

## AN ENGINEERING “GRAND CHALLENGE”: WHAT DO YOU THINK?

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### CURRENT ENGINEERING CHALLENGES: WHAT DO YOU THINK?

“In each of these broad realms of human concern — sustainability, health, vulnerability, and joy of living — specific grand challenges await engineering solutions.” For this assignment, you will investigate one of the 14 Grand Challenges delineated by the National Academy of Engineering (NAE), <http://www.engineeringchallenges.org/>. You will choose a topic related to that challenge, and you will write an 850-950 word “position paper” describing relevant details of that topic and **communicating your own opinions regarding the importance of that topic to engineering, and to the society served by engineering knowledge and practices.** Reading recent material on your topic will help you to clarify and support your opinions, though Writing Assignment #2 requires that you responsibly articulate your **own opinions** on the significance and impact of your chosen Challenge and related topic.

### SEARCH AND DISCOVERY: RESEARCH REQUIREMENTS

In addition to reading all relevant information on the NAE site, you will locate and read a minimum of 4 articles from the past 5 years (September '04—October '09, approximately) that are related to the Challenge and topic you have chosen. One article must be from what is often called a “trade” magazine in engineering, for example *Prism*, *Progressive Engineer*, or the Institute of Electrical and Electronics Engineers’ *Spectrum*. The remaining three articles can be from popular, general audience publications such as *Discover*, *Newsweek*, *The Atlantic*, *The New York Times*, *Scientific American*, or *The Wall Street Journal* or from articles or reports published by appropriate organizations, such as the World Health Organization, the Centers for Disease Control, the Flight Safety Foundation, or the Internet Security Alliance.

In addition to these articles and reports, you may use any other material that provides relevant information: you may use other appropriate web sites; you may use textbooks, lectures, or interviews. Your paper, however, must reflect your attention to the required 4 articles or reports from the required publication types or organizations. Further research details can be found in the document “Library Research Process for Assignment #2.”

### CHOOSING A CHALLENGE, FINDING A TOPIC: RESEARCH STRATEGIES

Part of the work of this assignment is choosing a topic relevant to one of the NAE’s 14 Grand Challenges. You might begin your research process with a particular topic in mind. For example, you may already have an interest in bioengineering and pharmaceuticals. Reading through the NAE’s “Engineer better medicines” challenge might further spark an interest in the development of drugs and/or drug delivery systems that could successfully counter a pandemic.

You would then proceed to do further research on possible pandemics and the role of chemical and/or biomedical engineering in fighting a potential pandemic. This research would contribute to the position you take vis-à-vis the significance of engineering’s focus on “Engineering better medicines” to counter a pandemic.

Perhaps you are beginning this assignment with very few ideas about what you want to write about. Your first research task, then, will be to carefully read through the 14 Grand Challenges, finding an overall area that is **interesting and important to you.** From there, you might do some initial research on several possible, related topics.

For example, after reading through the Challenges, you might find that the overall Challenge “Enhance virtual reality” is most interesting to you. Within that Challenge, you notice that aviation and medical applications are cited as important virtual reality areas. You might decide that you are especially interested in **virtual reality engineering and innovation in aviation.** **You would then continue to research the topic of virtual reality innovation for, perhaps, commercial pilot training.** Your research information should then help you to provide evidence and clarity for your opinions regarding the importance—for society, for engineers and engineering—of virtual reality innovations and applications for commercial pilot training.

### WRITING REQUIREMENTS: CONTENT

With your research providing information and inspiration, write an 850-950 word **“editorial” or “position paper” identifying your chosen Challenge and topic and articulating your own opinions on the importance of that topic** (note: word count does not include end-text References or Acknowledgments). You will describe your selected Challenge **and related topic**; you will articulate your opinion about the significance of that challenge and **related topic**; and you will detail the reasoning that informs your opinions.

Communicating *your point of view*, as a beginning engineer, about this Challenge and related topic is the central task of this paper. Having read your paper, readers should have an enhanced vision of why a particular challenge and related topic deserves the evaluation “Grand.” You will be offering your readers a responsibly considered opinion about why your chosen Challenge and related topic are enormously significant to the engineering profession and to society.

As you compose your paper, keep strongly in mind that you are not just summarizing what your chosen Challenge is (though you must provide those descriptions and details that will allow readers to clearly envision what you are writing about). What you must do is present your challenge/topic from an evaluative perspective. Your paper will communicate your own thoughtful, well-informed opinion or opinions on your chosen challenge/topic. This evaluation or opinion cannot take the form of a “tacked on” conclusion to your paper. Readers of your paper will expect to see, from start to finish, your well informed, carefully presented opinions about the importance of your chosen Challenge/topic.

### USING RESOURCE INFORMATION EFFECTIVELY

While this is not the kind of research paper that only summarizes research materials, you will need to make use of details from your resources to help you describe the Challenge and related topic. You will use information from your research resources to provide clarity and support for your opinions.

If you have, for example, chosen “Provide access to clean water” as your Challenge, and your related topic is a particular experimental desalination technology, you will need to use resources to help describe the Challenge, the related topic, and the relevant technologies. You may also draw on research sources to help articulate and clarify your opinion. You might, for example, quote an authority in the field of public health and an authority in the field of desalination initiatives.

This research information is not all your paper is about, however. The quotes of authorities are not the only voices your readers want and need to hear. Another scientist’s or engineer’s opinion might help you understand, contextualize, and articulate your opinions, but readers want to know, what your opinions are (and the thought process which informed or helped you arrive at those opinions) on particular desalination research or innovations. In your opinion, are the current desalination technologies you are writing about addressing truly “grand challenges?” If so, why can these problems and challenges be responsibly called “grand?” Should engineers devote much focus, time, and brainpower to the overall challenge of access to clean water, and to particular desalination technologies?

While the use of research information is important and will help provide details that inform and support your evaluations and opinions, the bulk of every section of your

paper should not be made up of the quotes or summaries of other writers. Readers want and need to see your opinions, accompanied by clear articulation of your reasoning.

### REQUIRED SECTIONS

Your paper must have sections, including an introduction and a conclusion. Your introduction will concisely state the focus of your paper. This focus must clearly state the Challenge and related topic and must also clearly state your opinions regarding that Challenge and topic. From your introduction, readers will know exactly what your paper is about and will have a sense of how you will proceed to explain your Challenge and topic and support your opinions.

After your introduction, you will use sections and possibly subsections to present an organized description of your Challenge and topic and to articulate and support your opinions. Your conclusion will reinforce—without relying on mere repetition or bland clichés—how and why this Challenge and topic are important to engineers and to the society served by the knowledge and work of engineers.

### EVERYTHING CONNECTS: STRATEGIC WRITING PROCEDURES

$\leftarrow \swarrow \rightarrow \text{Details} \leftarrow \swarrow \rightarrow \text{Evaluation} \leftarrow \swarrow \rightarrow$   
 $\text{Opinion} \leftarrow \swarrow \nwarrow \nearrow \uparrow \text{Evaluation} \leftarrow \nearrow \swarrow \rightarrow \text{Details} \rightarrow$   
 $\uparrow \nearrow \text{Opinion} \uparrow \leftarrow \nwarrow$

Again, you may begin your research with a Challenge or topic already in mind, or you may begin your research and then discover the Challenge and the topic that are most interesting to you. Either way, as you write your paper, you will need to provide an overall “picture” of the Challenge and a somewhat detailed “picture” of the topic. While this paper emphasizes your position on an engineering topic, readers need to understand the topic in order to understand and appreciate your evaluations and opinions. A successful paper will include descriptions and explanations of important aspects of the topic, but a successful paper will use these descriptions and explanations to support and illustrate your own evaluations and opinions.

#### Using Titles and Sections Effectively

Sections provide a valuable organizing strategy; section headings and sub-headings (as well as your paper title) provide a way of “mapping” your findings and ideas. Your paper title and your headings and sub-headings should be as specific as possible, alerting readers to (and sparking readers’ interest in) what is to come. If a paper is titled simply “Clean Water,” or “Individualized Drugs,” and the introduction is titled “Introduction,” a reader has little reason to be interested in that paper, and the paper’s author has not shown that he is fully cognizant of the content of his own work.

Titles such as “Recent Clean Water Innovations” or “Problems with Drug Resistance” are better, but still quite general, especially for a paper articulating an evaluative position. A paper titled “From Water Truck to Drinking Cup: Point-of-Use Water Treatment Initiatives” engages readers’ attention and indicates to readers what this paper is “about” (which simultaneously lets the readers know that the paper’s author is clear about the focus and subject of her paper).

Section and sub-section headings should serve the same purpose. These headings show that the writer knows where she’s been and where she’s going, and these headings introduce and reinforce important information for the reader. Section headings and sub-headings should always be as specific and as expressive as possible.

### ↩ Note Those Arrows

As you compose your sections, be sure to remember everything that your paper “is about,” and to continue to make necessary connections among the material in all sections. Readers should be able to see, clearly, how the information in one section is important to information in all other sections. If you are using a subsection to describe a particular point-of-use water decontamination technology, you will need to be sure to clarify how that technology is relevant to your opinions about the overall importance of “Clean water access.” If you are not sure readers can see why you are presenting particular information in a particular section at a particular point in your paper, then you must more clearly articulate for your readers just exactly how the information is interconnected.

The multiple arrows in the subheading “Details . . .” on the previous page are a reminder that all aspects of your paper are connected and interdependent; you must consistently interconnect information, explanation, and evaluation.

## PROFESSIONAL PRESENTATION: OVERALL FORMATTING REQUIREMENTS

### Always Check, Double Check, Recheck The Specs

Click on the Paper Format Guidelines for a formatting template that also details all formatting specifications. This Assignment you are reading right now is formatted according to those specifications so your finished paper will look much like this Assignment. For Writing Assignments #2, #3, and #4, a 3 point deduction will be taken for each formatting error, so, again, familiarize yourself with the formatting requirements, use the templates, and double check your paper before submission.

### Always Begin with [1]: How to Include Resource Material and How To Format References

You will be using resource information within your paper, and you will need to fully and properly reference any quoted, paraphrased, or summarized resource material. You must include an in-text reference for any quoted, paraphrased, or summarized resource material; for any figure (photograph, diagram, drawing); for any table; or for any equation taken from a resource. You do this by putting a bracketed number at the end of the quote, paraphrase, or summary, or at the end of a figure or table caption. The bracketed numbers in your paper must begin with [1] for your first quoted, paraphrased, or summarized material, then proceed sequentially ([2], [3], [4], etc.).

For example, the first resource information you use in your paper will look like this, if it is a direct quotation: A 2005 report by the World Health Organization says that, “Lack of drinking water and sanitation kills about 4500 children a day and sentences their siblings, parents and neighbours to sickness, squalor and enduring poverty” [1].

If your first resource information is paraphrased, it will look like this: In a 2005 report, the World Health Organization noted that microbial contamination of water continues to be an issue for engineers to address, but chemical contaminants such as arsenic are increasingly seen as posing a problem worldwide [1].

Remember, bracketed reference numbers proceed sequentially, so your next quoted, paraphrased, or summarized material from another resource will be referenced, in-text, as [2]. For example, if you are quoting from a *New York Times* editorial on clean water, this is how that quote will appear in your paper: As David Zetland, S.V. Ciriacy-Wantrup Postdoctoral Fellow in Natural Resource Economics and Political Economy at U.C. Berkeley argues in a 2008 *New York Times* editorial, “Bureaucrats will declare victory, outsiders will applaud, projects will wrap up, money will disappear, and those unlucky enough to have pipes with unsafe and unsustainable water will be left to their own devices” [2].

If you are summarizing Zetland’s *NYT* editorial, it might look like this in your paper: David Zetland, S.V. Ciriacy-Wantrup Postdoctoral Fellow in Natural Resource Economics and Political Economy at U.C. Berkeley, writing for the *New York Times* questions the accuracy of governments’ and relief agencies’ claims about successful clean water pipelines [2].

The next quote, paraphrase or summary from another resource will be referenced, in text, as [3]. If, later in your paper you quote again from Zetland’s article and that quoted information is from the same page (web or hard copy) of the *NYT*, you would use [1] again.

Every bracketed in-text reference must accurately correspond with the same numbered end-text reference in the References section of your paper. Using the WHO article example from above, [1] in the References section would

provide full bibliographic information for the WHO report. If [2] in your paper is a quote from or a summary of Zetland's *NYT* editorial, then [2] in your References section will include full bibliographic information for that *NYT* article.

A sample References section appears below. Consult the Paper Formatting Specifications template via the Paper Formatting Guidelines link for further References section specifications. Consult the document "Presenting End-Text References" via the How to Present References link for details on exactly how to present "full bibliographic information" for various kinds of resources.

### Sample References Section

#### REFERENCES

- [1] "Water for Life: Making it Happen." 2005. World Health Organization and Unicef. Geneva, Switzerland, p.5.  
[http://www.who.int/water\\_sanitation\\_health/monitoring/jmp2005/en/index.html](http://www.who.int/water_sanitation_health/monitoring/jmp2005/en/index.html). Accessed 19 September 2009.
- [2] Zetland, David. 9 September 2009. "Politics, Possibility, and Pipes, a Guest Post." *New York Times*.  
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<http://discovermagazine.com/2008/may/23-from-toilet-to-tap>. Accessed 23 September 2009.
- [4] Mulrine, Anna. March 2006. "To the Rescue." *Prism*. Accessed 23 September 2009. [www.prism-magazine.org/mar06/feature\\_incredibles.cfm](http://www.prism-magazine.org/mar06/feature_incredibles.cfm). Accessed 23 September 2009
- [5] "Provide Access to Clean Water." 2006 *Grand Challenges*.  
<http://www.engineeringchallenges.org/cms/8996/9142.aspx>. Accessed 24 September 2009.

### THE UGLY "P" WORD—PLAGIARISM

There are many different kinds of plagiarism and you never want to involve yourself, intentionally or unintentionally, with any of them. The most obvious form of plagiarism, of course, is using someone else's writing and claiming it as your own. Using another student's paper, or any portion of another student's paper, and presenting the material as your own is plagiarism. Using a paper or article or any section of a paper or article taken from the web or elsewhere, without clearly referencing that material is plagiarism.

**All past Pitt Swanson School of Engineering papers are archived in such a way that any current paper can be checked against them for plagiarism—so don't be tempted! Using the web, your writing and engineering instructors can also easily discern what information in a paper comes from other resources (books, articles, student papers, paper-selling sites, etc.), and your instructors can easily locate those sources.** So, again, don't be tempted to "take" information from another source and present it as your own. It may be easy to find material that can be copied, but it is also easy for your instructors to demonstrate that material has been copied.

Often, issues of plagiarism seem more complicated than the overt copying of someone else's work. Questions about what comprises "someone else's work" can arise. Must all material taken from any source in any way be referenced in order to avoid any appearance or charge of plagiarism? Basically, the answer to this question is "yes." If you paraphrase material from a publication, you must provide in-text and end-text references. If you summarize material from any publication, you must provide appropriate in-text and end-text references. If you quote or paraphrase from a lecture or from class handouts, you must provide appropriate in-text and end-text references. If you use material in any way from any web site, you must provide appropriate in-text and end-text references. Maybe your engineering mentor wrote a paper on a subject similar to yours. Can you use information from that paper? Yes, but you must treat it as you would information from any other resource, and provide appropriate in-text and end-text references. It is expected that you will familiarize yourself with definitions of plagiarism. Here are several excellent web sites that provide detailed information on what plagiarism is and how to avoid plagiarizing: <http://www.pitt.edu/~englit/plagiarism.htm> <http://owl.english.purdue.edu/owl/resource/589/01/>.

### ACKNOWLEDGMENTS

Your paper must have an Acknowledgements section. In this section, you thank anyone who has contributed in any significant way to the process of writing and completing your paper. For example, Acknowledgements for this actual Assignment might look like this: for Assignment #2, we would like to thank Dr. Karen Bursic for suggesting the significance of the NAE Grand Challenges to the freshman engineering curriculum. We would also like to thank the English/Freshman Engineering Writing Program staff for invaluable insight and clarifying editorial suggestions. Thanks, too, and always, to the 0011 Instructors, Dr. Laura Lund, Dr. Natasa Vidic, the late Pete Miller and, again, Dr. Bursic for their Writing Program contributions and their unwavering support.