Chapter 2
Aviation History and Unmanned Flight

Heavier-than-air flying machines are impossible.
Lord Kelvin, 1895

It is apparent to me that the possibilities of the aeroplane,
... have been exhausted, and that we must turn elsewhere.
Thomas Edison, 1895

Flight by machines heavier than air is unpractical and
insignificant, if not utterly impossible.
Simon Newcomb, 1902

This ‘pictorial’ Chapter presents a historical perspective on unmanned flight starting from the ancient times and reaching the beginning of the 21st Century. This is not aimed to be an exhaustive account of the history of neither aviation nor UAS. It is rather a glimpse of the stages of UAS evolution, complemented by an overview of the broad range of modern UAS sizes, types and capabilities, as well as, the large number of roles they are called upon to play. This will also put into perspective the daunting task of integrating all these different types of unmanned aircraft into an already crowded airspace. We believe that the best way to achieve this goal is through an account of key events and a series of photos.

This Chapter is divided into four sections corresponding to different time periods and — to a degree — to a different concept of what an unmanned aircraft is. The first Section concerns the first flying machines of antiquity and the Renaissance. The second Section is devoted to the first designs of unmanned aircraft that led to target drones and cruise missiles; followed by a section on the developments of the Cold War era, when the focus on research and development turned to unmanned, airborne reconnaissance. Finally a number of modern day systems, including some future designs are presented in the fourth Section.

2.1 Precursors of Flight and Unmanned Aircraft

In modern times, manned aviation appeared in the late 1700s and it took another century for heavier than air machines to take to the skies. Unmanned aircraft followed soon after the advent of the airplane, appearing around the time of the First World War (1916). However, the idea for a ‘flying machine’ was first conceived close to 2,500 years ago, in ancient Greece and China!

Pythagoras, Archimedes and others studied the use of autonomous mechanisms for a variety of applications. The first known autonomous flying machine has been
credited to Archytas from the city of Tarantas or Tarentum in South Italy, known as Archytas the Tarantine. Archytas has been referred to as Leonardo Da Vinci of the Ancient World and was also the father of number one in number theory [9] and the solution for doubling the cube. He was also possibly the first engineer, designing and building various mechanisms. In 425 B.C. he built a mechanical bird, which he called “the pigeon”, shown in Fig. 2.1. According to Cornelius Gellius in his Noctes Atticae, the bird was made of wood, nicely balanced with weights and flew using air (most likely steam) enclosed in its stomach [1]. It is alleged that Archytas’ pigeon flew about 200 meters before falling to the ground, once all energy was used. The pigeon could not fly again, unless the mechanism was reset [2].

During the same era in a different part of the Ancient World — China — at about 400 B.C., the Chinese were the first to document the idea of a vertical flight aircraft. The earliest version of the Chinese top consisted of feathers at the end of a stick. The stick was spun between the hands to generate enough lift before released into free flight.

Over the years, the Chinese experimented with other types of flying machines such as hot air balloons, rockets or kites. It is noteworthy that although some of these machines were used for entertainment, some of the applications were military