

# **WATERLOO** **ENGINEERING**

**Consulting Engineering  
Design Problem**

Spring 2013  
Waterloo Engineering Competition  
July 5-6

### General Rules & Guidelines

1. All communication devices must be turned off.
2. Competitors will be allowed to use:
  - a. Computers, USB keys, CDs, pre-existing files etc.
  - b. Internet
  - c. Reference books

All other tools must be cleared with the competition coordinator before use. Cell phones, online communication (e.g. MSN, GoogleChat, Skype) or other communication devices are prohibited.

**Violation of these rules may result in disqualification.**
3. Visitors are not allowed throughout the development and build stage.
4. Keep work stations clean. Tidy up at the end.

### Schedule

The schedule for Consulting Engineering is as follows:

<b>Friday, July 5<sup>th</sup></b>	5:00 p.m. – 5:30 p.m.	Check-In	EIT 1015
	5:30 p.m. – 6:00 p.m.	Welcome/Briefing/Question period	EIT 1015
	6:00 p.m. – 11:00 p.m.	Design	EIT 1 <sup>st</sup> and 3 <sup>rd</sup> Floor
	11:00 p.m. – 11:30 p.m.	Submissions/Debriefing	EIT 1 <sup>st</sup> Floor
<b>Saturday, July 6<sup>th</sup></b>	7:30 a.m. – 8:00 a.m.	Check-In	RCH Lobby
	8:00 a.m. – 2:00 p.m.	Presentation	RCH 309
	2:00 p.m. – 2:30 p.m.*	Prizes and Winner Announcements	RCH309

\*Times are approximate and will be confirmed completion day

Volunteers will bring food and drinks around to teams between 8:30:00 and 9:00 p.m. Each competitor will be given one (1) can of drink. Competitors are encouraged to bring water bottles as bottled water will not be provided. There will be water fountains nearby for refills. Please remind the competition coordinators and volunteers of your dietary restrictions and/or allergies

There will be a question period after the problem is presented during the briefing session. No questions will be answered during the development and build stage to ensure fairness in the competition.

**Background Information:**

Boeing is an American aerospace company founded in 1916, and is currently one of the global leaders in manufacturing commercial jetliners [1]. Boeing has a vast fleet of planes ranging from the 200 passenger Boeing 757 to the large, 467 passenger Boeing 747-8. The newest addition to the Boeing family was the highly anticipated Boeing 787 Dreamliner. In fact, this new plane promised so much potential that by November 2012, there were over 800 orders placed.

Such demand of this new aircraft was caused by the variety of technical innovations that has been incorporated into the design. Such components are the noise reduced turbines, composite body work, increased fuel economy and much more. Unfortunately, one of these technical changes backfired. In January 2013, multiple Boeing 787 planes had their lithium ion batteries erupt in flames causing the aircrafts to be grounded for a few months [2]. Boeing has recently received approval over their new design from the Federal Aviation Administration (FAA), allowing planes, once modified, to resume passenger service.

This battery situation has caused major problems in Boeing's financial and customer relations front. Firstly, the manufacturing costs for a single Dreamliner plane is approximately 207 million dollars (US), but each one is sold for only \$116 million (US) [3]. Secondly, with the grounding of the 787 Dreamliners, Boeing reliability has been slightly tarnished, and they cannot afford to let a serious problem, of this calibre, to happen again.

**Problem Statement**

During the battery fix, Boeing noticed that though the design of the plane works, it is not ideal. This means that while the planes are in for battery service Boeing has the opportunity to modify other aspects of the plane in order to benefit them financially, and help improve customer relations. However, Boeing is not sure, of what aspects of the plane they should modify. Clearly modifying the entire plane is not feasible, but changing certain aspects of the vehicle is very doable.

Boeing has hired your agency to propose design changes to their current 787-8 models. You are free to modify any aspect of the plane, and you can choose as many components as you see fit. However, all changes need to be justified with regards to cost, time, long term production, etc.

Ideally, your solution will solidify the design of the plane, while maintaining both the reliability of Boeing and the promise of what the Dreamliner plane offers customers (fuel efficiency, etc.).

**Advice**

Go here: [http://wec.uwaterloo.ca/consulting\\_engineering.html](http://wec.uwaterloo.ca/consulting_engineering.html) to see how you will be judged (“Marking Scheme”) and what you’re supposed to be doing (“Deliverables”).

It is highly recommended (as the marking scheme shows) to use a structured engineering design method to form the outline of the report and presentation.

Some questions that can get you started (but that do not necessarily have to be answered word-for-word; they are just meant to help you address the problem statement):

- Is it best to re-use old technology or to upgrade to the latest technology available?
- What are some possible metrics one can use to measure improvement in the industry?
- Is it best to focus on one larger change or multiple smaller changes?
- What effect can advanced technologies have in improving production?

**Deliverables:**

- 1) A technical report detailing your analysis and suggested solution (body no more than 15 pages long)
- 2) A PowerPoint Presentation, 15-20 minutes in length

**Additional Resources**

Federal Aviation Administration. <http://www.faa.gov/>

Boeing: The Bowing Company. <http://www.boeing.com/boeing/>

Boeing 787 Schematic. <http://av8rblog.files.wordpress.com/2013/01/boeing-787-schematic.gif>

For Competition Details and Marking Scheme; Deliverables; Permissible Tools please refer to [http://wec.uwaterloo.ca/consulting\\_engineering.html](http://wec.uwaterloo.ca/consulting_engineering.html)

You are expected to find your own data and statistics to support your analysis and solution.

**References**

- [1] Airport Suppliers – Boeing Commercial Airplanes – The World’s Premier Commercial Jetliner Manufacturer. Retrieved from <http://www.airport-suppliers.com/supplier/Boeing/>
- [2] J. Topham and A. Scott. (2013, Jan. 17). Boeing Dreamliners grounded worldwide on battery checks. *Reuters* [Online]. Available: <http://www.reuters.com/article/2013/01/17/us-boeing-dreamliner-idUSBRE90F1N820130117>
- [3] A. Fontevecchia. (2013, May 21). Boeing Bleeding Cash As 787 Dreamliners Cost \$200M But Sell For \$116M, But Productivity Is Improving. *Forbes* [Online]. Available: <http://www.forbes.com/sites/afontevecchia/2013/05/21/boeing-bleeding-cash-as-787-dreamliners-cost-200m-but-sell-for-116m-but-productivity-is-improving/>