

USC Viterbi School  
of Engineering

Systems  
Architecting &  
Engineering  
Program

**SAE 550:**

**Systems Architecting and the Political Process**

**Fall 2019—Wednesday—6:40-9:20 PM**

**Location: OHE 120 (DEN Webcasted Class).**

**Instructor: Mr. Kenneth L. Cureton**

**Office: Virtual – By Appointment**

**Office Hours: Virtual – By Appointment**

**Contact Info: cureton@usc.edu**

**Teaching Assistant: None**

**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.

**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 potential ways to mitigate programmatic risks originating from political impacts.
- To improve the students' ability to generate a professional-level research paper, suitable for presentation at a systems engineering conference or publication in a professional journal.

## **SAE 550: *Systems Architecting and the Political Process***

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

**Co-Requisite (s):** None

**Concurrent Enrollment:** None

**Recommended Preparation:** at least 2 years of work experience

### **Course Notes**

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.

### **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 strongly encouraged and is a 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 (i.e. at any time on any day). You can use e-mail, social media tools, collaboration tools and DEN discussion areas and thus interact asynchronously regardless of Time Zone differences and regardless of time-of-day.

There will be checkpoints in each lecture to allow student questions in real-time. You can also document your questions and observations on the DEN discussion areas so that others may respond either in real-time or at a later date. This way, there is a record of all discussions, questions-and-answers, etc.

Remember, student participation IS a factor in class grading!

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### Required Readings and Supplementary Materials

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

- 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 available in the USC Bookstore as the “Course Reader” for SAE 549.
- Mark Maier & Eberhardt Rechtin (2009). *The Art of Systems Architecting* (3rd ed.). Boca Raton, FL: CRC Press ISBN: 978-1-4200-7913-5
- 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.
- 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

### 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. Five bi-weekly 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	0	0%
Homework #1	32	8%
Homework #2	32	8%
Homework #3	32	8%
Homework #4	32	8%
Homework #5	32	8%
Participation	40	10%
<b>TOTAL</b>	<b>400</b>	<b>100%</b>

### 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.

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### **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 Instructor regarding the political influences and technical details of your chosen topic.

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

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 my 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 **September 25, 2019**.

FORMAT: Microsoft WORD (.DOC) or Adobe Acrobat (.PDF) format for abstracts and research papers.

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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 15 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 as per the Research Paper Checklist.

**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, as long as 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:** I cannot accept a request to limit access to your abstract or research papers. Although I do not plan to disseminate your work without your permission, I 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.

## **SAE 550: *Systems Architecting and the Political Process***

DELIVERY: Please submit on-line via DEN Assignments no later than the scheduled final exam date (**December 11, 2019**).

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.

I must turn in the class grades shortly after the end of the Semester (after Final Exams Week), so I'll 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 me 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 me for help in structuring your research plan. I will gladly work with you to review your outline, draft paper, potential references, etc.
- If English grammar, spelling and syntax are not your strong points, I strongly suggest that you obtain help in editing your text. Your grade depends on the clarity of presentation.

### **HOMEWORK**

GOAL: Every two weeks you will hear 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). Your goal is to demonstrate that you understood the political impacts to the system 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: The week after a case study is presented, 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. Therefore, your homework must be completed one week after each case study is presented, before the start of the next class, otherwise you'll receive only partial credit.

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**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 .PDF or .PPT (a template .DOC 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—BEFORE class, one week after the case study is presented in class. After that, you can submit late homework, but it will receive a maximum of 10 points. All late homework is due no later than the scheduled Final Exam date—all missing assignments will receive a score of zero.

**GRADING:** Each homework submission will be graded on a scale of zero-to-32, based on your analysis of the case study. You'll receive a 'grade' for the practice case study, but it won't be counted toward your class grade. I'll grade and comment on your homework as soon as possible after the appropriate due date.

### **CLASS PARTICIPATION**

**GOAL:** Each week you will have a chance to comment on the material presented in that lecture. 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. The week after each case study is presented, 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. You will be invited to participate in that analysis and to constructively voice your viewpoints. 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-40. Note that 'participation' must be in person or 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 40 points if you have a significant level of interaction with me 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 five homework assignments may range from 0 to 32 points. (The practice homework assignment is not counted in this total.)

Your level of participation in the class is added to the above (0 to 40 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, 40% for your homework assignments, 10% 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 letter grade.

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### Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Readings	Deliverable/ Due Dates
Lecture 1 Aug 28	Syllabus, Introduction to the Course	Reading material and lecture notes on-line	None
Lecture 2 Lecture 3 Sep 4	Introduction to the Political Process and the Political Facts of Life & US Federal Government Budgetary Process	Reading material and lecture notes on-line	None
Lecture 4 Sep 11	Practice Case Study and the Political Facts of Life	Reading material and lecture notes on-line	<i>Personal Introduction</i>
Lecture 5 Sep 18	Analysis of Practice Case Study	Reading material and lecture notes on-line	<i>Practice Homework due before class</i>
Lecture 6 Sep 25	Case Study #1: U.S. Space Stations (MOL, Skylab, SSF, ISS)	Reading material and lecture notes on-line	<i>Abstract for Research Paper</i>
Lecture 7 Oct 2	Analysis of Case Study #1	Reading material and lecture notes on-line	<i>Homework #1 due before class</i>
Lecture 8 Oct 9	Case Study #2: U.S. Manned Launch Vehicles (Apollo, Shuttle & future)	Reading material and lecture notes on-line	None
Lecture 9 Oct 16	Analysis of Case Study #2	Reading material and lecture notes on-line	<i>Homework #2 due before class</i>
Lecture 10 Oct 23	Case Study #3: V-22 Osprey Tiltrotor	Reading material and lecture notes on-line	None
Lecture 11 Oct 30	Analysis of Case Study #3	Reading material and lecture notes on-line	<i>Homework #3 due before class</i>
Lecture 12 Nov 6	Case Study #4: Federal Fire-Fighting Process	Reading material and lecture notes on-line	None
Lecture 13 Nov 13	Analysis of Case Study #4	Reading material and lecture notes on-line	<i>Homework #4 due before class</i>
Lecture 14 Nov 20	Case Study #5: Ground Transportation Infrastructure (Roads, Autos, Trucks, Trains, etc.)	Reading material and lecture notes on-line	None
Nov 27	Thanksgiving Holiday (no class meeting)		None
Lecture 15 Dec 4	Analysis of Case Study #5	Reading material and lecture notes on-line	<i>Homework #5 due before class</i>
FINAL Dec 11	None—no lecture	None	<i>Research Paper Due All Late Homework Due</i>

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### **Statement for Students with Disabilities**

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. Website and contact information for DSP: [http://sait.usc.edu/academicsupport/centerprograms/dsp/home\\_index.html](http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html), (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) [ability@usc.edu](mailto:ability@usc.edu).

### **Statement on Academic Integrity**

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *SCampus*, the Student Guidebook, ([www.usc.edu/scampus](http://www.usc.edu/scampus) or <http://scampus.usc.edu>) contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

### **Emergency Preparedness/Course Continuity in a Crisis**

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of on-line message systems, teleconferencing, and other technologies.