

Physicists, engineers and soldiers at the origins of the “Istituto Centrale Aeronautico Italiano” (Italian Central Aeronautic Institute)

Sandra Linguerri – University of Bologna; Museo storico della fisica e Centro di studi e ricerche “Enrico Fermi” – sandra.linguerri@unibo.it

Abstract: The current communication presents the results of an ongoing research on the origins and first years of activity of the “Istituto centrale aeronautico italiano” (ICA). The history of the ICA intertwines with the history of research on the high atmosphere, aerostats, airships and the first airplanes, and with the establishment of the Italian air force service.

Keywords: Italian Army Corps of Engineers, aircraft, wind tunnels.

1. The origins (1884-1914)

In 1915, with the 11th Royal Decree of January 17, the “Istituto centrale aeronautico” (ICA) (Central Aeronautic Institute) was officially founded. The history of the ICA has its roots in the end of the eighteenth century and is tightly connected to the events of the Specialist Brigade of the 3rd Regiment of the “Arma del Genio dell’Esercito” (Army Corps of Engineers). In 1884, an aerostatic Section inside the “Arma del Genio” was born, later transformed in 1887 in “Compagnia specialisti del Genio” (Specialist Company of the Corps of Engineers), stationed in Rome at the foot of Mount Mario. Simultaneously, a small mechanical workshop named “Officina (Mechanical workshop) compagnia specialisti” was created and annexed to the “Compagnia specialisti del Genio”. In 1894, with the transition from “Compagnia specialisti del Genio” to “Brigata specialisti (Specialist Brigade) del Genio”, the “Officina” also began to expand into the “Laboratorio (Laboratory) Brigata specialisti del Genio” and in 1899, after years of limited aerostatic equipment, namely few imported weather balloons for meteorological investigations in the high atmosphere, the “Laboratorio” promoted the design of a weather balloon through an entirely Italian project. In 1902 the “Brigata Specialisti del Genio”, along with its “Laboratorio”, took up quarters in the Cavour military base in Rome, located at the Lungotevere Milvio (today Michelangelo).

In 1904 the “Società aeronautica italiana” (Italian aeronautic society) was founded by – among others – the notable physicians Pietro Blaserna. His interest in aeronautics and aerological fields was also shared by other professors of the “Istituto di fisica dell’Università di Roma” (Physical Institute of the University of Rome) and their students: Alfonso Sella and Domenico Pacini, who studied atmospheric electricity and the processes of air

ionization; Alfredo Pochettino, who carried out observations on the vertical thermal gradient of the atmosphere and investigated, together with Sella, the conductivity of atmospheric air; and another one of Sella's students, Emilio Oddone, who analysed speed variations and wind directions in the various atmospheric layers in order to draft a wind topographic map of Italy. Luciano Orlando, assistant professor of physics and mathematics, examined several aerodynamic issues, such as the elastic connection of the wings to the airplane fuselage, based on prior research by Gaetano Arturo Crocco, a lieutenant of the "Brigata Specialisti del Genio", and a pioneer of Italian aeronautics who became professor in aeronautic engineering at the University of Rome after World War I.

Crocco had begun his scientific research dealing with telephotographic aerostatic machines; in 1903, he moved on to progressive studies on the stability of airplanes and to investigations on propellers; in 1904 he started designing hydroplanes and airships in a mechanical workshop on the banks of Lake Bracciano near Vigna di Valle, which eventually became an authentic construction site for aeronautic experiments. The studies conducted by Crocco on the stability of airships, encouraged by Blaserna gained sufficient funding to supply, in September 1904, a first rudimentary wind tunnel in the courtyard of the Cavour military base. Despite being basic, the aerodynamic experimental system allowed Crocco to take the first steps towards the discovery of the aerodynamic laws, which were still unknown at the time.¹ According to Crocco himself, the system symbolised the cornerstone of the future ICA.

Crocco's endeavour featured the renowned physicist and mathematician Vito Volterra, one of the most brilliant and influential figures of the research policy of liberal Italy. In 1909 the "Comitato talassografico italiano" (CTI) (Italian talassographic Committee) was created by Volterra and it was assigned the task to study the atmosphere to the benefit of aerial navigation. The CTI collaborated with the "Brigata specialisti del Genio" and participated in the creation of a meteorological department for aeronautical purposes based in Vigna di Valle.

Meanwhile, Crocco's research had borne its fruit. He had patented a hydroplane for the study of an aerial propeller, as well as applying technical novelties to a military airship in order to prevent structural deformations.

With law n. 422 of July 10, 1910, the Government granted a funding of 10 million liras to the War Minister "for the manufacture of airships, airplanes and relative systems", and a second, more powerful wind tunnel was accomplished. Still in 1910, civil engineer Giulio Costanzi was assigned to the "Brigata specialisti del Genio" and he continued and expanded the research on propellers started by Crocco. Said surveys appeared on the journal *Rendiconti (Account) dello Stabilimento di costruzioni aeronautiche*, a periodic publication started in 1911. In response to the aerial activities undertaken during the Italo-Turkish war, the prominence of the "Laboratorio (Laboratory) Brigata specialisti del Genio" grew, and so did its tasks, leading to its transformation into "Stabilimento esperienze e di Costruzioni aeronautiche" (Establishment for aeronautic experiments and designs) in 1912. One of its assignments was to design a series of modern aeronautic systems.

¹ According to the influential view of Th. von Kármán, around 1900 there was a branch of science known as semi-empirical aerodynamics which was loosely linked to the rational theory of fluid mechanics.

The starting point for Crocco's third wind tunnel were the numerous experiments conducted by Costanzi on small scale wind tunnels aimed at determining the most suitable one for aerodynamic research. Crocco's new wind tunnel – established in 1914 – displayed a remarkably innovative layout, a double-return and closed-loop format, the first of its kind worldwide, and one of the best at the time.

After the Italo-Turkish war, Crocco proposed to create a central aeronautic institution (the future Istituto centrale aeronautico, ICA) managed by an advisory committee composed of soldiers and scientists along the lines of the National Physical Laboratory, chaired by the celebrated Lord Raleigh. According to Crocco, such institution could have reported to the equally renowned Volterra. The project was commended, yet the military authority vetoed the notion of an advisory committee, whilst welcoming the idea of the future institution being under the direct dependence of the aeronautic Inspectorate, and of it having civilian personnel. That was how, in 1914, the ICA blossomed from the “Stabilimento esperienze e di Costruzioni aeronautiche”. The goal was to distinguish between construction and design of aeronautic products.

Concurrently, the parliamentary dispute over the formation of an independent aeronautic weapon had progressed. The outbreak of the first World War drew novel attention to the matter, which was temporarily solved thanks to the aforementioned 11th R.D. of January 17, 1915. The decree mandated the establishment of the Military Aeronautic Body, making it a weapon of the permanent Army, and it ratified the official inception of the ICA, which was assigned tasks pertaining to research, trial and innovation. Crocco was appointed director. Several scientists and soldiers joined the ICA: Costanzi, Volterra, the chemists Gino Gallo and Demetrio Helbig, who studied hydrogen for aeronautic purposes; the engineer and future professor of thermal and hydraulic machines at the University of Rome Alberto Anastasi, who devised an innovative engine power supply system to prevent the loss of power at high altitudes; the lieutenant of Genio Luigi Avorio, who tested the durability and waterproofness of fabrics for airship shells; the engineer Eugenio Prassone, an expert in the construction of airships and drakens; the engineer Antonio Eula who analysed multibladed propellers.

2. The post war period (1915-1927)

During World War I, research at the ICA dealt with large-volume airships required to compete with Zeppelin airships; high-altitude engines; course deviation indicators; fuses for anti-aircraft and anti-submarine weapons; remotely controlled bombs devised by Crocco and engineer Alessandro Guidoni, another pioneer of aeronautics; and ballistic charts, calculated by Volterra, for bullets shot by airships armed with mountain guns for high precision shooting. To this end, Crocco patented a device that released the gun pointer from the airship's motion, thus solving the problem of automatized variations of the target line.

As a cutting-edge facility in the field of research applied to military purposes, the ICA worked closely with the “Ufficio invenzioni e ricerche” (UIR) (Office for inventions and

research), founded in 1917 inside the Ministry of War by initiative of Volterra. The newborn institution had the task to encourage all relevant ongoing researches conducted in Italy and amongst international allies in the field of science applied to military needs.

In 1918 the ICA, which had been expanded and improved, became known as the “Istituto sperimentale aeronautico” (ISA) (Experimental aeronautic institution). It included a Technical Division and a “Direzione sperimentale dell’Aviazione militare” (DSAM) (Experimental management of military Aviation), overseen by Costanzi. Immediately after the war Volterra took action to transform the UIR and ISA into a centralized and outside university research facility for the resolution of problems relating to experimental science and technology: the “Consiglio Nazionale delle Ricerche” (CNR) (National Council for Research). In this regard, in February 1919 he and Crocco advanced a series of projects that originally placed the emerging CNR inside the ISA. As is known, said projects went unheeded, and we must wait until 1923 for the CNR to be established. Until now, such delay has been correctly attributed to varied motives; further complications to acknowledge are the events concerning the ISA, which was heavily affected by post-war demobilisation.

From now on, we enter quite a complex phase of the history of the ISA, which got mixed up in the reorganisation of the aeronautic departments. On June 30, 1919, Decree n. 1233 was issued, which dictated the merging of ISA with the “Istituto sperimentale delle ferrovie” (Experimental railway Institution). The logic behind this procedure remained unclear, even to the key players. According to Costanzi, the fact that such organisations shared the term “experimental” had convinced the unintelligent minds that they were replicas of one another, with interchangeable competencies, and could thus be united for the sake of saving. In the end the decree was never actualised. Under the following governments (Nitti, Giolitti and Facta), the legislation became even more chaotic, due to a deluge of regulations and amendments. The outcome was a legislative void with a negative influence on aviation, and an indirect impact on the ISA. Meanwhile, in 1920, Crocco left the direction of the ISA.

A breakthrough in the situation occurred in 1923 with the creation of the Royal Air Force and with the establishment of the “Corpo (Body) del Genio Aeronautico” founded by Guidoni, which exercised all technical, experimental and planning functions relevant to aircrafts. These were the first steps towards the creation of a Ministry of Aeronautics, which was indeed founded in 1925. The newly formed Royal Air Force required a complete experimental center to match new and future demands, though research conducted in the ISA was still impactful. As a matter of fact, the *Rendiconti* (Accounts) present research on coefficients of safety and stability of airplanes; investigations on floats for seaplanes; guidelines for metallic constructions of airplanes; studies on petrol for aeronautic use, on high altitude engines, and on the aerodynamic characteristics of wings.

In June 1927, the “Direzione Superiore Studi ed Esperienze” (DSSE) (Superior Management Studies and Experiences) was established with the goal to indirectly succeed the ISA, though with the same departments and functions, therefore inheriting its aerodynamic systems. Crocco was one of the founders of DSSE. In 1929, an additional wind tunnel became operational; though smaller, it was more powerful than the one designed in 1914. They were both functional in the Laboratory headquarters of the Cavour military base in

Rome until 1935, the year in which the “Centro studi ed esperienze di Guidonia” was created in Montecelio (Roma). Crocco conceived the project and promoted its fulfillment. The Centro was dedicated to Alessandro Guidoni and it hosted novel and more powerful aerodynamic tunnels, thus becoming one of the most internationally important centers for aeronautic research.

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