



# SEAHA

CENTRE FOR DOCTORAL TRAINING IN  
SCIENCE AND ENGINEERING IN  
ARTS HERITAGE AND ARCHAEOLOGY

## Fully Funded SEAHA Studentship:

### **Making the Antikythera Mechanism: Rebuilding Technology that changed History**

The Antikythera Mechanism is an extraordinary ancient Greek astronomical calculating machine of great sophistication. It is a key landmark in the history of science and technology, which has dramatically re-written the timeline of the early development of technology. Over the last hundred years, there has been great progress in understanding the Antikythera Mechanism. Recent research, based on new data gathered in 2005, has now established most of its structure and functions, revealing its design genius. The inscriptions that cover its external plates are broadly deciphered. However, its detailed mechanical construction is still poorly understood and no model has yet been built that incorporates all the latest ideas. All previous physical models have essentially incorporated modern mechanical principles, rather than closely following the original instrument. In addition, information about the technological context in which it was made is largely fragmentary and uncollated.

**Aims and methodology:** The project aims to explore a number of key questions, based closely on recent data, using a process of experimental archaeology as well as in-depth search of the existing literature:

1. How exactly was the Mechanism constructed?
2. What are the consequences for how the device was used and calibrated?
3. What does it tell us about the early language and development of mechanical design?
4. Can an appreciation of the Mechanism enhance knowledge of ancient technology (& vice versa)?

The Antikythera Mechanism is a witness to the first creation in ancient Greece of the basic language of mechanical construction. It is not structured according to modern engineering principles and the consequences for key factors such as friction are largely unknown. The student will explore in fine detail how the Mechanism was built, based on the high-resolution 3D X-ray tomography gathered by the *Antikythera Mechanism Research Project*. This data reveals all the plates, gears, arbors, bearings, spacers, pointers, catches, pins and inscriptions—but it is often very difficult to interpret. The tooth profiles, the design of the arbors, the ‘rocking’ of gears on their axes, friction and lubrication are all key mechanical aspects. To understand these issues, a process of “experimental archaeology” will construct both CAD and physical models of all the components of the Mechanism, which carefully interpret the fascinating mechanical details revealed by the X-ray CT data. This will be carried out in association with the *Institute of Making* at UCL, using all the latest technologies, such as laser cutting and rapid prototyping.

In order to achieve the aims of the project it will be necessary to explore the context and material culture for its fabrication in Hellenistic Greece, and consider some key issues. What was the level of bronze working at the time? How did the Greeks “cope” with the intricacies of the Mechanism? Did they utilize steel tools? Were lathes and/or metal casting used? Is there any evidence for plans or working drawings? What measurement techniques were employed for dimensions and angles? An overarching theme is whether a deeper knowledge of the Mechanism can feed back and inform our knowledge of ancient technology. To help deal with these issues, the project is fortunate in having access to the wealth of knowledge and experience at UCL’s Institute of Archaeology & UCL Classics.

On the academic side, the student will be supervised by Dr Adam Wojcik, Dr Tony Freeth and Dr Lindsay MacDonald from UCL’s Faculty of Engineering as well as by Dr Myrto Georgakopoulou UCL Qatar. Dr Adam Wojcik is a metallurgist and engineer with additional qualifications in archaeology and classical history. Dr Tony Freeth is a former mathematician with fifteen years experience at the centre of research on the Antikythera Mechanism. Dr Lindsay MacDonald is an imaging specialist with a wealth of experience in photogrammetry and image rendering of cultural heritage objects. Dr Myrto Georgakopoulou is an archaeological scientist with a specialism in early metal technology, circulation and production, especially in the context of ancient Greece.





# SEAHA

CENTRE FOR DOCTORAL TRAINING IN  
SCIENCE AND ENGINEERING IN  
ARTS HERITAGE AND ARCHAEOLOGY

On the Heritage side, the student will be supervised by Dag Spicer, Chief Curator of the Computer History Museum in California, USA, with an academic background in the history of science and electrical engineering. On the Corporate side, supervision will be by Dr Lucy Mason, a former materials scientist, now a patent specialist and company director of Matelect Ltd.

**Academic entry criteria and suitability:** We welcome students with any good science, engineering or mathematics undergraduate qualifications. Experience in designing and making mechanisms, devices or instruments, using a range of modern and traditional techniques, as well as an imaginative and creative approach to problem solving is desirable. Informal approaches are welcomed, should candidates have any queries about the project itself or their suitability—please contact Dr Adam Wojcik, [a.wojcik@ucl.ac.uk](mailto:a.wojcik@ucl.ac.uk).

**Further information:** The project is part of the EPSRC Centre for Doctoral Training in Science and Engineering in Arts, Heritage and Archaeology ([www.seaha-cdt.ac.uk](http://www.seaha-cdt.ac.uk)). SEAHA students are involved in activities ranging from residential events and group projects, to conferences and careers events. The SEAHA Studentship will cover home fees plus a stipend of up to £18,172 per year (current rate) for eligible applicants ([www.seaha-cdt.ac.uk/opportunities/eligibility-criteria/](http://www.seaha-cdt.ac.uk/opportunities/eligibility-criteria/)) and a substantial budget for research, travel, and cohort activities. The student will pursue the MRes SEAHA at UCL in year 1 and then be registered at University College London for years 2-4 of the SEAHA scholarship. Specialist training will be provided in the analysis of X-ray Computed Tomography and Reflectance Transformation Imaging as well as in the use of laser cutting and additive printing of components.

#### How to apply:

Your application should include:

- A covering letter clearly stating:
  - Your motivation and how the course will contribute to your career development. If relevant, you may also include images of mechanisms, devices or scientific instruments that you have made—either physical models or in computer software.
  - Your residency status and eligibility for funding according to the information provided at [www.seaha-cdt.ac.uk/opportunities/eligibility-criteria/](http://www.seaha-cdt.ac.uk/opportunities/eligibility-criteria/), or how you intend to sponsor your studies if not eligible for funding.
  - Your academic eligibility, including subjects studied and degree(s).
- Names of two academic referees (or one academic and one professional if applicable)
- Proof of meeting the UCL English language proficiency requirements where necessary. For SEAHA candidates, an advanced level certificate is normally required (details of English language proficiency requirements can be found at [www.ucl.ac.uk/prospective-students/graduate/apply/english-language/index](http://www.ucl.ac.uk/prospective-students/graduate/apply/english-language/index))
- A research proposal (max. 2000 words) written in consideration of the above research questions

The award will be subject to a Grant Agreement between University College London, Computer History Museum (USA) and Matelect Ltd.

**Applications should be sent by email directly to:**

**SEAHA Centre Manager:** [manager@seaha-cdt.ac.uk](mailto:manager@seaha-cdt.ac.uk)

UCL Institute for Sustainable Heritage

**Application deadline: the position is open until filled.**

UCL Taking Action For Equality

