



**FY13 RWDC Teacher and Coaches Guide:
Surface and Aviation Challenges**

Table of Contents

I. Introduction	2
II. Instructions	3
III. The Challenge.....	6
IV. Coaching an RWDC Team.....	8
V. Mentors	9
VI. Software.....	10
VII. Solving the Challenge.....	11
VIII. Submission Guidelines	16
IX. Dates and Deadlines	18
X. Scoring.....	19
XI. Rules.....	20
XII. Contact Information.....	22
Appendix 1: Engineering Design Notebook, Cover Page Template & Format.....	23
Appendix 2: Merit Awards	25



I. Introduction

Welcome to the Real World Design Challenge. This handbook is designed to provide information that you will need to successfully work through the Challenge.

The Real World Design Challenge is a Science, Technology, Engineering, and Math (STEM) competition for teams of three to seven high school students. There are two challenges this year: an Aviation Challenge and a Surface Challenge. Teams may either register for the Aviation Challenge or the Surface Challenge. Team members can only sign-up for one challenge. High Schools can enter as many teams as desired. The Challenge and additional supporting materials will be issued on October 25th and made available through the Real World Design Challenge website. You will use professional software tools and get to collaborate with mentors from industry, government, and academia.

Aviation Challenge

In the Aviation Challenge, you will design a Small Unmanned Aircraft System and develop a business plan in support of commercial applications. The competition will take place in two rounds. First is the state level. If your state is not officially participating this year, you can still do the Challenge, but you will be competing against all the other teams whose states are not officially participating in an independent state or territory category.

The champion teams from each participating state and or independent states and/or territory category move on to the National Challenge. You will get an additional problem that builds on the first one along with an all-expenses-paid trip to Washington, DC to compete in the National Finals. The top three teams will be recognized with trophies, and other top teams recognized with merit awards.

Surface Challenge

The Surface Challenge, you will design and evaluate efficiency improvements for a baseline heavy-duty combination truck. The Surface Challenge will take place in one round and will have a cut-off of approximately 50 teams that can register.

Teams will be scored based solely on their design notebook submission with the top overall team provided an all-expenses-paid trip to Washington, DC to present their design. The top three teams will be recognized with trophies, and other top teams recognized with merit awards.

Important Resources

Keep checking our website www.realworlddesignchallenge.org for updates along with the getting started page www.ptc.com/go/rwdcgettingstarted. If you get stuck, you can always email your questions to www.ptc.com/go/academic-support.



II. Instructions

These instructions lay out the basics of what you will be doing in the Real World Design Challenge. The rest of the guide will fill in the finer details.

Register

Registration is easy. Teachers register the whole team of three to seven high school students. Your team must register for this year's Challenge even if you have participated in the past.

Just go to www.realworlddesignchallenge.org and choose sign up. Once you sign up, you will get an email invitation to Windchill, which is a web-based collaboration environment for all your teams work and information. **You may register as many teams as you like!** There is no limit to the number of teams you may register. You may have students from different schools but all students must be from the same state.

And take a look at the *RWDC Getting Started Page* (www.ptc.com/go/rwdcgettingstarted). Throughout the RWDC virtually everything you need will be available on the Getting Started Page or in your Windchill project (<https://rwdc.ptc.com>). **The Getting Started Page is the place to go!!!** You should go to the Getting Started Page daily. New material will be continually posted there.

Note: Only teams that registered for the RWDC competition will have access to Windchill.

Contact your State Coordinator and Mentors

When you get started, you should contact your state coordinator. This person is a resource about the RWDC in your state. You can find them by going to the Participating States page on www.realworlddesignchallenge.org and selecting your state. If your state is not one of the officially participating states, you will get this information through www.ptc.com/go/academic-support.

You will also need to find a mentor. Go to the Getting Started page and click the link *Find a Mentor to Help Your Team*. You will download a document of mentors. Use this to find a mentor and try to set up a phone conference with them right away. **It is important that you begin working with your mentors right away!** They will help you formulate your plan of action, provide content expertise and be your key resource. Don't wait until you have your ideas together. Build your relationship with your mentors now! New mentors will be added to the page so keep checking for people with whom you want to work.

Please be courteous with your mentors. If you decide that you no longer need a specific mentor, please let them know so that they can help other teams.



Getting Started

Once your team is registered, you should follow the steps outlined on the *RWDC Getting Started* page.

What should my team do to get started?

Step 1: Register your team for the FY13 RWDC Competition

Step 2: The easiest way to get your team prepared for this challenge is to review Challenge materials on the Getting Started Website. Be sure to review the following documents:

- FY13 RWDC State Challenge Statement
- FY13 RWDC Challenge Detailed Background
- FY13 RWDC Teacher/Coaches Handbook

Step 3: As with previous years, a team's ability to successfully solve the challenge is made possible largely through the active partnership with mentors. To help your team find a mentor, the RWDC committee has authored a mentor spreadsheet divided by the mentor's area of expertise. Please review the spreadsheet and contact a mentor to get started. **Contact a mentor as soon as possible.**

Step 4: Access PlanetPTC and build networks with fellow team members, review discussion board, blogs, documents and videos.

- [RWDC Social Community site](#)

Step 5: Download the software applications that will be used for this year's challenge

- [RWDC Software Applications](#)
- Then email rwdc_support@ptc.com to get the software product codes. Please specify how many computers you will be installing the software on.

Step 6: Participate in the RWDC Training Webinars

All teachers and students should go through the RWDC Getting Started Courses. In addition, training webinars will be scheduled regularly through the Challenge to demonstrate tools and answer your questions. Information on Training Webinars will be posted on the RWDC Getting Started and emailed to team members.

Step 7: Complete Formative Surveys

Teams will receive points in their Design Notebook scoring for completing Formative Survey's throughout the challenge. Surveys will be distributed through email to teams and mentors. The surveys will help assess areas where teams need help and will allow the RWDC support team to take proactive steps to help teams stay engaged, and work through technical challenges leveraging mentors, webinars, and direct feedback.



Step 8: Download and monitor RWDC Challenge Resources

New Resources are added all the time – Keep checking to see what is new!

Download the RWDC Challenge Kit. This kit is what will include all materials for the challenge. The kit contains all the necessary Mathcad worksheets and other support materials.

For assistance, go to please send your questions to www.ptc.com/go/academic-support. If you have additional questions go to rwdc_support@ptc.com or visit the RWDC home page at www.realworlddesignchallenge.org.

Train on the software

Now that you have the software, it is time for teachers and students to do basic training on the various software packages that the RWDC provides you with. Going through the RWDC Courses will introduce you to the software used in the Challenge. Not only will this course provide a good foundation for the challenge, it will also introduce you to all the applications used in the challenge.

And if you get stuck or need some help, please send your questions to www.ptc.com/go/academic-support.

Solve the problem

Once you have the software and have gone through the RWDC Courses, you're ready to tackle the Challenge. The Challenge Statement is posted on the Resources menu on www.realworlddesignchallenge.org.

Submit your solution

Once you have completed the challenge, you will upload your project through Windchill and send a copy of your design notebook to your RWDC State Coordinator. State Coordinators are listed on your State Page. Additional instructions on submitting your solution will be provided by email to your team.

Aviation Challenge teams will compete with all of the other teams in your state. If you come out as the State Champions, you win an all-expenses-paid trip to Washington, DC to compete in the National Finals. You will receive an additional challenge that builds on the state challenge, which you will present in Washington in April.

Help

If you need help with anything, we have a number of resources:

- **RWDC Courses** – These prepare you for the Challenge by providing preparation in the use of the software and an introduction to aeronautical engineering.
- **The Teacher/Coaches Guide**—Contains the information you need to participate in the Challenge.
- **Challenge Detailed Background** - Contains detailed materials to familiarize you with the technical aspects of the challenge.



- **Training Videos**—Posted on the Getting Started Page (www.ptc.com/go/rwdcgettingstarted) and cover the technical skills you will need to complete the Challenge
- **Technical Support**— Submit your questions to PTC through www.ptc.com/go/academic-support.
- **Mentors**—Mentors provide content support to teams. They are not responsible for technical support which is provided by PTC.
- **State Coordinators**—Participating states have a State Coordinator who serves as an intellectual resources for the Challenge. Find yours by going to the states page, finding your state and going to your specific state’s page. Your coordinator’s contact information will be on the state page. If you are in an Independent State or if your state does not have a State Coordinator and you need help contact Dr. Ralph Coppola at: rcoppola@ptc.com or at 703-298-6630.

III. The Challenge

The full text of both the Surface Challenge and the Aviation Challenge and supporting materials will be posted on the RWDC Getting Started Site (www.ptc.com/go/rwdcgettingstarted) on October 25th.

Aviation Challenge

In the Aviation Challenge, you will design a Small Unmanned Aircraft System and develop a business plan in support of commercial applications. The competition will take place in two rounds, state and national.

PARTICIPATING STATES & TERRITORIES

Teams from all states and territories are encouraged to participate. Teams may participate from both RWDC Partner States and Independent States. If your state is not officially participating this year as an RWDC Partner State, you can still do the Challenge, but you will be competing in the Independent State Category.

RWDC PARTNER STATES

Teams from RWDC Partner States compete against other teams in their home state the state Challenge Level. One State Winner from each RWDC Partner State is invited to participate in the National Challenge. RWDC Partner States are states with which the RWDC has a partnership. The RWDC partnership, at the state level, is done with the Governor or Lt. Governor of the state. These executives help establish a partnership with their state departments of education. Through the department of education, other appropriate state agency or not-for-profit organization, we establish an RWDC State Coordinator. That person is the point of contact (POC) in the state. The RWDC State Coordinators play a key role as the primary POC in the state for teachers, state officials and RWDC staff.

They provide information and input to RWDC staff on how to improve the program, to meet the needs of teachers and students in the state. The State Coordinators also help recruit teams, work with RWDC staff to coordinate teacher training, organize state judges to evaluate RWDC Teams’ solutions, and organize the State Award Ceremony.



INDEPENDENT STATES

Independent States are locations where we do not yet have a partnership with the Governor or Lt. Governor. These states compete as one block of states and there is one winner from the whole group of Independent States that is invited to participate in the National Challenge. Our goal is to have all fifty states and all territories become Partner States. The RWDC Director serves as the State Coordinator for the Independent States.

Surface Challenge

The Surface Challenge, you will design and evaluate efficiency improvements for a baseline heavy-duty combination truck. The Surface Challenge will take place in one round and will have a cut-off of approximately 50 teams that can register.

Teams will be scored based solely on their design notebook submission with the top overall team provided an all-expenses-paid trip to Washington, DC to present their design. The top three teams will be recognized with trophies, and other top teams recognized with merit awards.



IV. Coaching an RWDC Team

Who can be a Coach?

An RWDC coach can be a formal classroom teacher in any school or an adult advisor to an after school or informal learning program. Although having specific expertise in engineering principles or a degree in a STEM-related field may be helpful, coaches are not required to have a technical background to participate. Coaches can be, but are not limited to: technology education teachers, science teachers, math teachers, or someone who is overseeing a math or science club or museum program.

What role does the Coach play on a team?

The coach should act as a facilitator, advisor, and educator for the team. Due to the competition's reliance on engineering software, the coach should be prepared to arrange access to computer-related resources and provide students with training and assistance with software.

What does a Coach do?

- * A coach may find it necessary to do any or all of the following:
- * Provide meeting space
- * Create a schedule of meetings
- * Attend and supervise all meetings
- * Obtain approval from school and permission from parents
- * Train students in the use of Creo Elements/Pro and Windchill software
- * Share the digital plane parts, training video, and other analysis tools provided to support the teams' work
- * Provide access to resources for students
- * Seek support, and encourage students to seek support, from RWDC national mentors
- * Offer guidance, lessons, or suggestions on basic fundamental principles in engineering (design process), science, and math
- * Assist with defining the roles of team members
- * Assist with communication and connection between the team and its mentor(s)
- * Provide suggestions and constructive feedback on strategy and models
- * Travel with and chaperone team, if necessary, at national event and other related events
- * Oversee online secure sites for team: register team, access online forms and password-protected areas, and assist with final submission
- * Assist with final submission criteria: oversee student deadlines and ensure all submissions are made properly and timely.

Support

It is important that you have support from the key players in your community, such as administrators, teachers, and parents. Because each team must have access to resources, communicating with your Teacher/Coach, school principal, or superintendent will be essential. If you win, you will be invited to go to Washington, DC for the National Challenge. Every school has policies that must be followed for that kind of trip. It is much easier if support is requested early and the approvals and permissions are arranged in advance.

Operating in Other Venues

Even if your team decides to work outside a formal school setting, it is likely that you will need to have an established educational organization to provide you with access to useful facilities. You may choose to work on the Challenge in an after-school program, such as a school club; at a science or technology center; or through another educational program. Determining the organization you will work with needs to be among the first decisions you make.

V. Mentors

Contacting Mentors

One of the first things that you do when you sign up for the Real World Design Challenge is finding a mentor. Please be courteous to mentors and respect their time.

There is a list of mentors available on the Getting Started Page (www.ptc.com/go/rwdcgettingstarted) under the link Find a Mentor to Help Your Team. Look through the list and find an initial mentor. As you progress through the Challenge, you can add up to three additional mentors, but start with one.

You may reach out to several mentors to find one, but once you choose one, contact the other mentors that you are not using that you will not need their assistance.

Once you have found your first mentor, please set up a call with that person to get to know them and to discuss the project.

Mentor's Roles

Mentors are professional scientists and engineers who will help you with the Challenge. Each team may recruit a maximum of four mentors with expertise in science, mathematics, engineering, and aviation design. Mentors may limit the number of teams they choose to assist and the amount of time they will devote to the mentorship process. Accordingly, mentors will be available on a first come/first served basis.



1. Mentors will present STEM concepts to your team in a fun and exciting way and give you a chance to interact with real world engineers and scientists.
2. They will help to stimulate creative thinking through assisting your team with the hands-on design of your project.
3. Mentors will provide advice to your team during the Governor's State Challenge, which will run from October through January.
4. If the Mentor's team is the State Winner, then mentors will provide advice for the winning team's National Challenge efforts through the end of the National Competition.
5. The Mentor is your subject matter expert.
6. Mentors will provide advice to you on science, math, and engineering principles and be a content resource for your team.
7. The Mentor is also the Teacher/Coach's advisor, assisting with knowledge of core principles processes, and knowledge of science, math, and engineering.
8. The Mentor should NOT solve the problem of the Challenge for the team.

VI. Software

All the software in the Real World Design Challenge is provided to you for free. You should download everything and get it working as soon as you sign up for the Challenge. To download the software applications that will be used in this year's challenge, go to www.ptc.com/go/softwareforrwdc.

To download the software applications that will be used in this year's challenge, follow step 5 above.

There are also videos on the Getting Started Page to learn how to use the software. www.ptcschools.com is available as a free training resource in Creo Elements/Pro.

Here is a list and descriptions of the software you will be using:

Creo Elements

Creo Elements/Pro (formerly Pro/ENGINEER) is the standard in 3D product design, featuring industry-leading productivity tools that promote best practices in design while ensuring compliance with your industry and company standards. Integrated, parametric, 3D CAD/CAM/CAE solutions allow you to design faster than ever, while maximizing innovation and quality to ultimately create exceptional products.

PTC will be providing Creo Elements for each team. If you are installing the software applications in a lab environment, you will need to download Creo Elements. To receive your product code for the University Edition, please fill-out the following form – www.ptc.com/go/uniforschools/.

If you are using standalone computers and not a lab environment, you will need to use the Creo Elements/Pro 5.0 Student Edition. This can be downloaded from http://apps.ptc.com/schools/WF5_Student_DVD.zip. To generate the Student Edition license during the installation process, you will need a set of unique products codes for each machine. Please send your request for Student Edition product codes to rwdc_support@ptc.com.



FloEFD for Creo

FloEFD for Creo is a full-featured 3D fluid flow, heat transfer analysis package that is both fast to learn and fast to use because it doesn't come with the numerical complexity and meshing overheads of traditional high-end CFD.

Mathcad Prime

Mathcad is engineering calculation software that drives innovation and offers significant personal and process productivity advantages for product development and engineering design projects. Unlike proprietary calculating tools and spreadsheets, Mathcad lets engineers design and document engineering calculations simultaneously with comprehensive applied math functionality and dynamic, unit-aware calculations.

Windchill

Windchill, PTC's Product Lifecycle Management (PLM) software for managing product content and processes, offers a powerful, proven solution. Fast, secure, and Web-based, this business collaboration software enables companies to streamline product development processes and deliver superior physical goods and information products.

Windchill is an online collaboration environment, hosted on a server. There is nothing to download. You will be sent an invitation as soon as you register for the Challenge.

VII. Solving the Challenge

Examine the Challenge and identify what needs to be done:

Now that the State Challenge is issued, determine what the goals are and what you will need to do to win. **Tip:** Look at the *RWDC Scoring Rubric* and see what the judges will be looking for and design your solution so that they conform to the *RWDC Scoring Rubric* in the order that they are provided. This helps make sure the judges will see all of your work and will not miss anything.

Determine what resources are needed to solve the problem:

You will need to figure out what resources you will need to solve the problem. These will include: (a) human resources (team members with expertise needed to do the task you identified); (b) research on what has been done to address the problem by others; and (c) tools needed to do the job.

Gather Your Resources

Each teams' goal is to create the best solution to the Challenge. This will require students to develop a strategy that addresses the following topics: team expertise, mentor expertise and support, differentiated roles, collaboration, capacity, and approach. Educational materials will be available to support the development of student team strategies, melding the professional practice of research-based product design with the entertainment value of role-playing games.



Researching What Has Been Done and Gathering Information

There are resources provided to you on the *Real World Design Challenge Website*. These are just a beginning. You should start your research by exploring what others have done to address similar Challenges. You may find information on the Web, in libraries, from mentors or other experts. When you register your team, you will be invited to *Windchill*, a web-based, collaboration and data management tool. Keep all of your information on your *Windchill Team Site*. It is a good way to stay organized and share information with your team. The research you do on what has been done will be the springboard for your work. From that information you will learn what others have tried and get ideas for how you may better develop an approach to solve the Challenge. Your mentors will be able to view all of your work on your *Windchill Team Site*. You will need to invite your mentor to the site and provide the mentor with the password.

Develop Challenge Team

Team members should be recruited to provide a variety of skills to the team. There should be distinct divisions of labor in the roles and functions of each team member. The exact set of team roles will be up to the team and may vary based on local expertise and strategy. Note that not every role needs to be filled and some team members may have multiple roles depending on available expertise and interest.

The nature of each team will determine how it functions. For instance, teams that meet after school will face a different set of needs than teams that function within a classroom. Your Teacher/Coach will help you decide which approach will work best in your community.

Not every member of the team needs to be an expert in the use of all the tools. However, at least one team member, the Project Engineer should possess a high degree of skill with the software. It is recommended that all team members have a working knowledge of these tools. The tools are provided to the teams for free.

Suggested Team Roles

Project Manager

The Project Manager will be responsible for recruiting a winning team and leading strategy design. The Project Manager is responsible for the overall success of the product or program. The Project Manager is the individual responsible for managing the project plan and deliverables, ensuring that all project team members have the necessary resources required to complete the project, and reporting status for the team, tracking timeline and milestones, and quality. Many times this individual plays additional roles in the project. The Project Manager leads the cross-functional team and is typically responsible for the development of the overall product, program or Engineering Design Notebook. They often monitor several interrelated sub-project activities engaged in by team members.

Design Coordinator

The Design Coordinator role arises your team is composed of members that are geographically dispersed. The role will not apply if your team is within a single class. The Design Coordinator acts as the liaison between the design partner and other internal engineering teams. The Design Coordinator is often responsible for integrating new or modified design data into the overall product design. The

Design Coordinator is the primary interface with the third- party partner. The Design Coordinator coordinates partner engineering resources and is either located locally in another class at the team's school, or remotely in another school.

Systems & Test Engineer

The Systems Engineer defines the product architecture, its modules, and interfaces. They have ultimate responsibility for ensuring the various parts of the product will work together as a whole when finally assembled. They provide direction to the design team, manage interfaces, and participate in design reviews. The role of Test Engineer is responsible for testing prototypes of designs and pre-production products created by the design team. The Test Engineer reviews test cases generated by the design team and collaborates with the design team during the testing phase. This role is the liaison with an engineering mentor, assisting the team with the incorporation of engineering advice. This person may also be a project simulation engineer on the team.

Simulation Engineer

The Simulation Engineer is the expert in the authentic simulation and modeling tools, such as 3D CAD and *Windchill*. The Simulation Engineer manages *Windchill's* Digital Project Space and is responsible for simulation and modeling application interoperability, file compatibilities, and file transfer.

Project Scientist

The Project Scientist should have a background in physics or a related field. This role will be responsible for the scientific integrity of the approach and for translating the scientific principles into the team's engineering design. This role is the liaison with a science mentor, assisting the team with the incorporation of scientific advice.

Project Mathematician

The Project Mathematician should have a background in mathematics, with a minimum of algebra and trigonometry. This role will be responsible for the mathematical integrity of the approach and for translating the mathematical principles and applications into the team's engineering design.

Project Communicator (or Communications Specialist)

The Project Communicator integrates ideas, approaches, and applications from the design team into written documents, videos, and presentations. This role is responsible for the team's brand. This person represents the team to the media and will work with the teacher/coach to coordinate event activities.

Utilize the Design Process

Engineers use a specific process to solve problems. The design process provides an effective way to learn how to develop innovative solutions in a systematic way. The process is much like the inquiry process in science. To effectively learn it you need to use it. All team members should learn and participate in the design process. Although the process has been described in a number of different ways, the basic concepts include:



Define the problem and need. We will provide the Challenge to you and that will frame the problem. You will need to define how you will solve the problem. This will provide the foundation for organizing your team and developing a work plan.

Research and gather important information about the problem. We will provide reference material, but we encourage you to identify additional material that will help you understand what others have done to address this type of problem. This information will help you develop an approach to the solution.

When you start out, you should brainstorm multiple possible solutions to the problem. Through your research you will be able to narrow and refine your potential solutions. When you identify the few you like best, design and test them.

Test, analyze, and gather data on the solutions. Testing the solutions will provide data on how well they worked in addressing the problem. Based on these data you will be able to modify your designs and choose the one that is the most promising.

Identify the solution that seems the most promising. Use your test data to modify the design and improve it.

Revise or redesign the best solution based on testing and analysis. This step may be done multiple times until you are satisfied with the results.

Develop a plan to communicate the results of your work to others. Keep in mind that your reviewers will be looking for a justification of your approach based on test data and your analyses. Also make sure that you include information about how you worked together as a team. Each member of the team should have made a contribution to the solution.

Develop a Design Plan

To be successful you will need to have a plan for your work. This should include:

- Team members with expertise to address the Challenge in fields such as science, math, and design
- Mentors to supplement the expertise of your team
- Physical resources such as a place to meet and work, computers, and software loaded on the computers
- A strategy that includes the application of the design process and mathematical and scientific principles to the Challenge
- Preparation of your Challenge Solution submission

Establish a Timeline with Milestones

A timeline with milestones is key to your success. You may need to revise this timeline as your work progresses. The Project Manager should call regular team meetings (at least once a week) to review the progress that everyone has made on their tasks:

- Key events should be noted as milestones. These milestones, such as the due date for the submission of the Challenge Solution, should drive the dates for the other tasks.



- It is easy for time to rush by so be sure to create a timeline with specific tasks for each team member.
- If problems arise, they should be dealt with efficiently and effectively, and a revised timeline should be created with the plan to resolve the problem included.

Develop and Utilize a Communication Plan

Strategize How to Communicate Your Challenge Solution

Keep in mind that a quality Challenge Solution is likely to require multiple drafts before it is polished and ready to submit. You need to plan for that part of the process. The Challenge Submission should be designed so that reviewers will see that all of the review criteria are addressed.

Link the Communication Plan to Your Timeline

Make sure that you reserve enough time for writing your Challenge Solution. Be sure that key writing tasks and milestones are included in your timeline.

Develop the Writing Team:

Each team member should be part of the writing team. Assign roles for the writing process and modify the plan based on the results of testing and redesigning your Challenge Solution. You should appoint one person, perhaps your project communication specialist, as the lead on the writing task. This team member might be responsible for ensuring that everyone meets their writing task goals and for undertaking the editing of the final document.

Keep an Engineering Design Diary

Keeping good records is part of good science and engineering. Each team member should have an *Engineering Diary* or project journal in which they record ideas, solution options, plans, sketches of designs, references they collect, actions that need to be taken, notes from meetings, tests and plans, etc. You will also have project space on the Windchill server, where your team will be able to keep all materials. The record archives will be helpful when you begin writing your Challenge Solution. Your *Engineering Design Diary* and your *Windchill Team Site* will contain information that you will include in Your *Engineering Design Notebook*. The *Engineering Design Notebook* is what you submit for Judging.

Submit Your Challenge Solution in the form of your Engineering Design Notebook

In the end, everything comes down to your submission. When you submit, make sure that,

- Your submission meets the guidelines
- You review the RWDC Scoring Rubric by which your submission will be judged
- Make sure your submission is as complete as you can make it.
- You submit **on time!**

VIII. Submission Guidelines

The Design Notebook should detail the design process and your team's results. Review the Scoring Rubric carefully to following its paragraph order and details on what judges are looking for. The Design Notebook has been limited to 80 pages this year so take extra time to submit your best narrative in response to each Rubric element. Do not postpone work on your Design Notebook, but work on it throughout the challenge.

The narrative sections of your report need to include information allowing judges to verify your analysis and design viability. It will communicate an understanding of the mathematics supporting the results of the proposed design. The data included in the report will explain how the images in your proposed solution relate to the testing results obtained from the mathematical formulae used for analysis, and how you have modified your designs based on testing. The narrative and graphic representations of your design should clearly communicate an analysis of how the proposed design works and why it works.

In the *Design Notebook*, you capture the history of your work, how you understand the design process, and develop and test your design concepts. It is a working document containing ideas tested, approaches and ideas that worked and that did not work. The notebook should include and represent the collaboration of your team, how team members understood the design, how mentors contributed to the solution, as well as how the design solution was tested. *The Design Notebook* will describe the strategy used to develop your solution, including the structure, roles, and responsibilities of your team members, your work plan, the mentors who guided your process, and any rules/procedures that you employed to guide the work. This document will chronicle the decisions and testing of solutions that led to the final design capturing the various iterations of the design evolution. It will include concepts explored and formulae tested that contributed to the evolution of the final design submitted, including sketches, drawings, and schematics of designs tested and modifications made.

Your *Engineering Design Notebook* should contain evidence collected over time and should be presented in the form of a report. It will be judged on the degree to which it demonstrates your team's:

- A. Winning strategy, including a description of team members' roles and a chronicle of the extent of collaboration among team members
- B. Level of innovation in addressing the Challenge process and the design solution
- C. Understanding of the engineering, science, and mathematics concepts underlying the problem and solution
- D. Demonstration of the use of the design process and skills in using design tools
- E. Evolution of the design (schematics) and decision/testing process leading to the solution proposed
- F. Teamwork and collaboration
- G. Networking and working effectively with RWDC national mentors to supplement your teams' needed expertise

Team Design Presentation (Aviation Teams only) is an optional activity for the **Governor's State Challenge**. States may choose to ask finalist teams to present their findings in the form of an electronic and/or in-person presentation to state judges. If your team is nominated as a finalist, you may be asked to submit with the final submission an electronic presentation consisting of no more than 20 slides that

communicate the results of your design solution. The electronic presentation is a stand-alone document that captures essential elements of your RWDC experience by including a description of your winning strategy, the evolution of your design, and your teams' understanding of the scientific principles that led to the design solution presented, along with the results of the design solution. Note that team presentations are an essential component of the National Challenge and can differentiate between two teams whose technical scores are comparable. For the National Challenge, the presentation will be judged on content (inclusion of elements identified) and how well the content is communicated to the audience.

Design Presentations at the National Challenge Competition (Aviation Teams Only) will be required of all State Winning Teams competing in the National Challenge. All State Winners will be required to prepare a 20 minute presentation in Microsoft PowerPoint format. Presentations will be made to the Challenge Judges. The overall top three teams will again present to a Blue Ribbon panel of judges in the evening.

Student Surveys will be conducted at the beginning and end of the State Challenge. In addition, formative surveys will be sent to teams and mentors throughout the challenge. Teams that fill out the surveys will get extra points in judging.

IX. Dates and Deadlines

Aviation State Challenge

State Challenge Issued	October 25, 2012
Team Registration Deadline	November 16, 2012
Solution Submission Deadline	January 18, 2013
State Challenge Digital Submissions Scored by Judges	January 21-February 5, 2013
State Winners Announced	February 5-8, 2013

Aviation National Challenge

National Challenge Issued	February 8, 2013
Solution Submission Deadline	April 5, 2013
National Challenge Digital Submissions Scored by Judges	April 8-18, 2013
National Challenge Event	April 19-22, 2013

Surface Challenge

Challenge Issued	October 25, 2012
Solution Submission Deadline	March 5, 2013
Challenge Digital Submissions Scored by Judges	March 8-18, 2013
National Challenge Event	April 19-22, 2013



X. Scoring

Your engineering Design Notebook will be scored by a team of professional engineers to evaluate the quality of your design submission using the RWDC Scoring Rubric. Be sure to review the Scoring Rubric carefully to ensure a high quality submission.

Design Notebook submissions are limited to 80 pages and are to follow the paragraph order of the RWDC Scoring Rubric. Teams can lose up to 15 points if their Notebook is more than 80 pages or if their Design Notebook does not follow the Scoring Rubric paragraph order. Supporting details including Creo models and analyses results should be uploaded to your Windchill project site. Technical Judges for the Surface and National Aviation Challenge will review Creo models and analyses supporting your design using your Windchill project site.

Scoring for the State Aviation Challenge and Surface Challenge will be based on the Design Notebook alone. Some states may elect to incorporate presentations at their discretion. State Coordinators will inform teams if this is the case in their state.

Scoring for the National Aviation Challenge will be weighted 35% on the Design Notebook submission, 35% on technical merit, and 30% presentation at the National Event. Technical merit scores will be based on the relative strength of teams' objective function, the Technical Judge's verification of analysis results, and the design viability of the final design. The top three teams in the Aviation Challenge will present to a Blue-Ribbon panel of executives in the aviation industry with the final ranking of the top three teams based solely on their presentation.

The Surface Challenge and National Aviation Challenge will use an improved statistical method to adjust scores that may be biased by conservative and/or liberal judges. Judges can be more conservative or liberal in scoring than their peers because of the diversity of their past experiences. The new statistical process cross correlates the scores of teams in common between judges bringing into balance liberal and conservative scores to accurately assess relative merit across a large field of teams.

Judges will be briefed before scoring to improve the consistency in their evaluations. The consensus of many judges is trusted and more accurate than the scores of a few judges. Numerous team submissions require a large number of judges to provide adequate coverage in a constrained timeframe. Because of the large number of teams in the National RWDC competition, judges do not all have the benefit of baselining their scores against other teams.

The distribution of teams into challenge rooms for their National presentation will be based on teams overall pre-ranking from Design Notebook and Technical Merit scores. Teams of similar strength based on these scores will be placed together in the same challenge room rather than spread across all challenge rooms. Judges will be in a better position to compare and contrast teams of similar strength. There will be four teams presenting in each challenge room. Half of the judges in each Challenge room will rotate to an adjacent room to allow for the best statistical evaluation of overall team performance.

Both Challenge Judges (scoring the presentations), and Technical Judges (scoring the Design Notebooks) will weigh in to select Merit Awards. Merit Awards will go to top teams, with anyone team only eligible for one award.

The entire judging process is monitored by an independent expert resource to ensure fairness and equity. The decisions by judges at the State and National Competitions are final!

Judging feedback to teams will be collected from Challenge and Technical Judges and shared with each team. Team ranking beyond the top three will not be shared.

XI. Rules

The following are the rules and eligibility requirements for RWDC participants. In order to qualify to participate in the National Event, each participant and team must meet all criteria and follow all stated rules.

A. Student Eligibility Requirements

1. To be eligible to compete as a student team member, a student must be currently enrolled in grades nine, ten, eleven, or twelve. Students enrolled in school environments with alternative grade or level designations must be engaged in a program of study equivalent to the corresponding high school grade level.
2. Student team members must have attained the age of 14 as of October 1, of the Challenge year 2012.
3. Student team members shall not yet have attained the age of 19 as of October 1 of the Challenge year 2012.
4. Teams may be organized around extra-curricular organizations. Science clubs and museum programs are encouraged to participate.
5. Student team members may only participate on one team.
6. Student team members *may not* transfer from one team to another.

B. Team Composition

1. An RWDC team consists of one designated teacher/coach and *no fewer than three nor greater than seven student* members.
2. Only those team members identified on the official registration form are considered part of the team.
3. Each team may compete in only one state competition and all team members must be permanent residents of that state or territory OR be enrolled in a school located in that state.
4. Team members may be added or changed up to November 18, 2012.



C. Competition Rules

1. One teacher/coach may lead multiple teams.
2. A team teacher/coach must be at least 21 years of age by October 1 of the Challenge year
3. A teacher/coach must have been trained in Creo Elements/Pro 3D CAD software usage or an equivalent engineering design software program.
4. Coaches may be a teacher or other responsible adult.
5. All submissions shall be the original work of the students involved.
6. All communications between members of a team and external persons shall be documented using the *Windchill* collaborative software.
7. No team may register after 10:00 PM Eastern Time November 18, 2012.
8. All work must be submitted prior to midnight on the date of the submission deadline in local time.
9. All submissions must conform to the specifications outlined in the Challenge.
10. Teams shall only contact mentors through the means and at the times specified by the mentors.
11. Only team members registered as of November 18, 2012 will be eligible to travel to the National Event.
12. A team can be represented by no fewer than three students or more than seven students at the National Event.
13. Students will be required to participate in all scheduled activities at the National Challenge Competition.
14. The team teacher/coach must accompany the team if the team is selected to attend the National Challenge Competition in Washington, DC.

XII. Contact Information

Dr. Ralph K. Coppola
Director, Real World Design Challenge & Senior Director of Global
Government & Strategic Education Programs
Parametric Technology Corporation
Phone: 703-298-6630
Fax: 703-871-5111
rcoppola@ptc.com

Anthony Coppola
Assistant Director, Real World Design Challenge
11710 Plaza America Drive
Suite 2000
Reston, Virginia 20190
Phone: 703-298-6630
Fax: 703-871-5111
Email: acoppola@ptc.com



Appendix 1: Engineering Design Notebook, Cover Page Template & Format

Design Name

Submitted in Response to the Real World Design Challenge

Submitted by

Team Name

Team Member Names

(list team members, with email addresses and phone numbers, and designate team leader)

School/Organization Name

Address

Date

Mentor(s)/Advisor(s): Mentor Name

Mentor Contact Info (Address, Phone, E-mail)

Team/Coach Validating Mark:

Participating students/team members completed Formative Surveys:



Format for the Engineering Design Notebook*

The *Engineering Design Notebook* (Team Report) should follow the paragraph order of the RWDC State Scoring Rubric. The RWDC State Scoring Rubric provided details on the number of points that are provided in each section. Judges will be looking for ability to express comprehension, and linkage between the design solutions to what students have learned. They will also look for a complete Engineering Design Notebook. Missing information will be result in a loss of points. That includes information on the Cover Page.

Appendix 2: Merit Awards

Top teams from both Surface and National Aviation challenges are eligible for merit awards.

Team Work and Collaboration

Teamwork is critical to succeed in RWDC and it is the key ingredient in any team's success. This award is presented to the team whose members best demonstrate extraordinary enthusiasm and spirit, exceptional partnership, the utmost respect for their own teammates, and support and encouragement of fellow teams. They demonstrate confidence, energy, strong problem solving skills, and great group dynamics. Successful teams devised unique ways to work together to be more than the sum of the individual contributors.

Effective Use of Mentors

Successful teams make effective use of mentors including parents and teachers. Mentors have given their time to provide wisdom and guidance. This award is given for the team that utilized this precious resource most effectively.

Impact on STEM

Consideration will be given to the influence of your team on promoting STEM at your school, and in shaping interests of team members.

Against All Odds

This award goes to the team that overcomes difficult barriers and demonstrates an attitude that shows, "We can overcome incredible odds if we never give up, no matter what!"

Best First Year Team

This award recognizes an outstanding team whose school has not previously participated in the challenge.

Innovation

Judges will consider both design and process innovation. This award is presented to the team that produces the most thought provoking and innovative solution.

Design Viability

Judges will review the team's work and design to evaluate the viability of the design's application in industry. This award will go to the team whose design is regarded as most likely to be successful in competition relative to other available commercial designs.



Best Business Case

The team demonstrates an understanding of the business perspective of the challenge, and is able to articulate the value proposition of their particular solution.

Best Presentation (Aviation Challenge Only)

This award is presented to the team that gives the most imaginative, creative presentation demonstrating the team's research and the path to their ultimate solution. It is one thing to create something unique, but you must also communicate what it is or convince others they should use it. Why is your solution better/faster/more efficient than something already out there? Or, if your creation is truly unique, what is it and what does it do? This award goes to the team that best convinces the judges their solution is the best for the given problem.