THE CONQUEST OF SPACE

Space Exploration and Rocket Science

LENGTH:	7 weeks
EFFORT:	3 - 4 hours per week
SUBJECT:	Engineering
LEVEL:	Introductory
LANGUAGE:	English
VIDEO TRANSCRIPTS:	English

SYLLABUS

Universidad Carlos III de Madrid

INTRODUCTION

The Conquest of Space has been a major event in the history of humankind. The wake of awe and admiration it produced reaches our time. The cultural, political and sociological repercussion was extraordinary. The amount of bibliography and information resources related to space and the history of space exploration is humongous. This course is conceived as a first step for those interested in learning more about the history of the space conquest, and the impact of space exploration and exploitation on our daily lives. In addition, the history of space exploration is presented from an European perspective

The main goal of the course ***The Conquest of Space: Space Exploration and Rocket Science*** is to provide students with technical and critical tools to continue their own research on the topic and navigate through the information that is available for the general public. This course emphasizes technical concepts since it has originated in a school of engineering. It is also intended to foster the sharing of information among students, creating a community of people with common interests even if they have different backgrounds.

Each week we will discover a major chapter in the history of the conquest of space. Each of these chapters will be accompanied with an introduction to the relevant technical topics that allow us to understand these historical developments. Therefore, during the seven weeks of the course, we will follow the technical, political and cultural contexts that lead to the birth of the space age, we will present the evolution of space exploration from a competition to a cooperation viewpoint in the Apollo and post-Apollo era and, finally, we will analyze some of the current trends in space. For this last aspect we count on experts from the European Space Agency and other space companies and research institutions.

If this is your first course on edX, do not hesitate to enroll in the Demo course to get to know the courseware: https://www.edx.org/course/demox-edx-demox-1.

OBJECTIVES

The learners should learn from this course:

- The main milestones in the history of astronautics.
- The interactions between astronautics, culture, politics and science.
- Fundamentals of aerospace engineering, including how to move in space and how rockets work.
- The key aspects of space systems and the space environment.
- The current trends and future projects in space exploration.

According to the Measurable Outcomes Index, after following this course the students should achieve the following objectives:

- Objective 1.0: Explain the necessary cultural and scientific steps to reach a feasible concept of space travel.
- Objective 1.1: Demonstrate the fundamental laws of motion in space.
- Objective 2.0: Consider the technological development of rocket technology during the 1930s and the WWII.
- Objective 2.1: Describe the basic principles of rocket propulsion and compute the required mass of a rocket in a given space mission.

- Objective 3.0: Explain the historical, scientific and cultural context that gave rise to the first launch of an artificial satellite.
- Objective 3.1: Describe the space environment in Earth orbit.
- Objective 4.1: Consider the origin, purpose and outcome of the competition to take a human being to the Moon.
- Objective 4.2: Differentiate the subsystems within a spacecraft.
- Objective 5.1: Explain the role of international cooperation in space, in the past and present.
- Objective 5.2: Explain the technical elements that allow living in space.
- Objective 6.1: List the main applications of space that make life on Earth easier.
- Objective 6.2: Describe the principles of operation of a Global Navigation Satellite System.
- Objective 7.1: Take account of the possible options in the future of space exploration.
- Objective 7.2: Describe the principles of operation of electric propulsion.

COURSE STAFF

- EDUARDO AHEDO GALILEA. Professor at Universidad Carlos III de Madrid. Global Assessment and Supervision of the MOOC.
- MANUEL SANJURJO RIVO. Visiting Professor at Universidad Carlos III de Madrid. Historical Content Creation and Supervision.
- MARIO MERINO MARTÍNEZ. Visiting Professor at Universidad Carlos III de Madrid. Technical Content Creation
- MANUEL SOLER ARNEDO. Visiting Professor at Universidad Carlos III de Madrid. Assessment of Historical Contents.
- GONZALO SÁNCHEZ ARNEDO. Visiting Professor at Universidad Carlos III de Madrid. Assessment of Technical Contents.
- FILIPPO CICHOCKI. PhD candidate at Universidad Carlos III de Madrid. Technical Activities Design and Creation.
- DAVID MORANTE GONZÁLEZ. PhD candidate at Universidad Carlos III de Madrid. Historical Activities Design and Creation.
- DANIEL PÉREZ GRANDE. PhD candidate at Universidad Carlos III de Madrid. Additional Material Creation and Communication Management.
- XIN CHEN. Postdoctoral researcher at Universidad Carlos III de Madrid. Course Activities and Communication Management.

COURSE STRUCTURE

WEEK 1: *The first dreamers and visionaries. Frau im Mond (1929)*

Towards space travel. When the story begins. Imagining space travel. Spaceflight literature. Promoting space travel. Pioneers and visionaries. The motion of celestial bodies.

WEEK 2: *The first missiles. The vengeance weapon V-2 (1944)*

Times of Weimar Republic and the Third Reich. Principles of rocket operation. V-2. Rockets and the birth of the Cold War. Chemical rockets.

WEEK 3: *The dawn of the Space Age. Sputnik (1957)*

Treaty of Rome and Sputnik. Intercontinental Ballistic Missiles. International Astronautical Federation. Rockets and Atmospheric exploration. IGY. The Space Environment. Sputnik and the birth of the space era.

WEEK 4: *The Giant Leap. Apollo 11 (1969)*

The Giant Leap. First Man in Orbit. Moon Race. Apollo. Introduction to Space Systems I.

WEEK 5: *Space Cooperation. Birth of ESA (1975)*

Post-Moon-race cooperation. Soyuz-Apollo programme. ESA example of cooperation. The International Space Station (ISS). Introduction to Space Systems II. Life in space. Accessing space.

WEEK 6: *Using space for Humankind. The exploitation of space*

Today's life needs space. Telecommunications. Earth Observation. GNSS. Space Situational Awareness. Space technologies back on the Earth.

WEEK 7: *Looking ahead. Ambition (2015)*

What's next? Human Exploration of the Solar System. Robotic Exploration of the Solar System. Scientific Exploration of the Universe. Space Tourism. Getting farther and beyond: electric propulsion.

COURSE METHODOLOGY

The course follows a historical thread from the conception of spaceflight to nowadays and the possible future development of space exploration. Each week is devoted to a historical period. Within the week, there will be several units with a common structure. The structure of each unit is a short expository video in which the teacher explains the main data and concepts of the topic, and activities that go into detail about them. Additional material, as documents, links to audiovisual material or websites, is also provided to allow the students to further explore the subject.

The estimated time learners need to complete each week is from 3 to 4 hours.

COMMUNICATION WITH LEARNERS

The **COURSE INFO PAGE** will be used to keep the students up to date in all the relevant aspects of the course. In particular, topics will be presented in the Course Info page to be discussed in the **FORUM**. The forum will also be used to encourage engagement and interaction with students. The topics addressed during the week will be discussed in the forum, especially those related to the additional resources that will be available for the students.

Our Twitter hashtag (#conquestspaceedx) will be used to keep the students posted with news related to space, because familiarization with the space sector is one of the objectives of the course.

EMAIL will be used to keep students up-to-date with the course development.

EVALUATION

The evaluation is based on weekly **TESTS** (90%) and a final **PEER ASSESSMENT** (10%) about the contents: videos and documents. To **PASS THE COURSE** and get a certificate (either verified or honor code) it will be necessary to obtain the 60% of the final grade.

It is possible to pass the course just doing the weekly tests, but it will be a much more enriching experience if you also do the formative activities (and therefore non graded) related to the videos.

CALENDAR

The course ***The Conquest of Space: Space Exploration and Rocket Science*** starts on February 9 and is 7 weeks long; the time of the course is always UTC (Coordinated Universal Time). The weekly content will be posted on the courseware, together with the activities and additional material, on Tuesdays. On Friday extra material about science and science-fiction topics will be posted.

Evaluation tests will be available until April 19 (23:59 UTC). Concerning the peer assessment, there will be two weeks for submission and an additional week for reviewing the essay of another five fellows, so the deadlines for submitting and reviewing will be April 12 (23:59 UTC) and April 19 (23:59 UTC), respectively.

The course will finish on April 19 (23:59 UTC). Certificates will be issued after this date.

WEEK	RELEASE DATES	CONTENTS
1	9 February	*The first dreamers and visionaries. Frau im Mond (1929)* Test (graded).
2	16 February	*The first missiles. The vengeance weapon V-2 (1944)* Test (graded).
3	23 February	*The dawn of the Space Age. Sputnik (1957)* Test (graded).
4	1 March	*The Giant Leap. Apollo 11 (1969)* Test (graded).
5	8 March	*Space Cooperation. Birth of ESA (1975)* Test (graded).
6	15 March	*Using space for Humankind. The exploitation of space* Test (graded).
7	22 March	*Looking ahead. Ambition (2016)*

		Test (graded). Peer-assessment (graded). • Submission from March 22 (00:00 UTC) to April 12 (23:59 UTC). • Peer grading from April 13 (00:00 UTC) to April 19 (23:59 UTC).