Introduction

Defining the scope of an investigation is one of the most important things to do, but also from experience one can say that it is most often forgotten. Often the investigation team or the lead investigator his left to define the scope themselves and although this has its merits, if the investigator is not suitably experienced you are likely to end up with an overdetailed , overly complex investigation reports that doesn't truly attack the root causes of the issue.

During the planning phases of the investigation one thing that the senior management team of an organisation will set out is the level or the depth of the investigation. There are a number of ways of doing this and on the course we discussed the two principal methods:

- HSG245 approach
- Network Rail Proportion Response Model (PRM)

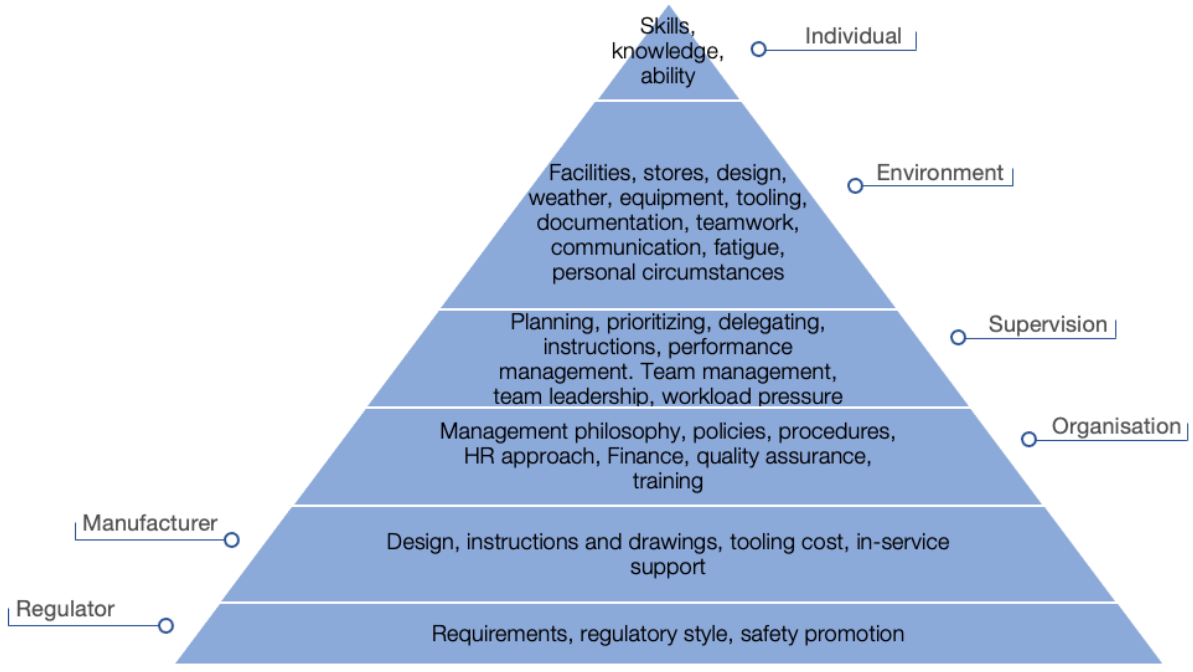
Although not an advocate of the PRM approach , feeling it is a bit of a sledgehammer to crack a nut, the stage 3 element looking at the wider issues is a very relevant exercise in helping define scope. In the model itself stage three is used to either extend or attenuate the investigation level , where is a better use is actually to help shape the depth the investigation is set to go towards.

It is likely that the scope will include:

- Identification of the lead organisation
- Brief details of the adverse event to be investigated (type of adverse event, date, location)
- Identification of the person appointed as lead investigator
- The objectives of the investigation

System of maintenance

As you recall from the course we spoke of the system of maintenance or the system of influence which is depicted below. The principle of this pyramid is that it covers all three of the human factors causes and probe further down to look at the manufacturer and the regulator perspectives.



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Depending upon the investigation experience of your lead investigator will to some extent determine the depth they are prepared to go down into the pyramid. Experienced technicians who are new to investigating will tend to stop in the first two layers, and often avoid some of the management and organisational issues that might arise. A well-defined scope will help the lead investigator effectively 'loaning' them the senior management authority to go looking for far-reaching organisational issues.

If your lead investigator is from within your organisation, a well scoped and well managed investigation should be able to competently address the first four layers of the system of maintenance. The RSSB guidance on human factors 10s to stop at this stage , however, it is our experience but good investigators that have many years' experience of investigating are able to probe down and look at issues associated with the manufacturer and the regulation. A good example is in the case study below.

Case study

On the 24th of May 2013 a British Airways Airbus aircraft departed London Heathrow. During take-off from Runway 27L at London Heathrow Airport, the fan cowl doors from both engines detached from the aircraft, damaging the airframe and a number of aircraft systems. The flight crew elected to return to Heathrow and on the approach to land on Runway 27R, leaking fuel from a damaged fuel pipe on the right engine ignited and an external fire developed. The left engine continued to operate satisfactorily throughout the flight. The right engine was shut down promptly, reducing the intensity of the fire, and the aircraft landed safely. It was brought to a stop on the runway and the emergency services were quickly in attendance. The fire in the right engine was extinguished and the passengers and crew evacuated via the emergency escape slides on the left side of the aircraft.

The investigation determined that a maintenance error had led to the fan cowl doors on both engines being left unlatched following scheduled overnight maintenance on the aircraft (pictures above). The unlatched condition of the fan cowl doors was not identified prior to the aircraft's departure the next

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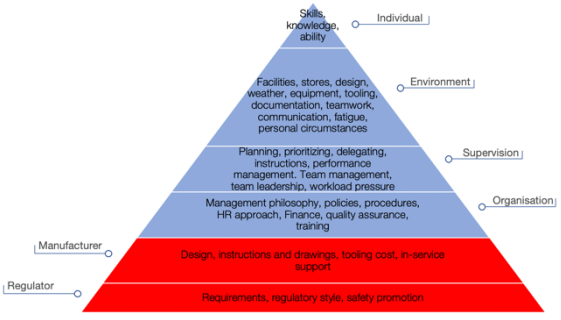
morning. A number of organisational factors were contributory to the maintenance error. The operator has since taken action to address these issues.

Now I'm reasonably confident that anybody that has worked on aircraft with wing mounted engines such as those here will be familiar with the challenges associated with latching and unlatching these doors. When we consider the human factors elements one of the biggest problems is that when the latches are undone if someone goes underneath they will catch their back on the latches which is very painful and because of this common practises emerged to open the cows and then close the latches. This meant that the only indication define cow was unlatched was a small deflection as can be seen in the picture above on the left. Both Boeing and Airbus started painting the catches red so that it would be easy to identify them when they're open, however the incidents still continued to happen. In 2013 there was three occasions when aircraft were dispatched with fan cows unlatched.

All of these incidents had been investigated but in most cases the root cause stopped at the organisational issues and didn't move further to address the challenges around manufacture and regulation. The issue lies in the fact that two spot and unlatched fan cow requires the maintenance crew or the flight deck crew during their walk round inspection to spot the cow as unlatched. Assuming it is a bright sunny day this is entirely possible, however if it is dark wet and miserable it is highly unlikely that people are going to lie on a wet floor to see if the cows are latched which is what is required.

Knowing this human factor limitation allowed the AAIB to dig deeper into the British Airways incident and place recommendations that fan cowls have a micro switch which shows a flight deck effect such that when take-off power is selected, and a fan cow is unlatched.

This, and numerous other similar events, shows that Airbus A320-family aircraft have a history of departing with the fan cowl doors unlatched. It is also evident that, in practice, the flight crew walk-around inspection is not entirely effective in detecting unlatched fan cowl doors and therefore a design solution is necessary. Enhanced methods of detection through design solutions are being considered by the aircraft manufacturer.



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Typical investigation objectives

The idea of setting investigation objectives is not to constrain the investigation team to look in certain areas only. The purpose of the investigation objectives is to allow the team to focus efforts in areas where the senior management believed most impact can be achieved as ultimately it is the senior management team they have to deliver the regulatory response.

When writing a scope for an investigation it is always worth putting the caveat in there that the investigation team as full and free authority to adjust the scope in light of any evidence presented. As an example of typical investigation objectives we would suggest the following:

- Determination of events leading up to the adverse event
- Identification of the immediate and underlying cause(s) as well as any contributory factors
- Identification of recommendations that could mitigate or eliminate the risk from such adverse events in future
- Any objectives which are specific to the adverse event, such as reputational lose and recovery
- Reporting of safety-critical issues found during the investigation by the lead organisation and which justify remedial action before the investigation report is completed
- A well-structured written report of the investigation containing any recommendations signed off by the investigation panel members
- Completion of the investigation within a defined time limit. The principle of proportionality is useful in setting the timescale
- In the case of a SPAD, specific and final confirmation, as agreed with the infrastructure manager, of the SPAD type as specified by NR or the alternative conclusion (together with the reasons for such a change)

Further reading

RIS3119
AAIB report 1/2015

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