

55th IAA HISTORY OF ASTRONAUTICS SYMPOSIUM (E4)
Scientific and Technical Histories (2)

Author: Mr. Nicolas Bérend
ONERA - The French Aerospace Lab, France, nicolas.berend@onera.fr

THE MISSING CALCULATION BEHIND THE ORIGINAL “KARMAN LINE” DEFINITION – A
CREDIBLE HYPOTHESIS**Abstract**

The “Karman Line”, currently defined by the FAI (Fédération Aéronautique Internationale) as the 100 km altitude line, is one conventional definition - arguably the most famous one - for the limit between spaceflight and atmospheric flight. As shown in recent work [Gangale 2017,2018], the first known definition of the Karman Line (named after Theodore von Karman) can be traced to Andrew G. Haley’s IAC 1957 paper “Space Law - The Development of Jurisdictional Concept”. Haley’s paper includes an indirect and - unfortunately - incomplete account on Karman’s views on how to compute the limit of “atmospheric and extra-atmospheric flight”, using some physical and technological considerations and a velocity-altitude diagram. In Haley’s paper, “Karman jurisdictional line” is set at 275,000 ft (83.8 km), but a clear and complete demonstration is lacking. Later, in 1960, FAI re-defined the Karman Line to 100 km and adopted it for the definition of spaceflight records, based on the work of an “informal group” of scientists, including Karman, Von Braun, Dillaway and others [Sanz Fernández de Córdoba, FAI website]. Unfortunately, no document from Karman himself detailing his calculations for the limit of space (either in the Haley definition or the FAI definition) are known to exist. The lack of an unambiguous definition supported by an actual calculation has led to different interpretations (involving lift, velocity, centrifugal force, etc.) that still co-exist in today’s literature. It also lets unanswered the question of which physical and/or technical considerations has been actually used by Kalman. In the first part of this paper, we detail what is known about Karman’s original definition of the “line between spaceflight and atmospheric flight”, mainly based on the most direct sources, which are the writings of Haley and the cited references. In the second part of this paper, we discuss Kalman’s missing calculation based on the technological and physical considerations which are hinted in these documents, and propose a credible explanation leading to the 83.8 km altitude cited by Haley. We also provide hypotheses on how the 100 km altitude could have evolved to the later 100 km definition. The only focus of this paper is Kalman’s original definition of the limit of spaceflight. The question of what altitude should be set for today’s applications (space law, spaceflight records, etc.) is outside the scope of this paper.