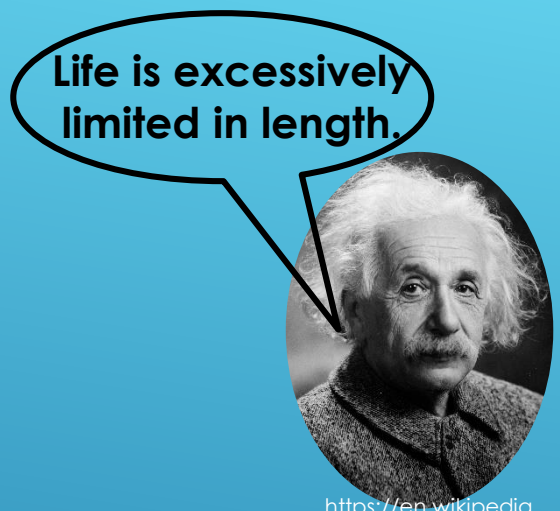
Richard A. Lanham



https://en.wikipedia.org/wiki/Albert_Einstein

https://www.flickr.com/photos/huffstutterrobertl/4544683126

TECHNICAL COMMUNICATION

WRITING

ME 481 Senior Design

Fall 2021

Outline

-Common attributes

-Types of technical written communication

-Oral Communications Basics

Technical Communication Attributes

Communicate

Succeed in conveying one's ideas or in evoking understanding in others.[1]

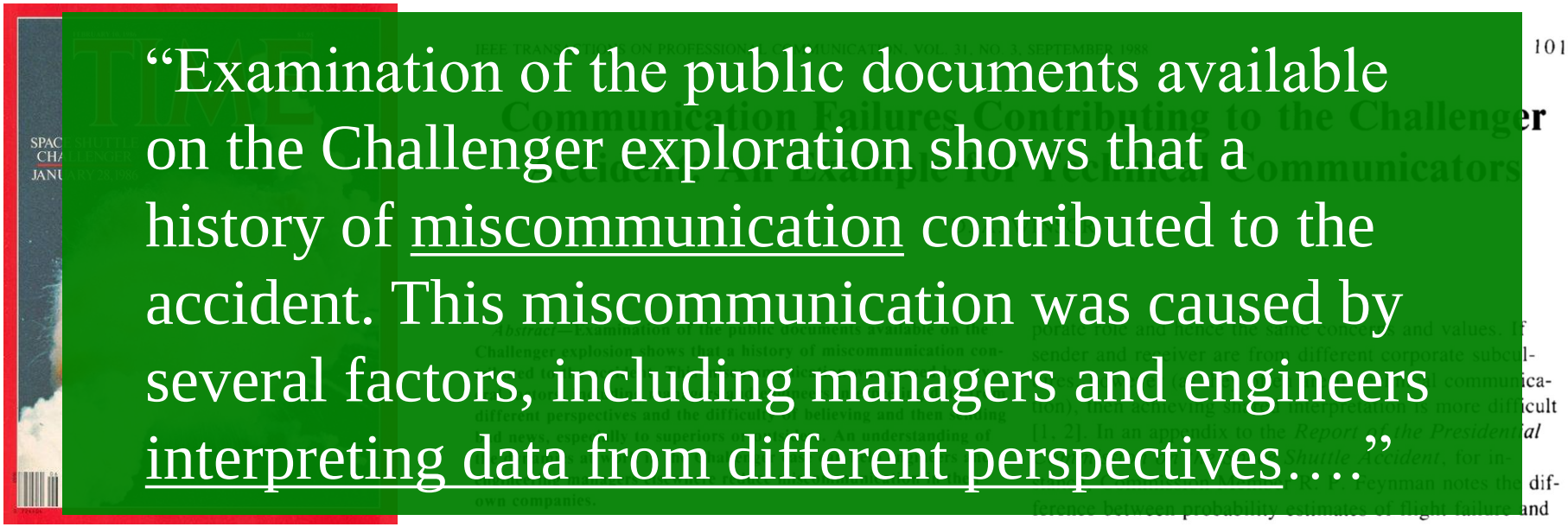
- Reader/listener giving you their most important resource: time[2]
  - Your reader only owes you one reading
    - Be clear
    - Be concise
    - Provide logical structure
- No mystery novels
  - Describe the whole before the part
- Reasons to communicate: **persuade**, inform, …
  - Convince not coerce

1. https://www.google.com/search?q=communicate+definition&oq=communicate&aqs=chrome.1.69i57j0l5.3547j0j7&sourceid=chrome&ie=UTF-8
2. Trimble, John R. *Writing with style: Conversations on the art of writing*. Prentice-Hall Order Processing Center, PO Box 11071, Des Moines, IA 50336-1071, 2000.

Why Is Communication Important?

"Ineffective communications is the primary contributor to project failure one third of the time, and had a negative impact on project success more than half the time."

-- Project Management Institute (PMI)



"Examination of the public documents available on the Challenger exploration shows that a history of miscommunication contributed to the accident. This miscommunication was caused by several factors, including managers and engineers interpreting data from different perspectives…."

How Are We Doing?

"52 percent of mechanical engineering department heads considered the written and oral communication skills of their mechanical engineering graduates to be strong, while only 20 percent considered these skills to be weak….

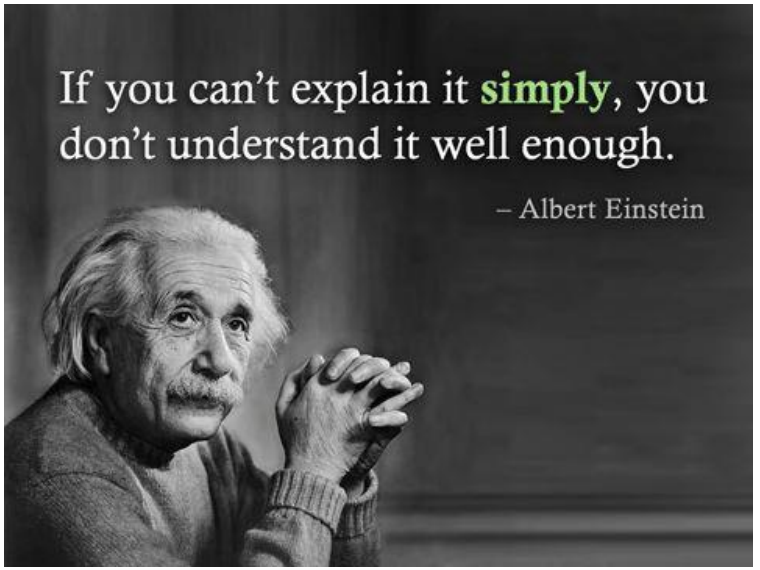
… a parallel survey of industry representatives found almost opposite results, with only 9 percent considering the communication skills of recent mechanical graduates to be strong and 52 percent considering those same skills to be weak. "

-- J.A. Donnell et al., "Why Industry Says That Engineering Graduates Have Poor Communication Skills: What the Literature Says", *American Society for Engineering Education (ASEE)*, 2011.

Effective Communication Basis

Effective communication demands what is written or said to be:

- Direct
- Accurate
- Clear
- Simple
- Without ambiguity*



https://www.exkalibur.com

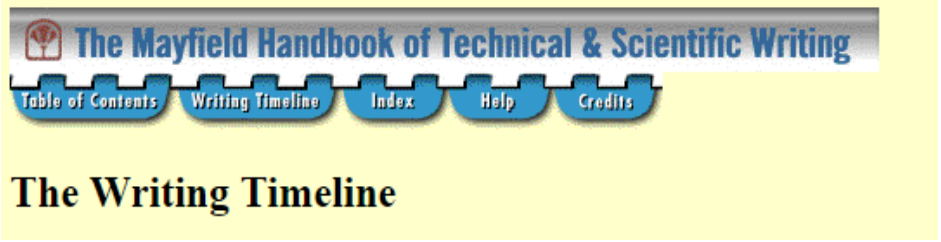
Example: Airplane Lavatory

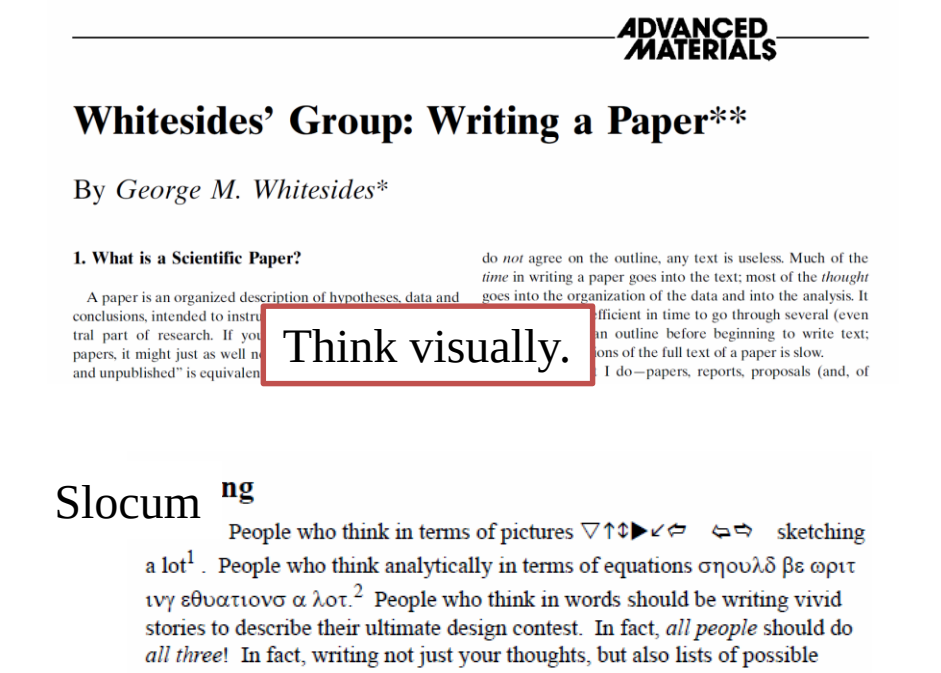
- "Discarding anything other than toilet tissue in the toilet can cause external leaks and create a safety hazard."
- "Please use the trash container for anything other than toilet tissue."
- "Please do not deposit any article in toilet."
- "Do not put any article in toilet."
- "Please do not throw towels, cups, sanitary napkins, bottles, razor blades, objects in toilet."
- "Do not throw paper towels, sanitary napkins, diapers, cups, bottles, other items in toilet."
- "Please do not throw foreign objects in flushing toilet"
- **"Please do not put objects such as air sickness bags, diapers, or towels in toilet."**

-- Jean H. Dawson, Examples of good and bad technical writing, *Weed Technology*, 1994.

POWER

- P – Plan the writing
- O – Outline the Report
- W – Write
- E – Edit
- R – Rewrite





Write ethically!

- Concise and accurate account of the work with an objective discussion of its significance
- Sufficient detail and references/resources to repeat the work or otherwise verify its accuracy
- Full, proper citations of all references, sources of information, and/or sources of inspiration.
- Not plagiarize or falsify
- Not reproduce data or graphics without proper copy write holder approval
  - An Example: Fair Use http://libguides.mit.edu/usingimages

Primary Source of Standards

Example: Dr. Obokata, Hakuro

- STAP (Stimulus-triggered acquisition of pluripotency)
- "…manipulating the image data of two different gels and using data from two different experiments…Given the poor quality of her laboratory notes it has become clearly evident that it will be extremely difficult for anyone else to accurately trace or understand her experiments, and this, too, is considered a serious obstacle to healthy information exchange…." – *Riken*
- 2 papers retracted
- Ph.D. degree revoked
- Mentor committed suicide
- Resigned from Riken

http://nexciencia.exactas.uba.ar

Write precisely and clearly

- Richard Feynman
  - "The first principle is that you must not fool yourself and you are the easiest person to fool."
  - "…boil down incredibly complex concepts and put them in simple language that other people can understand." Only when Feynman could do that did he know he truly understood a concept himself
- Lanham, Richard A. *Revising prose*. Longman Pub Group, 2006.

Write precisely and clearly: examples

Revision Exercise: Sentence

The relationship between the nature of salt water to fresh water in the Edgartown Great Pond that fluctuates often is extremely important to everyone including scientists, residents, and environmentalists on Martha's Vineyard.

Write precisely and clearly: examples

Revision Exercise: Sentence

The relationship between the nature of salt water to fresh water in the Edgartown Great Pond that fluctuates often is extremely important to everyone including scientists, residents, and environmentalists on Martha's Vineyard.

The fluctuating salinity of EGP concerns many environmentalists, scientists, and residents.

Write precisely and clearly: examples

Revision Exercise: Paragraph

Solution of the full three-dimensional equation set is too cumbersome for hand calculations. Furthermore, classical free-body diagrams cannot easily account for factors such as friction in each of the joints, elasticity in the joints and binding – all of which may change as a function of wear. Simplifications can be made to the free-body diagram set to reduce the problem to a series of planar systems, however solving these simplified equations does not yield a solution that accounts for the magnitude of the problem. For these reasons it is recommended that rigid-body FEA analysis of the system be performed. Such an analysis can accommodate all of the factors listed above, and can easily be modified to investigate a wide range of potential cases.

Write precisely and clearly: examples

Precision

-I only eat apples.
-I eat only apples.

Gopen, George D., and Judith A. Swan. "The science of scientific writing." *American Scientist* 78.6 (1990): 550-558.

Write precisely and clearly: examples

Precision

Key information in the main clause

Despite winning the game, the Rainbow Warriors made several errors in the first half.

http://web.mit.edu/me-ugoffice/communication/technical-writing.pdf

Write precisely and clearly: examples

Precision

Key information in the main clause

Despite winning the game, the Rainbow Warriors made several errors in the first half.

Despite making several errors in the first half, the Rainbow Warriors won the game.

http://web.mit.edu/me-ugoffice/communication/technical-writing.pdf

Write precisely and clearly: examples

Precision

Key information in the main clause

Despite winning the game, the Rainbow Warriors made several errors in the first half.

Despite making several errors in the first half, the Rainbow Warriors won the game.

The Rainbows Warriors won the game, despite making several errors in the first half.

http://web.mit.edu/me-ugoffice/communication/technical-writing.pdf

Write precisely and clearly: examples

Context

The average house in the area has a radon level of 0.4 picocuries per liter.

http://web.mit.edu/me-ugoffice/communication/technical-writing.pdf

Write precisely and clearly: examples

Context

The average house in the area has a radon level of 0.4 picocuries per litre.

The average house in the area has a radon level of 0.4 picocuries per litre, which is considered low by the EPA [Lafavore, 1987].

http://web.mit.edu/me-ugoffice/communication/technical-writing.pdf

Write precisely and clearly: examples

Context

The average house in the area has a radon level of 0.4 picocuries per litre.

The average house in the area has a radon level of 0.4 picocuries per litre, which is considered low by the EPA [Lafavore, 1987]. Levels between 20 and 200 picocuries per liter are considered high, and levels above 200 picocuries per liter are considered dangerous. For reference, the average radon level in outdoor air is about 0.2 picocuries per litre.

http://web.mit.edu/me-ugoffice/communication/technical-writing.pdf

First Person or Third Person?

- Chicago Manual of Style:
  - "When you need the first person, use it. It's not immodest to use it; it's superstitious not to." Simon Crowley: "Every time you use the passive voice, a kitten is killed by God."
  - Avoiding the first person used to be considered proper, but now it's considered very formal, if not old-fashioned. It's not a question of correctness, however; both styles are correct. If you feel strongly that the first person is out of place in your work, don't use it. —Chicago Style Q&A, December 2010

Write Clearly

- Provide all necessary information for the reader to understand
- Define all mathematical symbols right before or after their first occurrence
- If you must abbreviate, define the term in its first occurrence, and put abbreviations in parentheses, **e.g.**, American Society of Mechanical Engineers (ASME)
- ***Figure Caption (bottom of figure)***: Should provide sufficient information for the reader to understand the figure without referring to the context, **i.e.**, self-sufficient to explain the figure but should be concise; likewise for ***Table Title (top of table)***.
- All **Figures**, **Tables**, **References**, and **Appendices** should be **cross-referenced within the text in the order they appear.**

Write Precisely

- **Key information in the main clause:**
  - "Despite winning the game, the Rainbow Warriors made several errors in the first half."
  - "Despite making several errors in the first half, the Rainbow Warriors won the game."
  - **"The Rainbow Warriors won the game, despite making several errors in the first half."**

-- Nicole Kelley, MIT

Write Formally

Informal	→	**Formal**
• a lot of	→	much; many
• But…	→	However, …
• And…	→	In addition, …
• &	→	and
• Btw	→	by the way
• vs.	→	versus

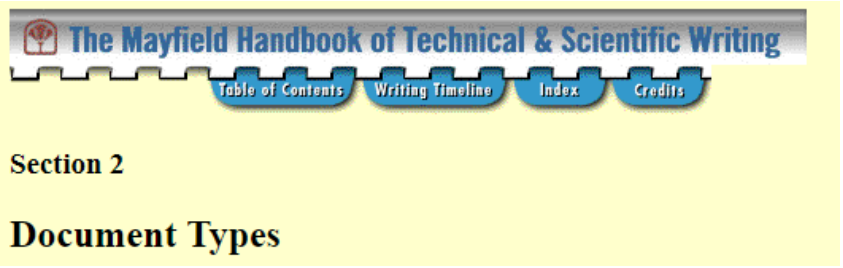
https://proofreadingpal.com/

Write Concisely

- Avoid redundancy (repetition):
  - already existing; mix together; at the present time; basic fundamentals; currently under way ….
- Avoid writing zeroes (empty phrases):
  - it is my intent to show that; as a matter of fact…
- Avoid near zero phrases (too wordy):
  - at this point in time (now); at that point in time (then); has the ability to (can); in the event that (if); in the vicinity of (near); owing to the fact that (because)

Types of written technical communication

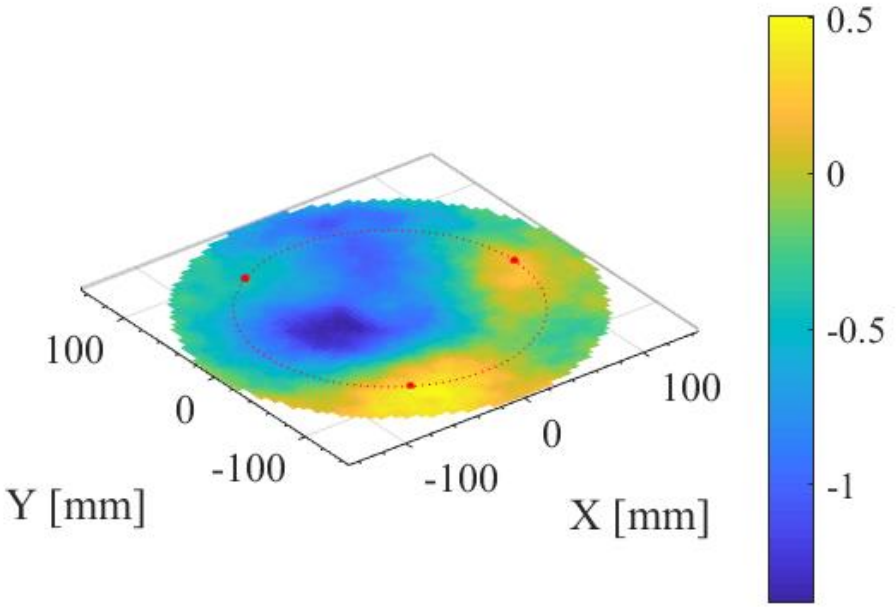
- Design Notebooks
- Proposals
- Technical Reports
  - Design reviews
  - Journal/Conference papers
- Instruction Manuals (SOP)
- Marketing Materials
  - SOP
  - Brochures
  - Websites



Presentations (1)

- Visual Events but communication is still primary goal
- Context is particularly important
- Time
- Nervous?

- Evaluation



Presentations (2)

- Study your audience
- Use visual aids properly
- Give roadmap before going into details
  (e.g., Give Presentation Outline)
- Include necessary and sufficient information
- Be on time!
- **Practice**, **practice**, and **practice** more
- All slides contents should be readable
- Do not make crowded slides (Rule of 6/8 x 6/8)

Presentations (3)

ME 481/482 Presentation Guidelines

10 Rules of presentations

- **1) Organize your presentation in a logical manner (give Needs, Objectives, Big Picture of Design with Subsystems identified, Methodology, Subsystems, DMMs, Analyses, Manufacturing, Assembly, Testing, and Modifications)**
- **2) Let everybody in your group speak**
- **3) Integrate your presentation with your visual aids**
- **4) Include all necessary details and eliminate all unnecessary ones**
- **5) Use good quality slides only**
- **6) Use plots, figures, and tables related to your design**
- **7) Use slides from the prototype during and after manufacturing**
- **8) Use text-slides where necessary (do not use crowded slides; 6/8 x 6/8)**
- **9) Present your slides as clearly as possible**
- **10) Rehearse your presentation until it is "letter-perfect," at least 3 times.**

Presentations (4)

ME 481/482 Presentation Guidelines

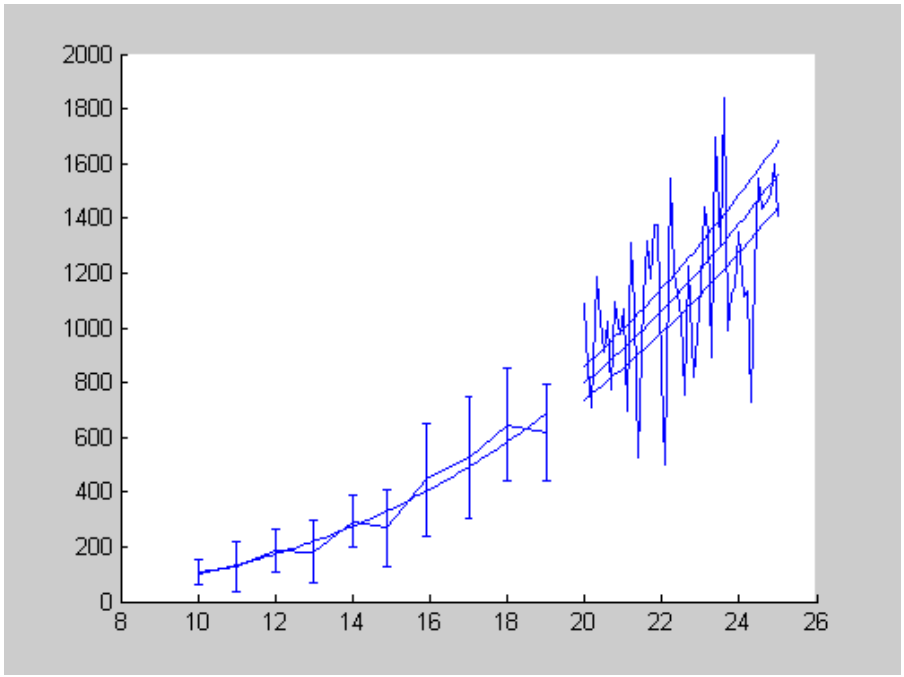
10 Items Sample Format

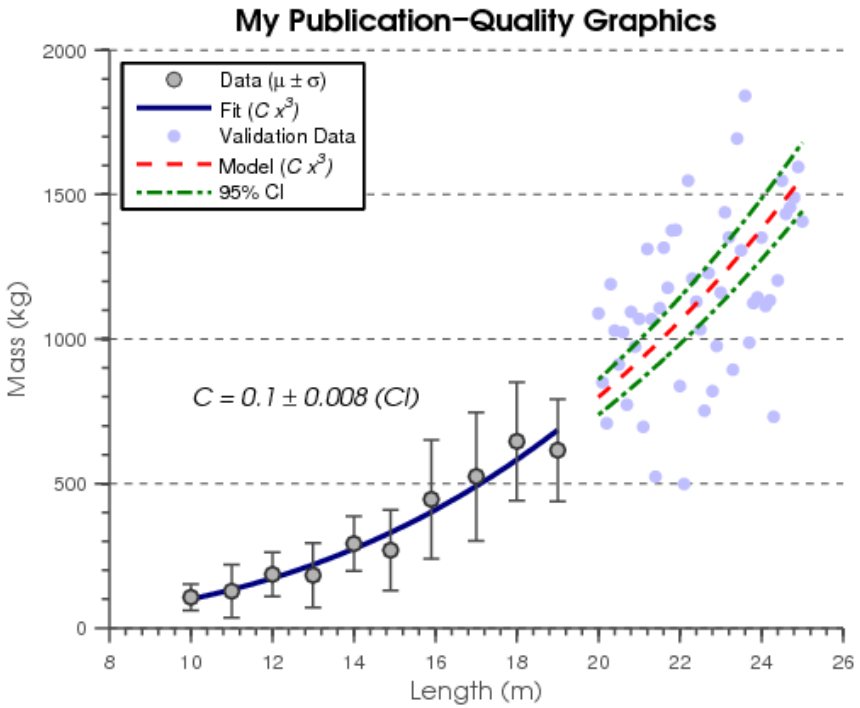
- **1) Title (Group members, ME 481/482, Fall 2021/Spring 2022, Instructor: Dr. xxxxx xxxxx, Dept. of Mechanical Engineering, UHM)**
- **2) Presentation Outline (Bulleted: Objectives/Backgrounds, Design, Analysis, Manufacturing, Assembly, Testing, and Modification)**
- **3) Objectives, Motivations (needs), Background**
- **4) Design Model (Big Picture of Design with subsystems identified; use SolidWorks/Solid Modeling assembly drawing, etc.)**
- **5) Results of Design (DMMs for at least 3 alternatives) and Analysis (Numerical/FEA and/or Analytical)**
- **6) Prototyping, Manufacturing, Assembly, Testing, and Modification followed by: *Final Design Hardware***
- **7) Contributions: You should CLEARLY state your CONTRIBUTION(S), also include strong and weak points of your design**
- **8) Conclusions (whether the objectives are met!)**
- **9) Future Recommendations**
- **10) Acknowledgements: (Sponsors: xxxx, and anyone who helped!)**

MATLAB Plot Guides

- Use **dark colors** for lines/points that will print well in black and white (-------, -------)
- Use line types and point types so the lines are easily distinguishable in black and white (….., ------, --.--.--.)
- Use reasonable precision on axis numbers (1.0, 1.5, 2.0 instead of 1.0000, 1.5000, 2.0000)
- Include several axis ticks on each axis (but not too many), this is usually only an issue on logarithmic scales
- Size or crop the final image to closely fit the actual content (no large margins)
- Use consistent font types and sizes
- UNITS!

Example: Plots





Loren Shure, MathWorks

Conclusion

Communicate

"The fundamental purpose of scientific discourse is not the mere presentation of information and thought but rather its actual communication. It does not matter how pleased an author might be to have converted all the right data into sentences and paragraphs; it matters only whether a large majority of the reading audience accurately perceives what the author had in mind."

--George Gopen and Judith Swan (MIT)

The Science of Scientific Writing