

1. INTRODUCTION

1.1. AGUSTA Background

The content of this chapter is taken from the AGUSTAWESTLAND [9]. The Agusta success started in 1907 when Giovanni Agusta, its founder, flew his first aeroplane. From 1923 onwards Agusta was active in the design, production and maintenance of fixed wing aircraft. Production of helicopters started in 1952 when Agusta signed an agreement with the American company Bell to build its helicopter under licence. Similar agreement were reached in the '60s with the other major US producers. This experience led to an independent research and development capacity being created which allowed Agusta to flight test the A101G prototype.

Agusta's place amongst the leaders in the vertical flight was secured with the A109 light twin turbine helicopter, a design with innovative features and high performance that was realised at Cascina Costa, Italy see Figure. Agusta reached a milestone in the development of helicopter technology in 1983 with the A129 Mangusta multi-role combat helicopter, which demonstrated Agusta's capacity to satisfy the most complex technical requirements.

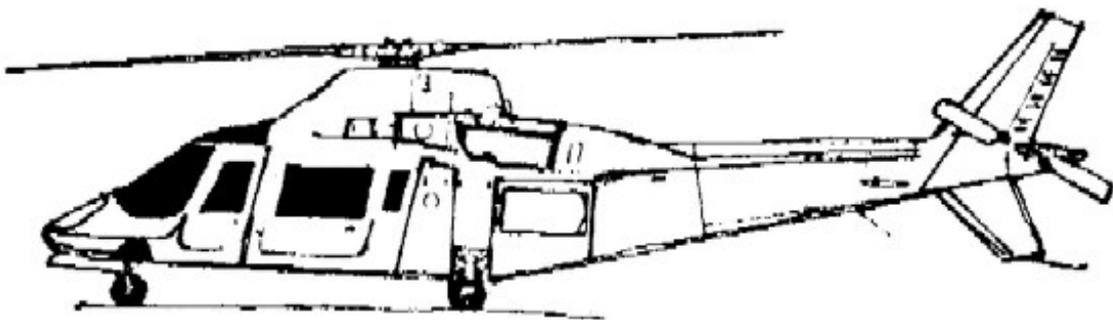


Figure 1-1: Early drawing of the A109.

During the late 1970s the design of the EH101 was initiated in partnership with Westland of the U.K. In 1985 Agusta, in collaboration with the helicopter manufactures of France, Germany and the Netherlands, launched the development of the twin engine 11 ton NH90

helicopter. During the latter years of the 1990s the Agusta product range expanded with the introduction of the A129 International in 1996, by a new version of A109 in the 1999 and with the A119 Koala in 2000. Agusta further increased its worldwide collaboration by signing in 1998 an agreement with Bell Helicopters creating a joint venture called Bell/Agusta Aerospace Company, for the development of the AB139 helicopter and the BA609 Tiltrotor. The day Bell took over the production licence of the AB139 was a historic event. Agusta, after almost fifty years in the role of licensee was now the licensor to its one time mentors, see [10].

Today AGUSTAWESTLAND, the Anglo-Italian helicopter company is owned by Italy's FinMeccanica. The company is one of the world's leading helicopter manufactures with a full range of rotorcraft for every commercial, government and military application and provides an unrivalled capability in training and customer support. The value of production in 2004 stood at 2,542 million Euro.

1.2. The background of the A109 Project

The content of this chapter is taken from the GB progetti [8]. In the early days AGUSTA actually started as a fixed wing manufacturer but soon after change direction into the rotary wing area. The very first helicopters produced were called the 100 series, since this was the 9th project in got its name A109, where *A* of course stands for AGUSTA. Following helicopter produced got similar names but with an increment in the middle number e.g A119 Koala, A129 Mangusta and A139.

It all started in 1969, the design and execution of the A109 which is the first helicopter fully design by AGUSTA to reach production. From December '68 until September '69 at least 10 separate possible configurations were worked out. Later on (in fact 19 September 1969) three of the prototypes were constructed because of the necessity of carrying out flight tests, see Figure 1. That was only two and a half years after the first feasibility studies. The results of the first flight were encouraging both as regards the reduction of vibration and handling qualities, advantage achieved by adopting an articulated four blade rotor. Also promising were in the area of noise abatement, for which a markedly tapered leading edge of the blade tip section had been designed.

February 1969

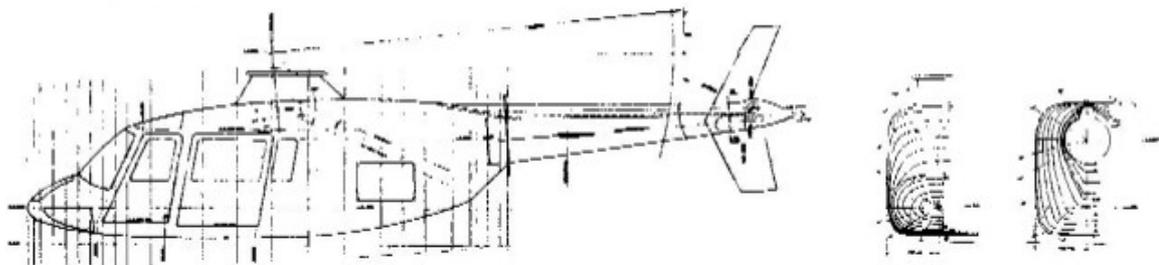


Figure 1-2: Drawing of A109 in February 1969.

The very first flight took place on August 4th, 1971 see Figure 4. The machine which flew then already looked very much like what we see today and the results of the first flight were exhilarating, see Figure 2. However, upon resuming the ground test an accident

ensued which destroyed the helicopter and killed the chief of the Testing Department. By investigation of the possible remedies for the faults at the source of this accident it was discovered that the negative influences on the machine were due to the fuselage's inherent frequencies when resting on the landing gear, which was later on redesigned.

may 1969

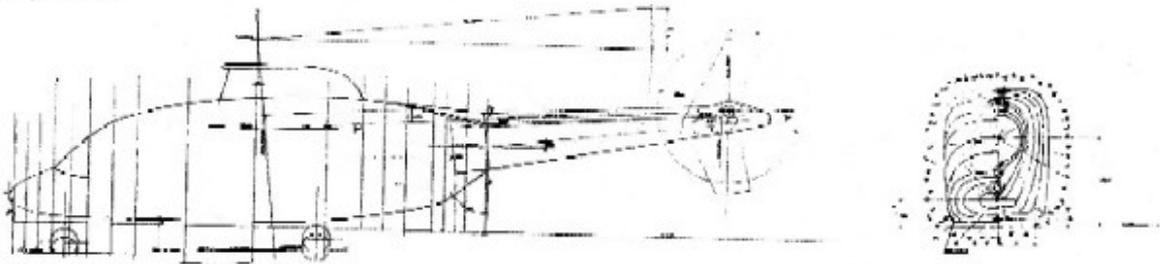


Figure 1-3: Drawing of A109 in May 1969.

After that all testes and flights went off smoothly, see Figure 3. Then all the needed certification test followed, and in May 1975 the machine was officially certificated by RAI and the Federal Aviation Agency (FAA). When designing the A109, the decisive points beside operative and structural criteria turned out to be basic aerodynamic considerations such as how to reduce the frontal area, avoid sharp edges and abrupt cross sectional changes (streamlining to the rotor hub and retractable landing gear). Other considerations of an aerodynamic nature concern the choice of profile: for the first time, hybrid profiles are used instead of the classic NACA profiles commonly used for fixed-wing aircraft. Moreover the blades are tapered despite their greater costs and complications.

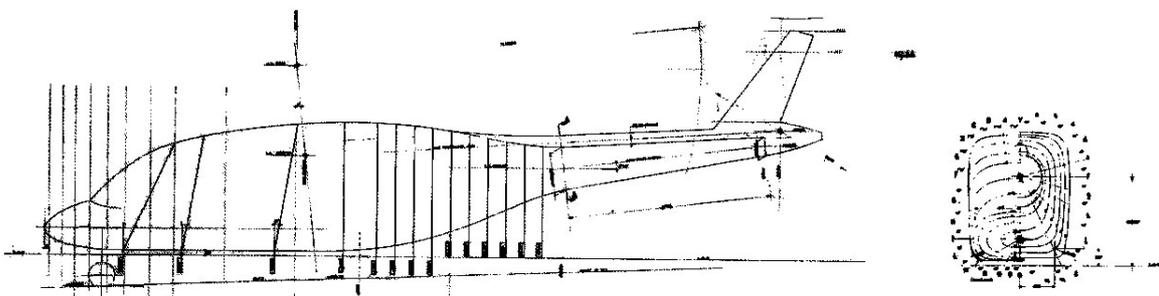


Figure 1-4: Drawing of A109 in October 1969.

Finally, aerodynamic refinement is achieved through a repetitive process supported by a program of wind-tunnel tests, so as to attain not only low drag features, but also the most regular aerodynamic airflow possible on critical helicopter parts, such as the noise around the rotor hub and on the aft section connecting the tail boom to the passenger cabin. In fact, a full 11 months were devoted to a detailed experimental aerodynamic analysis which would permit the refinement and optimisation of the aerodynamic features. The results of the analyses were later confirmed in the course of flight testing of the helicopter, in fact often with better results than those accomplished in the wind tunnel. As a consequence of this intensive experimental campaign, the AGUSTA engineers succeed in achieving a substantial reduction of drag during forward flight (up to 20% compared with the first configurations studied).



Figure 1-5: First flight of A109 in 1971.

After the certification of the basic A109 helicopter model, AGUSTA continued its development, improving its general performance and designing a series of versions destined for specific purposes: ambulance, law enforcement, alpine rescue, and coastal surveillance missions. So the A109 family is rather big consisting of various civilian, paramilitary and military configurations. For example some of the models are called: A109 C Executive/ Corporate Transport and Law Enforcement, A109 C Coastal Patrol Helicopter, A 109 K2 Light Multipurpose Helicopter, A109 KM Light Multirole Helicopter, A109 Power, A109 LUH Light Utility Helicopter and A109 S Grand.