

## An accident investigation: Case study and lessons learnt

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### INTRODUCTION

On 12 October 2007 an Air Defence Artillery (ADA) shooting incident took place during a training exercise at the Combat Training Centre in Luhatla. The author expresses his sympathy for the parties affected by this tragic event. The board of inquiry (BOI) convened a technical committee (TC) that was tasked with investigating the failure identified by the failure review board (FRB).

### INVESTIGATION PROCESS

#### Appointment of a technical committee

The board of inquiry decided that the technical committee (TC) chairperson was to preferably be an accredited engineer outside the employment of the SA Army, Armscor, the Original Equipment Manufacturer (OEM) and/or a Filial thereof. Trevor J Kirsten of the CSIR was appointed chairperson of the TC. His vast experience in defence research at the CSIR spans for almost 20 years. The technical committee coordinated its activities with that of the FRB without forfeiting independence. The TC was to investigate the verified Prime Mission Equipment failure but was not restricted to address other related failures identified during the investigation. The TC had free access to any product data and other related information deemed necessary to ensure a successful finding. When any constraints were experienced, the TC Chairperson had direct access to the President of the BOI to request appropriate action. The TC met at various times and at venues determined by the TC Chairperson. Owing to time constraints, the TC endeavored to not exceed 5 November 2007 to conclude the investigation and submit findings.

The proceedings of the TC were strictly confidential and therefore this report only provides generic information and insights.



#### User briefing

The first activity of the TC on the 25 October 2007 was the briefing by the SANDF officer who had been responsible for the incident investigation until then. This covered what had taken place on the day of the incident, the procedures followed, the initial findings and the areas requiring further investigation. This presentation included excellent photographic and video information.

#### Forming the right team

The TC Chairperson, after getting a feel for the scope of the investigation decided on the composition of the TC. He approached various individuals, some of whom were available at short notice and others not. It is felt that the final group was well balanced in terms of the required skills and representation. The areas covered were accident investigation, weapons system expertise, structural and material expertise, system integrity and safety, logistics, programme management and user system expert.

#### Equipment manufacturer representative visit

The design authority for this system is from overseas but is supported by a local organisation. The TC spent time with the equipment supplier on 29 October to familiarise the members with the equipment, supply history, maintenance, training and other pertinent issues.

#### Site visit

TC visited the equipment and maintenance organisation on 30 October. Here the actual equipment's operation could be understood. Some operational and maintenance staff were interviewed to understand the events around the incident better. The training unit was also visited to ascertain the training background of the crew and the procedures followed.

#### Dividing the investigation

It was clear that time would be extremely limited due to the sensitive nature of this incident, and an answer was needed quickly. It was therefore decided to split the team into different areas of investigation. Due to the excellent mix of skills this could be easily done. The individuals and smaller groups then performed independent investigations. They gave feedback and the outputs were reviewed by the larger group as required.

#### Further experts in key areas

It was vital that the technical evidence presented was irrefutable. Therefore, as the investigation progressed, it became clear that further experts were required to understand the failure. This led to bringing in specialist skills to perform certain key investigations and tests. The overseas supplier was also requested to provide specific information regarding the investigation. The design authority and original equipment manufacturer is best positioned to answer questions that go back far into the systems history.

#### Test data

The key element of this investigation was the experimental analysis and simulation of the failure. This ranged from metallurgical analysis to mechanical testing. The tests made use of in service components and sub-systems to make them as realistic as possible. Once the failure could be repeated under controlled conditions, the committee knew that irrefutable evidence was in place. This ended in the manufacture of a working model that could replicate the failure and it proved an invaluable tool for demonstration.

#### Consolidation

After all the evidence had been analysed, conclusions were drawn, reviewed and unanimously accepted by the TC. The next step was to consolidate all the information into a technical report that would stand up as a reference source in years to come when the authors may not be available. From this report, presentations were also generated for various audiences such as the BOI, FRB, manufacturer, stakeholders, and affected parties. These had to be pitched at the correct technical level to ensure a good understanding when taking the technical knowledge of the audience into account.

#### Presentation

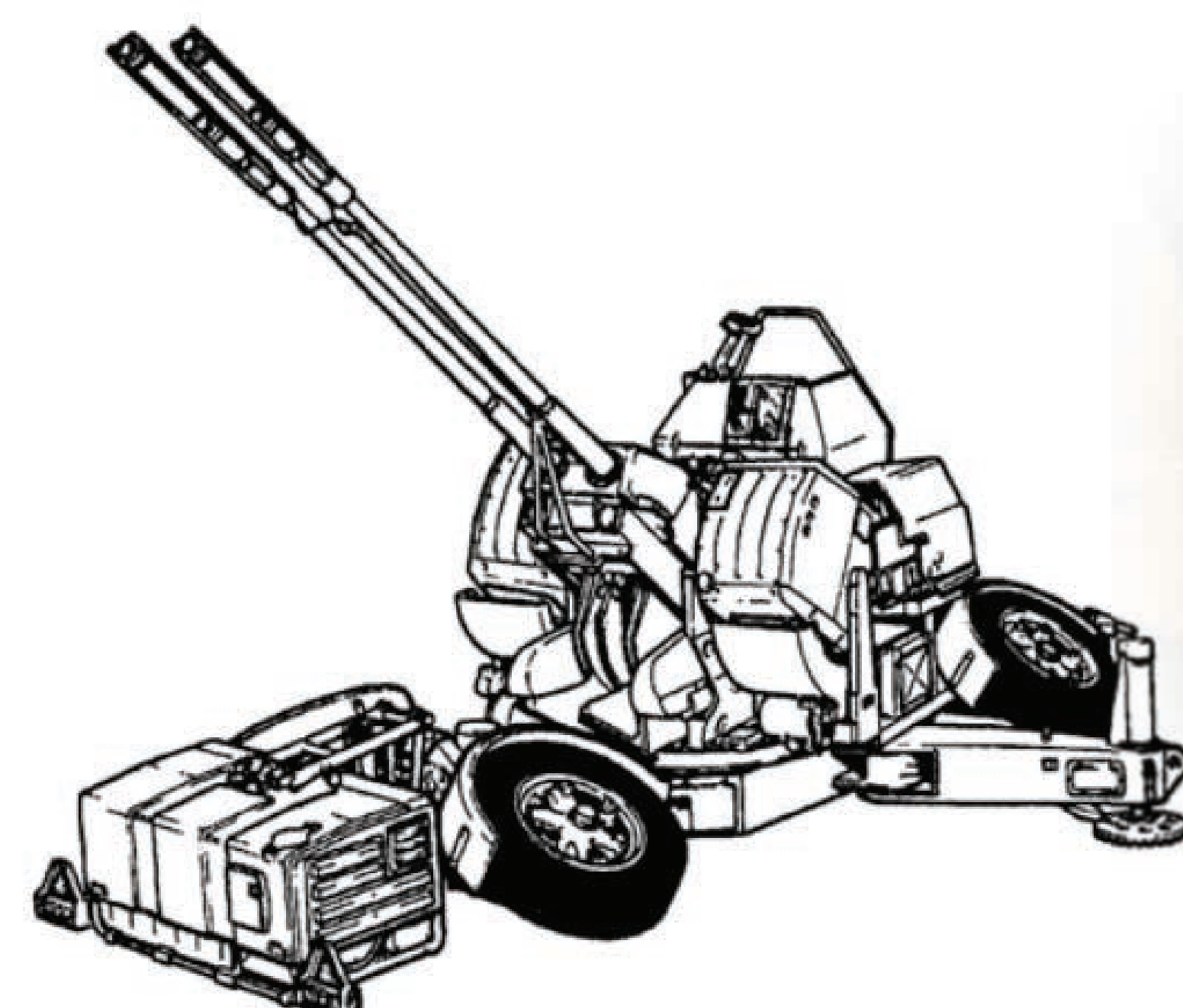
The TC determined the most likely cause of the failure and reported this to the BOI. Recommendations have been made regarding system safety and corrective actions. A proposal has been submitted regarding the future role of the TC in the implementation of these recommendations. The TC also identified other issues that relate to short comings of the product system management and suggestions have been made in this regard.

#### CONCLUSIONS

An accident investigation of this nature is thankfully a rare occurrence. The procedures and practices are normally not well understood and experts hardly ever have experience in this area. Therefore, this case study was presented in generic terms, to not breach confidentiality but to give some guidance, possibly for future use.

Some ingredients considered key success factors as extracted from this case study are:

- Clear guidelines that describe the expected outputs and allowed activities
- Composition of the team to meet the requirements of the investigation (not too big)
- Having knowledgeable experts in the relevant fields who are able to perform this type of investigation is key
- Dedicating time to this activity, at least for the major role players - this is not just an over-and-above activity
- Access to information, in all its forms, is key
- Look and listen first to understand, only later to explain
- Seek for a causal failure model that can be understood and accepted by all
- Bring in more experts than required
- Split up into smaller groups to get work done as quickly as possible
- Calculations are good but experimental data under realistic conditions are ideal
- Photographic and video evidence proved very beneficial
- Review small group outputs rigorously via the bigger group
- A working model helps explain the failure better than any spoken word, presentations or pictures
- Spend time explaining the investigation and findings to ensure all parties accept the results unconditionally
- Encourage taking the next step, in other words not just agreeing on the why and how, but agreeing to find solutions to fix and avoid the occurrence in the future
- Treat the affected parties with sensitivity and dignity.



**CSIR the first port of call for independent technical support after the unfortunate shooting incident in the defence force.**