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Slowdown

Aviation and modernity's lost dynamism

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Abstract:

The inevitability of technological progress is one of the most widely-held beliefs of our era but there is one very important field in which technological progress appears not only to have stagnated, but reversed. Examining the technical and commercial reality of modern aviation, there are three objective markers of slowdown. First, airplanes operational today can no longer reach the speed and altitude records set four decades ago. Second, commercial flight times have not only failed to get shorter, they actually take longer than they did in the past. Third, forty years after its introduction, supersonic flight is no longer available for civilians, neither in commercial nor private jets. While flight today is safer, cheaper, and more widespread than in the past, it has become slower, and jet-makers are strangely not even interested in exploring ways of making it faster. The paper concludes with a discussion of the cultural, political, economic, and institutional reasons behind this slowdown. The receding state of the art in aviation acts as both an object lesson and a warning for the state of economic dynamism overall.

Keywords:

Aviation, supersonic, speed, records, innovation, flight

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1. Introduction

One of the most widely-believed and strongly-held ideas in our modern world is the inevitability of human progress, and the inexorable march of technological innovation. In the space of a few years, our phones have become mini supercomputers and portable movie theaters, while our computers just keep getting more powerful, and connecting to the internet continues to allow us ever more amazing feats. Our cars are safer, faster, and more fuel-efficient, while the seemingly endless variety of consumer goods available somehow manages to continue getting better and more varied and affordable. But there is one very important industry that has witnessed significant regression in the past forty years, and that is aviation.

There may be no human achievement that is as symbolic of progress as the ability to fly safely around the world. For thousands of years, many of the world's brightest minds had attempted to achieve flight by jumping from heights, with success largely limited to not falling too violently on the ground, although some humans were successfully strapped to large kites in ancient China and Japan for punishment, entertainment, or espionage. By the end of the 18th century hot-air balloons were invented in France, and continued to be used throughout the 19th century. With their limited speed, range of motion and elevation, there was not much practical and commercial use for balloons as modes of transport, and they were mainly used for entertainment or surveillance. Mass transportation through flight in heavy machines seemed impossible to most in the 19th century, since balloons' flight was predicated on them being lighter than air.

Outside of some very isolated tribes, everyone alive today was born to a world were flight is possible and common, and very few people stop to think of just how improbable modern flight actually is, and how unfathomable it was before it became a reality. No less an authority on engineering and physics than Lord Kelvin wrote in 1896 "I have not the smallest molecule of faith in aerial navigation other than ballooning, or of the expectation of good results from any of the trials we heard of."[1] No less a visionary than Thomas Edison said in 1895 "It is apparent to me that the possibilities of the aeroplane, which two or three years ago were thought to hold the solution to the [flying machine] problem, have been exhausted, and that we must turn elsewhere."[2] Mathematician and astronomer Simon Newcomb famously said in 1903 "Aerial flight is one of that class of problems with which man will never be able to cope"[3].

The question had been so conclusively settled that the New York Times, on October 9, 1903 wrote:

> *"The flying machine which will really fly might be evolved by the combined and continuous efforts of mathematicians and mechanicians in from one million to ten million years — provided, of course, we can meanwhile eliminate such little drawbacks and embarrassments as the existing relation between weight and strength in inorganic materials. No doubt the problem has attractions for those it interests, but to the ordinary man it would seem as if effort might be employed more profitably."*[4]

Camped out in Kill Devil Hills, North Carolina, Orville Wright clearly had no access to the New York Times, as that day's entry in his diary read "We unpacked rest of goods for new machine and set to work on upper surface"[5]. Instead of "one million to ten million years", it took Orville and his elder brother Wilbur

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[1] Lord Kelvin, replying to an invitation from Major B. F. S. Baden-Powell to join the Royal Aeronautical Society, 1896. Quoted in Hallion, Richard P. 2003. *Taking Flight: Inventing the Aerial Age, from Antiquity through the First World War*. Oxford University Press, p.167

[2] Quoted in Peoples, Columba. 2009. *Justifying Ballistic Missile Defence: Technology, Security and Culture*. Cambridge University Press, p.147.

[3] Quoted in *The Independent: A Weekly Magazine*, 22 October 1903

[4] Flying Machines Which Do Not Fly. [Editorial] (1903, October 9). The New York Times.

[5] Diary entry, October 1903. Diary of Orville Wright, *Papers of Wilbur and Orville Wright*. Manuscript Division, Library of Congress.

sixty-nine days from the day of the Times' prophesy to fly their plane on the first manned flight in history. Such was the improbability of the Wright's feat, it took years for the rest of the world to believe that it had actually happened. The London Times was still writing in 1906 "All attempts at artificial aviation are not only dangerous to human life, but foredoomed to failure from the engineering standpoint." And in 1907, Britain's Minister of War, Lord Haldane, exasperated by the failure of the British army's attempts at flight, privately remarked that airplanes would never fly.[6]

While the Wright brothers were using their humble resources to construct their machine, the US government had granted Samuel Langley, a famous physicist and inventor, $50,000 to develop a flying machine. Langley's 'Aerodome' also had an Internal Combustion Engine, but needed a catapult to take-off, and had no landing mechanism, leading him to make trials over the Potomac River. Two attempts at flying it in October and December 1903 failed and crashed into the river and the project was abandoned. Another significant facet of the Wright's act is that it was the product of individual initiative. They were no scientific experts nor were they industrial powerhouses commanding large amounts of capital, nor were they the beneficiaries of government grants and resources. They were bicycle makers who used to spend their spare time trying to construct flying machines, making them but two of scores of amateurs around the world attempting mechanical controlled flight. In its beginnings, flight was the purview of the novice, amateur and individual daredevil, and not the governmental agencies and seasoned experts, who either failed at it, or were completely convinced it would fail.

The astonishing achievement of modern flight is further placed in perspective when one finds that Orville Wright himself wrote in 1913 that "Atlantic flight is out of the question"[7]. Even the Wrights could not conceive the significance of the machines they had built and the speed with which they would evolve and transform human society. In a mere five years after Wright's prediction, John Alcock and Arthur Brown flew from Newfoundland in Canada to County Galway in Ireland. Aviation advancements were setting a pattern that was to continue until the 1970s: What appears impossible to the most thoughtful observer is shattered at the hands of recklessly determined geniuses.

Whereas it first seemed that planes could only carry a pilot or two, in 1926 commercial aviation became a possibility for passengers. Expectations of aviation speed limits were to be continuously shattered with stronger engines, better frames, and superior design and engineering. Whereas the Wright Brothers had flown at a speed of 6.82 miles per hour, the 100 mph speed mark was broken in 1912, the 200 mph mark in 1921, and the 400mph mark in 1931. In 1947, a manned aircraft finally broke the sound barrier. Commercial aviation was constantly improving its speeds: Two to three decades after a speed record was broken, it would be available for passengers to fly commercially. There seemed to be no limits to the possibilities that flight unleashed, and skepticism of aviation seemed the height of folly as progress appeared unstoppable.

2. Markers of Slowdown

Somehow, progress seems to have come to a halt in the 1970's. Not only has betting against progress become a safe bet in the past four decades, but the ambitious visionaries seeking to redefine what's possible have all but disappeared. Airlines and aircraft makers have no intention of increasing their jets' speeds. Competition in the industry is restricted to the accounting arena, through cost cutting, creative overbooking, seat cramming and performance optimization, as well as the entertainment arena, with new gadgets, games and movies constantly added to alleviate the claustrophobia of the passengers crammed for longer and

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[6] Golin, Alfred. 1984. *No Longer an Island: Britain and the Wright Brothers, 1902-1909*. Stanford University Press, p 274

[7] Quoted in Kane, Robert M. 2003. *Air Transportation: 100 years of controlled powered flight*. Kendall Hunt, p.65

longer times. Long gone are the days where swashbuckling mavericks like the Wright brothers and Alcock and Brown astonished the world with feats deemed impossible. Three main markers of slowdown in the aviation industry can be identified.

2.1 Speed and altitude records

When the Wright Brothers took turns flying their airplane in 1903, the highest speed they recorded was 6.82 mph (10.98 km/h). In 1905, piloting the newer Wright Flyer III, they achieved a speed of 37.85 mph (60.23 km/h). As the engineering know-how and passion for flight began to spread around the world, more and more engineers and pilots attempted to fly at faster speeds, leading to an increase in speeds which was unfathomable even to the Wright Brothers themselves.

The Fédération Aéronautique Internationale was established in 1905 and has been the authority on airplane records, collecting them in dozens of different categories varying by plane type and course type. With the help of the FAI statistical office, all the records in all categories were sorted by year, to find the fastest record of each year, in order to construct a chronological list of the speed record as it evolved over the past 114 years, as presented in Figure 1.

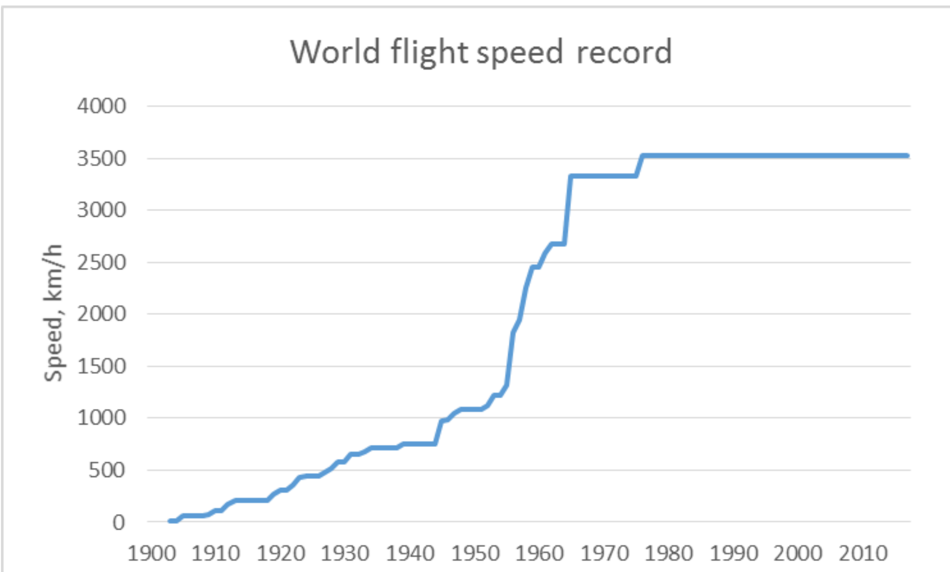

Figure 1: World flight speed record, 1903-2017. Data from 1910-2017 obtained from the FAI. Data from 1906 to 1909 obtained from Taylor, John and Kenneth Munston. 1961. *Jane's Pocket Book of Record Breaking Aircraft*. Collier Books, New York, NY. Data from 1903-1905 obtained from the Wright Brothers Virtual Museum www.wright-brothers.org

Aviation enthusiasts and experimenters were responsible for the majority of records in the early years of aviation, but during the 1920's, military pilots and aircrafts began to feature in the record books, and in the post-WWII era, the record books were entirely dominated by military jets, which had capacities that no civilians could reach. The breaking of the sound barrier came with military aircraft, which continued to achieve higher speeds until the Blackbird SR-71 was to appear. First commissioned in 1972, the SR-71 first flew in 1964, with the capability of exceeding Mach 3 (three times the speed of sound). On 28 July 1976, an SR-71 registered the fastest speed for an air-breathing aircraft, at 2,193.2 mph, 3,529.6 km/h, or Mach 3.3. On that same day, another SR-71 registered the highest altitude record of 85,069 feet (25,929 m). Forty-one years later, both records still stand.

The SR-71 never managed to fly higher or faster than it did on that day in 1976. It was retired in 1999, and no other aircraft has come close to breaking its speed and altitude records. The current fastest military jet is the McDonnell Douglas F-15 Eagle, whose maximum speed is around Mach 2.5, and its production is likely to stop in 2019, dropping the current available state of the art further behind that of the 1970's.

It is remarkable that no such slowdown is found in the performance of automobiles, which continue to get faster to the present day, with new speed records broken every few years. It is perhaps no coincidence that the automobile industry is less centralized and directed by governments, with a larger degree of entry and exit allowing many car-makers to excel in creating faster cars.

2.2 Supersonic flight

As flight speed continued to increase, aircraft began to experience exponentially rising drag as they approached the speed of sound (Mach 1, about 767 mph or 1,234 km/h), threatening stability and increasing the air pressure on the pilot to the point of fainting. This made aeronautical engineers believe the speed of sound was a natural limit to the speed of flying aircraft, which led them to invent the term "sound barrier" to signify this limit. But just like flight itself and cross-Atlantic flight, this barrier proved no match to the ingenuity and determination of humans.

In October 1947, USAF pilot Chuck Yeager flew a Bell X-1 past the sound barrier, inaugurating the era of supersonic flight. Once it was demonstrated that airplanes could indeed make it past the sound barrier, engineers turned their attention to building planes that could do so safely, which required radically different design considerations, mainly a sleek streamlined fuselage and a short wingspan. The first supersonic fighter jet, the USAF's Douglas F4D Skyray, flew its maiden voyage in 1951. The first supersonic bomber jet was the USAF's Convair B-58 Hustler, which first flew in 1956. Many more supersonic jets were introduced into military service in the US, and other nations were soon to introduce their own. The first was Sweden in 1952, and it was followed by the Soviet Union in 1953, United Kingdom in 1954, France in 1956, China and Canada in 1958, Egypt in 1964, Italy in 1966, Japan and Israel in 1971, West Germany in 1974 (as part of a joint project with Italy and the United Kingdom), South Africa in 1986, Taiwan in 1989, the European Union in 1994, Iran in 1997, South Korea in 2002, and Pakistan in 2003 (as part of a joint project with China).

Meanwhile, research teams in the USA, USSR, UK, and France started working on developing commercial supersonic flights. The Soviets Tupolev Tu-144 was the first supersonic airliner prototype to fly in 1968, and the British-French Concorde prototype followed in 1969. On 21 January 1976, less than three decades after Chuck Yaeger had broken the sound barrier, passengers could fly on the supersonic Concorde airplanes commercially[8]. The Soviet Tu-144 made its first commercial flight on 1 November 1977, but its service was discontinued after only 55 flights due to safety concerns.

Wary of the progress being made in Europe, US President John F Kennedy announced in 1963 that government should work with industry towards developing a commercial supersonic transporter. Three jet-makers and three engine-makers applied with designs, Boeing's 2707 was selected, along with General Electric's GE4/J5 engine. Airlines placed 122 orders for the 2707 by 1969, and it was widely believed by Boeing engineers that the future of passenger aviation was supersonic. Boeing's major subsonic project of the time, the 747, was designed with an upper deck as it was assumed it would eventually be switched to transporting cargo, as all passenger planes moved to supersonic models[9].

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[8] Strang, Dr. W.J, R. McKinley (1978). "Concorde in Service". *Aircraft Engineering and Aerospace Technology*. MCB UP. 50 (12)

[9] Haenggi, Michael. 2003. *Boeing Widebodies*. Motorbooks International

At that point, the future of aviation began to take an unexpected turn. Not only did aviation stop achieving the impossible, it also failed at achieving the possible and foreseeable. The 2707 project was scrapped even before two prototypes were completed, and the 747, instead of becoming a cargo carrier, was to become the world's most popular passenger jet, with more than 1,500 jets produced and it is still in production today, more than fifty years after its production began. In spite of receiving more than 100 orders from airliners worldwide, the Concorde was to never produce any new jets after the initial 14 that were built in the 1970s. British Airways and Air France operated seven each, until they were decommissioned in 2003. Instead of being the future of aviation, supersonic flight turned into a brief episode enjoyed by a relatively small number of people for a few decades.

In retrospect, it is baffling why supersonic flight did not take off and become more popular and commercially successful. It is highly likely that many of the affluent and business long-haul passengers would rather pay extra to reduce trip time by half than pay extra to have more comfort in business class on a longer flight. No other civilian aircraft makers have introduced any supersonic models, and Concorde remains three times faster than the average commercial carrier produced by Boeing and Airbus operational today. Its cruising speed is more than double that of the Airbus A380-800, the fastest commercial airplane in operation. Not even in the foreseeable future are there concrete plans for the reintroduction of supersonic jets to commercial travel.

Aircraft	Cruising speed, Mach
Current Boeing & Airbus average	0.72
Airbus A380-800	0.85
Concorde	2.04

Table 1: Speeds of Concorde compared to the fastest current commercial jet, the Airbus A380, and the average of the Airbus and Boeing fleets in operations. Source: Strang, Dr. W.J, R. McKinley (1978). "Concorde in Service". *Aircraft Engineering and Aerospace Technology*. MCB UP. 50 (12). And http://planes.axlegeeks.com/

Conflicting reports abound over the profitability of the operation of Concorde for Air France and British Airways, which is complicated by their being run as part of airlines that mainly ran subsonic flights, and further obscured by the fact that the creation of Concorde was more of a political move than a commercial one, with the strengthening of British-French relations seen as the primary goal. With significant hurdles to growing commercially and fulfilling orders from global airlines, the fate of the Concorde remained inextricably linked to the two national airliners it relied upon. The governments operating these airlines also had a strong role in the management and financing of Airbus, the pan-European airplane maker, whose predecessors had built the Concorde. Airbus announced in 2003 that it could not continue to offer maintenance to Concorde planes and that effectively sealed its fate.

It is unconvincing that the economics of supersonic flight were the reason it had to be discontinued. It is difficult to find reliable estimates of the profitability of the Concorde operations of British Airways and Air France, but a few salient facts fly in the face of a profitability explanation. Concorde had received a large number of orders which it never fulfilled[10]. Further, when they were decommissioned, Virgin Airlines, a private airliner, made a bid to buy the entire fleet of Concorde airplanes, but the French and British governments refused to entertain it. By allowing long-haul flight durations to be cut by half, the Concorde would have been extremely attractive to the richest and busiest people of the world, for whom saving four hours on cross-continental flight would be worth paying many thousands of dollars. If such a feat could be accomplished technically in the 1950s, and commercially in the 1970s, it is baffling that it is not available

[10] Bale, Bernard and Dan Sharp. 2013. *Concorde: Supersonic Speedbird—the full story*. Mortons Media Group

in 2017. At the very least, one would expect that the technology of the 1970s could be made to continue operation on a small scale for the richest at a very high price. Yet, even the richest people on earth cannot pay to cross the Atlantic in the speeds that were available in the 1970s.

The history of aviation, and most other technologies, shows how seemingly highly expensive inventions will drop in price as more of it is produced and the producers figure out various improvements and efficiencies. What starts off being a luxury for the richest eventually declines in price, and the question is: Why did supersonic flight did not go through this process? The Concorde was merely the first iteration of commercial supersonic flight, and a free market in aviation would have likely seen many improvements to the technology. The Concorde was produced only by a state-funded and directed company, as were all other attempts at producing it, the US Boeing 2707 and the Russian Tupolev, and perhaps that is what sealed its fate. It was also sold only to state-directed airliners, in an industry in which national politics played a heavy role.

Contrary to early developments in the aviation industry overall, supersonic development was largely a product of government planning, rather than private enterprise, and so it became a matter where public opinion, rather than market realities, dictated development. A major factor in the ending of supersonic flight was the growing popular campaign against it on both sides of the Atlantic. Motivated by an opposition to sonic booms and the large amount of noise that Concorde jets produced, popular campaigns mobilized to stop Concorde from expanding its operation. These campaigns were influential in getting the US Senate and Congress to cut funding for the Supersonic Transport project in 1971, which led to Boeing canceling its plans to develop the 2707. Further, these campaigns imposed regulations that banned supersonic flight over land and confined it to travel over oceans. In Britain, the Anti-Concorde Project helped sway the British government away from expanding the production of Concorde jets[11].

While concerns about noise can be understood, they did not have to completely kill the supersonic industry, which in a free market would have worked on reducing noise pollution and taking routes away from residential areas. With government in control of airplane makers, the technologies they employed were no longer to compete with subsonic airplanes through the test of market success, but through the political process.

The tale of the demise of the Concorde shows that competition in this arena had been stalled through government control and direction. In a free market, many were willing to buy Concorde planes and their production could have gone on. But as aviation became more of a government-operated industry, the survival of technology became more of a political decision than a commercial decision. Concorde's fate stands as a symbol for the transition from free market capitalism to state-managed economies over the twentieth century. In a free market, the incumbents would have had to adjust to the threat of the supersonic outsiders by either buying them, or copying their technology. Failure to do so would see the incumbent lose market share. But when the incumbents are state-sanctioned monopolies, it is possible to take the path of least resistance and mediocrity, ensuring that the significant financial and reputational investments governments made in airline makers and their aircraft and machinery continues to be profitable.

Airplanes first took-off at the turn of the century, with the Wright Brothers' individual initiative to try unconventional methods, while government-supported efforts around the world were failing. As the managerial state grew and took more control of the aviation industry, the Concorde was produced and funded by government agencies, which would ground it and prevent it from entering the market to produce planes to meet the growing demand for ever-faster planes. Had a government monopolized flight attempts at the turn of the century, one wonders whether anyone would have been able to fly at all.

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[11] See Wiggs, Richard. 1971. *Concorde: The Case Against Supersonic Transport*. Ballantine/Friends of the Earth

2.3 Slower Commercial Routes

Many anecdotal stories and press reports extol the virtues of the 'golden age of flight', where airplanes had more legroom and flights were supposedly faster, but such claims are usually met with skepticism by the younger generation that did not experience flight in the 1960's and 1970's, who are likely to chalk it up to typical old-timers' nostalgia making the past appear much better than it really was. But a more thorough examination of this claim is needed before dismissing it. Researchers for the SeatGuru website have indeed found that airline seats expanded from the 1960's to the 1990's, but started to decline with the turn of the millennium (which is particularly problematic since waistlines have been getting wider.)

But to the best of this author's knowledge, there has been no systematic comparison of airplane route durations over time. This paper performs this comparison by examining the 10 most popular routes in the United States of America in 2016, and comparing their scheduled flight times to the earliest schedules found on the internet. While the FAA does not have records going back to the 1960's or 1970's, the website departedflights.com contains a large number of historic flight timetables for flights around the world. The earliest timetables found for each of the ten routes was used for comparison, and the results are listed in Table X.

Most popular routes in 2016		Earliest available year	Flight time in 69, 71, or 72, minutes		Flight time in 2017, minutes		Slowdown in minutes		% Slowdown	
A	B		A to B	B to A	A to B	B to A	A to B	B to A		
Chicago	**New York**	1969	102	125	121	148	19	23	18.63	18.40
Los Angeles	**San Francisco**	1971	54	48	68	65	14	17	25.93	35.42
Chicago	**Los Angeles**	1969	234	208	260	229	26	21	11.11	10.10
Los Angeles	**New York**	1969	280	340	306	351	26	11	9.29	3.24
Atlanta	**Chicago**	1972	94	97	110	110	16	13	17.02	13.40
Atlanta	**New York**	1972	103	119	130	136	27	17	26.21	14.29
Miami	**New York**	1969	143	145	166	174	23	29	16.08	20.00
Chicago	**San Francisco**	1969	249	215	270	242	21	27	8.43	12.56
Chicago	**Minneapolis**	1972	67	62	85	83	18	21	26.87	33.87
Atlanta	**Orlando**	1972	65	69	85	81	20	12	30.77	17.39
								Average	**18.45**	

Table 2: 10 busiest US routes in 2016 data from Department of Transportation Statistics (www.transtats.bts.gov). Flight durations in 1972 from historical timetables available at www.departedflights.com. Flight durations in 2016 obtained from online search performed in www.kayak.com.

Every single one of the twenty legs of the ten most popular routes in the United States of America takes longer to fly in 2017 than it did almost 6 decades before. The average duration of the flight has increased by 18.45% minutes.

There are two sources of bias in this data: First, the routes chosen were the routes most popular in 2016, which means they had extensive coverage by various airliners likely to deploy several airplane models to the skies in the present. It is not clear how popular these routes were in the past, which may mean some of them did not have extensive or advanced airplanes deployed to them. Second, the durations examined for 2017 were obtained by running online searches that are easily sorted to find the shortest flight duration available between these cities. The flights from 1969-72 were not chosen based on being the shortest, they were merely the oldest flight records available to consult. Both these biases are likely to skew the results in favor of the present, in effect, meaning that these findings likely underestimate the extent of the slowdown in commercial aviation.

There are two main direct reasons for this slowdown, and a third, deeper reason. The first reason is that airports are becoming increasingly congested, requiring more time for airplanes to taxi through the runways after landing and before takeoff. Building new airports, or expanding new ones, typically faces significant political and popular opposition, necessitating ever-more crowding of existing airports, making the taxi phase of the journey longer, as well as the passenger's crossing of the airport itself.

Another reason for the slowdown of commercial airliners is fuel economy. Since the closing of the gold exchange window in 1971, oil prices went through many periods were they rose significantly, putting airliners under pressure, since jet fuel is a major component of their operating costs. Pilots are instructed to fly at the speed ranges that maximize fuel efficiency, generally between 0.78 and 0.82 Mach for most aircraft, even though many jetliners could be flying at faster speeds to arrive at their destinations faster.

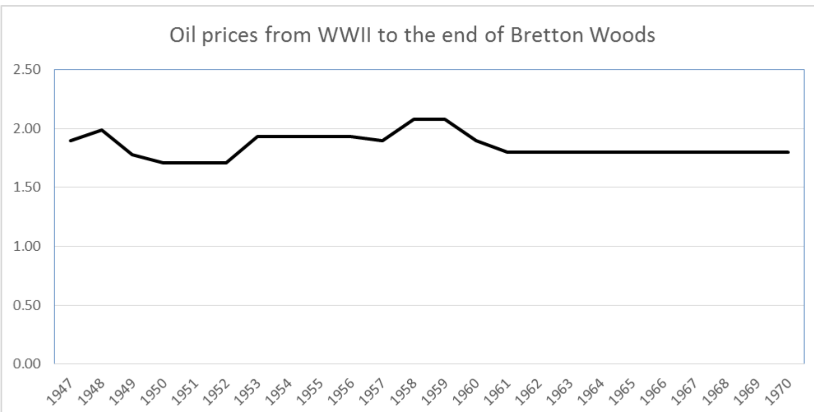

Figure 2: Oil prices from 1947 to 1970. Source: British Petroleum Statistical Review of World Energy, found on www.bp.com

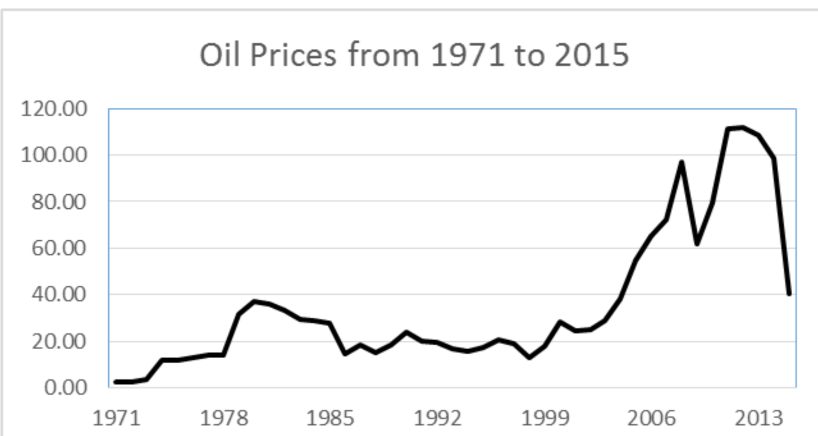

Figure 3: Oil prices from 1971 to 2016. Source: British Petroleum Statistical Review of World Energy, found on www.bp.com

But the deeper reason for this slowdown is the lack of innovation in aviation that means that today's state of the art airplanes are essentially no faster than the ones that flew almost five decades ago. The dog that didn't bark in this story is the five decades of missing innovation in aviation that could, and should, have made airplanes faster and allowed for the completion of these routes in shorter times than in the 1970's. The most important innovations here would have been the development of supersonic flight, and the expansion of airports and runway space.

3. Conclusions

Contrary to popular perceptions of inexorable progress accelerating over time, this paper lends support to a paper by Huebner (2005), which finds that the innovation peaked towards the end of the nineteenth century and has been declining since. The invention of the airplane, which was the most important milestone in aviation, came at the turn of the twentieth century. Marginal improvements came after that, but arguably stopped in the 1970s. By the turn of the twenty-first century, the state of the art actually regressed with the decommissioning of the Concorde and the SR-71, and the ever-longer durations of commercial flights.

Several factors are identified to explain this technological and economic regression: The high volatility of oil prices in the post-Bretton Woods era put a great strain on airliner budgets, forcing them to prioritize economy over performance. Secondly, the growing level of government involvement in the aviation industry, which has made progress subject to the vagaries of political processes, rather than responsive to consumer needs. As governments in the US and Europe took significant roles in the financing and direction of the jet makers in the postwar period, it became impractical for these jet makers to simply produce what consumers want—they had to produce what politicians told them. Whereas faster flight is what consumers would pay for on the market, politics favors the ethos of NIMBY—Not In My Backyard.

A cultural shift towards minimizing impacts, reducing noise and using the political process to stop individuals from innovating has become far more pervasive in the present than in the past. It was largely unthinkable that airplanes could be banned in the turn of the twentieth century when they were first invented, in spite of having a much more dubious safety record than today.

No such slowdown is found in the performance of automobiles, which suggests fertile grounds for future research on why air travel has regressed when land travel has kept improving. A preliminary hypothesis is that the postwar centralization of airplane production into a few large state-supported jet makers made them less agile and innovative. A plethora of smaller producers, as in the case of automobile industry, is like to generate a larger number of innovations and models, allowing the market test to determine which models would be more desirable, and constantly satisfying consumers who are looking for the cutting edge in innovation. The result is that some carmakers make a large number of economic cars, while others produce a few high performance cars for the high end of the market. With time, the innovations at the high end become popularized and economized and affordable to the mass market. State-directed monopolies, on the other hand, are far more likely to stick to tried and tested predictable formulas, and cannot innovate freely without political license. Thus, the Concorde's supersonic flight, which was economically operational in the 1970s did not spread to more airplanes, but instead was decommissioned, and the standard 1970's remain largely unchanged till today.

The history of aviation serves as a reminder and cautionary tale that progress is far from a certainty in our modern world. Stagnation and regression are a possibility, and some of the factors that may lead to it include corporatism and state direction of industry, and a culture that shifts from valuing achievement to valuing safety. More research needs to be conducted to understand the deeper societal, political, institutional and economic reasons for the decline in innovation in the aviation industry.

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