

Syllabus for SAE 550: *Systems Architecting and the Political Process*

USC Viterbi School of Engineering Systems Architecting & Engineering Program

SAE 550: Systems Architecting and the Political Process

Spring 2024—Wednesday—6:40-9:20 PM

Location: On-Line (DEN Webcasted Class).

Instructors:

Mr. Kenneth L. Cureton

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COURSE DESCRIPTION

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

Prerequisite(s): None; however, SAE 549 *Systems Architecting* is recommended.

Recommended Preparation: at least 2 years of work experience

LEARNING OBJECTIVES

- To provide students with an understanding of the various ways that the political processes drive the architecture of (U.S. and other) government-funded and corporate-funded systems.
- To examine the U.S. Federal Government acquisition processes (both Administrative and Congressional) for typical funding and approval procedures in major government-funded systems.
- To enhance anticipation of political impacts through application of political risk analysis and heuristics (the Political Facts of Life).
- To understand and analyze potential impact of programmatic risks originating from political factors and how to mitigate those risks by architecting appropriate system
- To improve the students' ability to generate a professional-level research paper, suitable for presentation at a system engineering conference or publication in a professional journal.

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COURSE NOTES, REQUIRED READING AND SUPPLEMENTARY MATERIALS

This is a webcasted class in Distance Learning format via the USC Distance Education Network (DEN). All course materials (webcasted lectures, lecture notes, references, and reading material) are available on-line via the DEN.

ALL required materials are available on-line via the DEN—no textbooks are required for purchase. However, the following materials are suggested for reference:

1. Eberhardt Rechtin (1991). *Systems architecting: Creating and building complex systems*. Englewood Cliffs, NJ: Prentice Hall. ISBN: 0-13-880345-5. Chapter 12. This text is out of print but is sometimes available on Amazon or American Book Exchange.
2. Mark Maier & Eberhardt Rechtin (2009). *The Art of Systems Architecting* (3rd ed.). Boca Raton, FL: CRC Press ISBN: 978-1-4200-7913-5
3. Michael E. Kraft & Norman J. Vig, ed. *Technology & Politics*, ed. Duke University Press, 1988: ISBN 0-8223-0838-X trade paperback
This text is out of print but is sometimes available on Amazon or American Book Exchange.
4. Kate L. Turabian (April 2018). *A Manual for Writers of Research Papers, Theses, and Dissertations, Ninth Edition* by The University of Chicago Press, Hardback ISBN: 9780226494425, Paperback ISBN: 9780226430577

TECHNOLOGICAL PROFICIENCY AND HARDWARE/SOFTWARE REQUIRED

Must have access to (and be proficient in the use of) a web browser in order to access course materials, view lectures, submit assignments, and interact with the instructor.

THIS IS AN EXPERIENTIAL COURSE!

This class is not a “one-way” lecture: student participation is necessary and is a significant factor in your class grade. You can choose to work as individuals or in groups or teams for discussions. Just as in the real world, interaction with the instructor and each other can be (but does not have to be) face-to-face. Interaction can be in class or real-time via the DEN tools (e.g., Webex) or even asynchronously via the DEN Discussion boards regardless of Time Zone differences and regardless of time-of-day.

Starting with the second lecture, several video segments presenting the lecture slides will be available on the DEN. Students are required to view each week’s lecture videos and accomplish required readings in advance—the scheduled class periods are for technical analysis of case studies and ***student interaction*** with the instructor and other students in real-time to discuss the presented concepts and to ask questions. All such interaction is recorded and available to all enrolled students. You can also document your questions and observations on the DEN discussion boards so that others may respond at any time. You should use the latter capability if you cannot participate in real-time during the scheduled class periods. This way, there is a record of all discussions, questions-and-answers, etc.

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DESCRIPTION AND ASSESSMENT OF ASSIGNMENTS

One Research Paper is required of each student in place of a Final Exam. Students choose their research topic and submit an abstract for approval by Instructor. A practice homework is assigned and scored, but that score is not considered in the class grade. Six graded homework assignments are required of each student in place of a mid-term exam.

GRADING BREAKDOWN

Assignment	Points	% of Grade
Research Paper	200	50%
Practice Homework (not counted in class grade), Homework #1 - #6 (25 points each)	150	37.5%
Participation	50	12.5%
TOTAL	400	100%

ASSIGNMENT SUBMISSION POLICY

Submit assignments on-line to the DEN system, according to the published course schedule (see below). All assignments (including late submissions) are due no later than the scheduled Final Exam date—no submissions will be accepted beyond that date.

RESEARCH PAPER

GOAL: Your paper must be purposeful—it should have an academically acceptable goal, something more than just demonstrating that you can accomplish research and write a cogent Research Paper that summarizes that research, as those are necessary but not sufficient goals for academic purposes.

For this class, your purpose should include two additional goals that are above and beyond conducting research and writing Masters-level Research Papers:

- Your first goal is to demonstrate that you understand and can properly apply the concepts presented in the class through the accomplishment of structured analyses of a technical topic. The required analyses are detailed in a Research Paper Checklist.
- Your second goal is to inform the reader and “teach” your instructors regarding the political influences and the technical details of your chosen topic.

Failure to achieve any of the above will impact your paper’s grade!

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RESEARCH PAPER (continued)

TOPIC: Describe an engineering or scientific program and analyze it in terms of the course concepts, both 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) and provide qualitative discussions based on the political risk mitigation factors presented in this course, as detailed in the Research Paper Checklist.

Subject to our approval, you get to choose the topic:

- It can be something that interests you, or something with which you have been personally involved. But be careful if using a program from a current employer—make sure that you have authorization to write on that topic!
- It can be an engineering program or a scientific program. Social programs are discouraged unless they have significant engineering or scientific components.
- It can be ongoing, or it can be past history. New or future programs are discouraged unless they have substantial progress to-date or comparable experience with past systems.

APPROVAL: You must submit a one-page abstract regarding your proposed topic for approval. Please submit on-line via DEN Assignments no later than **February 14, 2024**.

FORMAT: Microsoft WORD (.DOC or .DOCX) or Adobe Acrobat (.PDF) format for your Abstract and Research Paper.

The class website provides a list of topics from students in prior years. It also provides guidelines on how to write a research paper, with suggestions for format, organization, structure, and content of good research papers.

LENGTH: Experience to date shows that the average is somewhere around 20 pages, single-spaced, in 10 or 12-point type. Papers are NOT graded by their weight! Take as long as it takes to tell the story clearly and to present a well-organized analysis in terms of the course. N.B. very few papers of size less than 18 pages have been worthy of a good grade in this class. The point is not size, rather amount of analysis, which should be at least 10 pages of detailed analytical content and at least 5 pages of technical content as per the Research Paper Checklist.

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RESEARCH PAPER (continued)

SOURCES: You must properly reference all sources. We use the turnitin.com service to look for matches with existing books, magazine and newspaper articles, journals, prior student papers, and all Internet sources. Published works (such as books, scholarly articles, and journal publications) are preferred. If you obtain information via interviews, then a list of sources and contacts is essential, listing what sources you used and anyone you interviewed. Be sure to provide the URLs of any Internet sources used in your research. If you directly quote text from a source, you must properly designate quoted material “in quotation marks” or in italics and give a citation for each quotation via a footnote or a numbered reference or in-text (author-date) notation. The amount of quoted text relative to the total text in your paper should be kept to a minimum—if excessive; this will detract from your paper’s grade.

WARNING: Failure to properly designate copy-and-pasted text will be considered as a violation of academic integrity (see University Policy Statements at the end of this syllabus). This includes quotations from your prior papers (e.g., from SAE 549 or other classes)! You can build on your own work from other classes, and from other author’s works, if you properly cite those references. You must not directly copy text from those sources—even *your own*—unless properly marked and cited as a quotation. Instead, you must add value by citing then restating such work in your own words plus your own enhancements, such that the combination has enhanced relevance to this class. You can directly copy graphics, tables, or figures if you give a citation for each copied item. Although there is no limitation on the relative number of copied items, your own artwork—however crude yet clearly legible and illustrative—is always acceptable.

LIMITS: We cannot accept a request to limit access to your abstract or research papers. Although we do not plan to disseminate your work without your permission, we cannot guarantee that other people (including non-US citizens) will not view or handle your submitted materials. Thus, you must not use classified, proprietary or company limited-distribution materials in your coursework. If your employer requires review and approval for your submitted materials (e.g., Public Affairs Office or Export Compliance Review) then you must obtain such approval within the deadlines listed in this syllabus. As the approval practices in many companies may be time consuming, the best practice is not to use company material at all.

DELIVERY: Please submit on-line via DEN Assignments no later than the scheduled final exam date **(May 8, 2024)**.

GRADING: Your research paper will be graded on the letter scale: A, A-, B+, B, B-, etc.

N.B. very few papers are worthy of an “A” grade in this class unless they exceed most of the requirements given in the Research Paper Checklist (i.e., have more than the minimum required analyses and/or more than the required depth of analyses). The checklist descriptions represent the minimum requirements for a passing grade (“B”) in the class.

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RESEARCH PAPER (continued)

We must turn in the class grades shortly after the end of the Semester (after Final Exams Week), so we will inform you via e-mail regarding your research paper grade (as well as your overall grade) no later than two weeks after the paper is due.

Note: if your employer requires a written statement (or a signed postcard) for reimbursement for this class, then please provide us with the appropriate paperwork and a self-addressed, stamped envelope (or postcard) before the end of the semester.

ADDITIONAL INFORMATION:

- Please feel free to e-mail us for help in structuring your research plan. We will gladly work with you to review your outline, draft paper, potential references, etc.
- Potential topics for your Research Paper are your choice, subject to Instructor approval. You may find potential topics in the list of prior semester student topics presented in the Class References.
- 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.
- A special session will be held on **April 17, 2024**, in place of a regular lecture. This will be a course summary and a workshop where students can discuss their paper's structure, approach, preliminary findings, and areas of difficulty with the instructor and with other students.

HOMEWORK

GOAL: Most weeks you will review a different case study. You are to briefly analyze the case study in terms of the political facts of life (risk mitigation heuristics presented in the class) and their technical impact on system architecture. Your goal is to demonstrate that you understood the political impacts to the system architecture and derive mitigation plans for your architecture. The first case study (and analysis of that case study) is a practice assignment and includes detailed instruction on how to accomplish homework assignments.

DISCUSSION: Presentation of each case study is accomplished by the instructor via a collection of short, pre-recorded video segments. You are expected to view those segments before class and to accomplish the required readings. During class, we will analyze the impacts to the system's architecture and discuss lessons-learned and practical future consequences in terms of the political facts of life—essentially showing the answers to the assignment.

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HOMEWORK (continued)

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. Specific instructions for homework assignments are presented with the practice case study and are also available on the DEN.

FORMAT: Electronic format: .DOC or .DOCX or .PDF or .PPT (a template .DOCX file is provided on the DEN, but you can choose to use your own format.) You do not need to indicate sources or references for homework submissions.

DELIVERY: Please submit on-line via DEN Assignments no later than the designated due date— Your homework must be completed before the start of class, otherwise you'll receive only partial credit: 10 points. Any **late** homework must be submitted by **April 24, 2024**. All missing assignments will receive a score of zero.

GRADING: Each homework submission (including the practice case study) will be scored on a scale of zero-to-25, based on your analysis of the case study. We will grade and comment on your homework as soon as possible after the appropriate due date. The Practice Case Study score will not count toward your class grade.

CLASS PARTICIPATION

GOAL: Each week you will have a chance to discuss the material presented before that lecture, i.e., the video segments and required readings. For each case study, we will discuss the impacts to the system's architecture and discuss lessons-learned and practical future consequences in terms of the political facts of life. You will be invited to participate in that analysis and to constructively voice your viewpoints. If you cannot attend a lecture in person or on-line during the class, then you can post your analysis and comments on that week's discussion area on the DEN. We will read in class any comments that you've made on the DEN discussion area for that case study, so for your discussion to count as class participation, you must post it before the start of that class (or else participate in person or on-line during the class).

GRADING: Your participation is scored on a scale of 0-to-50. Note that 'participation' must be online during class or else posted on the appropriate DEN discussion area—e-mail correspondence and telephone calls, although encouraged to answer questions, do NOT count toward your class participation score. You'll receive all 50 points if you have a significant level of interaction with us and other students (on a weekly basis), either in-class or on-line or in a DEN discussion area for that lecture. Less frequent participation (less than an average of once each week) will receive 25 points. Occasional participation (more than once or twice) will receive 10 points, and if you choose to not significantly participate in the lectures (other than submitting required assignments), then you'll receive zero points for class participation.

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FINAL GRADE

GRADING: Your class grade is computed as follows:

First, your research paper letter grade is converted into a numerical score according to USC Grading Standards: 4.0 for A, 3.7 for A-, 3.3 for B+, 3.0 for B, 2.7 for B-, 2.3 for C+, 2.0 for C, 1.7 for C-, 1.5 for D+, 1.0 for D, 0.7 for D-, 0.0 for F. This score is then multiplied by fifty to achieve a point range of 200-to-0.

The total of all homework scores is added to the above. Note that the score for any one of the six homework assignments may range from 0 to 25 points (the practice homework score is not counted in that total).

Your level of participation in the class is added to the above (0 to 50 points total).

The grand total of points is divided by 100 (to scale your total to a range of four-to-zero):

$$\text{CLASS SCORE} = (\text{PAPER} + \text{HOMEWORK} + \text{PARTICIPATION}) / 100$$

(i.e., 50% for your research paper, 37.5% for your homework assignments, 12.5% for class participation.)

This class 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.

This letter grade is reported to USC as your class grade.

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Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Readings, Slides, and Videos	Deliverable/ Due Dates
Lecture 1 Jan 10	Syllabus, Introduction to the Course	Reading and lecture materials on-line	None
Lecture 2 Jan 17	Discussion of the Political Process and the Political Facts of Life (FOLs)	Reading and lecture materials on-line	<i>Personal Introduction</i>
Lecture 3 Jan 24	Discussion of the US Federal Government Budgetary Process	Reading and lecture materials on-line	None
Lecture 4 Jan 31	Impact of Various Constraints on System Architecture (Part 1) + Practice Case Study Presentation	Reading and lecture materials on-line Practice Case Study Online	None
Lecture 5 Feb 7	Impact of Various Constraints on System Architecture (Part 2) + Practice Case Study Discussion	Reading and lecture materials on-line	<i>Practice Homework due before class</i>
Lecture 6 Feb 14	Case Study #1: U.S. Space Stations (MOL, Skylab, SSF, ISS)	Reading and lecture materials on-line	<i>Abstract for Research Paper, Homework #1 due before class</i>
Lecture 7 Feb 21	Case Study #2: U.S. Manned Launch Vehicles (Apollo, Shuttle & future)	Reading and lecture materials on-line	<i>Homework #2 due before class</i>
Lecture 8 Feb 28	Case Study #3: V-22 Osprey Tiltrotor	Reading and lecture materials on-line	<i>Homework #3 due before class</i>
Lecture 9 Mar 6	Applying Lecture 4 & 5 concepts to Case Study 1-3	Reading and lecture materials on-line Optional: Federal Fire-Fighting Process	None
HOLIDAY Mar 13	Spring Break-- no lecture	None	None
Lecture 10 Mar 20	Case Study #4: Ground Transportation Infrastructure (Roads, Autos, Trucks, Trains, etc.)	Reading and lecture materials on-line	<i>Homework #4 due before class</i>
Lecture 11 Mar 27	Case Study #5: Superconducting Supercollider (basic research)	Reading and lecture materials on-line	<i>Homework #5 due before class</i>
Lecture 12 Apr 3	Case Study #6: Positioning, Timing, & Navigation Services (GNSS)	Reading and lecture materials on-line	<i>Homework #6 due before class</i>
Lecture 13 Apr 10	Applying Lecture 4 and 5 concepts to Case Study 5-7	Reading and lecture materials on-line Optional: Sardar Sarovar Dam (non-US topic)	None

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Lecture 14 Apr 17	Case Study #7 – Joint Strike Fighter (JSF) /F35	Reading and lecture materials on-line	None (no homework assigned for this Case Study)
Lecture 15 Apr 24	Class Summary and Research Paper Workshop	Reading and lecture materials on-line	<i>All Late Homework Due</i>
STUDY May 1	None – no lecture	None	None
FINAL May 8	None – no lecture	None	<i>Research Paper Due</i>

STATEMENT ON ACADEMIC CONDUCT AND SUPPORT SYSTEMS

Academic Conduct: Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press “0” after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298
equity.usc.edu, titleix.usc.edu

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

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Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298

usc-advocate.symplicity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity | Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs - (213) 740-0776

dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Campus Support and Intervention - (213) 821-4710

campussupport.usc.edu

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101

diversity.usc.edu

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

dps.usc.edu, emergency.usc.edu

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call

dps.usc.edu

Non-emergency assistance or information.