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Naissance et affirmation du groupe Airbus (années 1960-années 1980)

The Airbus Project Consolidates the Choice of Toulouse as the French Capital of Civil Aeronautics (1917-1970s)

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Jean-Marc Olivier

OUTLINE

TEXT

1 Today, it can be said that Toulouse is the world capital of civil aeronautics because the main workshops and operational headquarters of the European group Airbus are located there. This is different to Boeing as its production is centred in the Seattle area far from the company's headquarters in Chicago. Airbus's achievement is part of a rich history that links aviation and the city, a relationship that has just celebrated its 100th anniversary. [1]

2 Throughout this long journey Airbus has symbolised the decisive choice of Toulouse as the capital of French civil aeronautics. This said, before the company decided to settle in the city, Toulouse had already begun to develop civil and military aeronautical activities. Although the focus of this article is on civil aeronautics, it is impossible not to mention military aircraft. Indeed, the first heavier-than-air aircraft produced in the "Pink City" was a heavily armed reconnaissance aircraft, the Salmson 2A2. [2] A mention should also be given to the mythical Dewoitine D.520, an aircraft considered the best French fighter of the Second World War. [3] This analysis does not include Clément Ader even though he is part of the mythology of aeronautics. Indeed, he was not the founder of Toulouse's vocation for aircraft even if he was a native of the region. He did test kites in the Lauragais area, but his first attempts to fly heavier-than-air aircraft were carried out in the Paris region. There is, therefore, no link between Clement Ader and the development of aeronautics in Toulouse. In

fact, it all began in 1917 with Pierre-Georges Latécoère in Montaudran to the south-east of the "Pink City". This phase was not as triumphant as many laudatory works assert and the following period, which takes us up to the 1960s, also included many hesitations. In fact, it was not until the 1970s that the Toulouse hub definitively asserted itself with Airbus' first commercial successes. These three successive periods are articulated around questions that can be formulated as follows: what has been the respective roles of the State and local dynamics on this path towards making Toulouse an aeronautical hub? [4]

1. A period of doubt (1917–1945)

3 There is a sort of glorification of the origins of aviation in Toulouse as it was from here that Aéropostale's planes took off. However, it is important not to assimilate the development of the Montaudran factories too quickly with Aéropostale. Indeed, the history of the site goes back further with Pierre-Georges Latécoère, the person with whom everything began. [5] At the turn of the 20th century, the Pyrenean mountain range was home to a multitude of small businesses. Pierre-Georges Latécoère's father founded a sawmill in Bagnères-de-Bigorre in 1864, and the prosperity generated by his company enabled him to move from the construction of wooden frames and beams to the manufacture of train carriages. His son, Pierre-Georges Latécoère, who was studying at the Louis le Grand school and then at Centrale, decided to move part of the company to Toulouse because the presence of the national rail network made it easier to deliver the wagons. The emergence of this new factory was made possible by the collaboration between Pierre-Georges and his mother who was widowed in 1905.

4 Microhistorical research has revealed that in the 20th century Toulouse was an industrial city with a multitude of small businesses. [6] Women predominated in these businesses, either in workshops or at home but Pierre-Georges Latécoère developed a first workshop in Toulouse in which he employed men. Aware that there was a whole pool of qualified female labour in the fields of shirts, shoes and hat making, when war broke out, he began to produce large-calibre shells. As the men had been called up, he found himself obliged to employ women in his company. Like any good graduate of the École

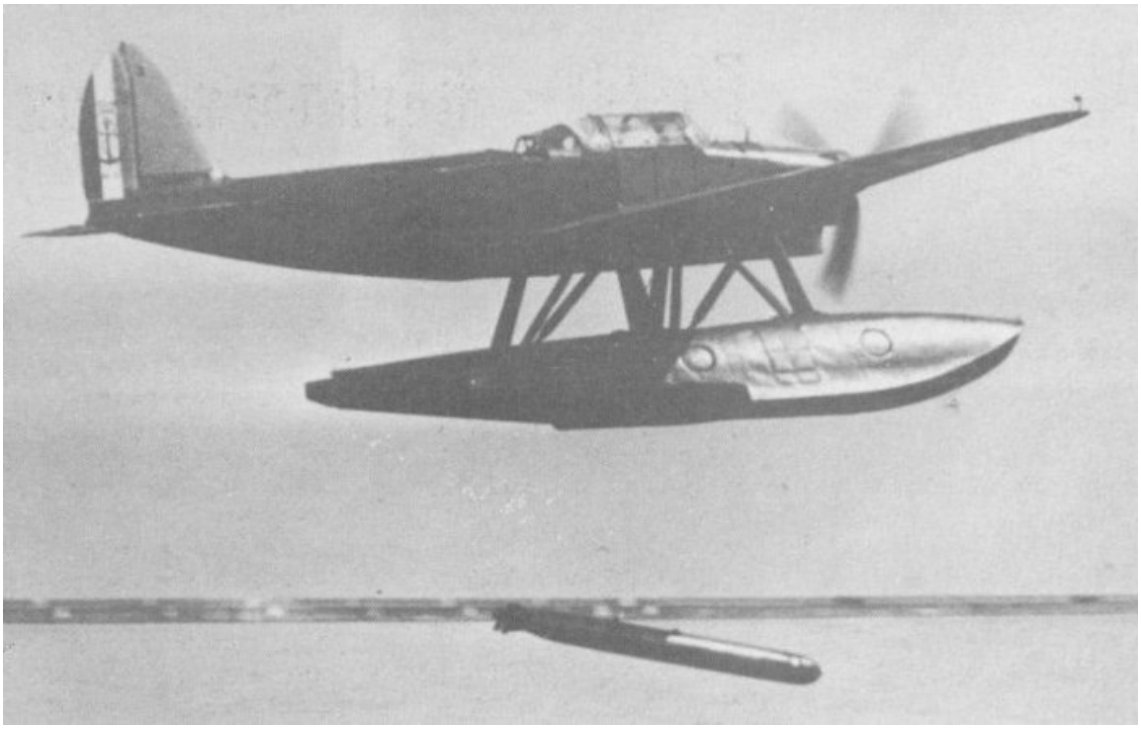
Centrale, he wanted to build an ideal factory, and the Minister of War, Louis Loucheur, agreed to finance him on condition that he produced Salmson 2A2 reconnaissance aircraft and not wagons as initially planned. The orders for these aircraft having already been placed, the Parisian aeronautical company Salmson was suffering from the effects of insufficient production capacity. Consequently, when Pierre-Georges Latécoère received the plans for the 2A2, he had to produce massively and as quickly as possible these observation aircraft which played an increasingly decisive role in the conflict. [7]

5 Pierre-Georges Latécoère accepted the offer and hired hundreds of women workers, the most famous of whom were the textile workers. The importance of their task of manufacturing aircraft wings made these textile women workers part of the mythology of those who participated in the war effort between 1914 and 1918. At the end of the conflict, the lack of orders and a market saturated by already-made aircraft sold for a symbolic franc put a strain on Pierre-Georges Latécoère's company. Given that producing military aircraft was no longer profitable, Pierre-Georges Latécoère thought that it might be interesting to turn to civil air transport and set up his own airline, *Lignes Latécoère*. Firstly, he used the modified Salmson 2A2, but this aircraft proved too fragile, so in the end he opted for the Breguet XIV, an old bomber. The routes were opened progressively with Toulouse as the starting point for air links, and after flights were operated to Barcelona from 25 December 1918, they were then extended to Morocco and Senegal. [8]

6 By 1922, this adventure made Latécoère Airlines the largest airline in the world with a network of 3,000 kilometres, 75 aircraft, 22 pilots and 120 mechanics. These pilots including Antoine de Saint-Exupéry, Jean Mermoz, Henri Guillaumet and others who contributed to the company's popularity, it witnessed, however, a series of problems leading to financial deficit meaning that it required permanent support from the State. Twelve of its pilots and mechanics died between 1919 and 1922 which tarnished the company's image, and it did not carry any passengers apart from employees. The company did, however, provide a strategic link between France and its colonial empire for the transport of mail and some civil servants or soldiers, and this role explains the constant support of the French state.

7 Faced with these difficulties, Pierre-Georges Latécoère decided to return to manufacturing, an activity that he knew well. By 1927, the demand for aircraft was increasing, so he sold his airline to Marcel Bouilloux-Laffont who transformed it into Aéropostale. Pierre-Georges Latécoère, whose aim was to cross the Atlantic, now began building seaplanes. Nonetheless, it was by developing torpedo planes for the army that he made the most money, selling several hundred of them including the Laté 298, 177 of which were produced for the French Navy.

Fig. 1. "Latécoère 298 firing its torpedo"



Cols bleus: hebdomadaire de la Marine française, n° 1388, August 16, 1975, 5.

(public domain)

8 Apart from a few occasional exploits over the coming years, Latécoère's civilian seaplanes suffered several failures and proved disappointing. Social tensions that appeared in 1936-1937 made things worse with the skilled workers in the aviation sector put themselves at the forefront of social struggles by supporting the Popular Front and occupying factories.

9 Refusing nationalisation, Pierre-Georges Latécoère lost most of his employees who did not accept his stance. [9] Concurrently, six national aeronautical companies were set up in France. The one in Toulouse was known by the acronym SNCAM (*Société Nationale des Constructions Aéronautiques du Midi*, or the National Company of Aeronautical Constructions of the Midi). In 1940, SNCAM was incorporated into SNCASE (*Société Nationale des Constructions Aéronautiques du Sud-Est*, or National Company of Aeronautical Constructions of the South-East). From then on, it was these national companies that contributed to the development of civil aviation in France – and more particularly in Toulouse – after the disaster of the Second World War.

2. Failures and partial successes (1945-1976)

10 From the post-war period, the French policy of regional planning led to the development of Toulouse as a metropolis specialising in civil aeronautics. Military construction, on the other hand, was concentrated in the northern part of the country. In Toulouse, the exile of Émile Dewoitine put an end to the development of its fighter production. Unfortunately for the site, the strategic choice to develop giant civilian seaplanes proved to be a mistake. Indeed, the *Laté 631 hexamotor* was a technical and commercial failure. Theoretically, the seaplane had the advantage of being able to land anywhere in the event of a problem but four of the nine *Laté 631s* crashed including one with forty passengers on board. Their being definitively withdrawn from service in 1955, seaplanes turned out not only to be a very poor aircraft, but also a very poor vessel. Effectively, Boeing also experienced setbacks with its seaplanes in the 1930s and eventually abandoned this type of civil transport in favour of the production of conventional airliners. In the case of Latécoère, dramatic accidents put an end to the production of complete aircraft by the company.

11 Other aircraft projects emerged from the nationalised companies such as the archaic four-engine SNCASE *SE.161 Languedoc*. Developed in Paris in the 1930s by Marcel Bloch, his company and then SNCASE had only produced a hundred or so models by the end of the Second World War at its new site in Saint-Martin-du-Touch on the outskirts of Toulouse. Another failure was the SNCASE *SE.2010 Armagnac*. De-

veloped in 1942, only nine aircraft were sold as it could not cross the Atlantic and was also too big for regional transport. Another aircraft built in Saint-Martin-du-Touch, it, too, quickly proved to be a commercial disaster.

12 Among other emblematic projects in the history of the aeronautical industry in Toulouse was the *Caravelle*.[10] Intended for short and medium-haul flights, it was the world's first civilian jet, and built and developed entirely in Toulouse, it became the "Pink City's" first success in the field of civil avionics when it made its inaugural flight in 1955 and when it entered service in 1958. Concurrently, and still at the initiative of the State, the nationalised companies SNCASE and SNCASO merged to create Sud-Aviation on 1 March 1957. 279 models of the *Caravelle* were sold and exported to several countries. Though it was estimated that the sales of the *Caravelle* had to exceed 500 in order for it to be profitable – a figure not reached – the aircraft was still considered a success compared to previous productions. Among the foreign airlines that bought it were Sabena, Alitalia, Scandinavian airlines such as SAS and Finnair, and the North African airlines Tunis Air, Air Algérie and Royal Air Maroc. Most importantly, the first aircraft sold to the United States by France was a *Caravelle* delivered to United Airlines and named "Ville de Toulouse". It made its first flight on the symbolic 14 July 1961. This showcasing confirmed the importance of aeronautics to the national economy. However, the American market remained fairly closed and the "Horizon" adaptation of the *Caravelle* marketed by Douglas in the United States with General Electric engines was quickly abandoned.

Fig. 2. The Caravelle "Horizon" intended for the American market. Its first run on the Blagnac runways on 28 August 1962

(Toulouse Municipal Archives, 53Fi2221, André Cros collection, licence CC BY-SA 4.0 (https://creativecommons.org/licenses/by-sa/4.0/deed.fr))

13 A new level was reached with the highly publicised *Concorde*, an aircraft adulated nationally and even more so in Toulouse as demonstrated through television, a new medium that was being installed in all French homes. Created in 1964, the ORTF constituted a state monopoly on radio and on the "small screen" which broadcasted filtered and even oriented information. Other mediums than the press and audiovisual media contributed to the myth of *Concorde* being assassinated by the Americans and their allies who forbade its landing in New York for more than a year. Among the admiring testimonies, the most surprising ones came from primary schools where drawing competitions were organised for the "beautiful bird". Numerous examples of these "paintings" were preserved by André Turcat, the very media-friendly person in charge of the flight tests. They can be viewed in the departmental archives of the Haute-Garonne where he deposited his very rich personal archives. [11] Criticism of *Concorde* was rare, but among them were complaints relating to the noise caused by afterburning and to pollution. A few rare French ecological pioneers such as Michel Moreau in the Jura [12] are among those who

have raised concerns, but the defenders of the environment are mostly active outside France and the United Kingdom. As for the inhabitants of Toulouse and Blagnac, it was not until the 21st century and the withdrawal of *Concorde* that they more easily recognised the infernal noise (120 decibels) and vibrations triggered by Concorde during its take-offs.

Video 1. "First flight of Concorde, March 2, 1969 in Toulouse"

(INA archives)

14 https://www.youtube.com/watch?v=Uipm-O53GTQ

15 This giant project remains at the heart of debate given that it was both a remarkable technical success and a commercial disaster. A disaster that can be explained by a mixture of American reservations and jealousy according to French commentators, in reality the issue is far more complex. In effect, right from the beginning of the project even leading French figures in the aeronautical sector raised doubts about its financial aspects. Henri Ziegler being among them, he unhesitatingly confided in his son Bernard that it was "not the right plane."[13] The figures would prove him right as the total number of supersonic aircraft produced by the French and British amounted to twenty with six used for testing only.

16 Although the 500-aircraft sold is not a valid threshold for Concorde, a figure that was never going to be reached, the work on the aircraft required the efforts of more than 100,000 people. As for this threshold, some even spoke about a figure of at least a thousand units sold before the supersonic aircraft became profitable. A shortfall of 986 units then, what worsened the situation was its entering service in 1976 just after the oil crises of 1973 and 1979. This making it impossible for the aircraft to be profitable, the state continued to support the project as Concorde embodied the political rivalry with the United States and the Soviet Union in the race for technical progress in aeronautics. The only two companies that acquired the supersonic – Air France and British Airways – could not object to flying it at a loss because they were companies that had been nationalised by the two states: 1945 for the former, 1974 for the latter.

17 More than a hundred (often apologetic) works devoted to the *Concorde* legend provide grist for the historian. These written in more

than twenty languages, it is not anecdotal that no history of the Tupolev TU-144 has been written in French. This is despite it making its inaugural flight and reaching Mach 2 before Concorde. Furthermore the "Concordski" – a name sometimes used by western press – is not a simple copy of Concorde as confirmed by the canard wings found at the front of the aircraft.

Fig. 3. Automotive and Technology Museum in Sinsheim (Germany), the only place where a Tupolev TU-144 and a Concorde are kept side by side

(Apocalyps, 15 October 2004, GNU Free Documentation License (https://en.wikipedia.org/wiki/en:GNU_Free_Documentation_License), Wikimedia Commons)

18 Although America abandoned its own Boeing 2707 supersonic project, it rapidly developed a long-haul subsonic aircraft that satisfied the needs of the market and the airlines to a tee. Named the Boeing 747, it made its first flight in 1969 and entered service the following year some six years before the Franco-British supersonic project. Moreover, the numbers speaking for themselves, the Boeing 747 could carry up to 660 passengers compared to *Concorde*'s 100. Sales-wise the results were clear, and the classic American long-haul aircraft triumphed with more than 1,500 models sold. Amounting to more than a hundred times the sales of *Concorde*, to revive the French civil aviation industry, it was essential to gain the upper hand economically and commercially as state aid was running out of steam. However, a second project to build a brand-new medium-haul, large-capacity aircraft was not met enthusiastically by the British government due

to it having its fingers burnt by the financial disaster engendered by *Concorde*. The UK finally announcing its withdrawal from this programme in April 1969, in spite of similar debts the French government did not want to embark on the adventure alone because the idea of a subsonic "air bus", or "Airbus", was not as popular with the public as the supersonic Concorde. The new industrial adventure was, however, a saviour for the French civil aviation industry and for the site in Toulouse as well as illustrating the transition from technological autonomy to commercial performance. [14]

3. Towards the success of the Airbus programme (1970s)

19 Airbus attempted to find its feet in the shadow of the *Concorde* project led by Sud-Aviation, but their co-existence proved to be problematic, especially in Toulouse. The teams working on *Concorde* often looked down on those working on Airbus, and the signing of a Franco-German agreement at the Paris Air Show in 1969 reawakened old resentments, even if it made it much easier to finance the programme. To soften the blow, the pre-eminence of the Toulouse site was accepted by the German Federal Republic that wanted more than anything to see the revival of an aviation industry that had thrived before 1945, and to develop a vast European industrial programme emblematic of the EEC created in 1957. [15] An equally shared Economic Interest Grouping (EIG) was therefore set up in 1970 between the two states. [16] The first version of the Airbus, the A300B, made its maiden flight in 1972 in Toulouse and it was marketed in 1974. This was two years before the Concorde, which had already made its first flight in 1969.

Video 2. Video presentation of the A300B on display at the Aéroscopia Museum in Toulouse-Blagnac, the only one preserved

20 https://www.youtube.com/watch?v=4rv0Q5fI2piA.

This document presents the exterior and interior of the aircraft, emphasising the width of the fuselage and the possibility of loading containers directly into the hold (visible thanks to a glass floor specially fitted by the museum).

(Guifeme, channel: "Tourisme, Automobiles, Trains, Avions")

21 Although it was a technical success, the A300B did not receive much praise from the media. Indeed, when the aircraft first left the factory, journalists used derogatory terms such as "fat Julie" or "fat cow" to criticise its wide body fuselage designed to satisfy airlines.[17] Airbus's commercial debut was catastrophic, reminiscent of Concorde, and largely due to American lobbying. Very few were sold between 1974 and 1978. However, the project continued as, like Concorde, the Airbus A300B was a "very political" aircraft. The West German governments was willing, moreover, to invest massively in this technological battle. Franz Josef Strauss, the "Bavarian Bull", was very active as the first chairman of the supervisory board of the EIG, and between 1966 and 1969 he reactivated the networks he had built up during his time as West German Finance Minister.[18] A man who was passionate about the aircraft industry, he also promoted the aircraft commercially and was willing to make the concession Toulouse would be the site of the only assembly line. A Franco-German decision based on the experience of the ruinous cost of the Concorde programme and its two assembly lines, the Airbus group had no hesitation in giving enormous praise to this complex, but visionary, character on the 100th anniversary of his birth in 2015.

22 In contrast to a harmonious Franco-German relationship, that with the United Kingdom was becoming more difficult. The British group Hawker Siddeley was proving to be a key player, as it had mastered the construction of the A300B's wings, but it lacked the financial means to do so since the UK government had decided to leave the Airbus programme at the end of 1968.[19] The result was that, in 1969, the German government took over and offered to support Hawker Siddeley in its costs, allowing the company to be officially included in the successive agreements. However, the problem of which engine to use still had to be resolved. Rolls-Royce had high hopes of supplying one to assert its great comeback among engine manufacturers, however, the development costs proved prohibitive and would lead to the company's bankruptcy and nationalisation in 1971.[20] Consequently, Airbus turned to General Electric's American engine, the CF6-50. In addition to its technical advantages and its more affordable price, this American engine offered the prospect of challenging Washington's formidable protectionism in the aeronautical field. The intrinsic qualities of the "air bus" finally recognised, after having been given a free

loan of four aircraft, the US company Eastern Airlines ordered twenty-three models in 1978.[21] This making it possible to launch the A300B on to the world market (see Gaëtan SCIACCO's article in this dossier), the head of Eastern Airlines was exonerated by members of the company's board, by federal officials and by the public when he praised the merits of the A300B. Effectively, this was because he, the astronaut Franck Borman, was a national hero.[22]

Fig. 4. Eastern Airlines Airbus A300B on the runway at Miami International Airport in 1983

(Clipperarctic, Eastern Airlines A300, May 1983, Creative Commons (https://en.wikipedia.org/wiki/en:Creative_Commons) Attribution-Share Alike 2.0 Generic (https://creativecommons.org/licenses/by-sa/2.0/deed.en))

23 In the late 1970s and early 1980s, orders poured in and with sales of 561 aircraft the Airbus A300B became the first European civil aircraft (from a Franco-German alliance) to make money. Theoretically, at least, as although it passed the symbolic mark of 500 planes sold, the real cost of the Airbus programme remains difficult to assess because of the amount of subsidies involved. These subsidies have generated a considerable collection of financial records, not all of which have been made available for study.[23] One thing is certain, this cost re-

mains much lower than that of the *Concorde* programme because the time needed for the development of the Airbus A300B was much shorter and there was only one assembly line. This Franco-German project has, therefore, been a tremendous economic success that allowed the European – and especially the French – civil aeronautics industry to carve out a place on the world market. The strategic heart of this challenge being Toulouse, its role as the capital of French civil aviation was confirmed with the long-haul A310, an aircraft that made its first flight in 1982 and entered service in 1983. Its testing and production took place in Toulouse (a city in which the A320, A340, A330, A380 and A350 were created, tested and assembled) as well as in its suburbs of Blagnac, Colomiers, etc.

24 Only the construction of the very extensive A320 family led to the relocation of production lines to Germany (Hamburg), China (Tianjin) and the United States (Mobile). Toulouse became the European capital of aeronautics when the Airbus Group's head office (a combination of the Munich and Paris divisions) was moved to Blagnac in 2014 at the request of the group's executive chairman, the German Tom Enders. To cap it all, in 2019, some had no hesitation in describing Toulouse as the world's civil aviation when Airbus's deliveries largely exceed those of Boeing with a record total of 863 aircraft delivered in one year.

NOTES

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12 V. Moire, "Écologie : à 88 ans, cette figure de Champagnole revient sur son parcours", *Le Progrès*, January 3th, 2021, (online: https://www.leprogres.fr/environnement/2021/01/02/michel-moreau-j-ai-ete-tres-vite-sensibilise-a-l-ecologie)

13 Oral interview with Bernard Ziegler, in his house in Pibrac (near Toulouse), August 31, 2019.

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15 T. Raabe, *Hochfliegende Ambitionen. Die Bundesregierungen und das Airbus-Projekt* (1969-1981) (Frankfurt: Campus Verlag, 2020), 176. Thomas Raabe was the spokesman for the German Federal Minister of Defense Franz Josef Jung from 2005 to 2009. His book is based on a variety of unpublished sources, mainly from the German Federal Archives.

16 J.-M. Olivier, 1970. *Airbus, naissance d'un géant industriel* (Toulouse: Éditions Midi-Pyrénéennes, collection "Cette année-là à Toulouse", 2020), 50.

17 Oral interview with Bernard Ziegler, in his house in Pibrac (near Toulouse), August 31, 2019.

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19 S. Skinner, *Hawker SiddeleyAviation and Dynamics*, 1960-77 (Ramsbury/New York: Crowood Press, 2014), 111-118.

20 B. Gunston, *Rolls-Royce Aero Engines* (Somerset: Patrick Stephens Ltd, 1989), 256.

21 "Les compagnies Eastern Airlines et El Al vont commander des Airbus", *Le Monde*, March 18, 1978.

22 It is interesting to note the double look on this order. It appears in the German and French wikipedia entries for Franck Borman, but not in the English one, which is much more extensive (entries consulted on November 3, 2021 at 7pm).

23 For example, at the French National Archives, Pierrefitte-sur-Seine site, in the section "Transports, Direction générale de l'aviation civile (DGAC), Direction des programmes aéronautiques civils (1963-1981), études économiques SNIAS", file number 19820420/93 contains the following documents: "Financement d'une série de 360 avions Airbus A300B (juin 1970, 23 pages)", "Financement du programme Airbus (décembre 1970, 23 pages)" and "Plan de financement de la série Airbus, 360 avions et rechanges) (10 janvier 1972, 18 pages)".

ABSTRACTS

English

The relationship between Toulouse and aeronautics began more than a century ago with the production of the Salmson 2A2 observation aircraft in the new Latécoère factory in Montaudran from 1917. From these beginnings there has always been a complex relationship between the role of the state and that of local actors (politicians, business leaders and workforces) which is the central theme of this article. Three successive chronological phases can be distinguished: 1917 to 1945 corresponds to a period during which there were the many initial doubts; 1945 to 1976 saw several ups and downs (Latécoère 631, Languedoc, Armagnac, Caravelle and Concorde); and, finally, commercial success came with the Airbus programme despite its difficulties of the 1970s. Toulouse and its suburbs benefited from the evolution of alliances – particularly when Germany took over from the UK – and, progress-

ively, it asserted itself as the major centre of French, European and eventually the world's civil aeronautics industry.

Français
La relation entre Toulouse et l'aéronautique commence il y a plus d'un siècle avec la production des avions d'observation Salmson 2A2 dans la nouvelle usine Latécoère de Montaudran, à partir de 1917. Dès ces débuts, il existe une relation complexe entre le rôle de l'État et celui des acteurs locaux (politiques, entrepreneurs et main-d'œuvre) ; ce thème constitue la problématique centrale de cet article. Trois phases chronologiques successives peuvent être distinguées : celle qui court de 1917 à 1945 correspond aux multiples hésitations initiales, puis arrive le temps des échecs et des demi-réussites entre 1945 et 1976 (Latécoère 631, Languedoc, Armagnac, Caravelle et Concorde) ; enfin, le succès commercial s'esquisse avec le programme Airbus malgré des débuts difficiles pendant les années 1970. Toulouse et sa périphérie bénéficient de l'évolution des alliances, en particulier lors du remplacement des Britanniques par les Allemands, et s'affirment progressivement comme le pôle majeur de l'industrie aéronautique civile française, puis européenne, voire mondiale.

INDEX

Mots-clés
Turcat (André), Aeroscopia, Aérospatiale, Airbus, Airbus A300B, Air France, Armagnac, British Airways, Ziegler (Bernard), Blagnac, Caravelle, Colomiers, Concorde, Dewoitine D.520, Eastern Airlines, Borman (Franck), Strauss (Franz Josef), General Electric, GIE Airbus, Siddeley (Hawker), Ziegler (Henri), Languedoc, Latécoère 631, Montaudran, Rolls-Royce, Salmson 2A2, Saint-Martin-du-Touch, SNCAM, SNCASE, SNCASO, Sud-Aviation, Toulouse

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Turcat (André), Aeroscopia, Aérospatiale, Airbus, Airbus A300B, Air France, Armagnac, British Airways, Ziegler (Bernard), Blagnac, Caravelle, Colomiers, Concorde, Dewoitine D.520, Eastern Airlines, Borman (Franck), Strauss (Franz Josef), General Electric, GIE Airbus, Siddeley (Hawker), Ziegler (Henri), Languedoc, Latécoère 631, Montaudran, Rolls-Royce, Salmson 2A2, Saint-Martin-du-Touch, SNCAM, SNCASE, SNCASO, Sud-Aviation, Toulouse

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