Discover Viterbi: Astronautical Engineering with Professor Mike Gruntman

Viterbi School of Engineering
University of Southern California

Spring 2019

USC Viterbi School of Engineering | USC University of Southern California

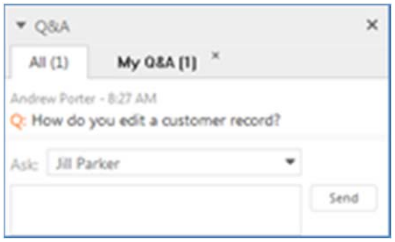
WebEx Quick Facts

Will I be able to get a copy of the slides after the presentation?

YES!

How can I ask a question during the information session?

1. Using the Q&A Panel, type a question in the box below the Ask drop-down menu.
2. Select a recipient from the Ask drop-down menu.



3. Click Send. We will respond as soon as we are able.

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Today's Program

- University of Southern California
- USC Viterbi School of Engineering
- DEN@Viterbi
  - Enrollment Options
  - Tuition & Fees
- Master of Science in Astronautical Engineering
  - Department & Program Overview
  - Application Criteria
- Q&A

USC Viterbi
School of Engineering

UNIVERSITY OF SOUTHERN CALIFORNIA

USC Viterbi
School of Engineering

The University of Southern California

- Oldest Private University in the western U.S.
  - Founded in 1880
- 47,500 Students
  - 20,000 Undergraduates | 27,500 Graduates
- 4,361 Full-time Faculty
- Diverse Student Population
- Located in Los Angeles

USC Viterbi
School of Engineering

Viterbi School at a Glance

Academic Departments

- 8 Academic Departments

Faculty

- 189 tenure-track faculty
- 16 Full-time, TT NAE Members (35 Total)
- 60+ NSF CAREER, National & Presidential Young Investigator

Alumni

- More than 76,000+

Student Populations

- 2,591 Undergraduate
- 5,702 Graduate students

Research

- Leader in funded research
- 35+ Research Centers
- More than $204M in research expenditures annually

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U.S. News & World Report, 2019

Best Engineering Graduate Schools

- **Top Ranked** Graduate Engineering Program

Best Online Graduate Engineering Programs

- **Ranked #1** Online Computer Information Technology Program (Computer Science)
- **Ranked #2** Online Graduate Engineering Programs

Best Online Graduate Engineering Programs for Veterans

- **Ranked #1** Online Graduate Computer Information Technology Program (Computer Science) for Veterans
- **Ranked #2** Online Graduate Engineering Programs for Veterans

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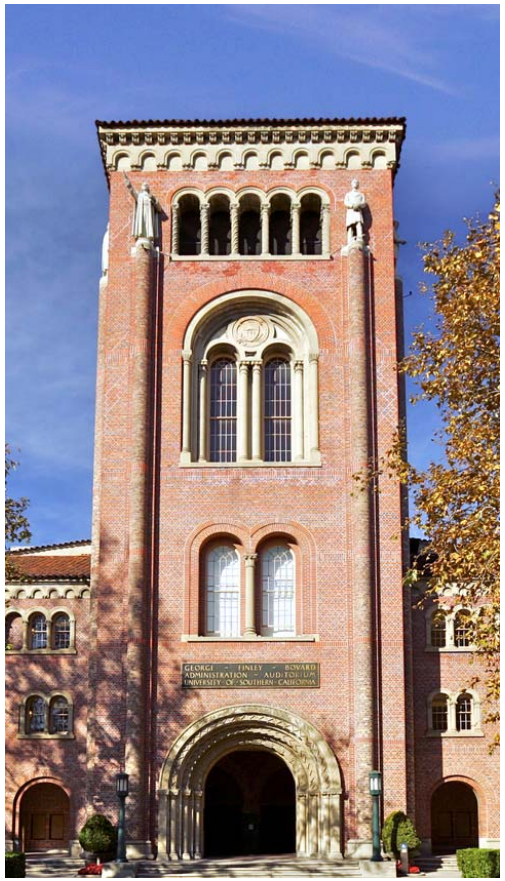
USC Engineering: Points of Distinction



- International Reputation for Excellence
- The Trojan Family Network: 76,000+ engineers strong
- Unique engineering programs available: *Online, on site & on campus*
- Complete range of programs
  - PhD, Masters and Bachelors
  - Graduate Certificates
  - Short Courses
  - Custom Programs

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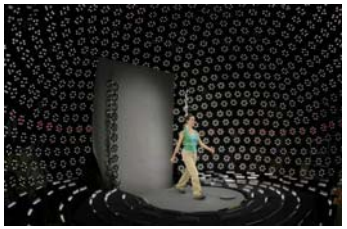
The Viterbi School of Engineering: A Leader in Research

Viterbi School is a consistent leader in funded research in the U.S.



Institute for Creative Technologies

Biomimetic Microelectronic Systems Engineering Research Center

National Center for Metropolitan Transportation Research

CREATE
Homeland Security Center

- Highly interdisciplinary research environment
- Diverse research areas such as robotics, software engineering, sensor networks, vision sciences, automated construction and photonics
- Over 35 research centers
- Industrial partnerships and collaboration

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Course Delivery Methods

Methods of Course Delivery

- On-campus, full time
  - 3 classes per semester
  - 1.5 – 2 years to complete

- Online delivery via DEN@Viterbi
  - 1-2 classes per semester
  - 2.5 – 3 years to complete degree

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School of Engineering

How DEN@Viterbi Works

The Viterbi School of Engineering uses a state-of-the-art, proprietary web-based delivery system that enables students from around the world to access classes live or on-demand.

DEN@Viterbi Students:

- View the same lectures as on-campus students, with fresh content every semester
- Participate in highly interactive discussions with professors and peers
- Submit homework electronically
- Take exams at proctored testing centers near their home or work (or at USC if in the Los Angeles area)

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DEN@Viterbi Overview

	DEN@Viterbi Student	On-Campus Student
Program Admission	USC Graduate Application & required materials	USC Graduate Application & required materials
Weekly Course Lectures	Online with Interactivity	On USC's Campus
Online Course Archives (Lectures & Course Documents)	✓	✓ *
Assignments	Submit electronically according to course deadlines	Submit during lecture or lab according to course deadlines
Exams	Proctored location	USC's campus
Courses per Semester (Average)	1-2	3-4
Degree Completion Requirements	27-37 units with a 3.0 GPA or above	27-37 units with a 3.0 GPA or above
USC Diploma (No Distinction)	✓	✓

*DEN@Viterbi Sections Only

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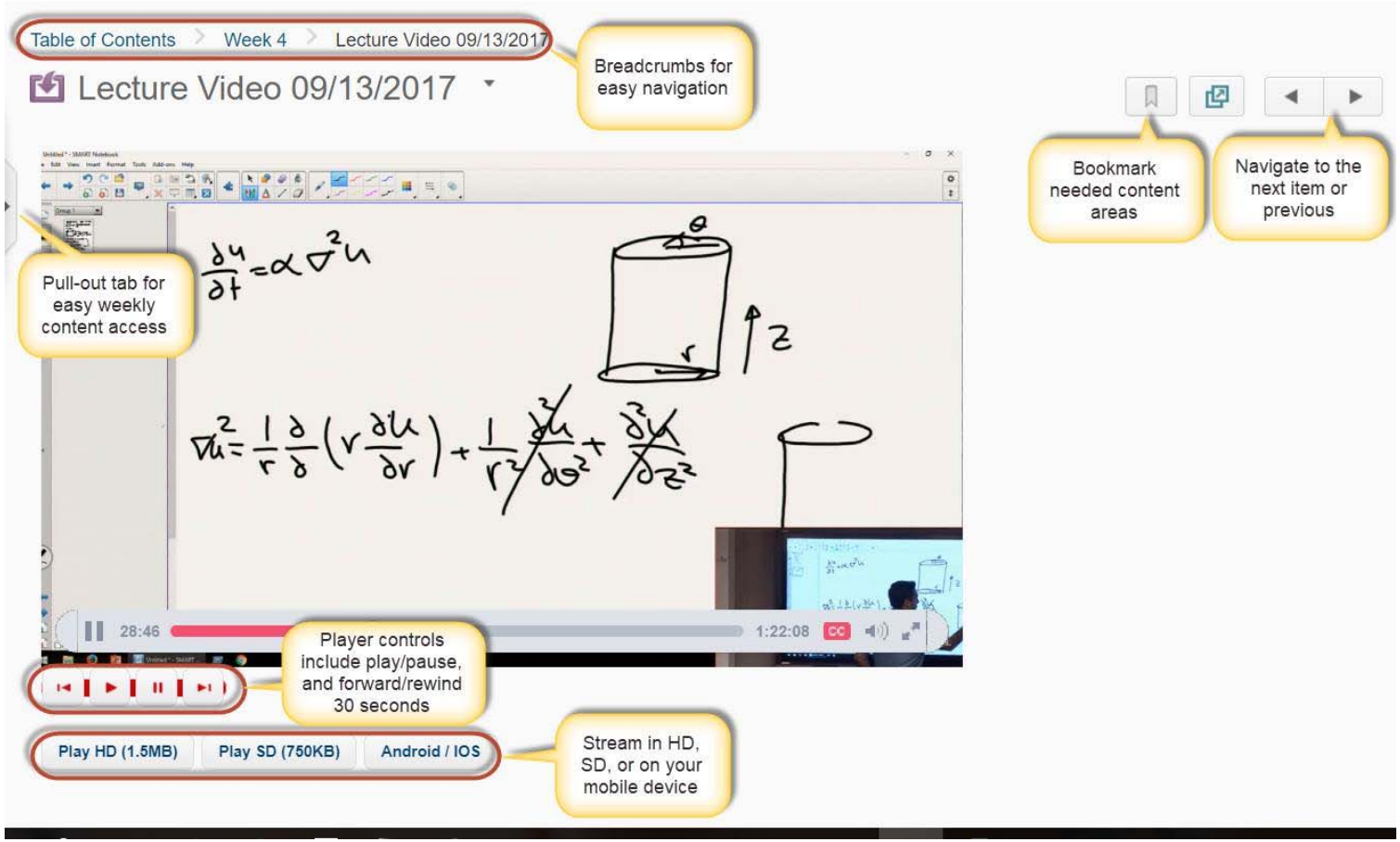
DEN@Viterbi's E-Learning System

DEN@Viterbi Classroom

USC Viterbi
School of Engineering

DEN@Viterbi's E-Learning System



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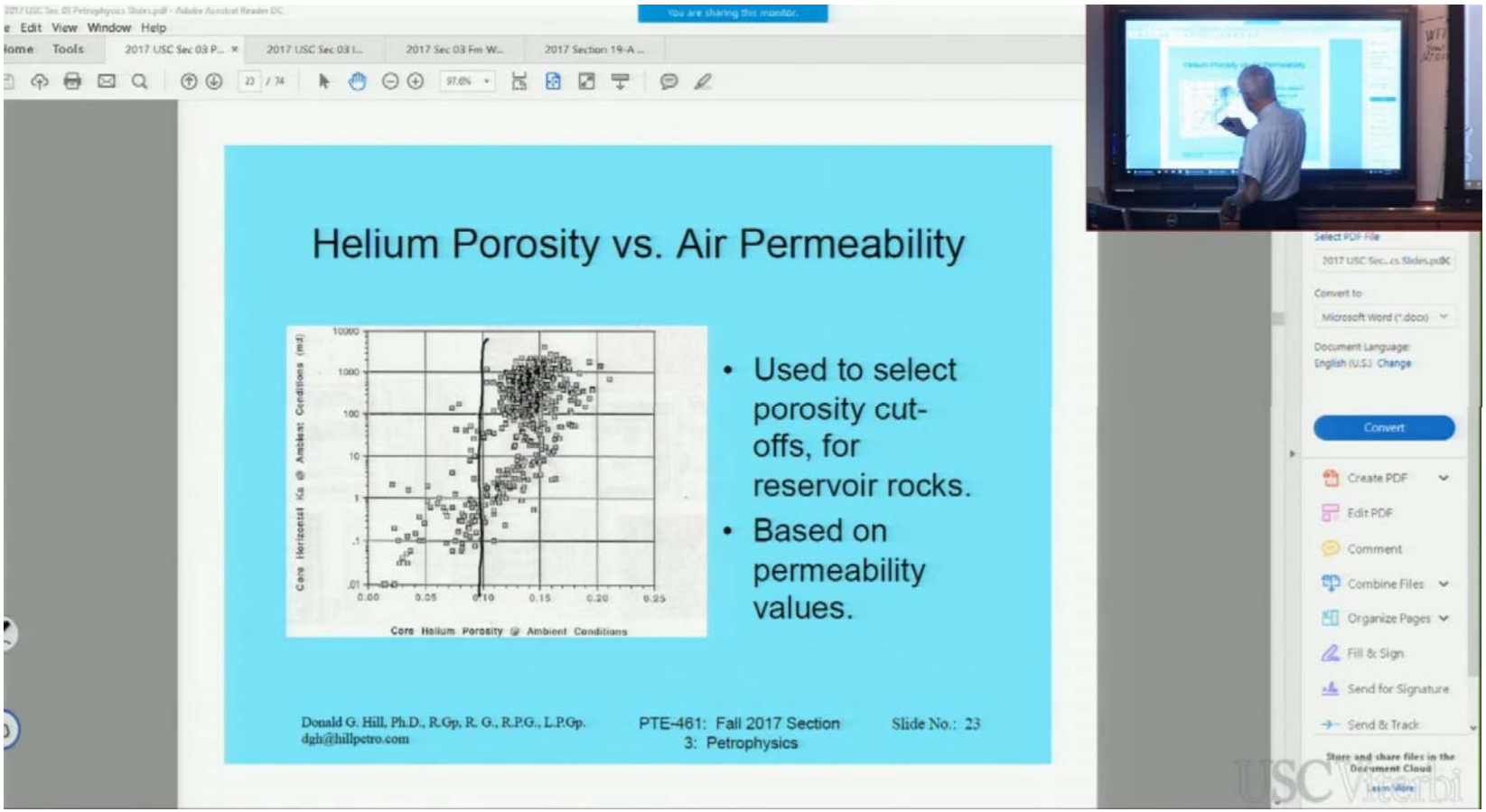
DEN@Viterbi's E-Learning System



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DEN@Viterbi Additional Info

Limited Status

- Allows qualified candidates to begin coursework before formal admission.
- Courses (***maximum of 12 units)*** can be applied toward degree program once admitted but ***limited status does not guarantee admission***.
- Get Started: https://viterbigradadmission.usc.edu/denviterbi/getting-started/

Tuition Deferment Program

- Students supported by company can defer “up front” payment of tuition until after the semester is over.
- Company must pay 75-100% of tuition to be eligible for program.
- For additional information: https://viterbigrad.usc.edu/tuition-and-funding/employer-supported

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Tuition & Fees (2018-2019)

PER-COURSE FEES	Unit Cost	Tuition for 3-Unit Course	Tuition for 4-Unit Course
Tuition for 500/600 level course	$2,005	$6,015	$8,020

Degree Programs are 27-36 units (9-11 courses)

For an overview of additional fees, please visit:
https://viterbigradadmission.usc.edu/programs/masters/tuition-funding/tuition-funding-masters/

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Application Deadlines

Application Deadlines for 2019-2020

Helpful Links:

List of DEN@Viterbi Programs
http://viterbi.usc.edu/DENDegrees

USC Graduate Application:
https://usc.liaisoncas.com

Fall 2019

- Deadline to submit all required materials: January 15, 2019*

Spring 2020

- Deadline to submit all required materials: September 15, 2019*
- Deadline for Scholarship Consideration (on-campus only): August 31, 2019

Fall 2020

- Deadline to submit all required materials: January 15, 2020
- Deadline for Scholarship Consideration (on-campus only): December 15, 2020

** A deadline extension for DEN@Viterbi applicants may be available. Please email DEN@Viterbi.usc.edu for more information.*

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Getting Started

For those interested in taking classes on campus:

- Visit USC campus
- Start your application:
  http://www.usc.edu/admission/graduate/apply

For those interested in taking classes online via DEN@Viterbi:

- Start as a Limited Status Student in Summer 2019 –or-
- Start your application:
  http://www.usc.edu/admission/graduate/apply

USC Viterbi
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Meet Professor Mike Gruntman

- Department Chair, Astronautical Department
- Program Director, Master of Science in Astronautical Engineering
- Professor of Astronautical Engineering
- Research in Astronautics, spacecraft and space mission design, space physics, space instrumentation and sensors, space plasmas, spacecraft technologies, rocketry, propulsion, orbital debris.
- Authored and co-authored more than 300 scholarly publications, including 4 books.

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USC Viterbi School of Engineering

USC University of Southern California

Master of Science in Astronautical Engineering

Mike Gruntman

Department Chair, Astronautical Engineering

Program Director

Master of Science in Astronautical Engineering

USC Viterbi School of Engineering

Agenda

- Department of Astronautical Engineering
- Faculty
- Research Areas, Collaborations
- Degree: *Master of Science in Astronautical Engineering*
- Students
- Coursework
- Criteria for MS Applicants
- Contact info

Mike Gruntman
mikeg@usc.edu
Dept. of Astronautical Engineering, VSOE

About the program – articles 2018, 2014, 2017
http://astronauticsnow.com/aste.pdf

USC Viterbi School of Engineering

Department of Astronautical Engineering

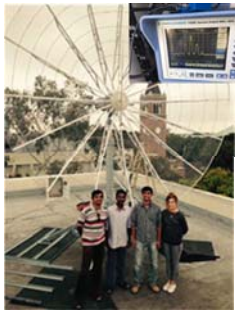
Statue of Neil Armstrong on USC campus.
Sculptor: Jon Hair.

- Established in 2004
  "to take full advantage of growing opportunities in space"
  - founding Chairman (2004–2007) Prof. Mike Gruntman
  - history, rational, development – articles 2018, 2014, 2007
    (download http://astronauticsnow.com/aste.pdf)
- Operated as an independent department from 2004
- Built upon astronautical specialization, started in 1995
- Followed standard process in building a new department in a university (degree approval, course development, ABET accreditation, student affairs, …)
- Responsible for programs in space engineering in USC
- Established a full set of degrees, including a large nationally-prominent Master's degree program

USC Viterbi School of Engineering

Department of Astronautical Engineering

- Unique pure-space-engineering department (established in 2004)
- Built upon astronautical specialization, started in 1995
- Full set of degrees in **Astronautical Engineering (ASTE)**
  - ❑ Bachelor of Science (BS)
  - ❑ Bachelor of Science Minor
  - ❑ Master of Science (MS)
  - ❑ Engineer
  - ❑ PhD
  - ❑ Graduate Certificate



Mission:
to provide forefront research and education in astronautical (space) engineering

- Among largest national programs in space engineering on Master's level

USC Viterbi School of Engineering

Department of Astronautical Engineering

Faculty, Adjunct Faculty, and Lecturers

Faculty

- Prof. Mike Gruntman (Chairman; Director, Master of Science Program)
- Prof. Daniel Erwin (Director, Bachelor of Science Program)
- Prof. Joseph A. Kunc
- Prof. Azad Madni
- Prof. Garrett Reisman
- Prof. Joseph Wang (Director, PhD Program)

Research Faculty

- Prof. David Barnhart
- Prof. Sergei Gimelshein

Adjunct Faculty and Lecturers (grad courses)

- Dr. Mohamed Abid (JPL)
- Dr. Oscar Alvarez-Salazar (JPL)
- Dr. Rodney Anderson (JPL)
- Prof. Bruce Cordell (21st Century Waves)
- Prof. Don Edberg (Cal Poly Pomona)
- Dr. Anthony Freeman (JPL)
- Dr. Keith Goodfellow (Aerojet Rocketdyne)
- Dr. Troy Goodson (JPL)
- Prof. Gerald Hintz (ret., JPL, Aerospace Corp.)
- Prof. Michael Kezirian (IAASS, ISSF)
- Mr. Steve Matousek (JPL)
- Dr. Leila Meshkat (JPL)
- Prof. Ryan Park (JPL)
- Dr. Robert Parker (ret.; Northrop-Grumman)
- Dr. G.P. Purohit (Aerospace Corp.)
- Dr. David Reese (Aerospace Corp.)
- Prof. Anita Sengupta
- Mr. Madhu Thangavelu (AAA Visioneering)
- Prof. Kent Tobiska (Space Environm. Techn.)
- Prof. James Wertz (Microcosm)
- Dr. Bret Williams (Raytheon)
- Dr. Sydney Yuan (Aerospace Corp.)

USC Viterbi School of Engineering

Department of Astronautical Engineering

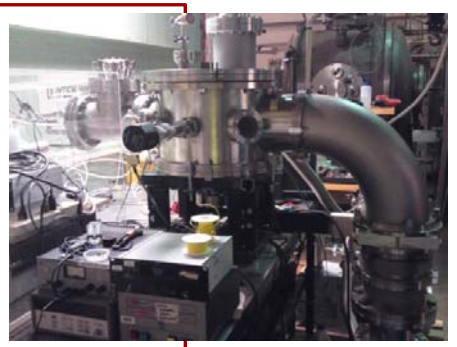
Books by Faculty and Lecturers

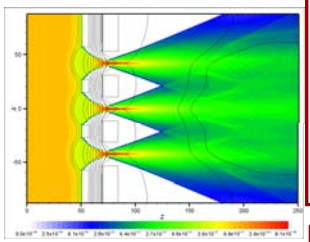
USC Viterbi School of Engineering

Department of Astronautical Engineering

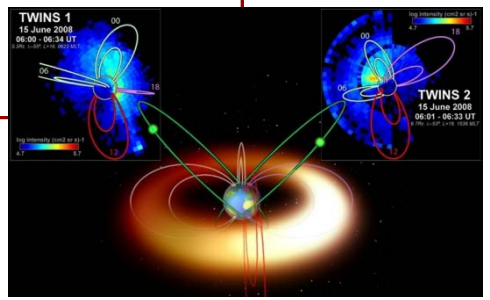
Research Areas

- Astronautics
- Space environment and spacecraft interactions
- Space science
- Space instrumentation and sensors
- Spacecraft propulsion
- Space mission and spacecraft design
- Non-equilibrium processes in gases and plasmas
- Computational physics and high performance computing





- Faculty are PI's and Co-I's on programs supported by NASA, Air Force, Navy, NSF, industry
- Science team member/investigator/development: Pioneer 10/11, SOHO, Deep Space 1, IMAGE, Dawn
- Current NASA missions Co-I: TWINS and IBEX



- Student (undergraduate and Master's) projects
  - Rocket propulsion lab
  - Liquid-propulsion lab
  - Lunar lander
  - Student microsatellites and cubesats

USC Viterbi School of Engineering

Department of Astronautical Engineering

Interdisciplinary Collaborations

Interdisciplinary collaborations with other USC departments/schools

- Electrical Engineering
- Mechanical Engineering
- Information Sciences Institute (ISI), VSOE
- Systems Architecting and Engineering
- Physics and Astronomy

External collaborations

- U.S. Universities (Harvard, UC Berkeley, U of Arizona, BU, …)
- NASA centers (JPL, Goddard)
- DoE National Labs (Los Alamos)
- R&D centers (Applied Physics Laboratory; Southwest Research Institute, …)
- Industry (Northrop-Grumman, Lockheed-Martin, Boeing, …)
- Foreign R&D centers and universities (Germany, Japan, …)

USC Viterbi School of Engineering

Master of Science Program in *Astronautical Engineering*

- Degree in the highly dynamic and technologically advanced area of astronautics and space technology
- Program designed for those with B.S. degrees in science and engineering who work or wish to work in the space sector of the space/defense/aerospace industry, government research and development centers and laboratories, space operations and academia
- Combines science and engineering fundamentals with specialized courses
- VSOE Astronautics faculty and adjunct faculty and lecturers from leading space companies and government space R&D centers

  (Boeing, Lockheed-Martin, Northrop-Grumman, Aerospace Corporation, NASA Jet Propulsion Laboratory, Raytheon, Aerojet Rocketdyne, Microcosm, Space Environment Technologies, …)

USC Viterbi School of Engineering

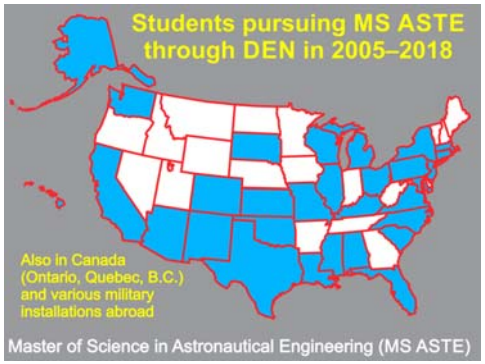
Master of Science Program in *Astronautical Engineering*

Students

- Students pursuing MS in Astronautical Engineering
  - Full-time on-campus students – 35-40%
  - Working full-time and studying part-time students (through Distance Education Network of the Viterbi School – DEN@Viterbi) – 60-65%
  - Active duty military (Air Force, Army, Navy, Marine Corp)
  - Student background (BS and MS degrees)
    - Astronautical engineering
    - Mechanical Engineering
    - Electrical engineering
    - Aerospace engineering
    - Other areas (chemical, computer, systems, etc) of engineering
    - Physics and Astronomy
    - Other areas of science (including medical doctors)
    - Planning to apply for astronaut training
- Pathway to positions in system engineering of space systems
  (especially important for engineers with BS and MS in EE, ME, etc.)

USC Viterbi School of Engineering

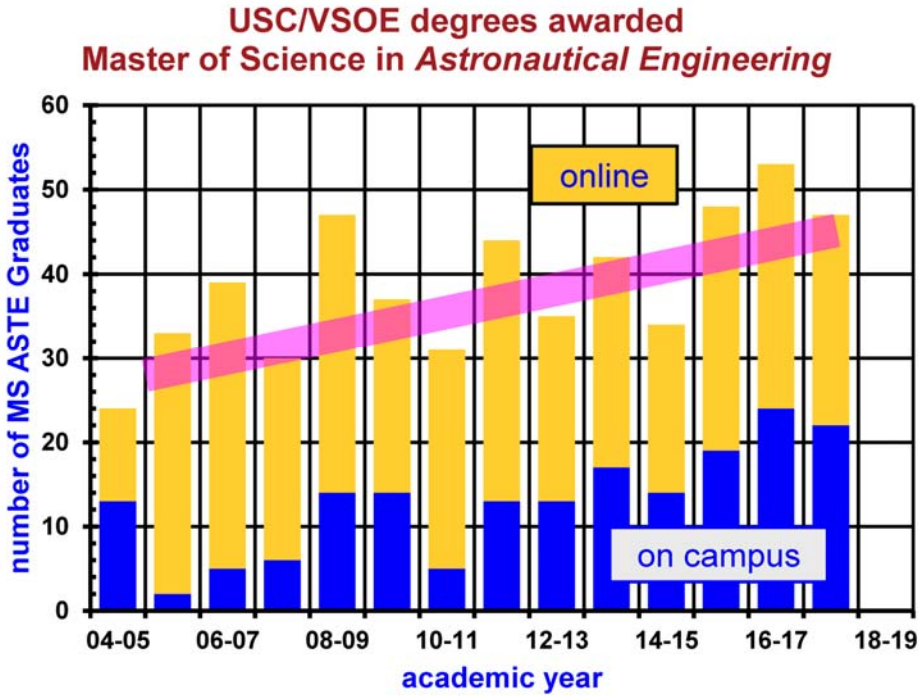
Master of Science Program in *Astronautical Engineering*



Students

545 MS ASTE degrees awarded from 2004–2018;
~42 annually during last 10 academic years

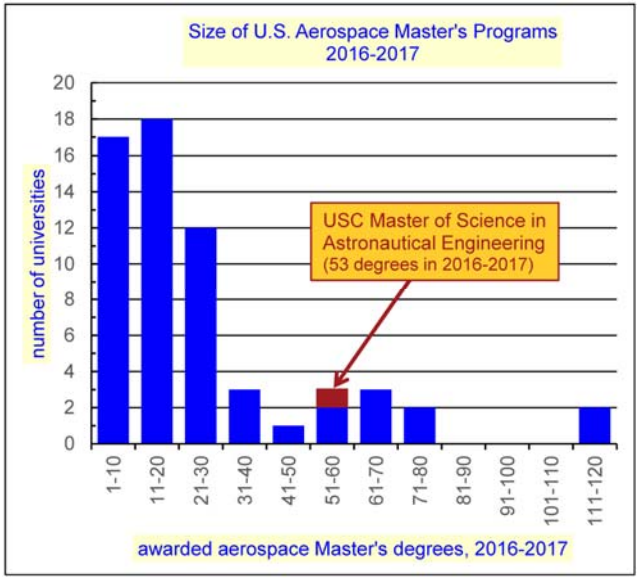
3.0-3.5% nationally awarded Master's degrees in astronautical/aeronautical/ aerospace engineering



USC Viterbi School of Engineering

Master of Science Program in *Astronautical Engineering*

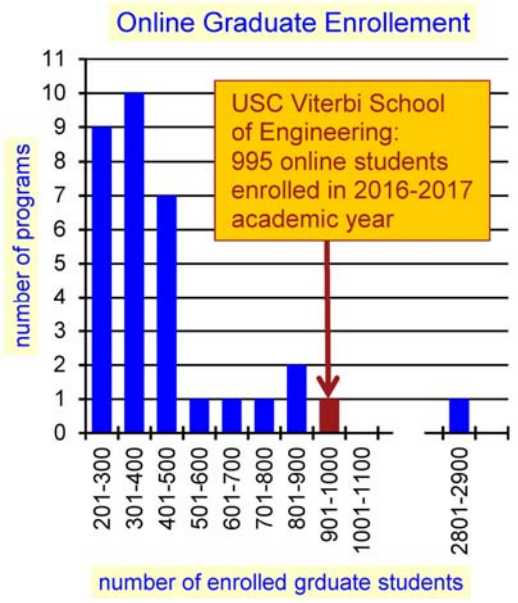
Statistics



USC Astronautics – 8th
in the United States in 2016-17 AY
(in awarded MS aerospace degrees)

Distance Education in U.S.

Master's degrees online – particularly important in space, aerospace, defense industries



USC
MS ASTE
2/3
students
are
distance
(online)

USC Viterbi School of Engineering

Community of Alumni, Students, and Supporters


USC Astronautics Alumni, Students, Faculty, and Friends

Connect with your fellow Astro-Trojans. Ad Astra!

In order to get the T-shirt and follow the post

NASA Administrator Charles Bolden (left) at the 49th AIAA Aerospa Meeting in Orlando, Fla., with the *USC-Astronautics rocket-scientist* Gruntman is on the right; VSOE MAPP's Billy Schwerin is behind th center. January 5, 2011.

Apollo astronaut Buzz Aldrin (center) and the instructor of ASTE's S Studio Madhu Thangavelu (right) with the *USC-Astronautics rocket shirt*; ASTE graduate student Sam Barbour is next to Aldrin and Mik the left. December 13, 2012.

This USC Astronautics LinkedIn networking group launched on 11 April 2009.

More than 300 members as of January 2012.

http://astronauticsnow.com/astrousc_linkedin/[4/14/2012 1:17:05 PM]

USC Astronautics Alumni, Students, Faculty, and Friends

USC Astronautics
Alumni, Students, Faculty, and Friends

USC Master of Science in Astronautical Engineering: Overview (video; 53 min)

USC program Master of Science in Astronautical Engineering: update - April 21, 2011 (pdf)

LinkedIn Group

USC Astronautics Alumni, Students, Faculty, and Friends

The network of the alumni, students, faculty, and friends of the USC Astronautics, a rapidly growing program offering degrees in astronautical engineering. Hundreds of our alumni work in the leading American space companies and government research and development centers.

The true story ... Now it can be told

We welcome not only our current and former students with the degrees in *Astronautical Engineering* (or the old degree *Aerospace Engineering, Astronautics*), but also all current and former USC students who took our space classes and are part of the great space enterprise. USC Astronautics began as a space engineering specialization in the Viterbi School of Engineering of the University of Southern California. Today, it is an independent space-focused *Department of Astronautical Engineering* in the Viterbi School. (Astronautics program history, focus, dynamics.) Please check the statistics on the number of awarded degrees (about 40 MS deg four academic year) and program reac

In addition, we welcome to USC-Astro program friends, all those space profe industry, national labs and FFRDCs, g advocates) who are interested in and

Periodically, our group members post job offerings -- many will certainly find them useful.

http://astronauticsnow.com/astrousc_linkedin/[4/14/2012 1:17:05 PM]

USC Astronautics

USC Astronautics networking group launched in April 2009

>650 members as of 2018 and growing

http://astronauticsnow.com/astrousc_linkedin/

USC Viterbi School of Engineering

Master of Science Program in *Astronautical Engineering*

Admission requirements

- Bachelor of Science degree in engineering or science (no Bachelor's aerospace degree required)
- Minimum cumulative grade point average [GPA] of 3.0 on a 4.0 scale
- Graduate Record Examination [GRE]
- Two letters of recommendation

Many (on-campus) Master's students participate in student projects such as *Liquid Propulsion Lab*

MS ASTE Admission and Coursework

Master of Science in Astronautical Engineering coursework requirement:
total of 27 units or 9 courses (one course is usually 3 units)

- **4 required astronautics courses**
  - Spacecraft Systems Design
  - Space Environment and Spacecraft Interactions
  - Spacecraft Propulsion
  - Orbital Mechanics
- **3 core elective courses** from the list of astronautics courses
- **2 technical elective courses** selected from courses in astronautical engineering and/or from other science/engineering graduate courses
- MS Thesis is optional (possible but not required)

USC Viterbi School of Engineering

Master of Science Program in *Astronautical Engineering*

Astronautics Coursework

- Spacecraft System Design
- Space Environment and Spacecraft Interactions
- Design of Low Cost Space Missions
- Space Studio Architecting
- Entry and Landing Systems

- Orbital Mechanics I
- Orbital Mechanics II
- Space Navigation
- Solar System Navigation
- Spacecraft Attitude Dynamics
- Spacecraft Attitude Control

- Spacecraft Propulsion
- Liquid Rocket Propulsion
- Solid Rocket Propulsion
- Advanced Spacecraft Propulsion
- Space Launch Vehicle Design
- Physical Gas Dynamics I, II

leading specialists in space industry teach most specialized courses (part-time lecturers)

- Spacecraft Structural Dynamics
- Spacecraft Structural Strength and Materials

- Spacecraft Thermal Control
- Spacecraft Power Systems
- Systems for Remote Sensing from Space
- Spacecraft Sensors
- Space Cryogenic Systems

- Safety of Space Systems and Missions
- Reliability of Space Systems

recent growth areas

- Human Spaceflight
- Human Factors in Space Operations
- Engineering Principles of Human Spaceflight

USC Viterbi School of Engineering

Master of Science Program in *Astronautical Engineering*

Criteria for Applicants

- Candidates for formal admission to the Master of Science in Astronautical Engineering program require:
  - ❑ Bachelor of Science degree in engineering or science from a regionally-accredited institution
  - ❑ Minimum cumulative grade point average [GPA] of 3.0 on a 4.0 scale
  - ❑ General portion of the Graduate Record Examination [GRE]
  - ❑ Two letters of recommendation
- Department application deadlines:
  1 June for fall; 1 November for spring; 1 March for summer – check with Student Advisor!
- DEN@Viterbi (online) Students: It is possible to begin classes as early as this summer semester, prior to formal admission via Limited Status Enrollment, if qualified. For more information and to get started: https://viterbigradadmission.usc.edu/denviterbi/getting-started/
- Conditional admission

USC Viterbi School of Engineering

Master of Science Program in *Astronautical Engineering*

Common Questions

- Typical time to complete the program
  - Full-time students: 1.5 years (3 semesters)
  - Part-time student: 3 – 4 years (1 – 2 courses per semester)
- Course sequence (e.g., required before electives?)
  - Course sequence is entirely up to students. Advisors help as needed. Few exceptions: space navigation requires orbital mechanics; advanced propulsion requires propulsion, …
- Waiver of required courses – yes
  - Required courses waived if a student had similar level courses elsewhere.
- Technical electives from other departments – yes
  - Almost any graduate science and engineering course approved
- System engineering
  - Pathway to system engineering of space systems, especially for engineers with BS and MS in EE and ME
- Attending classes on campus by DEN@Viterbi students – welcome!
- Difference between programs in *Astronautical* and *Aerospace* Engineering
  - see: http://astronauticsnow.com/2014aste.pdf
- Industry interest
  - Enrollment dynamics proves that the program meets the real demand of the industry/gov't

USC Viterbi School of Engineering

Contact Us

Department of Astronautical Engineering

Department of Astronautical Engineering (ASTE)

ASTE Administrator
Ms. Dell Cuason
cuason@usc.edu
tel. 213-821-5817

Student Adviser
Ms. Nicole Valdez
nicoleva@usc.edu
tel. 213-821-4234

Department Chair; MS ASTE Program Director and Faculty Adviser
Prof. Mike Gruntman
mikeg@usc.edu
tel. 213-740-5536

Frequently Asked Questions
http://astronauticsnow.com/msaste/faq.html

- **Enrollment as limited student**

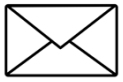
  Corporate and Professional Programs
  Meghan Balding
  DEN@viterbi.usc.edu
  tel. 213-740-4488 (option 4)

About the program – articles 2018, 2014, 2017
http://astronauticsnow.com/aste.pdf

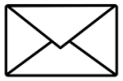
USC Viterbi School of Engineering

Contact Us

USC Viterbi School of Engineering
Graduate & Professional Programs



On Campus Prospective Student Inquiries:
viterbi.gradprograms@usc.edu



DEN@Viterbi Prospective Student Inquiries:
DEN@Viterbi.usc.edu

213.740.4488

http://viterbi.usc.edu/gradprograms

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