



NRL DOCUMENTATION DETAILS

While taking time to put together a documentation book is not nearly as exciting as building the robot itself, the documentation process is an important part of manufacturing and today's marketplace.

Keeping accurate records of an engineering project is a necessary skill. Records serve not only as a communication device between group members, but as legal media proving design ideas. In industry, inventions without dated and signed documents that show the process followed rarely get patents. Poor documentation can lead to critical mistakes on jobs, potentially costing companies great expense in repairs on the job. NRL's goal is to create a well-educated and technologically skilled workforce.

Each documentation portfolio has the potential to earn a total of 10 points. Here are some items that will help your documentation book receive high marks:

- Professionally presented in a neat and orderly fashion
- Followed the rubric and addressed each industry skill/category
- Provided supporting documentation (i.e., spreadsheets, drawings, specs, etc.)
- Used correct and specific technical terms as found in industry
- All documentation labeled clearly
- All drawings, specs and diagrams labeled clearly
- Used original writing specific to the team's current robot
- Included team members' names throughout documentation to show individual contributions.

The reason you want to take your time to do this is to learn and prepare yourself for the position you will be hired for in today's job market. Learning to be clear, concise and specific in your communication is a necessary skill to be successful in the work place.

NRL recognizes the importance of documentation and has instituted the mandatory presentation of team documentation for the upcoming competition. Each Bot should have its own unique Engineering Documentation Binder. There will be an award for the team that provides the best documentation for this event.

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What should be included in your Engineering Documentation Binder?

An engineering documentation binder is a collection of material assembled over a period of time by a learner to provide evidence ... of his/her competence, knowledge, skills, abilities, dispositions, and improvements toward a project or life goal in the area in which the learner is preparing (i.e., Manufacturing).

Your Engineering Documentation Binder should show include the following:

DESIGN MOTIVATION/STRATEGY

- Influences
 - If your team had a bot the previous year, review:
 - What was good about the bot
 - What should be changed in the future
 - Design research
 - Research other bot competitions and the different kinds of bots that won and lost to come up with ideas
- Offensive
 - How is your bot going to inflict damage on other bots
- Defensive
 - How is your bot going to prevent damage being incurred by another bot
 - Any special armor
 - Maneuverability
- Winning
 - Of the different aspects that the bot is judged on, what is the focus of the design that will make it win matches?
 - Aggression
 - Speed
 - Damage

Team Procedures

- Team Management
 - Every meeting held by the team should have meeting minutes. Meeting minutes should include:
 - Topics discussed
 - Team members in attendance
 - Date of meeting
 - Any decisions made at the meeting
 - Any actions from the previous meeting plus new actions from the meeting (this should be an ongoing list with assignees and estimated completion dates)

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Team Procedures (*continued*)

- Material Management
 - Track all material purchased for the bot. This can be done through copies of purchase orders
 - A Bill of Materials showing how all of the material relates to each other (qty needed for the bot, where the part is used in the bot, etc.)
- Accounting/Budget
 - This should be a listing of all expenses incurred. This can be tracked during the project through Purchase orders, then make a list at the end of the project to summarize
 - Purchase orders of all of the materials
 - Purchase orders of t-shirts/promotional materials
- Time Management
 - A project plan is necessary to make sure all aspects of the project get completed in time.
 - Be sure to list and track all major steps that need to happen on your plan
- Data Management
 - This is how you keep all of the information and materials collected throughout the project together in a way that's easy to access and refer back to.
 - Is it easy to find items in your binder?
 - Is it organized to be functional for the needs of the project?
- Promotional/Fundraising
 - Have a copy of any posters that were made to post at the school to get others to attend.
 - Document any fundraising events that happened including date of event, money raised, method of raising funds

DESIGN PROCESS

- Research Methods
 - Show the different designs that were considered
 - Results of any brainstorming sessions to determine design.
- CAD Models
 - 3D models from CAD of your bot design
- Refinement
 - List what refinements were done based on the risk analysis and testing
- Structural Analysis
 - Pros and cons of your bot design
 - Risk Analysis (Failure Modes and Effects Analysis- template can be found online- this is a pretty typical risk analysis tool in industry) to determine where the weaknesses are in your bot, and how to mitigate those risks.

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DESIGN PROCESS (*continued*)

- Engineering Drawings Set
 - These drawings should come from CAD, and should include dimensions on fabricated parts, and should include the specific parts used (i.e. specs of motors, screw specifications, etc)
- Material Selection
 - List what materials were used to build your bot (the parts that were fabricated) and why you decided to use these materials. This is your Bill of Materials.
- Manufacturing Plans
 - Written procedure to show how to assemble the bot. This should include pictures with indicators of where the pieces go. Someone assembling your bot for the SECOND time should be able to take this procedure and assemble the bot without help.
- Assembly Models
 - This should include pictures of any models that were made of the bot before the actual build to work on design.
- Weapon System Details
 - Description of the weapon on the bot with advantages and possible disadvantages of this choice (the risk analysis would be a helpful reference here)
- Drive System Details
 - Description of the choice of drive systems, and why it was chosen over others.
- Power System Details
 - Description of the choice of drive systems, and why it was chosen over others.
- Wiring Schematic
 - Drawing (could be in CAD- there are also software programs online) of the electrical wiring for the bot.
- Testing Results (Tests should be done via the scientific method. Results should be quantifiable and documented. And, whenever possible, tests should be repeated to ensure repeatability of the performance of the bot)
 - Aggression testing
 - Durability testing
 - Maneuverability testing

Your Engineering Documentation should be a 3-ring binder that shows evidence of the above information. The judges will carefully review each section of your team's binder so it is important to take this into consideration when creating your documentation.

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Robot Project Portfolio Documentation Rubric



Criteria / Sections	0 Points Area not covered	1 Point Area covered, but poorly	2 Points Area covered adequately	3 Points Area covered with above average content	4 Points Area covered with superior content
Organization					
Binder					
Sections Match Rubric					
Team & School Name and Members on Front of Binder					
Extra Organizational Functionality					
Design Motivation/Strategy					
Influences					
Offensive					
Defensive					
Winning					
Team Procedures					
Team Management					
Material Management					
Accounting/Budget					
Time Management					
Data Management					
Promotional/Fundraising					

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Robot Project Portfolio Documentation Rubric
(continued)

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Design Process					
Research Methods					
CAD Models					
Refinement					
Structural Analysis					
Engineering Drawing Set					
Material Selection					
Manufacturing Plans					
Assembly Models					
Weapon System Details					
Drive System Details					
Power System Details					
Wiring Schematic					
Testing Results					