

Anatomy of an A3 Report

Focusing Knowledge for Better Decision-making

KEY TAKEAWAYS



- A3 reports present the essential information about one focused subject on a single large sheet of paper, using visual models to deepen shared understanding.
- Three types of A3 reports share some standard elements but allow for flexibility.
- The A3 format is highly versatile so long as documents follow the principles of focus, brevity and visual models.

What is an A3 report?

A3 reports get their name from the paper size used to print them. In their purest form, they are reports written on a single sheet of A3 (or 11" x 17") paper. This is a paper size that works well for presenting the essential elements of a single idea, with enough information to make a decision about it. Letter size is too small - one can't get enough on it and maintain readability. Larger sizes contain too much information, and the large format paper can become unwieldy. An 11 x 17 document is just right - it has enough room for a concise chunk of knowledge, and it fits within the average person's field of vision. The readers may focus on one part at a time, but they can always see the whole. Some teams use on-line versions of A3 reports. While they may appear quite different, they contain the same elements and emphasis on visual knowledge.

Common elements in a versatile format

The A3 format is highly versatile. Templates serve only to give the author a starting point. As authors begin to create the reports, their guiding principle is to include whatever information needed to create a complete picture of the issue at hand - and eliminate everything else until only the essentials remain. Some basic elements appear on every report:

- ❑ Title
- ❑ Author's name and contact information
- ❑ Theme
- ❑ Visual models wherever possible
- ❑ References

These common elements help the reader identify at a glance whether or not the report is of interest to them, and find out where to go for more information. Visual models and pictures are, as they say, worth a thousand words each.

Elements of a Knowledge Sharing Report

The picture at left shows the elements of an A3 report for sharing knowledge - in this case, how battery life affects a robot's ability to navigate using timed movements.

The Elements of an A3 report for Knowledge Sharing

Theme: one or two sentences about your issue.

Title: Descriptive label for your report.

Author and contact information: Katherine Radeka, 503-701-3945, katherine@whittierconsulting.com

Visual Models: diagrams, charts and graphs that visualize your knowledge to deepen discussion.

Experimental Conditions: for some reports, we need to know how the data was or will be obtained.

Countermeasures: how can we live within our design space or alter it?

References: what data sources did you use?

Background or Current Situation: what do you observe about your issue?

Root Cause Analysis: what's causing the problem? This one is a Causal Diagram, a format invented by Dr. Allen Ward for engineers. Other types of Root Cause Analysis also work.

Theme: How does battery life affect robot performance for timed missions?

Background: The ORTOP LEGO Robotics Tournament is a robot design competition for children ages 9 - 14. The children have a specific parts list and software that they use to design robots that can fulfill a specified set of missions. The robots must navigate across a playing field about the size of a pool table, and perform specific missions, such as moving an object from one place to another. The tournament officials take many steps to ensure consistency of object placement within the playing field between competition rounds.

Trade Off Curves: The RCX uses alkaline batteries that produce less power as they become depleted. Therefore, we hypothesize that one significant variable in reliable navigation is battery life.

Root Cause Analysis: Consistent Object Placement, Consistent Starting Point, Consistent Playing Field, Robot Movement Consistency, Motor Consistency, Speed Consistency, Reliable Navigation.

Countermeasures: Here are some strategies for adapting to the change in power over the life of the batteries:

- Begin each competition round with a fresh set of batteries (one can use rechargeable batteries to minimize the environmental impact of this choice).
- Use a rotation sensor to count wheel rotations to measure distance.
- Use a light sensor to detect marks on the playing field to assist with navigation.

References: Star Batteries FAQ: <http://www.starbatteries.com/batteryfaq.html>
 Energizer AA Battery Technical Datasheet: <http://data.energizer.com/PDFs/e91.pdf>

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Elements of an A3 Proposal

Proposals analyze a problem, then present a recommended course of action. The overall objective of the proposal is to make our thinking about the problem and its solution more visible, so that we can have effective discussion and a robust, timely decision that sticks. Proposals include these elements:

- ❑ **Background, Current State or Situation Analysis:** a description of the current conditions. Wherever possible, include a picture of the problem - a photograph or a schematic drawing.
- ❑ **Root Cause Analysis:** what are the root causes that have led to the current situation?
- ❑ **Data organized into a graph or chart of some kind.** This may be part of the Current State or a separate section depending upon whatever works best for the audience.
- ❑ **Alternatives:** what are the possibilities that we considered? We include a summary of the alternatives we considered, including ones we have discarded, to enrich our discussion about the recommendation.
- ❑ **Recommendations:** what would we do and why?
- ❑ **Future State picture:** what will things look like after we're done?
- ❑ **Implementation plan with action items, dates, owners, cost, issues and metrics.**

This may seem like a lot of information for a single sheet of paper. In practice, the proposal contains just a summary of the data, root causes, alternatives and implementation plan. It may serve as the executive summary for a more comprehensive proposal with more detailed information.

Elements of an A3 Status Report

A3 status reports present a brief update on our progress towards some set of objectives. Project sponsors can quickly scan the document to get a picture of the team's accomplishments and challenges. They often have these sections:

- ❑ Project goals and objectives
- ❑ Major deliverables and other milestones
- ❑ Action items, owners and due dates
- ❑ Outstanding issues and risks
- ❑ Target vs. actual for cost, schedule and metrics

Ways to use A3 reports

- Describe a problem
- Present a new product concept
- Propose a technical solution
- Capture knowledge from past programs
- Describe a product family's architecture
- Explain an organization's mission
- Charter a project team
- Present market research and customer data
- Communicate experimental results
- Analyze trade-off decisions
- Document a standard procedure or test


Anatomy of an A3 Report

Focused Knowledge for Better Decisions

By Katherine Radeka

Theme: How does battery life affect robot performance for timed missions?

Background:
The ORTOP LEGO Robotics Tournament is a robot design competition for children ages 9 - 14. The children have a specific parts list and software that they use to design robots that can fulfill a specified set of missions. The robots must navigate across a playing field about the size of a pool table, and perform specific missions, such as moving an object from one place to another. The tournament officials take many steps to ensure consistency of object placement within the playing field between competition rounds.



The robots use an RCX controller that contains the programming unit and the batteries. The RCX has the ability to operate the robot's motors at a specified power level for specified periods of time. Some children use this feature to navigate, telling the robots to move forward for ten seconds, then turn for two seconds, then move forward for five seconds, etc. However, this is not a reliable way to navigate because the motor's speed can vary from round to round.

Root Cause Analysis

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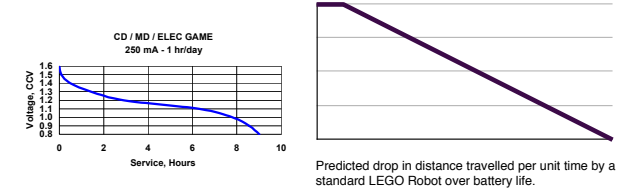
    graph TD
      BatteryLife[Battery Life] -- "+" --> MotorConsistency[Motor Consistency]
      MotorConsistency -- "+" --> SpeedConsistency[Speed Consistency]
      SpeedConsistency -- "+" --> RobotMovement[Robot Movement Consistency]
      RobotMovement -- "+" --> ReliableNavigation[Reliable Navigation]
      ConsistentObject[Consistent Object Placement] -- "+" --> ConsistentField[Consistent Playing Field]
      ConsistentStarting[Consistent Starting Point] -- "+" --> ConsistentField
      ConsistentField -- "+" --> ReliableNavigation
  
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Battery Performance for Timed Missions
Author: Katherine Radeka
Contact Information: 503-701-3945, katherine@whittierconsulting.com

Trade Off Curves

The RCX uses alkaline batteries that produce less power as they become depleted. Therefore, we hypothesize that one significant variable in reliable navigation is battery life.



The first curve comes from the datasheet for an Energizer AA battery, showing the voltage drop over the life of set of batteries in an electronic game. The second shows the predicted drop in motor speed over the life of batteries in a LEGO RCX unit.

We will test our predictions as follows:

- Program a robot to navigate forward for 30 seconds under full power. Repeat until the batteries are dead.
- Measure the distance the robot travels in each trial.

By using the same robot and brand of batteries, we will keep weight, motor speed and construction techniques constant.

Countermeasures:

Here are some strategies for adapting to the change in power over the life of the batteries:

- Begin each competition round with a fresh set of batteries (one can use rechargeable batteries to minimize the environmental impact of this choice).
- Use a rotation sensor to count wheel rotations to measure distance.
- Use a light sensor to detect marks on the playing field to assist with navigation.

References

Star Batteries FAQ: <http://www.starbatteries.com/batteryfaqs.html>
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