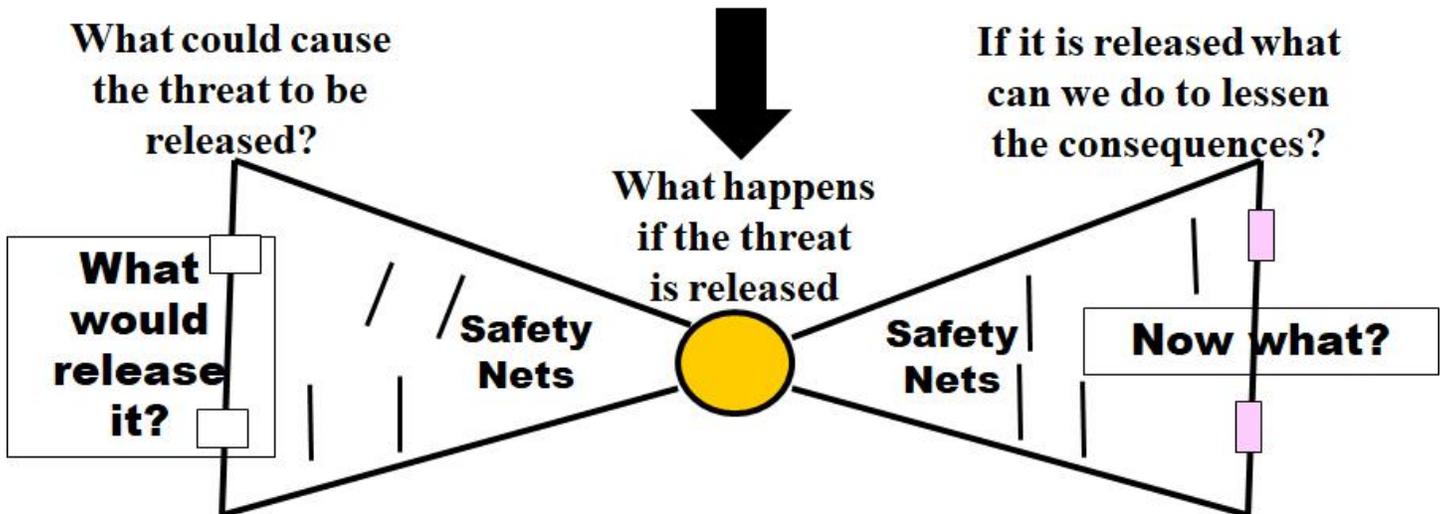
h) TEM (Threat & Error Management)

- A relative new comer to risk analysis, it is **Proactive** and mainly used by pilots
- In its simplest form the pilot first looks for threats to the Safety of a flight and red flags them so he is prepared to deal with them
- He then anticipates what could occur and seeks to avoid them
- If one of the threats still comes to be, he is able to recognize and trap it
- Should the threat still occur, he is prepared to recover and manage it
- This model requires training to understand how to be prepared for all phases
- It is a more comprehensive version of “Take a Minute for Safety.”



i) The BowTie Analysis tool

What is the threat?



- The BowTie Analysis is an excellent tool, and mainly **Proactive** and **Predictive**
- It looks at what is likely to occur if the threat (hazard) is released (happens)
- It then looks at what could release the threat
- Safety nets (also called barriers) are developed to help prevent the release
- The Safety nets are given a % number for efficiency in preventing the release
- It also looks at the possible consequences if the barriers fail and the threat occurs. It then looks at Safety nets to lessen the consequences.
- Once completed, one has a very clear visual picture of the threat
- It is very time consuming
- It requires training to obtain full use of it
- There is a computer program that will assist in building the diagram

There are many other tools developed to determine risks in a given operation. Programs such as **Fault Tree Analysis (FTA)** is mostly **Predictive**. It was heavily used on the space shuttle development and asked a lot of "ifs." If this pump fails, what are the consequences and how do we lower them? **Flight Risk Awareness Tool (FRAT)** is likened to our "Take a Minute for Safety" or simply what can go wrong and how do we mitigate the risk?

The next step is to determine the Severity and Probability of the identified hazards. If you go back to Article 14, May 2016 issue, you will find a few models to help determine the level of risk.

All of this information must go into a database. Without data all you have is a person's opinion. This data is critical to obtain maximum benefit from your SMS. Excel can be used for a small company, but here is where a computer program tailored to your requirements is most beneficial. The regulator will want to see your data and what you have done with it. It can quickly tell them if you have a true functioning SMS. Too little data will indicate your SMS is not working.



Too much data without the corresponding corrective actions (CA) will indicate your SMS is not working.

But a reasonable amount of data with corresponding CAs will indicate a functioning SMS that will require less auditing.

This data will:

- a) indicate success of your HF & SMS training
- b) contain the "*Free Lessons*" that the reporting system will provide
- c) enable a company to have a clear picture of error potential (greatest error risk)
- d) indicate success in the management of risks
- e) indicate where improvements may be required
- f) help ensure that your Safety is truly ALARP

Your SMS is now well on its way, but still requires a few more steps to reach its full potential towards bringing about a true Safety Culture.

If it was easy everyone would have at least one SMS, but while Safety is hard, it is also rewarding and necessary in our Safety critical industry.