WELCOME TO 16.621/622

(and some comments on how to succeed)

- **Some Questions**
  - **Team selection process?**
  - **Project selection process?**
  - **Advisers can commit to projects Tuesday after 4 pm**

- **A Requirement**
  - **Photos**

TODAY'S TOPICS

- Status check, photo opportunity
- Course goal and course learning objectives
- Some comments on the research process
  - The research "catechism"
- The 16.62x cycle (16.62x Syllabus)
- Our thoughts on progress and achievement in 16.62x

QUOTES FROM THE SYLLABUS

- **"First and foremost this is your project. You choose the topic and advisor."**

- **"Your responsibility is to define an experimental program, develop a hypothesis, objective statement(s), and success criteria consistent with the definition of the problem"**

- **One role of the course staff is to *help* in this process**

- **We will ask for feedback about how well we are doing**

GOAL FOR 16.62X

The goal of 16.62X is to enable you to master the relevant methods, processes and techniques necessary for conceiving, designing, implementing, operating, and documenting an experimental project that addresses the investigation of a hypothesis

16.62X AND INSTITUTE REQUIREMENTS

- **Institute Laboratory Requirement (satisfied by 622) for conducting an experiment dealing with phenomena of the natural world and testing (assessing) a hypothesis**

- **Phase II writing requirement can be satisfied by final 16.621 project proposal (or solely authored 622 report)**
  - **Grade of B- or better is necessary**

LEARNING OBJECTIVES

At the end of the 16.62X cycle you will be able to:

- **Formulate** the overall objectives and success criteria for an experimental assessment of a hypothesis about the natural world

- **Develop**, as a two-person team, strategy and tactics for design of an experiment and data analysis to achieve these objectives

- **Implement**, as a two-person team, the detailed experiment design and data analysis

- **Execute**, as a two-person team, an experiment which will successfully assess a defined hypothesis

- **Effectively communicate**, orally and in writing, the key aspects of the project, from concept to end goal

Your 16.62X Journey

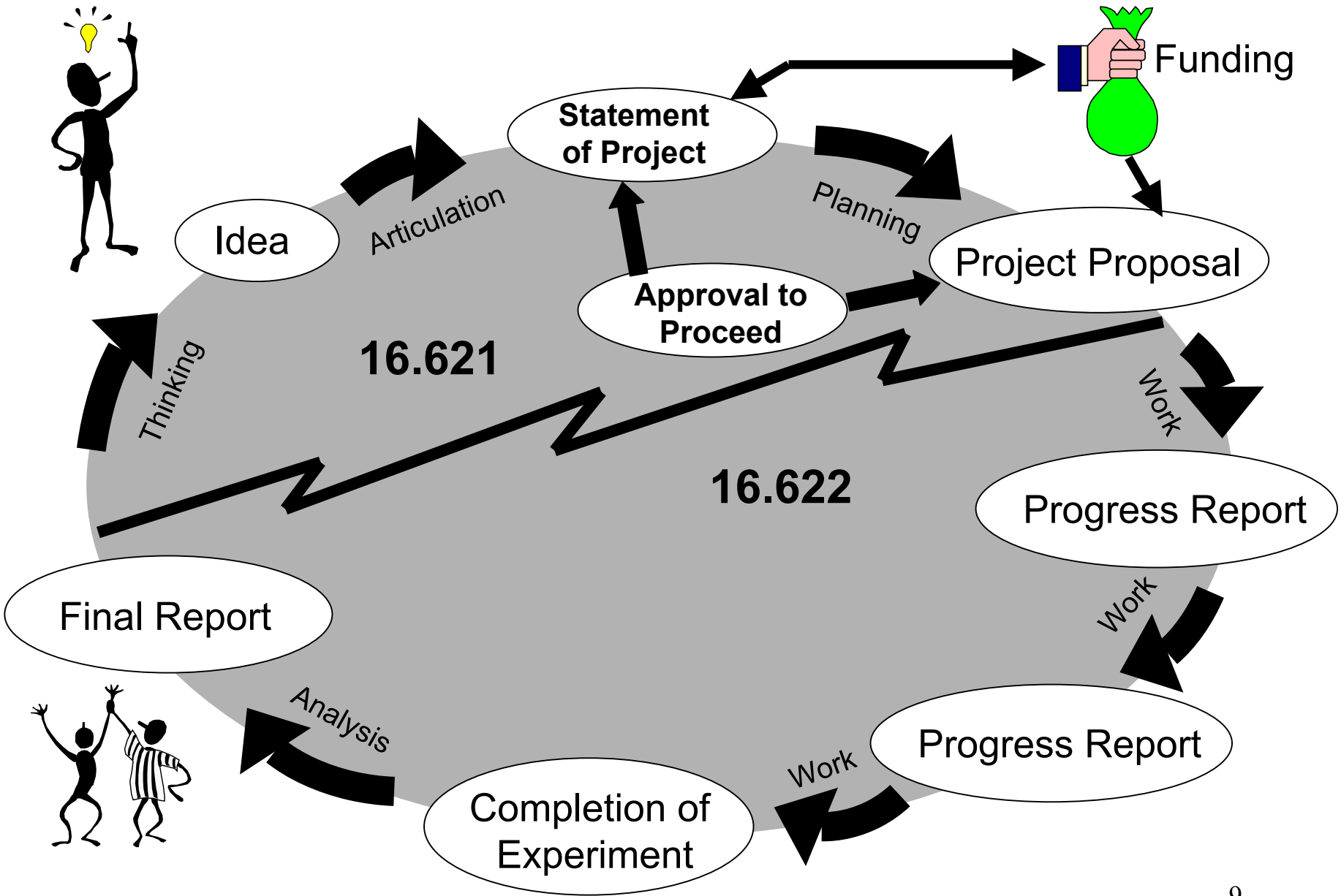
16.621 - SP03

Wk	Task	Due
2	Select Partner, Project & Advisor	
4 7	<u>Conceive Phase</u> Background, Overview Hypothesis, Objective(s), Success Criteria Literature Review Technical Approach	Prop Ver 1 Prop Ver 2
8	**Spring Break (Sun!)**	
10 15	<u>Design Phase</u> Experimental Design Data Analysis Project Planning Needed Facilities & Space Engineering Drawings and/or Psuedo Code Detailed Parts List	Oral Prop Prop Ver 3
	Proposal Accepted -Onto 622	
	Proposal Not Accepted - I	

16.622 - F03

Wk	Task	Due
5	<u>Implement Phase</u> Construct Apparatus and/or Write Software Calibrate Take Preliminary data <u>Operate Phase</u> Collect Data Reduce Data Check For Validity	Oral Prog Rept
11	**Last Day to Take Data**	
13 15	<u>Report Phase</u> Analyze Data Assess Hypothesis Report Results in Form Suitable for submission to Student Conference	Oral Rept Final Rept
	Optional - Conference Pub	

THE 62X RESEARCH CYCLE



The “Idea”….

- ….can come from
  - Curiosity
  - Your “boss” or in 621 your advisor
  - A need
  - A brainstorming session
  - A previous project
  - ….

- Be sure the idea addresses something of value to society.

TIPS ON PICKING A 62X PROJECT [Murman]

- **Do you like your advisor and think you will be able to work well with her/him?**
- **Does the topic excite you <u>and</u> your partner?**
- **Does the project seem doable in 132 hours (11 weeks) of work in 622 if it is well planned in 621?**
- **Are the major facilities that you need available?**

WHY RESEARCH?

- To uncover the way nature works
  - To discover the “laws” that describe these workings
  - To find out relationships that are not known
  - To determine the value of physical constants
- ...

- ...

- To define ways to make aerospace devices “better”.

HOW RESEARCH?

- **Figure out which problems/relationships are not known**
- **Develop hypothesis about relationship (between inputs & outputs)**
- **Design an experimental procedure to illustrate the relationship**
- **Build/buy the equipment required for procedure**
- **Set up experiment**
- **Analyze results**
- **Verify results**

} **Iteration is involved**

- **Communicate/publish results (Iteration needed:** "Easy writing's vile hard reading" [Sheridan]**)**

G. H. HEILMEIER'S* "CATECHISM" FOR EVALUATING A RESEARCH PROJECT

- **What are you trying to do? (Articulate your objectives using absolutely no jargon)**
- **How is it done today and what are the limits of current practice?**
- **What is new in your approach and why do you think it will be successful?**
- **Who cares? If it is successful, what difference will it make?**
- **What are the risks and the payoffs?**
- **How much will it cost? How long will it take?**
- **What are the midterm and "final" exams to check for its success?**

*** Look him up on the web if you want to see an impressive resume**

THE 16.621 SYLLABUS AT A GLANCE

- The next few slides give a short tour of the 16.62X Syllabus

- This is only an overview -- as it says on the front page "YOU are responsible for reading and understanding this document"

- Appendix B gives a list of the specific 16.621 Deliverables

- Some options for dealing with the list of deliverables
  - Memorize the list and recite it often to yourself
  - Call up Professor Murman at midnight and ask him what is due the next day*
  - Tattoo the list somewhere prominent
  - Less exciting, but perhaps more practical - keep the Syllabus handy and consult it often for specific information

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*Follow-up with another phone call at 2 am to make sure you have all the information

16.621 MILESTONES

Milestone	**Week***
Select Partner	1
Select Project/Advisor	3
Version I (draft **S**tatement **o**f **P**roject)	4
Team Meeting (all stakeholders in one room)	6
Version II (revised Version I + other material)	7
Oral Presentation	10
Team Meeting	14
Final Written Proposal: Version III (Revised Versions I,	15

* Week count includes spring break

MORE MILESTONES (Notebooks)

- **Laboratory Notebooks will be discussed in more depth in next lecture. For now just three points:**

- **Your notebook should be an accurate and definitive record of your work**

- **Notebooks are to be handed in for grading three times in term**
  - Week 5
  - Week 8
  - Week 11

- **Last term several teams where the notebooks made a letter grade difference between the two members**

16.621 GRADE ALLOCATION

Assessment Tool	% Final Grade
3 Notebook Checks	9%
Version I	10%
Version I rev., Version II	10%
Oral Project Proposal (I,II)	20%
Advisor's Grade - I	10%
Final Written Proposal	20%
Advisor's Grade - II	10%
Technical Staff Grade	10%
Subject Evaluation	1%

CLIFF NOTES FOR THE SYLLABUS

- **Although Murman, Craig, and Greitzer have worked hard on the syllabus, we understand you may not want to take the time to commit it to memory**

- **The TAs have volunteered to address this possible disconnect**
  - **Develop a student-oriented "Mini-Syllabus" with information you are likely to need on an ongoing basis**

- **We emphasize that there is other information in the Syllabus that you are going to need**
-

WHAT'S THE MESSAGE?

- **The process we are describing is one that requires a sustained consistent effort**

- **The deliverables during the term will feed in directly to the final report**

- **It is difficult, if not impossible to "do it all in the last two weeks" (two days/two hours/….)**

- **The faculty/staff will help with this by following your progress**
  - **This is diagnostic, not punitive**
  - **Green, yellow, red - we will share information with you about the status**

SOME OTHER COMMENTS

- **The process you are engaged in has many similarities with "real world" projects:**
  - **The need to have a clear idea and vision for what you are trying to do**
  - **The nature of a process with specific "gates" or hurdles which must be crossed (Staged Gate Process, Passport Review)**
  - **The need for iteration in both research and communication aspects**
  - **The need for teaming in stepping up to project with high impact**
  - **The opportunity to create something you can be proud of-- and the chance to know how enjoyable that is**

- **It's your project--we hope you have a great time with it**