Science is built up with facts, as a house is with stones. But a collection of facts is no more a science than a heap of stones is a house.

- J. H. Poincaré
ECE 2031 Writing Assignments

All UPCP assignments in 2031 have:

- **In-class lecture**: Overview of the assignment
- **Assignment sheet**: Details of the assignment
- **Template**: Microsoft Word template with formatting
- **Evaluation Sheet**: Used by GTAs to grade the paper
- **Example documents**: To show you writing style

- All of these resources are on the UPCP site:
  upcp.ece.gatech.edu
Spring 2016 Writing Assignment

- In the final project, you will be using a robot called the DE2Bot, which uses ultrasonic rangefinders to sense the world.
- Ultrasonic rangefinders have limitations...
Basics of Sonar

1. A transducer produces a short burst of sound.
2. That “ping” travels through the medium (air).
3. The ping bounces off of something and returns.
4. The time-of-flight is measured and converted to distance (using the speed of sound).
Basics of Sonar

1. A transducer produces a short burst of sound.
2. That “ping” travels through the medium (air).
3. The ping bounces off of something and returns.
4. The time-of-flight is measured and converted to distance (using the speed of sound).
Basics of Sonar

1. A transducer produces a short burst of sound.
2. That “ping” travels through the medium (air).
3. The ping bounces off of something and returns.
4. The time-of-flight is measured and converted to distance (using the speed of sound).
Basics of Sonar

1. A transducer produces a short burst of sound.
2. That “ping” travels through the medium (air).
3. The ping bounces off of something and returns.
4. The time-of-flight is measured and converted to distance (using the speed of sound).
Limitations of Sonar

- Ultrasonic rangefinders have desirable traits:
  - Cheap, simple, robust, accurate (in good conditions…)

- But they also have many limitations:
  - Low measurement rate and low angular resolution
  - Measurements can be inaccurate, or fail, in some situations

- Example: not perpendicular to flat surface:
Assignment Motivation and Info

- Your writing assignment will give you (and your future team) a head start in understanding how rangefinders will behave in certain situations.
  - This will help you to make informed design decisions as you decide how to solve the project problem.
- We will provide a source of some good, relevant information to get you started.
  - You will also need to do some independent research.
- All provided materials related to this assignment will be hosted on the UPCP site.
Engineers are Communicators

- “Professional engineers will spend 40-60% of their working time writing and giving presentations.”
- “Ironically, most engineering programs devote less than 5% of their curriculum to communication skills.”


- Your value as an engineer is your knowledge, and knowledge is only useful when shared.
- Technical communication competency is a highly desirable trait in the professional world.
Technical vs Prosaic Writing

- Other types of writing actively try to complicate things.
- Technical writing works to simplify things.
- Focus on **accuracy**, **clarity**, and **efficiency**
  - Concise, unambiguous sentences
  - Emphasis on organization
  - No embellishment or fluff
  - No superfluously big words
Cater to the Audience

- Every technical document has an audience. Always keep them in mind.

- Different audiences can require substantially different information:
  - Type of information
  - Depth of information
  - Even minor things like whether or not you need to define acronyms before use.
Things to Avoid

● No personal pronouns
  o “We did [something]” → “[Something] was done”

● No contractions

● No slang or conversational speech
  o “Hook up the circuit” -> “connect”, “attach”
  o “Deal with the problem” -> “investigate”, “solve”

● No fluff
  o “The findings are extremely important…”
  o “In today’s society, robots are ubiquitous…”
Writing Style

● Data is quantified
  ○ Avoid vague language: ‘somewhat’, ‘very’, ‘several’, etc.

● Passive voice is acceptable
  ○ “An ASM chart is shown in Figure 3.”

● Technical documents tend to be “dry.”
  ○ And that’s fine; writing to inform, not to entertain
Avoid Monotony

- “Dry” does not mean monotonous
- Avoid repeating the same sentence structure over and over; vary your sentences
- Example sentence openers:

<table>
<thead>
<tr>
<th>type</th>
<th>example</th>
</tr>
</thead>
<tbody>
<tr>
<td>subject-verb</td>
<td>Pulse-width modulation is a technique ...</td>
</tr>
<tr>
<td>prepositional phrase</td>
<td>By varying the duty cycle, PWM can ...</td>
</tr>
<tr>
<td>dependent clause</td>
<td>Although PWM generates a digital output, a simple passive filter can ...</td>
</tr>
<tr>
<td>adverb</td>
<td>Often, the load itself provides adequate ...</td>
</tr>
<tr>
<td>infinitive phrase</td>
<td>To avoid dangerous voltage spikes, a diode ...</td>
</tr>
</tbody>
</table>
Efficient Wording

- Unless a more complicated word or phrase adds meaning, use the simpler form

<table>
<thead>
<tr>
<th>Verbiage</th>
<th>Efficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>commence</td>
<td>start</td>
</tr>
<tr>
<td>endeavor</td>
<td>try</td>
</tr>
<tr>
<td>in the majority of instances</td>
<td>usually</td>
</tr>
<tr>
<td>connected together</td>
<td>connected</td>
</tr>
</tbody>
</table>
The goal of every technical document is information transfer.

Overly prosaic text distracts and confuses, and has no place in technical writing:

- Innuendo, euphemism, hyperbole, sarcasm, word-play, dramatic imagery, suspense

Give all the information up front, as clearly and concisely as possible.
While passive voice is acceptable, active voice is still often preferred.

“A new control method was explored in the summer 2015 project.”

“The summer 2015 project explored a new control method.”
Wording Examples

- Same information, simpler wording:
  - In the majority of failed cases, poor lighting conditions were found to be the cause.
  - Most of the failures were caused by poor lighting.

- Less information but more accessible:
  - Operations at the plant stopped momentarily because the thermal storage charging system’s desuperheater attemperator valve was replaced.
  - Operations at the plant were stopped for 1.5 hours to replace a valve in the thermal storage system.
Avoid Ambiguity

- If a sentence can be interpreted in more than one way, it must be rephrased.

“Reductions of up to 80% in heat and mass transfer coefficients were measured due to outgassing.”

- Were the reductions caused by outgassing?
- Is the heat and mass transfer from outgassing?
- Was it measured because of outgassing?
Spelling and Grammar

- Spelling and grammar are even more important in technical writing than in prose.
- Mistakes can change the meaning of a sentence, causing costly errors.
- Even if the meaning can be deciphered, your credibility will be damaged.
- Proofread for proper grammar, punctuation, word-usage, and sentence- and paragraph-level coherence.
Grammar Rules to Watch For

- **Numbers:**
  - Zero-nine, spell the number out; 10+, use numerals.
  - **Exceptions:**
    - Numbers with units or decimals: 3V, 9%, factor of 6.5
    - Enumeration: Figure 5, Samples 1-4
    - Start of sentence: “Sixty-one gates were used.”
      (re-word sentence to avoid, if possible)

- **Initialisms:**
  - ‘A’ vs ‘An’ depends on sound, not letter.
    - an FPGA, a UART

- **Symbols:**
  - $u \neq \mu; \ m \neq M$

More number rules: [http://www.mhhe.com/mayfieldpub/tsw/numbers.htm](http://www.mhhe.com/mayfieldpub/tsw/numbers.htm)
Large-scale Organization

- Technical documents usually have a clear introduction, body, and conclusion
  - **Introduction**: provides motivation and context; “big picture” information
  - **Body**: contains technical details
  - **Conclusion**: reemphasize main points and discuss “big picture”
Small-scale Organization

- Most technical writing makes heavy use of **headings and subheadings**
  - Should be descriptive enough to guide reader to appropriate section

- Paragraphs tend to be shorter than in other types of writing

- Goal is to make information as accessible and easy-to-find as possible
Using Visual Information

- Large paragraphs of text are the least-accessible form of information.

- When possible, make use of lists, tables, charts, figures, and other graphics.
  - Visual information is nearly always better.
  - But don’t shy away from using text to explain or give context to figures.
  - And there are things that do work better as text. Use common sense.
• Remember: accuracy, clarity, and efficiency

  o Tailored to the audience
  o Concise, unambiguous sentences
  o Emphasis on organization
  o No fluff