

March 22, 2022

**To: Astronautics Students
 Students Enrolled in Astronautics Classes
 Astronautics Program Instructors
 Astronautics Program Supporters and Friends**

Astronautics Master's Program Update

As always this time of the year, we provide an update on the recent developments in the program ***Master of Science in Astronautical Engineering*** or **MS ASTE**.

1) The Master of Science program in astronautical engineering (MS ASTE) is in excellent shape (see statistics pp. 3, 4). From humble beginnings and in a record short time since its founding in 2004, it has grown into a major, among largest, internationally recognized space-engineering program. We reach students all over the United States and Canada as well as at military installations at home and abroad.

The Department awarded more than **730 Master of Science ASTE degrees** from 2004. During the last 5 years, it was on average **57 Master's degrees annually**.

2) The admission requirements to MS ASTE have been changed to the **undergraduate GPA of 3.2 or higher**.

3) The required course ASTE-470 in spacecraft propulsion has been replaced by the *identical course* **ASTE-575** (pp. 13, 14). This class will be offered in the spring semesters.

We offer ASTE-470 for the last time in Fall 2022 for undergraduate students only. Master's students can also take this course if needed for graduation or other academic reasons. In such cases, please contact ASTE student services to obtain permission.

4) The preparations for the resumption of **ASTE-584** in the academic year 2022-2023 are in progress (pp. 13, 14). We anticipate that **ASTE-501a** will also resume in the academic year 2023-2024.

5) The newsletter provides program news, a long-term course schedule, and other information about coursework of interest to our current, past, and future students. Please always check with ASTE Student Services Assistant Director the near-term course schedule.



6) Meet ASTE staff (photos on the right).

Please do not hesitate to contact Astronautics Business Manager Ms. **Dell Cuason** (OHE-500U; tel. 213-821-5817; cuason@usc.edu) should you have any questions about the program.

Ms. **Linda Ly** (OHE-530B; tel. 213-740-7228; lylinda@usc.edu) supports business operations of the department and research grants and contracts of the faculty.

Ms. **Marlyn Lat** (OHE-500V; tel. 213-740-4009; marlynlat@usc.edu) supports various administrative, student admission, and budgetary operations of the department.

Mr. **Luis Saballos** (OHE-500Q; tel. 213-821-4234; lsaballos@usc.edu) is ASTE's Student Services Assistant Director.

Luis is the first contact for students on questions regarding class registration, schedule, and admission to programs in astronautics. Before your inquiries, check MS ASTE frequently asked questions at <http://astronauticsnow.com/msaste/faq.html>.

7) Please find below

- (a) ASTE program statistics (pp. 3-4)
- (b) recent books by Astronautics instructors (p. 5)
- (c) student resources – *The Space Show* (p. 6)
- (d) Astronautics program classes in the Summer and Fall semesters of 2022 and Spring semester of 2023 (pp. 7-12)
- (e) long-term class schedule (pp. 13, 14)
- (f) MS ASTE catalog description (pp. 15-17)
- (g) admission requirements, transfer to graduate degree programs in Astronautical Engineering, GPA, leave of absence, and graduation (pp. 18-21)

Ad Astra!

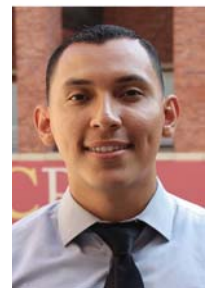


Mike Gruntman
Professor of Astronautics
Director, *MS in Astronautical Engineering*

P.S. We have to amend our motto on reaching to the stars as government and university regulations are becoming more and more bureaucratic and restrictive rather than inspirational.

Per aspera (et statuta) ad astra!

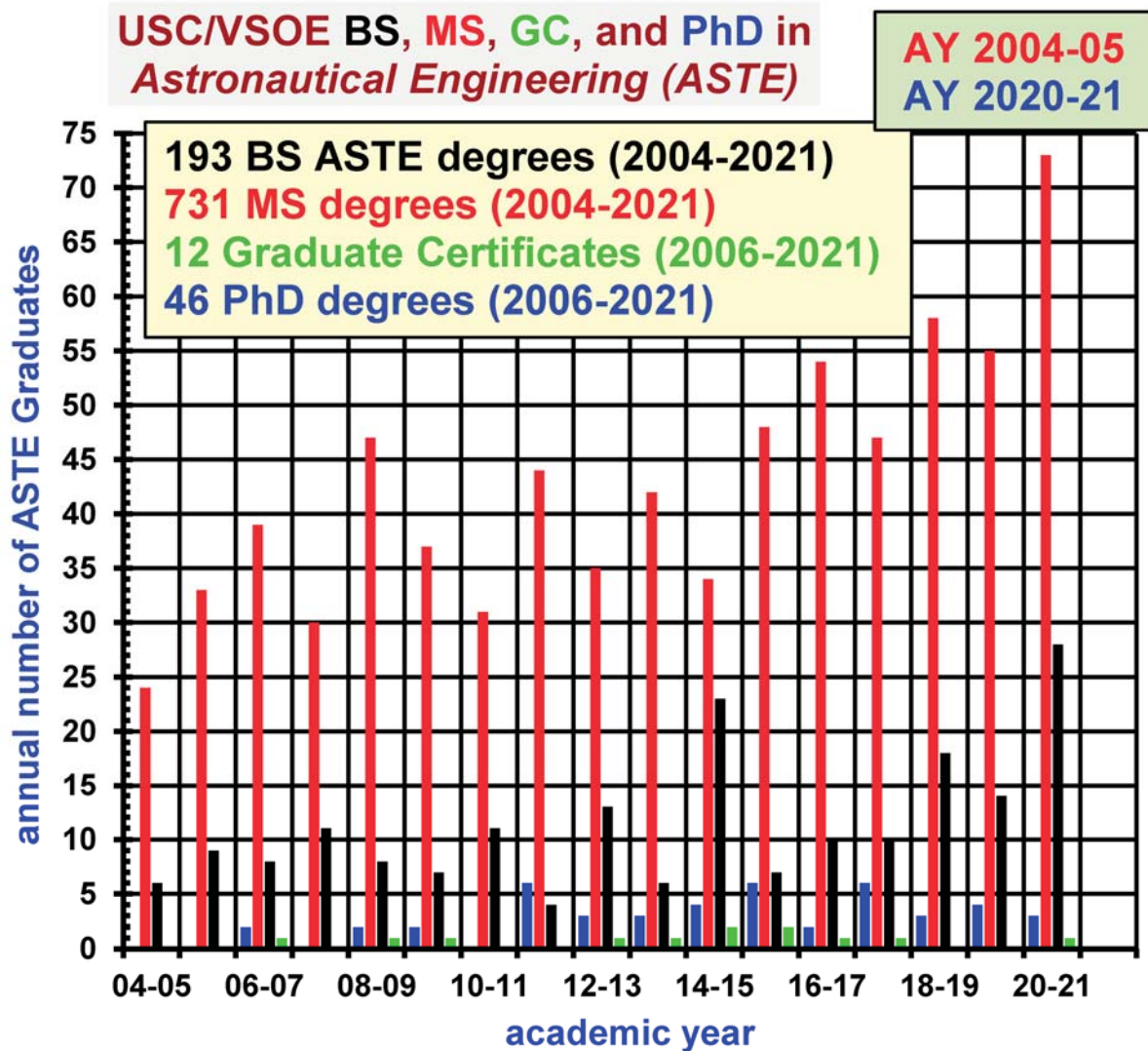
Through difficulties (and [unfortunately] regulations) to the stars!



ASTE staff:
Dell Cuason
(top),
Linda Ly,
Marlyn Lat,
Luis Saballos
(bottom)

Degrees in Astronautical Engineering – Statistics

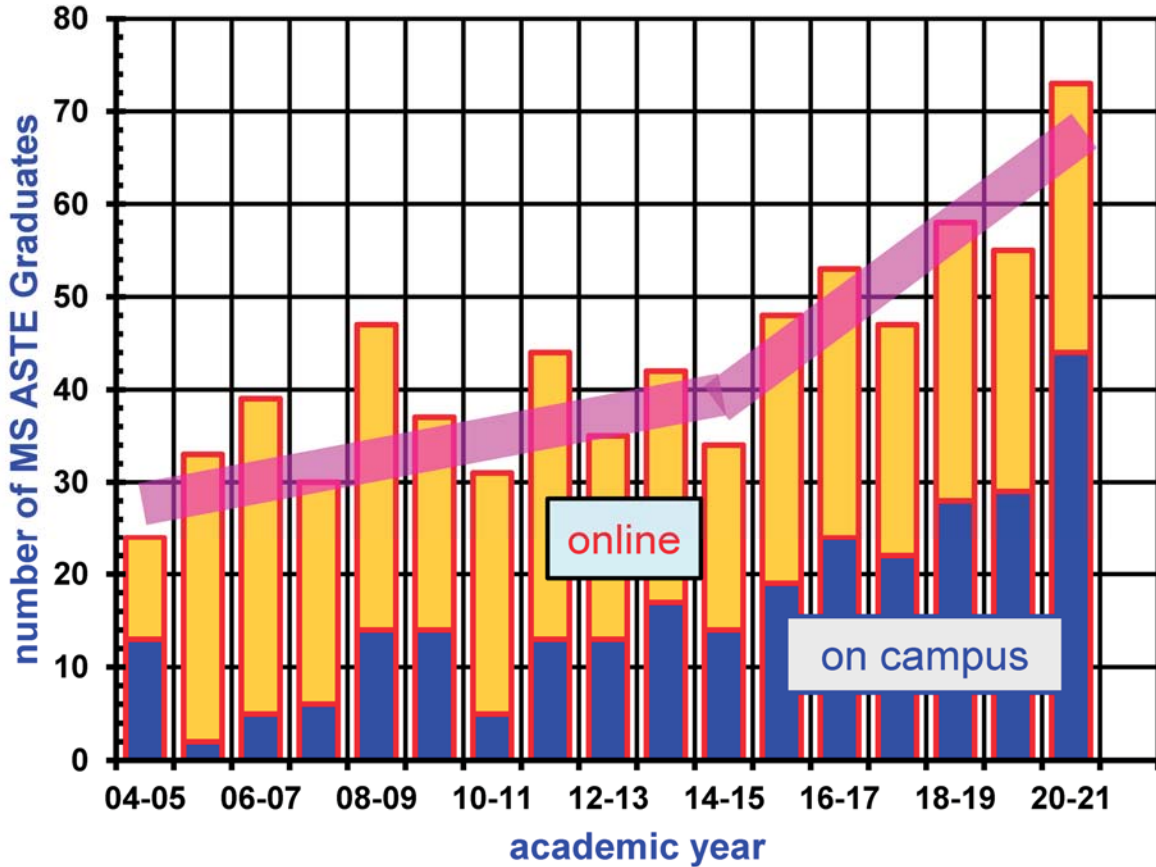
Since its founding in 2004, the Astronautical Engineering Department offers the full set of degrees in *Astronautical Engineering* (ASTE) – see figure below.



From AY 2004-2005 to AY 2019-2021, the Department has awarded **193** Bachelor of Science degrees, **731** Master of Science degrees, **46** PhD degrees, and **12** Graduate Certificates.

Master of Science – MS ASTE

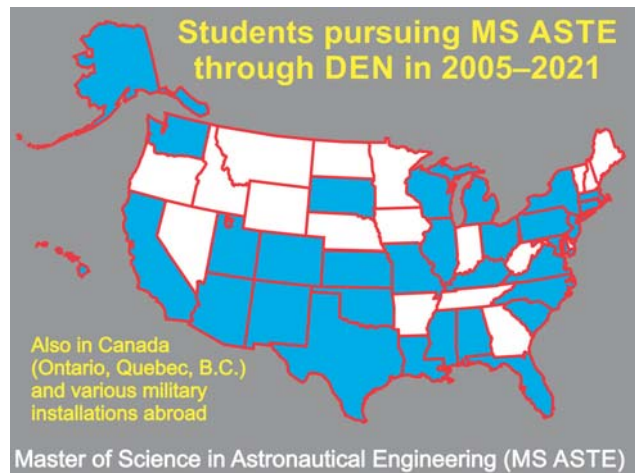
USC/VSOE degrees awarded Master of Science in Astronautical Engineering



The Master of Science in Astronautical Engineering (MS ASTE) program awarded more than **730** degrees from 2004.

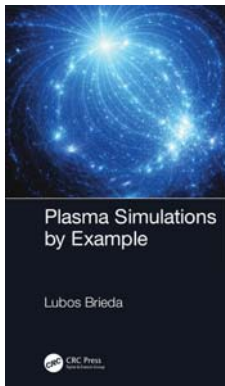
Full-time on-campus students earn now about one-half of the degrees. Online students account for the other half of the students.

The program reaches students all over the United States and Canada as well as at military installations at home and abroad through Viterbi's Distance Education Network (DEN).



MS ASTE flagship class, *Spacecraft Systems Design (ASTE 520)* More than **2200** graduate students enrolled in ASTE-520 since 1994.

Recent Books by Astronautics Instructors



Lubos Brieda

Plasma Simulations by Example

CRC Press, 2021

ISBN 978-1032176147 (paperback)



Don Edberg and Willie Costa

Design of Rockets and Space Launch Vehicles

AIAA, 2020

ISBN 978-1624105937

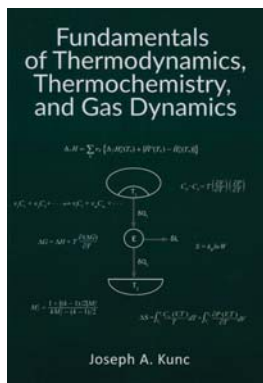


Mike Gruntman

My Fifteen Years at IKI, the Space Research Institute: Position-Sensitive Detectors and Energetic Neutral Atoms Behind the Iron Curtain

Interstellar Trail Press, 2022

ISBN 979-8985668704



Joseph A. Kunc

Fundamentals of Thermodynamics, Thermochemistry, and Gas Dynamics

2020

ISBN 978-1733009805

The Space Show – Resource for Students



The Space Show has been on the air for almost 20 years and it is heard in more than 50 countries around the world.

<http://thespaceshow.com>

The host and USC-Astronautics supporter, **Dr. David Livingston** (right), broadcasts a few times each week. In contrast to many radio talk shows, the discussions with guests last 1.5 hours or longer which allows in-depth coverage of various topics.



This is one of the best informative and educational programs on the radio that brings problems and challenges of our vast space enterprise to a diverse audience of listeners across the globe. Space policies and politics; science, technologies, and education; entrepreneurial endeavors and innovations; "new" and "legacy" space – all are discussed by stellar guest specialists.

The Space Show focuses on timely and important issues influencing the development of outer-space commerce, space tourism, space exploration, and space development. The Space Show is committed to facilitating our becoming a space-faring nation and society with a growing and self-sustaining space-faring economy.

While the primary focus of the Space Show is on the “new” space ventures, it also covers traditional areas of the space enterprise. Many leading specialists including former NASA administrators, top scientists and technologists, space entrepreneurs, authors, and leaders of space advocacy groups were among its guests. **The list also includes at least six ASTE instructors.**

All shows – **more than 3600** – are archived and conveniently accessible through the new flashy website <http://thespaceshow.com>. One can search for various topics and guests, download mp3 files (usually 30-50MB), and listen on computers or other devices. Many listen to programs live on the Internet and call in with questions.

The Space Show is a great resource for Astronautics students.

Schedule of Astronautics Courses

When you plan your coursework, please always check in advance with ASTE Student Adviser the availability of the chosen courses.

While we carefully plan our course offerings, it is the Dean's Office that makes the final scheduling decision. Then, there is a challenge of the availability of DEN studios. You may call it, using the language of physics and mathematics, the "boundary conditions" or "constraints." Also, sometimes our instructors from industry and government centers cannot offer scheduled courses due to work-related or personal emergencies.

We try to minimize such occurrences, but they are outside our direct control. Please always check in advance with ASTE Student Adviser the availability of the chosen courses.

Special arrangements for some courses in the summer and fall semesters of 2022 and spring semester of 2023 (subject to change)

Summer 2022

ASTE 580 *Orbital Mechanics I*

Instructor: Prof. Ryan Park (JPL)

ASTE 585 *Spacecraft Attitude Control*

Instructor: Prof. Henryk Flashner (USC)

Fall 2022 -- limited enrollments

ASTE 527 *Space Architecting Studio*

Instructor: Madhu Thangavelu (AAA Vis.) enrollment limited to 12 students:
6 on-campus; 6 DEN-webcast

ASTE 556 *Ground Communications for Satellite Operations*

Instructor: Prof. David Barnhart (USC) enrollment limited to 12 students:
6 on-campus; 6 DEN-webcast

ASTE 561 *Human Factors of Spacecraft Operations*

Instructor: Prof. Garrett Reisman (USC) enrollment limited to 21 students:
11 on-campus; 10 DEN-webcast

Spring 2023 -- **ASTE-584** (resumed offering with new instructors)

limited enrollments

ASTE 556 *Ground Communications for Satellite Operations*

Instructor: Prof. David Barnhart (USC) enrollment limited to 12 students:
6 on-campus; 6 DEN-webcast

University of Southern California

Department of Astronautical Engineering (ASTE)

Astronautics Classes offered in the summer semester, 2022

Required courses

ASTE 580 (3) – Orbital Mechanics I DEN-webcast
Instructor: **Prof. Ryan Park** (JPL)



Prof. Ryan Park
(Jet Propulsion Laboratory)
ASTE 580
Orbital Mechanics I

Core Elective and Elective Requirements

ASTE 585 (3) – Spacecraft Attitude Control DEN-webcast
Instructor: **Prof. Henryk Flashner** (USC)



Prof. Henryk Flashner
(USC)
ASTE 585
Spacecraft Attitude Control

For more information on the *Master of Science in Astronautical Engineering* (MS ASTE) program please check <https://viterbigradadmission.usc.edu/programs/masters/msprograms/astronautical-engineering/> and contact ASTE Senior Administrator Ms. Dell Cuason (OHE-500U; tel. 213-821-5817; cuason@usc.edu) or ASTE Student Services Assistant Director Mr. Luis Saballos (OHE-500Q; tel. 213-821-4234; lsaballos@usc.edu).

MS ASTE Frequently Asked Questions are at <http://astronauticsnow.com/msaste/faq.html>.

Instructors of *Astronautics* courses in Fall 2022 (alphabetically)

University of Southern California



Dr. Oscar Alvarez-Salazar
(JPL)

ASTE 556
Spacecraft Structural Dynamics



Dr. David Reese
(The Aerospace Corp.)

ASTE 571
Solid Rocket Propulsion



Prof. David Barnhart (ASTE
and ISI; University of
Southern California)

ASTE 566
*Ground Communications for
Satellite Operations*



Prof. Garrett Reisman
(Univ. of Southern California)

ASTE 524 Human Spaceflight
**ASTE 561 Human Factors of
Spacecraft Operations**



Prof. Mike Gruntman
(Univ. of Southern California)

ASTE 520
Spacecraft Systems Design



Prof. Anita Sengupta
(Hyperloop)

ASTE 577
*Entry and Landing Systems
for Planetary Exploration*



Prof. Gerald Hintz
(The Aerospace Corp.)

ASTE 589
Solar System Navigation



Madhu Thangavelu
(AAA Visioneering)

ASTE 527
*Space Exploration
Architectures Concept
Studio*



Steven Matousek (JPL)

ASTE 553
*Systems for Remote Sensing
from Space*



Prof. Kent Tobiska
(Space Environment
Technologies)

ASTE 535
*Space Environments and
Spacecraft Interactions*



Prof. Ryan Park
(Jet Propulsion Laboratory)

ASTE 580
Orbital Mechanics I



Prof. Joseph Wang
(Univ. of Southern California)

ASTE 505a
Plasma Dynamics

University of Southern California

Department of Astronautical Engineering (ASTE)

Astronautics Classes offered in the fall semester, 2022

Core Requirements

ASTE 470 (3)	–	Spacecraft Propulsion; Instructor by special permission only; take ASTE-575 in spring 2023 instead	DEN-webcast
ASTE 520 (3) Instructor:	–	Spacecraft System Design Prof. Mike Gruntman (USC)	DEN-webcast
ASTE 535 (3) Instructor:	–	Space Environment and SC Interactions Dr. Kent W. Tobiska (Space Environment Techn.)	DEN-webcast
ASTE 580 (3) Instructor:	–	Orbital Mechanics I Prof. Ryan Park (JPL)	DEN-webcast

Core Elective and Elective Requirements

ASTE 505a (3) Instructor:	–	Plasma Dynamics I Prof. Joseph Wang (USC)	on-campus only
ASTE 524 (3) Instructor:	–	Human Spaceflight Prof. Garrett Reisman (USC)	DEN-webcast
ASTE 527 (3) Instructor:	–	Space Exploration Architectures Concept Studio Madhu Thangavelu (AAA Visioneering) limited enrollment (6 on-campus + 6 online)	DEN-webcast
ASTE 553 (3) Instructor:	–	Systems for Remote Sensing from Space Steven Matousek (JPL)	DEN-webcast
ASTE 556 (3) Instructor:	–	Spacecraft Structural Dynamics Dr. Oscar Alvarez-Salazar (JPL)	DEN-webcast
ASTE 561 (3) Instructor:	–	Human Factors of Spacecraft Operations Prof. Garrett Reisman (USC)	DEN-webcast limited enr (11 on-campus + 10 online)
ASTE 566 (3) Instructor:	–	Ground Communications for Sat. Ops Prof. David Barnhart (USC)	on campus and DEN limited enrollm (6 on-campus + 6 online)
ASTE 571 (3) Instructor:	–	Solid Rocket Propulsion Dr. David Reese (Aerospace Corp.)	DEN-webcast
ASTE 577 (3) Instructor:	–	Entry and Landing Systems for Planetary Exploration Prof. Anita Sengupta (Hyperloop)	DEN-webcast
ASTE 589 (3) Instructor:	–	Solar System Navigation Prof. Gerald Hintz (Aerospace Corp.)	DEN-webcast

For more information on the *Master of Science* degree program in *Astronautical Engineering* (MS ASTE) please check <http://gapp.usc.edu/graduate-programs/masters/astronautical-engineering> and contact ASTE Student Services Assistant Director Mr. Luis Saballos (tel. 213-821-4234; lsaballo@usc.edu)

MS ASTE Frequently Asked Questions are at <http://astronauticsnow.com/msaste/faq.html>.

Instructors of *Astronautics* courses in Spring 2023 (alphabetically)



Prof. David Barnhart (ASTE and ISI; University of Southern California)
ASTE 566
Ground Communications for Satellite Operations



Dr. Michael Kezirian (IAASS) -- lead
ASTE 599
Safety of Space Operations



Dr. Lubos Brieda (PIC-C)
ASTE 546
Computational Plasma Dynamics



Prof. Ryan Park (JPL)
ASTE 581
Orbital Mechanics II



Prof. Don Edberg (Cal Poly Pomona)
ASTE 574
Space Launch Vehicle Design



Dr. G. P. Purohit (The Aerospace Corp.)
ASTE 570
Liquid Rocket Propulsion



Prof. Keith Goodfellow (LM Aerojet Rocketdyne)
ASTE 572
Advanced Spacecraft Propulsion



Prof. Garrett Reisman (Univ. of Southern California)
ASTE 562
Spacecraft Life Support Systems



Prof. Mike Gruntman (Univ. of Southern California)
ASTE 575
Rocket and Spacecraft Propulsion



Prof. Joseph Wang (Univ. of Southern California)
ASTE 535
Space Environments and Spacecraft Interactions



Prof. Gerald Hintz (The Aerospace Corp.)
ASTE 580
Orbital Mechanics
ASTE 683
Adv Spacecraft Navigation



Prof. James Wertz (Microcosm)
ASTE 523
Design of Low Cost Space Missions

University of Southern California

Department of Astronautical Engineering (ASTE)

Astronautics Classes offered in the spring semester, 2023

Core Requirements

ASTE 535 (3)	–	Space Environment and SC Interactions	DEN-webcast
Instructor:		Prof. Joseph Wang (USC)	
ASTE 575 (3)	–	Rocket and Spacecraft Propulsion; Instructor	DEN-webcast
Instructor:		Prof. Mike Gruntman (USC)	
ASTE 580 (3)	–	Orbital Mechanics I	DEN-webcast
Instructor:		Prof. Gerald Hintz (Aerospace Corp.)	

Core Elective and Elective Requirements

ASTE 523 (3)	–	Design of Low Cost Space Missions	DEN-webcast
Instructor:		Prof. James Wertz (Microcosm)	
ASTE 529 (3)	–	Safety of Space Systems & Space Missions	DEN-webcast only
Instructor:		Prof. Michael Kezirian (IAASS)	
ASTE 546 (3)	–	Computational Plasma Dynamics	DEN-webcast
Instructor:		Dr. Lubos Brieda (PIC-C)	
ASTE 562 (3)	–	Spacecraft Life Support Systems	DEN-webcast
Instructor:		Prof. Garrett Reisman (USC)	
ASTE 566 (3)	–	Ground Communications for Satellite Operations	on campus and DEN
Instructor:		Prof. David Barnhart (USC)	limited enrollment (6 on-campus and 6 DEN students)
ASTE 570 (3)	–	Liquid Rocket Propulsion	DEN-webcast
Instructor:		Dr. G. P. Purohit (Aerospace Corp.)	
ASTE 572 (3)	–	Advanced Spacecraft Propulsion	DEN-webcast only
Instructor:		Prof. Keith Goodfellow (LM Aerojet Rocketdyne)	
ASTE 574 (3)	–	Space Launch Vehicle Design	DEN-webcast
Instructor:		Prof. Don Edberg (Cal Poly Pomona)	
ASTE 581 (3)	–	Orbital Mechanics II	DEN-webcast
Instructor:		Prof. Ryan Park (JPL)	
ASTE 584 (3)	–	Spacecraft Power Systems	DEN-webcast
Instructor:		to be announced	
ASTE 683 (3)	–	Advanced Spacecraft Navigation	DEN-webcast only
Instructor (lead):		Prof. Gerald Hintz (The Aerospace Corp.)	

For more information on the *Master of Science* degree program in *Astronautical Engineering* (MS ASTE) please check <http://gapp.usc.edu/graduate-programs/masters/astronautical-engineering> and contact ASTE Student Services Assistant Director Mr. Luis Saballos (tel. 213–821–4234; lsaballo@usc.edu).

MS ASTE Frequently Asked Questions are at <http://astronauticsnow.com/msaste/faq.html>.

Preliminary Astronautics Class Schedule (as of Mar 2022)

(subject to change – always check with *ASTE Student Adviser*)

Required Courses				2022	2023	2023	2024	2024	2025	2026	2026
				Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
ASTE 520	Spacecraft Design	1	D R	▼		▼		▼		▼	
ASTE 535	Space Environment and Spacecraft Interactions	2	D R	▼	▼	▼	▼	▼	▼	▼	▼
ASTE 580	Orbital Mechanics I	2	D R	▼	▼	▼	▼	▼	▼	▼	▼
	Orbital Mechanics I		D R	also offered in summers -- see next page							
ASTE 470*	Spacecraft Propulsion	1	D R	▼			see next page				
ASTE 575*	Rocket and SC Propulsion	1	D R		▼		▼		▼		▼
Elective Courses											
ASTE 501ab	Physical Gas Dynamics I, II	1r	N C			a-?		a-?		a-?	
ASTE 505ab	Plasma Dynamics I, II	1#	N C	a		a		a		a	
ASTE 523	Design Low Cost Sp Missions	#	D C		▼				▼		
ASTE 524	Human Spaceflight	1	D C	▼		▼		▼		▼	
ASTE 527	Space Studio Architecting	1	D C	▼		▼		▼		▼	
ASTE 528	Reliability of Space Systems	#	D C			▼				▼	
ASTE 529	Safety Space Sys. & Missions	#	D C		▼				▼		
ASTE 546	Comp. Plasma Dynamics	#	N E		▼				▼		
ASTE 552	Spacecraft Thermal Control	#	D C			▼				▼	
ASTE 553	Sys Remote Sensing Space	#	D C	▼				▼			
ASTE 554	Spacecraft Sensors	#	D C			▼				▼	
ASTE 555	Space Cryogenic Sys & Applic	#	D C	see next page							
ASTE 556	SC Structural Dynamics	#	D C	▼				▼			
ASTE 557	SC Structural Materials	#	D C			▼					
ASTE 561	Human Factors Spacecraft Ops	1	D C	▼		▼		▼		▼	
ASTE 562	Spacecraft Life Support Sys	1	D C		▼		▼		▼		▼
ASTE 566	Ground Comm Satellite Ops	1	N C	▼	▼	▼	▼	▼	▼	▼	▼
ASTE 570	Liquid Rocket Propulsion	1	D C		▼		▼		▼		▼
ASTE 571	Solid Rocket Propulsion	#	D C	▼				▼			
ASTE 572	Advanced SC Propulsion	1	D C		▼		▼		▼		▼
ASTE 574	Space Launch Vehicle Design	1	D C		▼		▼		▼		▼
ASTE 577	Entry & Landing Planet. Sys.	1	D C	▼		▼		▼		▼	
ASTE 581	Orbital Mechanics II	1	D C		▼		▼		▼		▼
ASTE 583	Space Navigation	#	D C			▼				▼	
ASTE 584	SC Power Systems	1	D C		▼		▼		▼		▼
ASTE 585	SC Attitude Control	1	D C	offered in summers -- see next page							
ASTE 586	SC Attitude Dynamics	#	D C				▼				▼
ASTE 589	Solar System Navigation	#	D C	▼				▼			
ASTE 599	Safety of Space Operations	#	D E				▼				▼
ASTE 599	to be announced		E								
ASTE 683	Adv. Spacecraft Navigation	1r	D E		▼				▼		

*ASTE 575 and ASTE 575 --- see the next page

Required course in spacecraft propulsion

The required ASTE-470 is not available for graduate credit anymore.

It has been replaced by ASTE-575 which is required for MS ASTE and is identical to ASTE-470. (ASTE-575 duplicates the credit for ASTE-470).

Graduate students pursuing MS ASTE are required from now on to take ASTE-575.

In Fall 2022, ASTE-470 will be open to undergraduate students only. For Master's students, special permission is needed to take ASTE-470 in Fall 2022 when it is offered for the last time.

Courses in summer

Required Courses				2022 summer	2023 summer	2024 summer	2025 summer
ASTE 580	Orbital Mechanics I	2	D R	▼	▼	▼	▼
Elective Courses							
ASTE 585	Spacecraft Attitude Control	1	D C	▼	▼	▼	▼

Courses listed but not offered (due to availability of instructors)

Elective Courses												
ASTE 501b	Physical Gas Dynamics II	Ir	N C									
ASTE 555	Space Cryogenic Sys & Applic	#	D C									
ASTE 584	SC Power Systems	1	D C	We plan to offer ASTE-584 annually from spring 2023								

Table notation

SC = spacecraft

2 = course offered in both fall and spring each year

1 = course offered each year

= course offered every second year

Ir = course offered irregularly

▼ = planned (subject to School approval)

R = required MS ASTE

C = core elective MS ASTE

E = technical elective

D = webcast through DEN

N = on campus; not available through DEN

? = uncertain, check with ASTE Student Adviser

The course schedule is subject to change. Please check with ASTE Student Advisor.

Master of Science in Astronautical Engineering

This degree is in the highly dynamic and technologically advanced area of astronautics and space technology. The program is designed for those with B.S. degrees in science and engineering who work or wish to work in the space sector of the defense/aerospace industry, government research and development centers and laboratories and academia. The program is available through the USC Distance Education Network (DEN).

The general portion of the Graduate Record Examinations (GRE) and two letters of recommendation are required.

Required courses: 27 units

CORE REQUIREMENT (12 units)		Units
ASET 575	Spacecraft Propulsion	3
ASTE 520	Spacecraft System Design	3
ASTE 535	Space Environment and Spacecraft Interactions	3
ASTE 580	Orbital Mechanics I	3
CORE ELECTIVE REQUIREMENT (9 units - choose three courses)		Units
ASTE 501ab	Physical Gas Dynamics	3-3
ASTE 505ab	Plasma Dynamics	3-3
ASTE 523	Design of Low Cost Space Missions	3
ASTE 524	Human Spaceflight	3
ASTE 527	Space Exploration Architectures Studio	3
ASTE 528	Reliability of Space Systems	3
ASTE 529	Safety of Space Systems and Space Missions	3
ASTE 552	Spacecraft Thermal Control	3
ASTE 553	Systems for Remote Sensing from Space	3
ASTE 554	Spacecraft Sensors	3
ASTE 555	Space Cryogenic Systems and Applications	3
ASTE 556	Spacecraft Structural Dynamics	3
ASTE 557	Spacecraft Structural Strength and Materials	3
ASTE 561	Human Factors of Spacecraft Operations	3
ASTE 562	Spacecraft Life Support Systems	3
ASTE 566	Ground Communications for Satellite Operations	3
ASTE 570	Liquid Rocket Propulsion	3
ASTE 571	Solid Rocket Propulsion	3
ASTE 572	Advanced Spacecraft Propulsion	3
ASTE 574	Space Launch Vehicle Design	3
ASTE 577	Entry and Landing Systems for Planetary Surface Exploration	3
ASTE 581	Orbital Mechanics II	3
ASTE 583	Space Navigation: Principles and Practice	3

ASTE 584	Spacecraft Power Systems	3
ASTE 585	Spacecraft Attitude Control	3
ASTE 586	Spacecraft Attitude Dynamics	3
ASTE 589	Solar System Navigation	3

TECHNICAL ELECTIVE REQUIREMENT (6 Units)

Two 3-unit courses. Students are advised to select these two elective courses from the list of core electives or from other courses in astronautical engineering or from other science and engineering graduate courses, as approved by the faculty adviser. No more than 3 units of directed research (ASTE 590) can be applied to the 27-unit requirement. New courses on emerging space technologies are often offered; consult the current semester's course offerings, particularly for ASTE 599 Special Topics.

At least 21 units must be at the 500 or 600 level.

Areas of concentration:

Students choose core elective and technical elective courses that best meet their educational objectives. Students can also concentrate their studies in the desired areas by selecting corresponding core elective courses. Presently, ASTE faculty suggests the following areas of concentration:

Spacecraft propulsion Choose two core electives from

ASTE 501ab	Physical Gas Dynamics	3-3
ASTE 505a	Plasma Dynamics	3
ASTE 570	Liquid Rocket Propulsion	3
ASTE 571	Solid Rocket Propulsion	3
ASTE 572	Advanced Spacecraft Propulsion	3
ASTE 574	Space Launch Vehicle Design	3
ASTE 584	Spacecraft Power Systems	3

Spacecraft dynamics Choose two core electives from

ASTE 556	Spacecraft Structural Dynamics	3
ASTE 557	Spacecraft Structural Strength and Materials	3
ASTE 581	Orbital Mechanics II	3
ASTE 583	Space Navigation: Principles and Practice	3
ASTE 585	Spacecraft Attitude Control	3
ASTE 586	Spacecraft Attitude Dynamics	3
ASTE 589	Solar System Navigation	3

Space system design Choose two core electives from

ASTE 523	Design of Low Cost Space Missions	3
ASTE 524	Human Spaceflight	3
ASTE 527	Space Exploration Architectures Studio	3
ASTE 528	Reliability of Space Systems	3
ASTE 529	Safety of Space Systems and Space Missions	3

ASTE 557	Spacecraft Structural Strength and Materials	3
ASTE 562	Spacecraft Life Support Systems	3
ASTE 574	Space Launch Vehicle Design	3
ASTE 577	Entry and Landing Systems for Planetary Surface Exploration	3

Spacecraft systems and operations

Choose two core electives from

ASTE 524	Human Spaceflight	3
ASTE 529	Safety of Space Systems and Space Missions	3
ASTE 552	Spacecraft Thermal Control	3
ASTE 553	Systems for Remote Sensing from Space	3
ASTE 554	Spacecraft Sensors	3
ASTE 555	Space Cryogenic Systems and Applications	3
ASTE 561	Human Factors of Spacecraft Operations	3
ASTE 562	Spacecraft Life Support Systems	3
ASTE 566	Ground Communications for Satellite Operations	3
ASTE 584	Spacecraft Power Systems	3

Space applications

Choose two core electives from

ASTE 524	Human Spaceflight	3
ASTE 527	Space Exploration Architectures Studio	3
ASTE 553	Systems for Remote Sensing from Space	3
ASTE 554	Spacecraft Sensors	3
ASTE 555	Space Cryogenic Systems and Applications	3

Safety of Space Systems

Choose two core electives from

ASTE 528	Reliability of Space Systems	3
ASTE 529	Safety of Space Systems and Space Missions	3
ASTE 561	Human Factors of Spacecraft Operations	3

Human Space Flight

Choose two core electives from

ASTE 524	Human Spaceflight	3
ASTE 529	Safety of Space Systems and Space Missions	3
ASTE 561	Human Factors of Spacecraft Operations	3
ASTE 562	Spacecraft Life Support Systems	3

Note to students:

Please note that tracks, or areas of specialization (concentration), within the program do not appear in transcripts or have separate post-codes. Faculty uses tracks in advising students on different routes to the degrees meeting their educational objectives. The tracks are usually listed in the catalog to help describe the program to prospective students.

Admission Requirements for Graduate Degrees in *Astronautical Engineering* – Code **ASTE**

The **Department of Astronautical Engineering (ASTE)** of the **USC Viterbi School of Engineering** offers degrees in **astronautical engineering**, code **ASTE**. The admission to the Master of Science degree program (MS ASTE) is based on the totality of the applicant's record which includes GPA, GRE, and two letters of recommendation.

Required items:

	<u>Send To</u>
Application	Office of Grad. and Int'l Admission
Official Transcript(s)	Office of Grad. and Int'l Admission
General Record Exam	Office of Grad. and Int'l Admission
TOEFL (international students only)	Office of Grad. and Int'l Admission
Financial Statement	Office of Grad. and Int'l Admission
Recommendation Letters	Office of Grad. and Int'l Admission

Application

All applications should be submitted online at <http://www.usc.edu/admission/graduate/apply/>

Official Transcript(s)

The University requires official transcripts from the accredited colleges or universities the applicant has attended. The MS Degree Program in Astronautical Engineering (Code ASTE) requires a minimum GPA of 3.2.

USC now accepts official electronic transcripts, provided they meet the following guidelines:

1. The transcript originates from a secure site formally linked to the sending institution.
2. The school is located in the United States. We do not accept electronic transcripts from any institution overseas.

General Record Exam

The Department of Astronautical Engineering requires the general GRE. The GRE must be taken within five years of the application date. USC's ETS school code is 4852. Applicants taking the GRE should use this code to ensure the official submission of test scores.

English Language Proficiency for International Applicants

In addition to the general admission criteria listed above, international students whose first language is not English are required to take the TOEFL or IELTS examination to be considered a candidate for admission. There is no minimum TOEFL or IELTS score required for admission to the Viterbi School. For possible exemption from additional language requirements, you must achieve an Internet Based TOEFL (iBT) score of 90, with no less than 20 on each section, or an IELTS score of 6.5, with no less than 6 on each band score.

For more details on English Proficiency Criteria for the University of Southern California, please visit <https://www.usc.edu/admission/graduate/international/englishproficiency.html>.

Recommendation Letters

Please provide two professional letters of reference (former instructors, supervisors, professional colleagues, advisers, etc.) to be filed through the online application process.

Mailing addresses, if needed

Office of Graduate and International Admission
University of Southern California
3601 S. Flower St, Room 112
Los Angeles, CA 90089-0915

Department of Astronautical Engineering
ASTE Graduate Program, 3650 McClintock Ave, OHE-500
University of Southern California
Los Angeles, CA 90089-1451

Department Application deadline

15 January for fall; 1 October for spring; 1 February for summer.

Please note that verification and processing of materials by the Office of Graduate and International Admission may take four to six weeks.

Limited Status Enrollment

Limited enrollment is to provide strong candidates for admission the opportunity to get started, without having to wait for the next admissions cycle. Strong candidacy is indicated by a B.S. in engineering or science from a regionally accredited institution with a GPA of 3.20 or above. Students who do not meet these standards must apply for admission where their GPA, transcripts, GRE scores, and letters of recommendation will be evaluated by admissions officers and faculty.

Limited-status students can take up to three (3) courses. These courses will be credited, after formal admission to the program, toward the Master's degree in Astronautical Engineering (MS ASTE).

Students who are interested in pursuing a graduate degree should not delay their application. We have many limited-status students in the program.

Admission

Admission decisions are based on the totality of the applicants' records, including academic performance, test scores, letters of recommendation, and other supporting materials. Applicants will be notified once an admission decision has been reached. Admitted applicants will receive further information about advisement, housing, orientations, and campus tour.

Conditional Admission

Applicants who do not meet admission qualifications may be granted conditional admission. Conditionally admitted students will be notified in writing of their admission status and of the conditions which must be satisfied to gain regular student status. Students must satisfy the admission conditions typically during the first semester of study.

Other Questions:

Please contact ASTE Senior Administrator Ms. Dell Cuason (OHE-500U; tel. 213-821-5817; cuason@usc.edu) and ASTE Student Services Assistant Director Mr. Luis Saballos (OHE-500Q; tel. 213-821-4234; lsaballo@usc.edu) and visit <http://astronautics.usc.edu>.

Student Transfer to Degrees in Astronautical Engineering – Code ASTE

Transfer Process – Viterbi Engineering Students

Please refer to the VSOE change of major form and contact ASTE Student Services Assistant Director Mr. Luis Saballos (OHE-500Q; tel. 213–821–4234; lsaballo@usc.edu) for further details of the process.

Transfer Process – Non-Engineering Students

Transfer to a program in Astronautical Engineering, Code ASTE, requires a non-engineering student to file the USC application for graduate admission to the program in Astronautical Engineering. Processing of the application does not require re-submission of supporting documents (e.g., transcripts) that have been previously submitted to USC. Check with ASTE Student Services Assistant Director Mr. Luis Saballos (OHE-500Q; tel. 213–821–4234; lsaballo@usc.edu).

Restrictions

Transfer to a program in Astronautical Engineering, Code ASTE, cannot be requested during the first semester of student studies at USC.

Questions?

Please contact ASTE Senior Administrator Ms. Dell Cuason (OHE-500U; tel. 213–821–5817; cuason@usc.edu).

GPA, Leave of Absence, and Graduation

Grade Point Average

Students must maintain an overall 3.0 GPA on 400-level and above work attempted at USC beyond the bachelor's degree to graduate. A minimum grade of C (2.0) is required in a course to receive graduate credit. Transfer units count as credit (CR) and are not calculated in the GPA.

Leave of Absence

There are times students suspend their studies for a semester due to heavy workload or personal matters. Students must file for leave of absence within the department, and withdraw from classes before the last day to drop classes without a mark of W (see in the Schedule of Classes). Students who miss the deadline for LOA may still withdraw from classes with a mark of W but must apply for readmission to the program.

Graduation

At the beginning of the last semester, students should file an Application for a Master's Degree and contact the Student Affairs staff. This will initiate the degree check process, verifying that all academic and administrative requirements are met.

Questions?

Please contact ASTE Senior Administrator Ms. Dell Cuason (OHE-500U; tel. 213-821-5817; cuason@usc.edu) and visit <http://astronautics.usc.edu>.