

SAE 550 Lecture #1:

Syllabus and Introduction to the Course; Intro to Political Process & Political Facts of Life



**University of Southern California
Viterbi School of Engineering
Systems Architecture & Engineering (SAE)**



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Dr. Edwin Ordoukhanian - ordoukha@usc.edu**



- Instructor of many Systems Architecting & Engineering (SAE) classes since Fall of 1996
- Senior Systems Engineer (Retired) for The Boeing Company Huntington Beach CA-- Boeing Defense, Space, & Security: Phantom Works
 - Manned Space, Launch Systems, Satellite Systems, Networked Systems, Cyber Security, and Defense Conversion
- Was employed as a Computer Hardware/Software and Systems Engineer for 46 years: Government, Small Business, & Aerospace Sectors
- Professional Societies (Senior Member): AIAA, INCOSE, IEEE
 - IEEE SMC former co-chair MBSE Working Group
 - INCOSE Resilient Systems Working Group (RSWG) chair
 - AIAA Space Settlement & SE Technical Committee Member
 - Network-Centric Operations Industry Consortium (NCOIC) Technical Council Chair Emeritus
- Formal Education:
 - BS in High-Energy & Nuclear Physics
 - MS in Systems Architecting & Engineering



- **Experience:**
 - Systems Engineer at Crane Aerospace and Electronics
 - MBSE, Brake Control System Development, Modeling and Simulation
 - Former Teaching Assistant at USC
 - SAE 549, SAE 541, SAE 548, SAE 550, SAE 551, SAE 560
 - Former Research Assistant at USC
 - Self-Driving Cars, UAV Swarms
- **Education:**
 - Ph.D., Astronautical Engineering, USC
 - Specializing in Systems Architecting and Engineering
 - M.S. Aerospace Engineering, USC
 - B.Eng., Automation and Control, National Polytechnic University of Armenia
- **Societies**
 - INCOSE and INCOSE TLI, AIAA, IEEE
- **Research Interest:**
 - MBSE, Autonomous Systems and SoS, Engineered Resilient Systems, Complex Engineered Systems, Human-System Integration

SAE 550 Description

❑ Part of Systems Architecting & Engineering (SAE) Series

- The design and development of a major engineering system is often strongly influenced by politically-driven processes for funding and approval of that project
 - Processes in Governments, Large Organizations, etc.
- System architects are carefully trained in analytical techniques for dealing with cost, schedule, and performance challenges
 - But often woefully unprepared for the role of governmental or organizational politics in their projects
- This class provides system architects with training in political risk mitigation tools
 - Heuristics that aid in understanding/surviving the political processes that inevitably affect engineering decisions
- Real-world Case Studies are provided to demonstrate the impact of political processes
 - And analyzed to reveal potential risk mitigation techniques

SAE 550 Description

- ❑ **Part of Systems Architecting & Engineering (SAE) Series**
 - **Elective Course in University of Southern California's Masters Program in Systems Architecting & Engineering**
 - **Class originated by Dr. Brenda Forman in the late 1980s**
 - **Class restarted in 1996 through 2014 by Ken Cureton, then Dr. Elliot Axelband for 2015-2016, Ken Cureton resumed in 2017, Dr. Ordoukhanian joined as co-Instructor in 2024**
 - **About 1,000 Students have completed the class**
 - **Student Demographics:**
 - **About 1/2 are employed by aerospace companies**
 - **About 1 out of 20 are Space Force, Air Force, Navy, or Army officers**
 - **Remainder are foreign students or those with more of a commercial background**

SAE 550 Class Grading Summary

- ☐ **One Research Paper is required of each student**
 - **In place of a Final Exam, 50% of class grade**
 - **Papers are typically 20 single-spaced pages, suitably formatted for publication in a technical journal**
 - **Student materials on “How to Write a Research Paper”**
 - **Students are encouraged to interact with the Instructors regarding questions, outlines, drafts, etc.**
- ☐ **Students choose research topic & submit abstract for approval**
- ☐ **5 Case Studies with homework assignment for each**
 - **These Case Studies are different than the 9 Case Studies analyzed in class**
- ☐ **Take-home Midterm Exam**
- ☐ **Structured analysis required for Paper, Homework, Midterm Exam**
 - **Specific analyses required in each case to demonstrate student’s ability to apply the class fundamentals:**
 - **Political Risk Mitigation Factors**
 - **Also known as the Political “Facts Of Life” or FOLs**

SAE 550 Class Grading Summary

Assignment	Points	% of Grade
Research Paper	200	50%
Homework #1 - #5 (20 points each)	100	25%
Midterm Exam	100	25%
TOTAL	400	100%

- The grand total of points is divided by **100** (to scale your total to a range of **four-to-zero**): **Class Score = (Paper + Homework + Participation) / 100**
- **i.e., 50% for your research paper, 25% for your homework assignments, 25% for your Midterm Exam**

❑ Total score is converted into a letter grade for the class:

A 4.0 to above 3.7
A- 3.7 to above 3.3
B+ 3.3 to above 3.0
B 3.0 to above 2.7
B- 2.7 to above 2.3
C+ 2.3 to above 2.0
C 2.0 to above 1.7
C- 1.7 to above 1.5
D+ 1.5 to above 1.0
D 1.0 to above 0.7
D- 0.7 to above 0.5
F 0.5 or below

Your Instructors follow University Policy regarding grading!

- Grades are **EARNED**, and not **NEGOTIATED**
 - **Please DO NOT attempt to contact us to change your Class Grade!**
- We strive to be *as deterministic as possible* in grading assignments
- We apply *consistent scoring* across all students

Access to Class Instructor & TA

☐ Instructor: Mr. Kenneth L. Cureton

- **Office: (only virtual for Fall 2025)**
- **Office Hours: By Appointment, ZOOM Meetings**
 - **Please schedule desired meetings by sending a request via e-mail**
- **Contact Info: cureton@usc.edu**
 - **Please only for Urgent Messages—**
Cell Phone: (714) 342-7818

☐ Instructor: Dr. Edwin Ordoukhanian

- **Office: (only virtual for Fall 2025)**
- **Office Hours: By Appointment, ZOOM Meetings**
 - **Please schedule desired meetings by sending a request via e-mail**
- **Contact Info: ordoukha@usc.edu**

☐ Teaching Assistant: (none)

Required Readings & Supplementary Materials

- ❑ All required materials are available on-line via the DEN
 - <https://brightspace.usc.edu>
- ❑ Much of the Class Readings and Supplementary materials are also available on a personal website: <http://www.skit.com>
 - If asked for a password when accessing a particular item, use ise550 (all lower case, no spaces) Note: not SAE550
 - Certain DEN items are NOT available on *skit.com*
 - Recorded webcasted lecture videos
 - Discussion Boards
 - DEN Assignments for Homework & Research Paper submissions
 - Your grades
 - Purpose of *skit.com* is to provide you with continued access to current course materials, long after you've completed this class
 - Also provides a current e-mail address into the future, in case you want to ask questions or interact later on

About the Research Paper

❑ Research Paper (in place of a Final Exam)

- Counts as 50% of your Class Grade
- Due the Final Exam week in place of a Final Exam: **Dec 17th**
 - Extensions beyond midnight that day *cannot* be granted as we must grade all papers and submit class grades to the University's Grading & Roster System within a few days thereafter!
- One goal of this class is to improve your ability to generate a professional-level Research Paper
 - Suitable for presentation at a systems engineering conference
 - Or publication in a professional journal
- You must submit a one-page abstract regarding your proposed topic for approval
 - Please submit on-line via DEN no later than **October 8th**
 - See References for 'How to Write an Abstract'
 - Also see second page of Sample Research Papers for examples of abstracts
 - Can work in Teams– see Joint Paper Guidelines

About the Research Paper

❑ Additional information:

- **Please refer to the Class Syllabus**
- **The 'Research Paper Checklist' and 'How to Write a Research Paper for this Class' are available on the DEN References**
 - These provide guidelines on how to write a research paper, with suggestions for format, organization, structure, and content of good research papers
- **The last class session is a CLASS SUMMARY AND RESEARCH PAPER WORKSHOP**
 - An interactive review of the Research Paper guidelines
- **Please feel free to ask us for help in structuring your research plan and Research Paper**
 - We will gladly work with you to review your research methodology, paper outline, draft paper, potential references, etc.
- **If English grammar, spelling and syntax are not your strong points, we strongly suggest that you obtain help in editing your text**
 - Your grade depends on the clarity of presentation!

About the Homework Assignments

❑ Homework Assignments

- **Counts as 25% of your Class Grade**
 - Five Homework Assignments, one for each Homework Case Study
- **Each homework submission graded on a scale of zero-to-20**
 - Based on your analysis of the case study
 - We'll grade and comment on your homework as soon as possible after the appropriate due date
- **Homework content: analyze the Case Study in terms of the course concepts, in terms of:**
 - Events (what happened, how and why) and
 - Lessons-learned (how to apply learnings on other programs)
 - Your analysis should be quantitative where possible (e.g. budgets, votes, constituency)
 - Also provide qualitative discussions based on the political risk mitigation factors (heuristics) presented in this course

About the Homework Assignments

❑ Format:

- Microsoft WORD (.DOC or .DOCX) or Microsoft PowerPoint (.PPT or .PPTX) or Adobe Acrobat (.PDF) format for homework assignments
 - Microsoft WORD format is preferred
 - A template .DOCX file is provided in the DEN References, but you can choose to use your own format
 - Do not need to cite References or Quotations

❑ Length:

- Two or three pages should be sufficient for each homework assignment
 - Keep your descriptions brief: accomplish your analysis in bullet format for each required analysis
- The point is not size, rather *quality* of analysis

About the Midterm Exam

❑ Take-home Exam

- **Consists of questions regarding political facts of life and their impact on system architecture and architecting process**
 - The exam will be a maximum of 100 points, and covers topics from the first 7 lectures
 - The exam will be an individual effort, take-home exam with open book and notes.
- **Exam opens after Lecture #7: October 8, 2025 at 9:20 PM**
- **Exam due before Lecture #8: October 15, 2025 at 6:40 PM**
 - All times are Pacific Time
- **GRADING:**
 - We'll grade and comment on Midterm Exams as soon as possible after the appropriate due date
 - All late or missing submissions will receive a score of zero
 - Collaboration on the Midterm is forbidden. Violators will receive an automatic score of zero.

Fall 2025 Schedule (1 of 2)

Lecture	Date	Topics/Daily Activities	Assigned	Due
1	27-Aug	Introduction to the Course; Discussion of the Political Process	Personal Introduction	-
2	3-Sep	Discussion of the US Federal Government Budgetary Process	-	Personal Introduction
3	10-Sep	FOL Characteristics and Budgetary Defense	-	-
4	17-Sep	Case Study #1: U.S. Manned Launch Vehicles (Mercury, Gemini, Apollo, Shuttle & future)	HW1: Superconducting Materials & Application	-
5	24-Sep	Case Study #2: V-22 Osprey Tiltrotor	HW2: Space Station Freedom (SSF)	HW 1
6	1-Oct	Case Study #3: Joint Strike Fighter (JSF) / F35	-	HW 2
7	8-Oct	Systems Engineering Concepts and Programmatic Risk Management	Take Home Midterm	Term Paper Abstract

Fall 2025 Schedule (2 of 2)

Lecture	Date	Topics/Daily Activities	Assigned	Due
8	15-Oct	Case Study #4: Ground Transportation Infrastructure (Roads, Autos, Trucks, Trains, etc.)	HW3: Assured Crew Return Vehicle (ACRV)	Midterm
9	22-Oct	Case Study #5: Superconducting Supercollider	HW4: Federal Fire-Fighting Process	HW 3
10	29-Oct	Case Study #6: Positioning, Timing, & Navigation Services (GNSS)	HW5: National AeroSpace Plane	HW 4
11	5-Nov	Case Study #7: California High-Speed Rail	-	HW 5
12	12-Nov	Case Study #8: Hoover Dam	-	-
Holiday	26-Nov	No Class; University Holiday	-	-
14	3-Dec	Class Summary, Research Paper Workshop and Systems Engineer's Toolset to Navigate Political Process	-	-
STUDY	10-Dec	None – no lecture	-	-
FINAL	17-Dec	None – no lecture	-	Research Paper Due

Academic Integrity and AI Use Policy

Artificial Intelligence (AI) tools (including generative AI such as ChatGPT, Claude, Copilot, Grok, etc.) are permitted in this course under the following conditions:

❑ Allowed Uses:

- **Brainstorming and concept exploration - Generate initial ideas or approaches to problems**
- **Research starting points - Find relevant papers, standards, or methodologies (you must verify all sources, as AI-identified sources may not exist)**
- **Solution verification and error checking - Using AI to review your completed work, identify errors, and suggest corrections (you must understand and independently verify any suggested changes)**
- **Writing assistance - Grammar checking, clarity improvements, and structural suggestions for papers and reports**

❑ Required Disclosures:

- **Document all AI use - Include a brief statement at the end of each assignment listing: (1) which AI tools you used, (2) what specific tasks you used them for, and (3) how you verified or modified any AI-generated output**

❑ Prohibited Uses:

- **Direct copying - Submitting AI-generated content without your substantial modification and intellectual contribution**
- **Complete solutions - Having AI initially generate papers, reports, or solve entire problems without your prior intellectual contribution**
- **Fabricated data or citations - Using AI to create fake references, technical specifications, papers, or reports**

Remainder of Tonight's Lecture

- ❑ **Intro to the Political Process and Political Facts of Life**
- ❑ **Your Instructor's Humble Apologies!**
 - **This will be more of a Political Science lecture, and less of an Engineering lecture**
 - **Will point out Implications to Engineering & Science Programs**
 - **But forthcoming Case Studies will do a better job**
 - **Honest!!! We will be focused on more technical topics soon**
 - **After next week's lecture on Budget & Acquisition Systems**

Why This Class?

☐ Why we're here:

- **Show intimate effect on Engineering design processes of pressures of political process**
- **Help you understand that process, to give confidence & effectiveness in future**

☐ This is NOT a Political Science class!

- **Focus is on Engineering & Scientific impacts of the Political Process**
 - **Not on the full details of the Budget Process, Acquisition steps (e.g. DAU classes)**
- **Instructor chooses to not express personal opinions on Elections or Political Figures/Events**
 - **But will comment on potential impacts with enthusiastic sarcasm!**

Class Focus

❑ Political Process vs. Scientific/Engineering Design Process

❑ Central Point:

- High-Tech usually means High-Budget and thus High-Visibility
- High-Visibility programs are more than Engineering challenges; they are Political challenges of first magnitude
- Physical Engineering must be impeccable
 - Political engineering must be equally so
 - Can't just dismiss the situation: "Oh, that's politics"
 - Won't just "go away"
 - Politics is an ever-present set of factors
 - *Will influence program at every turn*
- Politics:
 - Ignoring it only ensures later ambush
 - Must instead be understood
 - Understanding often results in confidence
 - Need to avoid sounding naïve or "stepping on land mines" (e.g. *not* use the word "Congressmen"... *faux pas!*)

What is the “Political System”?

❑ The Political System:

- **Essential to grasp term's meaning**
- **Not just formal political institutions (Administration/President & Congress & Supreme Court), but also:**
 - Interagency rivalries
 - Intra-agency tensions
 - Dozens of lobbying groups
 - Influential external review groups
 - Powerful individuals both within and outside government
 - And always, the Media
- **Extremely complex interaction!**
 - Impossible to model quantitatively: too many variables, most unquantifiable
- **Constant unpredictable change**
- **Confusing, sometimes chaotic**
- **But -- determines budgetary funding levels & approvals!**

The “Political System”

❑ **Either enables Engineering Design Process to go Forward or Imposes Constraints:**

- **Budget Cuts**
 - Usually far more demands for scarce resources than available
- **Schedule Stretch-outs**
 - To “Peanut Butter” scarce funding across high-priority projects
- **or Schedule Acceleration**
 - May be needed to support critical schedules
 - May be needed to support (re)election schedules
- **Technical Reviews**
 - May be to get evidence to cancel (or support!) projects
- **Reporting Requirements**
 - To mollify risk-adverse Approvers
- **Threat of Outright Cancellation**
 - To “get your attention”
- **And Actual Cancellation**

The “Political System”

❑ Why so Complex?

- **Power is very widely distributed in most Governments**
 - Like Fractal Geometry: the closer you look, more detail found
 - No single, clear-cut locus of authority to support for long-term, expensive programs
- **Support must be cobbled together from grab-bag of widely varying groups**
 - Each may perceive program's worth very differently
 - Interests may diverge radically when pressure is on
- **Dispersion of power = central characteristic of governments--confuses outsiders**
- **Anything that happens in Governments = resultant of dozens of political vectors, all pulling in different directions**
 - Vector algebra: any progress comes from imbalance
- **Everything is a product of maneuver through negotiations & compromise**
 - When those fail, result = policy paralysis
 - i.e. “Do Nothing” or defer to next budget cycle

Political Power in Government

☐ Not necessarily in obvious places

- **Staffers**
 - Example: Secretary to a Corporate VP/CEO
- **Weak Incumbent in theoretically Strong Job**
 - Example: “Lame Duck” President
- **vs. Supposedly obscure position occupied by Strong Individual**
 - Example: J. Edgar Hoover of FBI

☐ No clear-cut Chains of Command in Governments

- **Nothing like Military or even Corporation**
 - Government has no “bottom line”
 - Goal is to decide what goal should be
- **Difficult anywhere, herculean here**

☐ Most Governments Suffer from Highly-Polarized Partisanship

- **Distrust/Hatred between Parties, reminiscent of the Cold War**
 - Not as visible to “outsiders”

Political Power in Government

❑ Power does not stay put in most Governments

- **More than shift after an Election**
 - **Presidential: every 4 years**
 - **House of Representatives: everyone, every 2 years**
 - **Senatorial: every 6 years (about 1/3 every two years)**

❑ Power Relationships are Constantly Changing

- **Gradually or Suddenly**
- **Shifts alter Policy Agenda-- and therefore Funding Priorities**
 - **e.g., Defense Spending level decline after Cold War's end in 1990s**
 - **And Sudden Resurgence after 9/11**
- **Dynamic Process: Continuous ebb/flow of power and influence**
 - **Congress/white house**
 - **Rival agencies**
 - **Ambitious individuals**
- **And everyone is playing to the Media, especially Television & Social Media**

Media Impact on Political Process

❑ My Rant: the Media is NOT in the Business of Truthful News!

- ***They are in the Business of selling their Media!!!***
 - In most cases, Subscribers drive Advertising which drives Revenue
 - Media is biased, not toward liberal or conservative views, but biased toward *selling their media*
 - Influential media personnel often exert biased influence (e.g. Editors) but will mitigate their stance (maybe only slightly) if it has a negative impact on revenue
- For most Media, present facts that subscribers want to hear

❑ For the Political Process, the Media is generally not a friend!

- Nor are they (usually) an enemy; more like a tool to be used
 - Media (usually) accepts being used; (usually) attracts subscribers
- Love/Hate Relationship between Politicians and the Media
 - Most Reporters under *extreme* time pressure; want quick, snappy “sound bites” that will sell their story (and improve their position), they love controversy & excitement, but no time to “get it right”!
 - Later editing may change the message that was recorded (anything that you say Can and Will be misused against you)

Coping Skills for Modern Engineer/Scientist

❑ Essential Skill:

- Ability to think in its terms

❑ Must understand that:

- Reasoning processes used by the Political System is *entirely different* from the one in which scientists and engineers are trained

❑ The “Logic of Politics” is “Rigorous”, but:

- Premises & Rules are *profoundly different* from scientific & engineering logic
- Will repeatedly arrive at *different conclusions* on basis of *same data*
- Appears to be *highly illogical* (insane?) to Scientists, Engineers, and Mathematicians
 - Who appear to be *highly naïve* to Politicians

Coping Skills for Modern Engineer/Scientist

❑ Scientific/Engineering proof:

- Firm assumptions + accurate data supports logical deduction

❑ Political reasoning structured entirely differently!!!

- Not “logical proof”
- Instead, based on Negotiation, Compromise & Appearances
- Political Proof = “Having the Votes”
 - If so: a Program is *by definition* worthy, useful and beneficial to the Nation, because of negotiated compromise or appearances!
 - If not: no matter what its technological merits, that program will lose out
 - Example: “Let’s Do Lunch”

❑ In summary:

- Successful Engineer needs both highest engineering skills and intimate understanding of Political Process
- Or else get blindsided-- and not understand why!

119th Congress: House of Representatives

- ❑ **Period of Service: January 3 2025 to January 3 2027**
- ❑ **435 Voting Members in House of Representatives:**
 - **222 Republicans (51.0%), 215 Democrats (49.4%), no Independents** (need 218 votes for a voting majority)
 - **Four Vacancies at present (0.6%)**
 - **6 Non-Voting Members (e.g. Resident Commissioner for Puerto Rico, Delegates for Washington D.C., Territories such as Guam)**
 - **Gender: 307 men, 125 women**
 - **Race Identification: 58 Black, 42 Hispanic, 19 Asian, 4 Arab/Persian, 3 Indigenous American**
 - **81 are Military Veterans (4 Purple Heart recipients)**
 - **63 are Freshmen (first time elected to House of Representatives)**
 - **7 Accountants, 42 MBAs, *21 Engineers/Scientists*, 21 Doctorates**
 - **136 members have a Law degree (31%)**
 - **Average age is 57 years old, length of office 7 years (3 terms)**
 - **17 members were born outside of the United States**
 - **11,248 Staffers, average age 32 years old**

119th Congress: Senate

- ❑ **Period of Service: January 3 2025 to January 3 2027**
- ❑ **100 Voting Members in Senate:**
 - **53 Republicans (53%), 45 Democrats + 2 Independents (47%)**
 - **Independents usually caucus with Democrats**
 - **No Vacancies at present**
 - **VP of United States (currently James David 'JD' Vance, a Republican) presides over Senate, votes only as a tie-breaker**
 - **Gender: 74 men, 26 women**
 - **Race Identification: 6 Hispanic, 5 Black, 3 Asian, 1 Indigenous American**
 - **18 are Military Veterans**
 - **12 are Freshmen (first time elected to Senate)**
 - **1 Accountant, 5 MBAs, 2 *Engineers/Scientists*, 4 Doctorates**
 - **54 members have a Law degree (54%)**
 - **Average age is 63.9 years old, length of office 11 years (~2 terms)**
 - **3 members were born outside of the United States**
 - **6,789 Staffers, average age 33 years old**

Backlash of Political Process

- ❑ **Starting in 1993, Federal Government set out to substantially change the way that Government does business**
 - **Clear from the forthcoming Case Studies:**
 - **Political process has tremendous impact on System Architecture, Design, Development, and Operation**
- ❑ **Any Significant Change in the Political Process**
 - **Implies momentous change in fates of current / future Engineering Systems**
- ❑ **Prior efforts to improve the Federal Government generally failed**
 - **Various Administrative Agencies resist substantial change**
 - **Washington views grand initiatives to improve Government with cynical mixture of Hope and Fear**
 - **See Class References for “US Political Party Fiscal Initiatives”**

Bottom Line about Change

- ❑ **Most Efforts to Reform Government Don't Obtain Goal of:**
 - **Simplification**
 - **Cost Reduction**
- ❑ **Because Most Federal Agencies Flourish with:**
 - ***More* Complication**
 - ***Higher* Budgets**
 - **Whether or not they really need it!**
- ❑ **Most Politicians are Painfully Aware of Public's Frustration**
 - **But are generally Clueless what to do about it**
 - **May enact "Silly Laws" as a result**

Silly Laws

- ❑ **Legislators Become Frustrated with Science, Math, Engineering**
- ❑ **Step in to “Help”, for example:**
 - **1897 Indiana State Legislature took offense at the notion of “Irrational Numbers”**
 - Demanded that certain numbers be rational, i.e. expressed as a ratio, and voted on a bill
 - Considered “A New Mathematical Truth”
 - Correct value of Pi is 16/5, or 3.2!
 - **Indiana House Committee of Education:**
 - Deliberated proposed bill & recommended that it be passed
 - **Indiana State General Assembly:**
 - February 5 1897 vote of 67 to zero (!!!)
 - Bill then went to Indiana Senate
 - **Fortunately:**
 - Mathematics professor from Purdue happened to attend debates
 - Set the record straight: Pi exactly defined as ratio of a Circle's Circumference to Diameter

Bill to “Correctly Re-Define Value of Pi”

- ❑ **Apparently Appeased Indiana Senate: Bill was Not Passed**
- ❑ **How could such Silliness Ever Occur?**
 - **Speculate not on intelligence of Legislators**
 - **Consider this Quotation:**
 - **An ex-teacher from the Eastern part of the state was saying, "the case is perfectly simple. If we pass this bill which established a new and correct value for Pi, the author offers to our state without cost the use of his discovery and its free publication in our school text books, while everyone else must pay him a royalty."**
 - **Indiana Legislators acting in part with Public Interest in mind?**
 - **Don't ridicule them**
 - **Their area of expertise did not include Mathematics**
 - **Legislators were acting on information given**
 - **Probably with best of intentions**

Today's Politicians

- ☐ **Also not Experts in Science, Math, Engineering**
 - **Not formally trained in Advanced Economics, Decision Theory, Distributed Hierarchical Management Systems, etc.**
- ☐ **Could they be...**
 - **Acting with good intent but in ignorance?**
 - **Frustrated by conflicting expert advice?**
 - **Mandate change on a wild tangent?**
- ☐ **Or could they just be taking bold, necessary steps?**
- ☐ **See Class References for Links to Recent Initiatives**

Example: The National Performance Review (NPR)

- ❑ President Clinton commissioned the NPR on March 3 1993**
 - Designated Vice President Gore as the NPR Project Leader**
 - Gave him the goal of completing the Report in six short months**
- ❑ This was not to be “just another study”**
 - Stated goal was to Re-Invent Government**
 - From the ground up, if necessary**
- ❑ Prior efforts to reduce size of Federal Government failed miserably**
 - Agency resistance to change**
 - If not for sheer self-protection of “turf”**
 - Everyone fed up with Study-after-Study that identified Problems & Solutions**
 - Then would up on the shelf**
 - Sometimes steps partially implemented**
 - Resulting in conflicting policies and documentation of “Administrivia”**

NPR Savings

❑ Some Savings Easy to Recognize as Elimination of Waste:

- **By 1993, Roughly 1/3 of Federal Workforce occupied in writing Rules and Directives for remaining 2/3**
 - Most of Industry balks at 10% of employees as “overhead”
- **Antiquated organizations**
 - Tea-Tasters Board
- **Obsolete items**
 - Mohair Subsidy (Angora Goat)
- **DoD examples:**
 - 27 different Payroll Systems
 - 91 different General Accounting Systems

❑ NPR Example of Bureaucratic Overkill:

- **Six-page Spec for “Ash Receivers, Tobacco (Desk Type)”**
- **Glass ashtrays carefully specified as being Colorless Glass**
 - Not coated or tinted!
- **Broke into pieces according to Test Procedure on next page**

Bureaucratic Over-Kill Example from NPR

- ☐ **“Breakage, Type I Glass. The Test Shall Be Made By Placing The Specimen On Its Base Upon A Solid Support (1-3/4 Inch (44.5 Mm) Maple Plank), Placing A Steel Center Punch (Point Ground To A 60 Degree Included Angle) In Contact With The Center Of The Inside Surface Of The Bottom And Striking With A Hammer In Successive Blows Of Increasing Severity Until Breakage Occurs. The Specimen Should Break Into A Small Number Of Irregular Sized Pieces Not Greater Than 35, And It Must Not Dice. Any Piece 1/4 Inch (6.4 Mm) Or More On Any Three Of Its Adjacent Edges (Excluding The Thickness Dimension) Shall Be Included In The Number Counted. Smaller Fragments Shall Not Be Counted.”**
- ☐ **Look at the Cost Implications of this Test Procedure!!!**

Other Budgetary Reform Initiatives (see class website)

❑ Contract With America (CWA)

- **1994/95 Congressional Initiative to Match NPR**

❑ A Blueprint For New Beginnings

- **2001 Bush Administration Initiative to Match NPR**
 - **“A Blueprint For New Beginnings: A Responsible Budget For America’s Priorities”**
 - **Genesis of Sequestration (tax cuts that expired in 2011)**

❑ Renewing America’s Promise

- **2009 Goals Of Obama Administration**
 - **Campaign slogan: “Change”**

❑ Make America Great Again

- **2016 & 2024 Goals of Trump Administration**

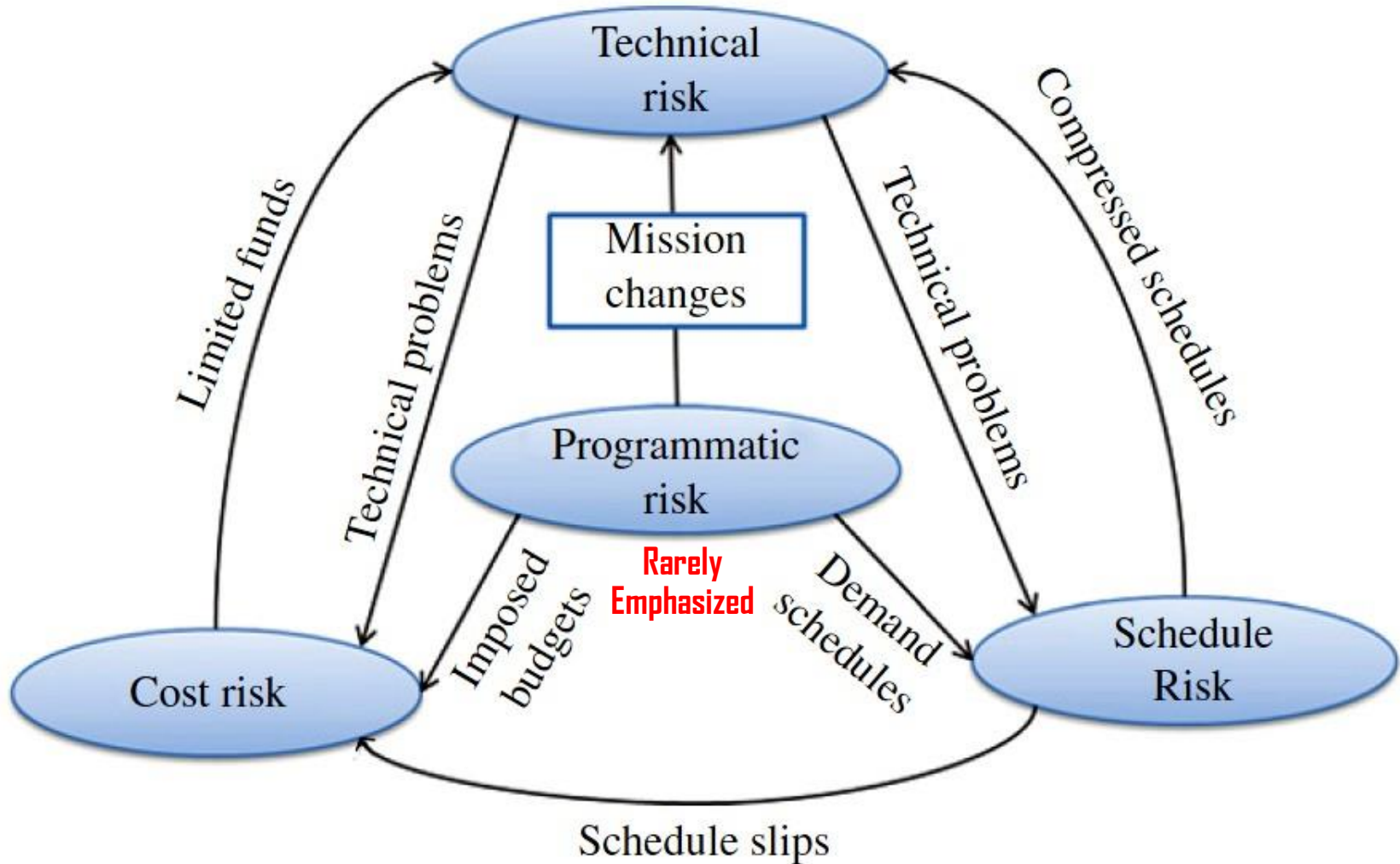
❑ Building A Better America

- **2020 Goals of Biden Administration**

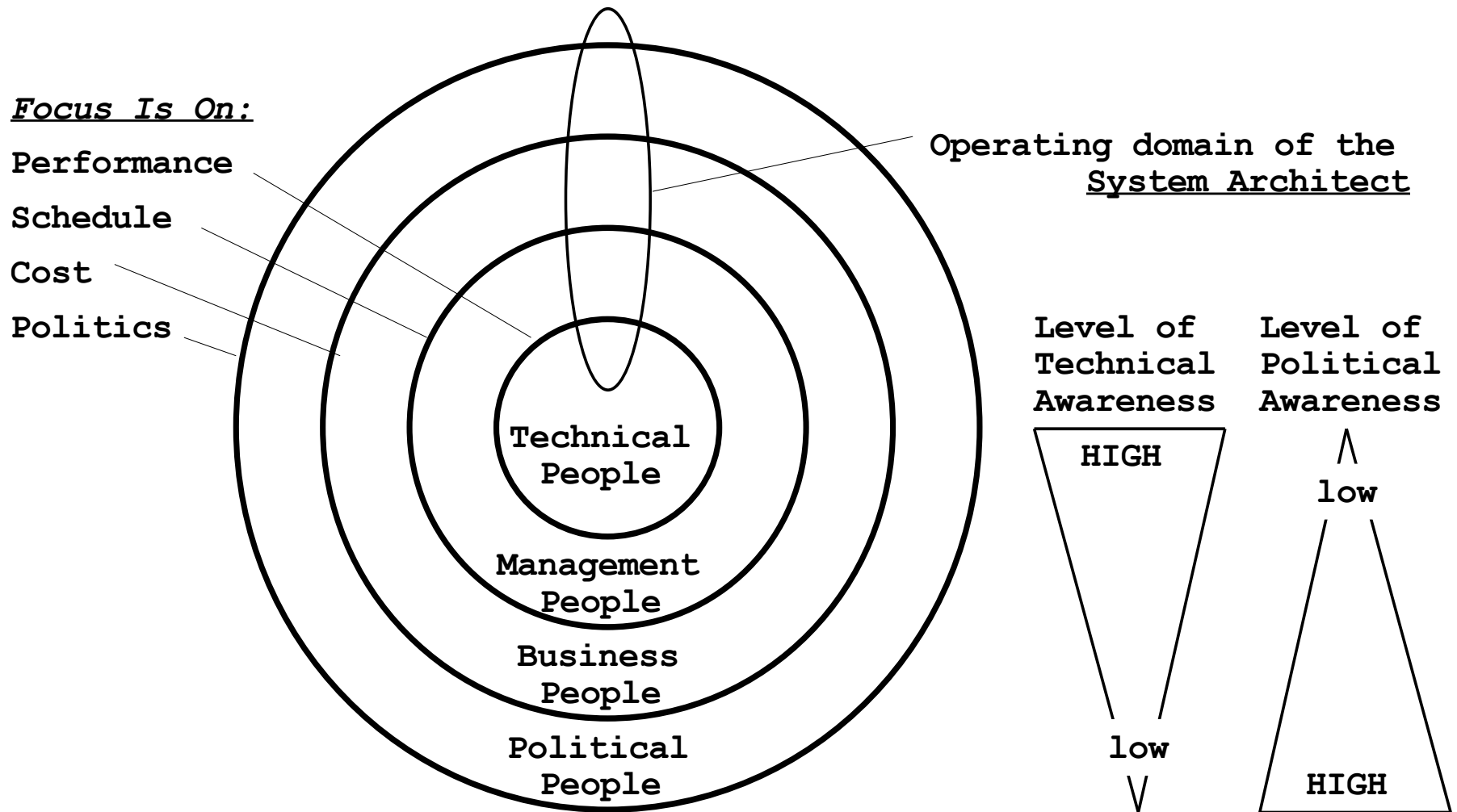
Don't Panic!

- ❑ **Political System is Bewildering and Intimidating to Uninitiated**
 - **But need not be so!**
- ❑ **A Profoundly Interesting, Engrossing, & Challenging Process!**
 - **As challenging as knottiest Engineering Problem**
 - **It is an Engineering challenge because it molds the context in which System Design must function**
 - **Only when they are not understood do the Facts of Life instill cynicism or a sense of powerlessness**
 - **Once understood, they are tools for astute Managers to pursue program success**
 - **That success yields satisfaction of winning in one of the toughest games going**

INCOSE Risk Categories



Visualization of the Socio-Political Situation



Political Risk Heuristics: Analysis Tools for Logical People

❑ **Dr. Brenda Forman's Political "Facts of Life" (FOLs)**

- **Not In Priority Order!**
- **Ordered by Ease of Understanding**
- **These Apply to almost all Situations!**
- **All are Expressions of "Money = Politics"**
- **Phrased by Dr. Forman for Engineers/Scientists**
 - **Most experienced Politicians are puzzled by the phraseology**
 - **Will make more sense to students when shown in Case Studies**

#1 Politics, Not Technology, Controls What Technology is Allowed to Achieve

#2 Cost Rules

#3 A Strong, Coherent Constituency is Essential

#4 Technical Problems Become Political Problems

#5 The Best Engineering Solutions are not Necessarily the Best Political Solutions

Other Political Risk Heuristics

❑ Other FOLs:

- These have been identified by your Instructor
- These apply to many (but typically not all) situations
- We will explore these in the Case Studies, but not in this Lecture
- Propose your own insights for your own Research Paper
- Students must propose at least one new FOL, may be applicable only to their chosen topic (as a lesson-learned)

6. Timing is Everything

7. Political Problems Become Technical Problems (or Opportunities)

8. Politics Prefers Immediate, Near-term Gratification

9. Politics Believes in Gurus and Heroes

10. A Catchy Slogan is Essential to Getting Attention

11. Perception is Often More Important than the Truth

12. Staffers Shape Decision-Making

13. Mental Bias Due To Risk Denial

FACT OF LIFE #1

- ❑ **Politics, Not Technology, Controls What Technology is Allowed to Achieve**
 - **Easiest FOL to understand**
 - Usually appears as a Constraint
 - Original wording by Dr. Forman: “Limits” rather than “Controls”
 - **Control is typically in one or more of the following ways:**
 - Budget Limitations
 - Regulatory Constraints
 - Schedule Deadlines
 - **Budgetary Limitations**
 - No Money, no Program (obviously)
 - Getting and Keeping funding over time = political undertaking
 - Funding constraints set limits that are typically much narrower than technology can achieve if full funding were available
 - Technological reach increasingly exceeds budgetary grasp
 - One frustrating limitation is “color of money”-- how budget can be spent (example: automobile purchase vs. maintenance)

FACT OF LIFE #1 *(continued)*

❑ Politics, Not Technology, Controls What Technology is Allowed to Achieve

- **Regulatory Constraints**

- Example: ITAR/EAR restrictions (export compliance)
- “Bad Guy” lists (changes over time: Cuba? Iran? North Korea?)
- Budget Law “fencing” (example: conditions on kids allowance)
- Balance-of-Trade preferences (example: China, Japan)
- Laws (e.g. Environmental, Restricted Species of Plants/Animals)

- **Schedule Deadlines**

- “Impossible” schedules, not enough time to “do it right” (e.g. Apollo Program, Military operations)
- Visible progress to meet Re-Election needs/commitments
- “Checkpoints” to achieve Progress Payments to Corporate supporters

FACT OF LIFE #2

❑ Cost Rules!

- **High Tech steadily more expensive**
- **Only Governments can afford it**
- **Money = Politics**
- **Funding does not stay won, must be fought for every year!**
- **Almost all programs funded one year at a time**
 - **Even though a multi-year contract has been awarded!**
(Note: contract termination for convenience of the Government)
 - **Every year is a new struggle**
 - **Intense, continuous, demanding process-- takes time & energy**
 - **Corporate CEOs, Company Presidents, Program Managers, Professional Lobbyists**
 - **And next year, it starts all over again**
- **Keeping a program "sold" is a Continuous Political Exercise**

FACT OF LIFE #2 *(continued)*

- ❑ **Cost Rules-- typically exhibited in one or more of the following corollaries:**
 - **Sometimes have to Overstate the Benefits and Understate the Costs just to get a program started**
 - Because full disclosure of all cost risks and cost implications during budget approval would likely result in no funding
 - *You Cannot lie !!!* But you CAN mislead... (e.g. initial funding versus life-cycle costs)
 - Example: attracting a “Significant Other”
 - Example: purchasing a New Vehicle
 - **Program Funding has to be Re-Won each Year**
 - Never enough money available to properly fund all items (“somebody” is likely to be rejected or deferred to “next year”)
 - Always “somebody” attacking you, trying to take funding away
 - **Government rarely provides an Optimal Funding Profile (prefers reduced & level-loaded funding over a longer time)**
 - Again, result of many demands for scarce resources

FACT OF LIFE #3

❑ A Strong, Coherent Constituency is Essential

- No program ever funded solely (or even primarily) on the basis of technological merit of engineering elegance
 - Somebody, somewhere, has to want the program and is willing to influence voting
 - What they “want” may simply be political influence (e.g. JOBS in their district to improve chance for re-election)
 - Funding is usually a function of both the strength & staying power of the constituency
- Right Constituency is a Delicate Challenge!
 - Constituency broad enough is prone to internal divisions
 - Tight/homogeneous constituency is probably too small and likely doesn’t have enough political influence
 - Note that Constituents support for all sorts of reasons
 - Ergo, heterogeneous coalitions resulting in political fault lines
 - Part of the Art of Politics is how to knit them together to have lasting influence

FACT OF LIFE #3 *(continued)*

❑ Constituents

- **Anyone in the Political System is Potentially a Constituent**
 - Not just Members of Congress and Administration
 - Anyone who can influence them!
(e.g. Companies, Lobbying groups, Advisory groups, Media...)
 - Often there are Anti-Constituents!

❑ This FOL is essential because of one or more of these corollaries:

- **Every Successful Program Must Serve Multiple Agendas**
 - Because of diversity of Constituents and rationale for their support
- **Government Loves to Dictate Multiple-Mission Systems**
 - Misguided but eternal hope for a “One Size Fits All” system
(e.g. Joint Strike Fighter, which became the F-35 Program)
 - Note that System Users have different needs (e.g. DoD services)
 - Often much more than commonality to avoid “Re-Inventing the Wheel”
- **The Media Can Strongly Influence Supporters & Detractors**
 - Note the rising influence of Social Media (e.g. Twitter),
Crowdsourcing, and Big Data Analytics

FACT OF LIFE #4

❑ Technical Problems Become Political Problems

- Any program Stretching Technological Envelope *will* meet technical difficulties
 - Example: Basic Research (Edison and the Electric Light Bulb)
 - But result is that "technical" reports become political events
- No such thing as a purely Technical Problem
 - Technical problems become Political Ammunition
 - Remember the Anti-Constituents?
 - Remember the people who weren't funded? (or were underfunded)
- Scientific and Technical Reviews
 - e.g. GAO, CRS, NRC, NAS
 - Some reviews are Mandated by Law or by Contract
 - Other reviews may be self-initiated
 - Even excellent reviews may be misinterpreted or misused
 - Some (notably GAO reports) instigated by hostile Members of Congress (to "get some dirt" on a Program or Organization)

FACT OF LIFE #4 *(continued)*

❑ Technical Problems

- **Scientific, Engineering, and Technical knowledge is rare (bordering on non-existent) in Congress**
- **So Members of Congress have little ability to assess technical challenges**
 - **And may not want to-- that's what their Staffers are for**
 - **Staffers may (or may not!) have technical expertise**
 - **Profile of typical Staffer ("Senior Staffers" are an exception):**
 - **Very young, treated as slave labor**
 - **Big egos, often compensate for their low pay & position**
 - **Highly driven, very motivated**
 - **Hoping to "learn the ropes" and advance in political ranks**
 - **Lots of turn-over; many Staffers come-and-go**
 - **But Staffers usually are a filter for what gets to "The Boss"!**
 - **Personal example: "Big Shrimp"**

FACT OF LIFE #4 *(continued)*

❑ Technical Problems

- **Damage control constantly needed**
 - **Sound & valid Technical Reports lead to hearings**
 - **Rival Expert Witnesses, contradictory testimony**
- **Presumably Technical Issues are often a disguise For Determining Consideration**
 - **Affordability = Majority Vote**
 - **“Unaffordable” = No Majority Vote**
- **High-tech Engineering Design operates in a Political Fishbowl**
 - **Unless Classified (simplifies because limits number of participants)**
 - **However, unclassified information about a classified design becomes known**
 - **Also, Congress is skeptical about Classified Programs (“do we really know what’s going on?”)**

FACT OF LIFE #5

- ❑ **The Best Engineering Solution is Probably not the Best Political Solution**
 - **Hardest concept to grasp (for logical people)**
 - But key to this class!
 - **Requirements of Political Logic repeatedly run counter to those of Engineering Logic (e.g. Program Schedules):**
 - Engineering terms: Optimum Schedule = makes best/most economical use of resources & time, yields the lowest unit cost
 - Political terms: Optimum Schedule = affordable in current fiscal year and maximizes political benefits (e.g. voter jobs)
 - Routinely collide; Political definition *always* wins
 - **“Optimum Schedule” examples in our personal lives:**
 - House Repairs vs. Kids Shoes
 - Car for College Students: New Rolls Royce vs. Used Low-End Car

FACT OF LIFE #5 *(continued)*

- ❑ **“Best” Engineering Solution vs. “Best” Political Solution**
 - **Government functions on Cash-Flow Basis, which means that:**
 - Long-term savings routinely foregone to minimize immediate outlays (i.e. this year, maybe next year)
 - Overall life-cycle economics of scale are routinely sacrificed for slower acquisitions & stretch-outs, even if cause higher unit costs & greater overall expenses!
 - **Technological merit is essential & engineering elegance necessary**
 - But funding = function of interaction between costs & constituents
 - Determining factor = “affordability” (i.e. near-term)
 - **Scientific Or Engineering Reasoning Process vs. Political Reasoning Process**
 - Negotiation, Compromise, and Appearance
 - Usually selects different “better choice” than Engineering Logic!
 - **Usually appears as a Trade Study**
 - But with technically-questionable (insane?) choice of trade option
 - This is the differentiator between FOL #1 and FOL #5!

Other Political Facts of Life (as observed by Mr. Ken Cureton)

- 6. Timing Is Everything**
- 7. Political Problems Become Technical Problems (or Opportunities)**
- 8. Politics Prefers Immediate, Near-Term Gratification**
 - **Political Process Constantly Striving to Satisfy Immediate, Urgent Needs With Insufficient Resources (Money, Time) (This Year is More Important Than Out-Years)**
 - **Election “Event Horizon” Also Encourages Near-Term Focus (in USA: 2 Years for House, 4 Years for President, 6 Years for Senate)**
- 9. Politics Believes In Gurus And Heroes**
 - **And Once Tarnished, Forever Untrustworthy (Stink Sticks)**
- 10. A Catchy Slogan Is Essential To Getting Attention**
- 11. Perception Is Often More Important Than The Truth**
- 12. Staffers Shape Decision-Making**
- 13. Mental Bias Due To Risk Denial**

So, In Coming Lectures...

- ❑ **Convey Fascination of Political Process**
- ❑ **Walk Through How it Affects Programs**
 - **We will examine several Case Studies**
 - **Analyze Real-World impacts**
 - **The significance of the Political FOLs will be more apparent in the forthcoming Case Studies**
- ❑ **Impart Confidence**
 - **Identify potential ways that Engineers & Scientists can Cope**
- ❑ **See That it is Not Incomprehensible**
 - **It is merely Different**
 - (and VERY frustrating to logically-minded people!)

Reminders for Next Class Session

☐ **Next Week's Lecture #2:**

- **Discussion of the US Federal Government Budgetary Process**
- **Required Reading Text:**
(please read before start of class)
 - **Intro to the Political Process and the Political Facts of Life**
 - **Re-Inventing Government**
 - **An Introduction to the U.S. Federal Budget System**

☐ **Personal Introduction due by end-of-class NEXT WEEK!**

- **Download and complete the form attached to that assignment**
- **Please be sure to RENAME the downloaded file to include your LAST NAME**

Questions?

(can also use Discussion Boards before/after class)