

Data Capturing and Evaluation

KB pt.2

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Data Capturing and Evaluation



Part 2-

Data Capturing and Evaluation (ACDB)

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Introduction

This critique will focus on the data capturing equipment utilized during the small arena trial, including how these tools were set up and incorporated into the trial. Each piece of equipment will be detailed, explaining its intended function and performance within the context of this trial. The advantages and disadvantages of each tool will be discussed to illustrate their effectiveness, as well as to consider why alternative options might have been superior. Potential substitutes will be suggested, along with explanations of why they could have proven more effective. Following that, the post-trial evaluation process will be examined, identifying any shortcomings and presenting alternative methods for data assessment. Additionally, recommendations for future trials will be provided, detailing what the group could have altered to streamline the process and improve the accuracy of the results. Finally, a conclusion will summarize the arena trial, addressing both the successes and challenges of the entire process from beginning to end.

Data Capture Equipment

Strawboard

Strawboards are used in data capturing primarily in the field of structural testing and blast analysis. There are many ways in which they are utilized:

- **Pressure Measurement:** Strawboards can be employed to capture pressure changes during explosive events. They are designed to deform under pressure, allowing researchers to measure the magnitude of the blast.
- **Damage Assessment:** By analysing the deformation patterns on strawboards after a test, researchers can assess the impact and effectiveness of different materials or structures under blast conditions.
- **Calibration Reference:** They can serve as a calibration reference for other measuring devices, ensuring that data captured is accurate and reliable.
- **Field Testing:** Strawboards are lightweight and easy to deploy, making them suitable for field tests where portability is essential.

Blast Gauge

Blast gauges are specialized instruments used in data capturing during explosive testing and analysis. There are many ways in which they function:

- **Pressure Measurement:** Blast gauges are designed to measure the pressure exerted by a blast wave. They can capture peak pressure, duration, and other critical parameters that are essential for evaluating the effects of explosions.
- **Data Logging:** Many modern blast gauges come equipped with data logging capabilities, allowing them to record pressure readings over time. This data can be analysed later to understand the dynamics of the blast event.
- **Calibration and Validation:** These gauges can be calibrated against known standards to ensure accuracy. This is crucial for validating the results obtained from explosive tests.
- **Field Deployment:** Blast gauges are often rugged and portable, making them suitable for deployment in various environments, including military and construction sites.

- **Comparative Analysis:** By placing multiple gauges at different distances from the blast source, researchers can compare data to assess how pressure dissipates over distance and materials' effectiveness at mitigating blast effects.

Velocity Foil

Velocity foils are used in data capturing to measure the speed of projectiles or the velocity of fluid flows in various applications. They work by:

- **Measurement Principle:** Velocity foils typically consist of a thin film that can respond to changes in velocity. When a fluid or projectile passes over the foil, it creates a change in pressure or temperature that can be measured.
- **Data Collection:** As the foil experiences these changes, it generates data that can be recorded and analysed. This data often includes the velocity of the flow or the speed of an object at different points in time.
- **Calibration:** To ensure accurate measurements, velocity foils are often calibrated against known velocity standards before use.
- **Applications:** They are commonly used in wind tunnels, ballistic testing, and fluid dynamics studies, providing critical insights into the behaviour of objects in motion.

Strengths and Weaknesses

Strawboard

Strengths:

- **Cost-Effective:** Strawboard is generally inexpensive compared to other materials, making it a budget-friendly option for data capturing projects.
- **Lightweight and Portable:** Its lightweight nature allows for easy handling and transportation, which is beneficial for field data capturing.
- **Environmental Sustainability:** Made from recycled materials, strawboard is an eco-friendly choice that can appeal to environmentally conscious projects.

Weaknesses:

- **Durability Issues:** Strawboard may not withstand harsh weather conditions or extensive handling, leading to potential damage and loss of data integrity.
- **Limited Lifespan:** Due to its composition, strawboard may degrade over time, especially if exposed to moisture, which can affect long-term data capturing efforts.
- **Inconsistent Quality:** The quality of strawboard can vary, leading to potential inconsistencies in data capturing processes if the material is not up to standard.

Velocity Foils

Strengths:

- **High Sensitivity:** Velocity foils are highly sensitive to changes in velocity, allowing for accurate and precise data capturing in various applications.
- **Real-Time Data Collection:** They enable real-time monitoring, which is essential for applications that require immediate feedback and analysis.

- **Versatility:** Velocity foils can be used in a wide range of environments and conditions, making them suitable for diverse data capturing needs.

Weaknesses:

- **Calibration Requirements:** Velocity foils often require regular calibration to maintain accuracy, which can be time-consuming and may lead to data inconsistencies if not done properly.
- **Cost:** They can be more expensive than other data capturing methods, which may limit their use in budget-sensitive projects.
- **Environmental Sensitivity:** Performance can be affected by environmental factors such as temperature and humidity, potentially impacting the reliability of the data captured.

Blast Gauges

Strengths:

- **High Precision:** Blast gauges provide precise measurements of pressure changes, making them effective for capturing data in explosive environments.
- **Durability:** They are designed to withstand extreme conditions, including high pressure and temperature, ensuring reliable data collection in harsh environments.
- **Immediate Data Acquisition:** Blast gauges can capture data in real-time, allowing for immediate analysis and response to explosive events.

Weaknesses:

- **Calibration Needs:** Regular calibration is necessary to ensure accuracy, which can be a drawback in time-sensitive situations.
- **Cost:** The initial investment for blast gauges can be high, making them less accessible for smaller projects or organizations.
- **Limited Application Range:** While effective in specific scenarios, blast gauges may not be suitable for all types of data capturing, limiting their versatility.

Alternative Methods of Data Capture

Flash X-ray

Flash X-ray is a powerful imaging technique that captures high-speed events with incredible detail. Here are some key points about it:

- **Rapid Imaging:** Flash X-ray systems can produce images in microseconds, making them ideal for capturing fast-moving phenomena, such as explosions or the dynamics of mechanical systems.
- **High Resolution:** These systems provide high-resolution images, allowing for detailed analysis of the internal structures of objects without needing to physically alter them.
- **Non-Destructive Testing:** Flash X-ray is often used in non-destructive testing (NDT) applications, enabling engineers and scientists to inspect materials and components for defects without causing any damage.

- **Versatile Applications:** It's used in various fields, including aerospace, military, and medical research, showcasing its versatility in providing critical insights across different domains.
- **Real-Time Analysis:** The ability to capture images at such high speeds allows for real-time analysis of processes, which is valuable in research and development.

Overall, flash X-ray is an innovative technology that enhances our ability to study and understand rapid processes in various scientific and engineering contexts.

Radar

Radar (Radio Detection and Ranging) is a technology that uses radio waves to detect and locate objects. Here are some key points about radar:

- **How It Works:** Radar systems emit radio waves that bounce off objects and return to the radar receiver. By analysing the time it takes for the waves to return, the system can determine the distance to the object.
- **Applications:** Radar is widely used in various fields, including aviation for air traffic control, meteorology for weather monitoring, and military for surveillance and target tracking.
- **Types of Radar:** There are different types of radar systems, such as pulse radar, continuous wave radar, and Doppler radar, each serving specific purposes and applications.
- **Advantages:** Radar can operate in various weather conditions and can detect objects at long ranges, making it a reliable tool for monitoring and detection.
- **Modern Developments:** Advances in radar technology have led to improvements in resolution and accuracy, including phased array radar and synthetic aperture radar (SAR) for high-resolution imaging.

Overall, radar is a crucial technology that enhances our ability to detect and track objects in a range of environments.

High-speed cameras

High-speed cameras are specialized devices designed to capture fast-moving events at very high frame rates, often thousands of frames per second. Here are some key points about them:

- **Frame Rate:** High-speed cameras can record at frame rates ranging from hundreds to millions of frames per second, allowing for detailed analysis of rapid motions that are invisible to the naked eye.
- **Applications:** They are used in various fields, including sports analysis, scientific research, engineering, and entertainment. For example, they can capture the motion of a baseball as it travels through the air or analyse the dynamics of a car crash.
- **Slow Motion Playback:** The footage captured by high-speed cameras can be played back in slow motion, providing insights into the mechanics of fast events, which is valuable for both educational and practical purposes.
- **Technology:** High-speed cameras use various technologies, such as CMOS sensors or specialized imaging techniques, to achieve high frame rates and maintain image quality.

- Benefits: These cameras are essential for understanding complex phenomena, testing materials under stress, and improving performance in sports and other activities.

Sand/ Gravel Pits:

The chemical composition of the sand and gravel aids in preventing fragmentation during flight. When gathered, the sand can be sifted to uncover all fragments.

Some benefits of this approach include:

- Greater durability of sand and gravel compared to straw packs, as well as their enhanced ability to absorb the force of fragmentation, which is particularly useful when managing large, high-velocity fragments.
- The method of retrieving fragments from sand or gravel is significantly less labour-intensive than using straw boards. Utilizing straw boards can take several days to thoroughly remove and identify all fragments, especially in larger testing arenas; however, sand or gravel can be quickly and easily sifted.

Some disadvantages of this method may be:

- If an excessive amount is present, the fragments may become too deeply embedded, necessitating a complete filtration process to extract specific pieces.

Alternative Methods of Evaluating Data

Pressure Capture

Pressure capture is a significant aspect of data capturing, and it has several advantages:

- Critical Measurements: It provides essential data on the pressure within a system, which is vital for understanding fluid dynamics, weather patterns, and various engineering applications.
- Real-time Monitoring: Like velocity capture, pressure capture allows for real-time monitoring, enabling quick responses to changes in pressure that could affect system performance.
- Accuracy and Precision: Pressure sensors are designed to deliver precise measurements, which is crucial for ensuring data reliability in experiments and practical applications.
- Integration with Other Data Types: Pressure data can be integrated with other measurements, like temperature and velocity, to give a more comprehensive view of the system.
- Wide Range of Applications: Pressure capture is used in many fields, including aerospace, automotive, environmental monitoring, and HVAC systems, showcasing its versatility.

Overall, pressure capture plays a vital role in data capturing by providing valuable insights into the behaviour of systems under varying conditions.

Fragmentation Capture

Fragmentation capture is useful in data capturing for several reasons:

- **Detailed Analysis:** It allows for the collection of data in smaller, manageable pieces, which can lead to more detailed analysis and insights. This is particularly beneficial in complex datasets where understanding specific segments is crucial.
- **Error Reduction:** By breaking data into fragments, it becomes easier to identify and correct errors within those smaller segments, improving overall data quality.
- **Efficient Processing:** Fragmentation can enhance the speed of data processing, as smaller pieces can be analysed simultaneously or in parallel, leading to quicker results.
- **Improved Flexibility:** It provides flexibility in how data is captured and analysed, allowing for adjustments based on specific needs or changes in the research focus.
- **Enhanced Collaboration:** Different team members can work on various fragments of the data simultaneously, promoting collaboration and expediting the overall data capturing process.

Overall, fragmentation capture is a valuable approach in data capturing, making it easier to manage, analyse, and improve the quality of data.

Velocity Capture

Velocity capture is quite useful in data capturing for a few key reasons:

- **Real-time Measurements:** It allows for the collection of velocity data in real-time, which is essential for applications where changes happen quickly, like in fluid dynamics or aerodynamics.
- **Precision:** Velocity capture methods, such as using sensors or velocity foils, can provide highly accurate measurements, which is crucial for reliable data analysis.
- **Dynamic Analysis:** It enables the analysis of how objects or fluids behave under different conditions, helping to understand complex systems better.
- **Integration with Other Data:** Velocity data can be combined with other types of measurements (like pressure or temperature), providing a more comprehensive view of the system being studied.
- **Application Versatility:** This method can be applied in various fields, from engineering to environmental science, making it a versatile tool for researchers and professionals.

Overall, velocity capture enhances the ability to gather important data efficiently and accurately.

Recommendations for future trials

- **Statistical Analysis:** Use statistical methods to analyse the data, including descriptive statistics (mean, median, mode) and inferential statistics (t-tests, ANOVA) to determine the significance of your results.
- **Data Visualization:** Create visual representations of the data, such as graphs and charts, to identify trends, patterns, and outliers more easily.
- **Comparative Analysis:** Compare the results against control groups or previous trials to assess the effectiveness of the intervention or method used.
- **Qualitative Assessment:** If applicable, analyse qualitative data through thematic analysis or coding to gain insights into participant experiences or perceptions.

- **Cross-Validation:** Use cross-validation techniques to verify the findings by comparing them with other datasets or methodologies.
- **Review and Reflect:** Conduct a thorough review of the data collection process and methodology to identify any potential biases or errors that may have influenced the results.
- **Collaborative Review:** Engage with peers or experts in the field to discuss findings and gather diverse perspectives on the data.

These recommendations can help ensure a comprehensive evaluation of the data collected during the trial. To enhance accuracy in data capturing, you might consider using the following additional equipment:

- **High-Precision Sensors:** Utilizing advanced sensors that offer higher resolution and sensitivity can significantly improve measurement accuracy.
- **Data Loggers:** These devices can continuously record data over time, allowing for more detailed analysis and reducing the risk of data loss.
- **Calibration Tools:** Regular calibration tools ensure that your equipment remains accurate over time, which is essential for reliable data.
- **Environmental Monitoring Equipment:** Instruments that monitor environmental conditions (like temperature and humidity) can help account for variables that might affect data accuracy.
- **Advanced Software:** Using sophisticated data analysis software can help in processing and interpreting data more effectively, leading to better insights.

References

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GRADEMARK REPORT

FINAL GRADE

36/100

GENERAL COMMENTS

Hi Katie,

This was a slightly better submission than part 1. Sadly, it is not a Level 6 submission.

It provides lists, not analysis of the most appropriate alternatives or enhancements. For example, how could you use radar for a trial on an RGD-5? Flash x-ray and high-speed cameras would be more appropriate but how would you deploy them? Similarly, what pressure capture technique would you use, what insights would it provide to inform results?

Sand and gravel pits would need to be maintained, so perhaps on an arena trial like this, why not just use ricochet capture? This would have removed the 'noise' of rebounding fragmentation.

I agree that statistical analysis needed to be refined but are you clear about the options you are recommending. Would increasing the number of detonations not be a statistical improvement?

Your referencing was poor.

Overall you have demonstrated a marginal fail:

1. Poor engagement with essential reading. No evidence of wider reading. Reliance on inappropriate sources. Heavily reliant on information gained through class contact and lists. Inconsistent and weak use of referencing. 4/10

2. Gaps in knowledge, with only superficial systematic understanding. No awareness of knowledge of the latest research and/or advanced scholarship within the discipline. 8/20

3. Largely descriptive work, with superficial use of critical evaluation. Weak development of arguments and judgements. Information accepted uncritically, uses generalised statements made with scant evidence. Ideas sometimes illogical and contradictory. 11/30

4. Rudimentary application of methods, materials, tools and/or techniques but without consideration. Weak understanding of the application of theory to practice, with only occasional evidence of making appropriate links between the two. 11/30

5. Communication medium is poorly designed and not suitable for the audience.
Work is poorly presented in a disjointed and loose structure, with information and ideas often poorly expressed. Weak use of technical language. Weak independent initiative. Limited evidence of the skills required in graduate employment. 4/10

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