Abstract: Prediction of the motion of the planets in the Solar system has been promoting scientific progress since ancient times. Attempts to explain the nature of their motion eventually led to the discovery of the law of universal gravitation in the late 17th century. It allows to describe the problem as a second-order ordinary differential equation system. More than 300 years later, we know how to explicitly solve this system for the case of two bodies and for some special cases of larger systems, but still require numerical simulation for everything else.

Yet, 47 years ago, our understanding of the system was already sufficient to reliably land two men on the moon. This is fascinating, because while computers at that time could already solve the boundary value problem for ballistic flight of a rocket in a gravitational potential, it was out of the question to solve it again in real time to compensate for slight errors in firings of the rocket, let alone optimize for the necessary correctional engine burns. Instead, a system of clever approximations was devised, together with the mathematical machinery to control the resulting error.

The talk will explore the interplay between mathematical modelling and the engineering reality at the time of the Apollo program. It will give a deeper introduction to the mathematical formulation of the problem and acquaint the audience with some of the key challenges imposed by the technology of that time, followed by a presentation of how they were overcome.