

# Ethics and Experimental Research Projects

16.621

# Why be concerned about ethics?

- **Science and engineering are professions whose integrity rely on the participants behaving in ethical ways.**
- **Unethical behavior can lead to loss of life, property, or other resources.**
- **Individuals can also lose respect and their reputation.**
- **Without ethics, the profession loses the public trust, in which case it will not be valued or it will become highly regulated with much oversight.**
- **Due to past transgressions, our profession has lost considerable public trust. Oversight has increased.**
- **Current aerospace companies and agencies place considerable priority on ethics training and ethical conduct.**

# Macro and Micro Ethics

- **Macro ethics affect large segments of society, e.g. safety of an aircraft or a nuclear power plant**
- **Micro ethics affect individuals or small groups, e.g. impact on a student or employee.**
- **“Ethics and the Second Law of Thermodynamics” by Norm Augustine\* is an excellent easy to read introduction to this topic.**
- **In 16.62X we are mainly concerned about micro ethics surrounding data collection and handling, and reporting of results.**

**Remember - All of us have human weaknesses!**

\*The Bridge, National Academy of Engineering, Fall 2002, pp 4-7

# Three basic ethical principles

- **Full disclosure**
  - Don't hide anything.
  - Operate under the principle that one day, you may run for public office and be fully investigated.
  - You don't want any skeletons in the closet.
- **Don't “invent” the truth**
  - Be an objective, unbiased researcher
- **Give credit for source of information or ideas.**
  - Don't claim something was your discovery when it was someone else's idea.
  - Note: this is one reason why you keep a notebook so the source of your ideas are clear.

# Things to avoid in handling data

- **Cooking the data**
  - Retaining only those points that fit the theory and discarding others
- **Trimming the data**
  - Smoothing of irregularities to make the data look extremely accurate and precise
- **Forging data**
  - Should be patently clear that it is unacceptable to “invent “data
  - Yet it has happened! How or when might this occur?
- **All data is “real data”**
  - Seek to explain outlying data points - it might be an important discovery
  - If you don't use a data point, explain why

# Reporting results

- **Plagiarism**
  - **Verbatim copying of other people's words is unethical**
  - **More subtle form is not plagiarizing words, but ideas**
- **Citations**
  - **All material taken from other sources should be referenced**
  - **This includes figures and materials from other 16.622 projects**
  - **Err on the side of giving credit, but don't go overboard.**

# Reporting results - Continued

- **Acknowledgements**
  - **Always acknowledge someone's help if it impacted the work**
  - **Most reports have an “Acknowledgements” section**
- **Copyright permissions**

# A Hypothetical Situation - I

Jose's 16.622 project has gone well. All the data is collected. On his way to turn in his lab notebook on this final day to take data he passes by his good friends Robin and Wade. They are nervously working to finish their project. In response to "how's it going", they reply "we just figured out how to satisfy our advisor".

Robin and Wade had an exciting project which would prove or disprove their advisor's theory. Prof. Astro was an engaging but somewhat demanding faculty member coming up for tenure next year. Robin and Wade had shown their experimental data to Prof. Astro last week, but it didn't agree well with the theory. Prof. Astro told them the results couldn't be right and that they should redo the experiment. This had upset Robin and Wade and who were looking towards applying to graduate school and hoping to earn an A in 16.622.

# A Hypothetical Situation - II

**Robin and Wade's final oral presentation followed Jose's. He was surprised when they showed results in remarkable agreement with Prof. Astro's theory. In the Q&A session, Prof. Astro monopolized the time, mostly talking about the good results and not asking many questions. With little time left, a 16.622 faculty member asked what had led to the successful outcome, knowing that the experiment had come down to the wire. Robin and Wade, said they fixed a faulty electrical connection and got the data on the last day.**

**At the end of the session, Jose overheard the 16.622 faculty asking the technical staff about the faulty connection. And as he left the room, he passed by Prof. Astro who was excitedly talking to Robin and Wade. The experimental proof of the theory would be a big boost to Prof. Astro's stature.**

**Apparently the professor wanted the students to write a paper with the three of them as co-authors.**

# Jose's dilemma

Several things bothered Jose about Robin and Wade's project. He expected a good grade in 16.622 and wanted to ask the course faculty for a grad school letter of recommendation. He didn't want to rock the boat, and Robin and Wade were good friends. But he didn't sleep well that night.

**If you were Jose, what would you be thinking about? Is there anything you would do?**

# Summary

- **Follow the ethical principles suggested**
- **Keep a notebook and follow guidelines in the syllabus**
  - **Your grade will depend upon it!**
- **Ethical issues are often in the “gray zone”**
  - **Rarely are they completely cut and dried**
- **If in doubt**
  - **Ask us or your supervisor when you are working, or**
  - **Talk to MIT’s ombudsman**