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Fading Away: Technological Decline in Canadian Aviation

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Résumé de l'article

Lorsque la Western Canada Airways ouvre une nouvelle voie aérienne le long de la Vallée Mackenzie en 1929, elle le fait avec une flotte entièrement composée d'avions de modèle 'Fokker Super Universal'. Toutefois, avant la fin de l'année 1933, la compagnie considère déjà le 'Super Universal' comme désuet, et commence à le remplacer par d'autres modèles d'avion. En seulement quatre ans, le 'Fokker Super Universal' perd son statut de pointe et devient obsolète. Tout en étudiant la décision de la Western Canada Airways' de remplacer les 'Supers', cet article porte un regard sur la nature de l'obsolescence, démontrant que la soudaine désuétude de l'appareil ne résulte pas de changements techniques dramatiques ou de percées majeures dans le design d'autres appareils. Le 'Super Universal' devient plutôt obsolète en raison des changements de son contexte d'utilisation. L'émergence d'une 'ruée' vers les minerais du 'Great Bear Lake', l'introduction de nouveaux modèles d'avions dans la région, l'accroissement de la compétition, ainsi que les changements d'attentes de la clientèle encouragent la direction de la Western Canada Airways' à réévaluer sa définition de ce qui constitue une technologie 'supérieure' dans la vallée Mackenzie. Si le contexte de 1929 a fait du 'Super Universal' la meilleure option, dès le fin de 1933, ces circonstances ont évolué de manière à rendre le 'Super' obsolète. En retraçant cet épisode de l'histoire de l'aviation canadienne, cet article explorera les dimensions contextuelles de l'obsolescence et le rôle des circonstances historiques dans le déclin technologique.

Fading Away: Technological Decline in Canadian Aviation

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Résumé : Lorsque la Western Canada Airways ouvre une nouvelle voie aérienne le long de la Vallée Mackenzie en 1929, elle le fait avec une flotte entièrement composée d'avions de modèle 'Fokker Super Universal'. Toutefois, avant la fin de l'année 1933, la compagnie considère déjà le 'Super Universal' comme désuet, et commence à le remplacer par d'autres modèles d'avion. En seulement quatre ans, le 'Fokker Super Universal' perd son statut de pointe et devient obsolète. Tout en étudiant la décision de la Western Canada Airways' de remplacer les 'Supers', cet article porte un regard sur la nature de l'obsolescence, démontrant que la soudaine désuétude de l'appareil ne résulte pas de changements techniques dramatiques ou de percées majeures dans le design d'autres appareils. Le 'Super Universal' devient plutôt obsolète en raison des changements de son contexte d'utilisation. L'émergence d'une 'ruée' vers les minerais du 'Great Bear Lake', l'introduction de nouveaux modèles d'avions dans la région, l'accroissement de la compétition, ainsi que les changements d'attentes de la clientèle encouragent la direction de la Western Canada Airways' à réévaluer sa définition de ce qui constitue une technologie 'supérieure' dans la vallée Mackenzie. Si le contexte de 1929 a fait du 'Super Universal' la meilleure option, dès le fin de 1933, ces circonstances ont évolué de manière à rendre le 'Super' obsolète. En retraçant cet épisode de l'histoire de l'aviation canadienne, cet article explorera les dimensions contextuelles de l'obsolescence et le rôle des circonstances historiques dans le déclin technologique.

Abstract: When Western Canada Airways began flying its pioneering air route down the Mackenzie Valley in 1929, it did so with a fleet comprised entirely of Fokker Super Universal aircraft. By the end of 1933, however, the airline had declared the Super Universals obsolete, replacing them with other aircraft models. In only four years, the Fokker Super Universal had gone from state of the art to obsolescent. Exploring Western Canada Airways' decision to replace the Supers, this paper offers insight into the nature of obsolescence, demonstrating that the aircraft did not achieve this status because of technical changes or dramatic technical breakthroughs in the design of other aircraft. Instead, the Super Universal became obsolete because of changes in its use-context. The rise of the Great Bear Lake mineral rush, the introduction of new sorts of aircraft into the region, increased competition, and changing passenger expectations all encouraged Western Canada Airways' management to re-evaluate their definition of what constituted a superior technology within the context of the Mackenzie Valley. While conditions in 1929 made the Super Universal the best possible choice, by the end of 1933 those circumstances had changed such that the Super was now obsolete. By tracing this episode in Canadian aviation history, this paper will explore the contextual dimensions of obsolescence and the role of historical circumstances in effecting technological decline.

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During the 1920s and 1930s, Canadian prospectors were busily engaged in pushing back the country's northern frontier. As they sought to reach ever further into the wilderness of the Canadian Shield, they turned to bush pilots and their planes for transport support. Conceived in response to Canada's transport environment in the interwar decades, bush flying developed in tandem with the northern resource industries. First used in forestry, aircraft soon offered important transport services for prospectors and mining developers. By using float and ski-equipped aircraft to land on water or ice, bush pilots were able to exploit the North's geography and transform a transportation obstacle, the rocky hills, lakes, and rivers of the Shield, into the basis of a new aviation system that did not rely on fixed landing strips and wheeled aircraft. Canadian Airways Limited (CAL), Canada's largest commercial airline of the 1920s and 1930s, was one such company, operating bush services across the Shield.[1] In 1929, the company decided to extend its commercial service north along the Mackenzie River, reaching all the way to Aklavik on the shores of the Beaufort Sea. Facing the rigors of northern flying, the airline made the Fokker Super Universal the backbone of its Mackenzie fleet. Looking back, the company president, James A. Richardson, would declare that, at the time, the Super was the only available plane appropriate for bush operations along the Mackenzie.[2] Only five short years later, however, C.H. Dickins, the company's Mackenzie District Superintendent, would begin withdrawing the aircraft from northern service.[3]

The Fokker Super Universal's rapid decline raises a set of interesting questions, most intriguingly: what had happened to transform the users' perception of the Super Universal? One might assume it was a case of technological progress—a new and better design replacing the previous leader. However, there had been no dramatic technical breakthroughs in mid-sized transport aircraft design to render the Super Universal outdated. In fact, the planes operating along the Mackenzie in the early 1930s were all part of the same generation of high-wing, multi-purpose transports developed in the mid-to-late 1920s.

1. The airline began life as Western Canada Airways and, after a series of amalgamations, changed its name to Canadian Airways Limited in 1931.
2. Archives of Manitoba, Canadian Airways Limited Collection (hereafter AM-CALC), MG 11 A 34, Box 6, Correspondence, James A. Richardson, "Canadian Airways Limited, Memorandum," 7 April 1934; See also, AM-CALC, MG 11 A 34, Box 42, Edmonton and McMurray Base Correspondence, C.H. Dickins, "Report on Conditions McKenzie [sic] River District," 20 February 1931.
3. "The subject of new equipment to replace what is agreed to be positively obsolete (this applies to all of the equipment of the Company except the Junkers, Sikorsky Amphibian and Fairchild 71C) is a very complicated one…," AM-CALC, MG 11 A 34, Box 6, Correspondence, W.C. Sigerson to Dickins, 2 January 1934.

So what had happened? This case study suggests that the answer to that question was complex. New centres of activity and hence new transport routes emerged after the Fokker Super Universal's introduction. These changes, which were themselves partly the result of aircraft use (notably the discovery of radium at Great Bear Lake), reconfigured the region's geography. As a consequence, aircrafts' use-patterns changed. This new geography met changing economic conditions, specifically the Great Depression and the appearance of aerial competition along the Mackenzie, which in turn altered users' perceptions of the available technology. Changes in the region's geography help to explain the Super Universal's passage from fleet backbone to retired aircraft. The following pages analyse the interaction between physical geography and historical developments, demonstrating the importance of incorporating such an analysis into the history of technology.

Historians of science and technology have previously considered the utility of exploring their subjects with reference to the importance of place. Historian of technology Thomas P. Hughes, along with historians of science such as Mary Jo Nye and Jonathan Harwood, highlight the important influence of national context, including institutions, politics, economics, and culture, on the development of particular approaches to science or technology. More recently, David Edgerton has argued that technologies have different trajectories in different places and that a failure to look beyond a northern or a western context risks missing that difference. Other historians, such as Dianne Menghetti, raise important questions about the utility of this framework in the context of technologies that flow across borders. This warning is particularly relevant in the history of northern Canadian aviation, especially before the development of Canadian-manufactured bush planes, as aircraft migrated from one national context to another as they moved from manufacturer to user. Although we are right to be cautious, the history of Canadian aviation, including this case study, indicates that place plays a significant role in the history of technology.[4]

4. David Edgerton, *The Shock of the Old: Technology and Global History since 1900* (Oxford: Oxford University Press, 2007); Jonathan Harwood, "National Styles in Science: Genetics in Germany and the United States between the World Wars," *Isis* 78, 3 (1987): 390-414; Thomas P. Hughes, *Networks of Power: Electrification in Western Society, 1880-1930* (Baltimore: The Johns Hopkins University Press, 1983); Diane Menghetti, "Invention and Innovation in the Australian Non-Ferrous Mining Industry: Whose Technology?" *Australian Economic History Review* 45, 2 (2005): 204-219; Mary Jo Nye, "National Styles? French and English Chemistry in the Nineteenth and Early Twentieth Centuries," *Osiris* 8 (1993): 30-49.

The recent geographical turn in the history of science and technology, exemplified by David Livingstone's work, reinforces the importance of place in this history.[5] However, there is a tendency to focus on the locus of scientific practice—such as the field station, hospital, or laboratory—and the ways in which science and these places construct one another. This paper seeks to expand this focus by incorporating physical geography into the history of technology. Using the Super Universal's life along the Mackenzie as a case study, this analysis expands technology's relevant historical context to include the influence of geography and will consider how aircraft and historical developments reconfigured northern geography, which in turn altered how users perceived different aircraft and changed the models they selected as best suited to their needs.

When it began its Mackenzie River air service, the very nature of northern bush flying encouraged Canadian Airways' decision-makers to value characteristics such as ruggedness, reliability, versatility, manoeuvrability, the ability to access remote wilderness locations year-round, and the capacity to carry a variety of cargos—all characteristics the airline's management identified in the Super Universal. The company's confidence came partly from the Super's own design and partly from the airline's experience with the aircraft's predecessor, the Fokker Universal.

Developed in 1928, the Super Universal was a high-winged mid-sized transport with a fabric-covered metal fuselage frame, and square, boxy silhouette topped with Fokker's signature thick, cantilevered, wooden-framed, plywood-covered wing (see fig. 1). Equipped with a Pratt & Whitney Wasp engine of 400 hp, the aircraft was capable of maintaining a cruising speed of 118 mph with a payload of 750-800 lbs. Previous operating experience with the Super's older sibling, the Fokker Universal, on Canadian Airways' southern bush routes, the Canadian government's Hudson Strait Expedition (1927), Canadian Airways' 15,000 lbs Hudson Bay freight contract (1927), as well as C.H. Dickins' success with a Super on his Barren Lands flight of 1928 all suggested Fokker's aircraft were well-adapted to northern bush flying. Based on this acquaintance and the Super Universal's performance capacities, Canadian Airways selected the aircraft as the backbone of its Mackenzie District fleet.

5. David N. Livingstone, *Putting Science in Its Place: Geographies of Scientific Knowledge* (Chicago: University of Chicago Press, 2003).

Figure 1. CF-AJC, Canadian Airways' Fokker Super Universal, 1930.

Source: Alberta Aviation Museum Photo Collection, 202151. Courtesy of the Alberta Aviation Museum and the Faltinson Collection.

As it turned out, the Super Universals would have significant difficulties operating in the northern winter. To understand these challenges and the airline's response requires a short technical digression. Underneath its cantilevered wings, the Fokker Super Universal was equipped with "vertical struts fitted with shock absorbers between axles and front wing spar, taking the bulk of wing weight directly instead of through [the] fuselage. [The] shock absorbers [were] formed of elastic cord [wound] over pins…"[6] This arrangement had originally been designed on the assumption that the Fokker Super Universal would operate on wheels. However, equipping the aircraft as a bush plane meant fitting it with floats or skis, thereby eliminating the rubber tires' shock absorbing capacity. When the aircraft encountered extremely cold weather, the rubber cords would loose their elasticity, forcing the thin metal struts to absorb all the

6. AM-CALC, MG 11 A 34, Box 32, Fokker Aircraft, Individual Fokker Aircraft, Atlantic Aircraft Corporation, "Standard Specification, Fokker Super-Universal Monoplane," 12 June 1928; C.G. Seaborn, "Anatomy and Oddities: An Inside Look at a Pioneering Canadian Bushplane 1929-1937," *Canadian Aviation Historical Society Journal* 35, 1 (1997): 20-21.

landing force, snapping or bending the strut, and rendering the aircraft unusable.[7] These undercarriage failures occurred at such a rate that the airline became seriously concerned.[8]

Despite these technical difficulties, the company did not replace the Super. Instead, the airline's management chose to invest time and energy working with the manufacturer to develop a solution. This process took some time, but in the autumn of 1930, responding to the advice of its pilots, the airline began to incorporate aerol struts into the Super's undercarriage. These aerol struts, which replaced the bungee cord arrangement, used a cylinder filled with air to absorb the forces of landing and taxiing. Unlike the rubber bungee cords, as long as the parts were well lubricated, the aerol shock would continue to function even under the coldest temperatures. After these modifications, in 1931 C.H. Dickins, now the Mackenzie District Superintendent, reaffirmed his belief that these aircraft were "the best equipment now available for the kind of work that [the company was] doing."[9]

Although the shocks functioned well through the winter of 1930-1931, earning high praise from Canadian Airways' pilots, in the winter of 1931-1932, the northern climate again exacted its price. That season, winter temperatures dropped so low that the lubricating oil in the aerol struts congealed. When this happened, the shocks would often compress and jam, forcing the strut to absorb the excess stresses, which translated into collapsing undercarriages. Again, the company chose to make adjustments rather than abandon the aircraft as unsuitable to the North. By substituting lighter oil, Canadian Airways' engineers were able to correct the problem by the spring of 1932.

However, just as the airline appeared to have adapted the aircraft to suit the Mackenzie's environment, Canadian Airways began removing the plane from Mackenzie District service and replacing it with other aircraft. This despite the company's three-year investment in modifying the aircraft to suit the region. Company records reveal that the reasons for this shift had very little to do with the Super Universal's internal arrangements. The change in policy had much more to do with developments that occurred in the Mackenzie Valley during 1932.

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7. The struts had a wall-thickness of 0.095" and the manufacturer recommended a thickness of at least 0.120" for ski flying. AM-CALC, MG 11 A 34, Box 32, Fokker Aircraft, Individual Fokker Aircraft, Charles Froesch to W.L. Brintnell, 16 January 1929.
8. AM-CALC, MG 11 A 34, Box 1, Correspondence, Brintnell to Dickins, 22 February 1929; AM-CALC, MG 11 A 34, Box 42, Edmonton and McMurray Base Correspondence, Dickins to Brintnell, 15 April 1930.
9. AM-CALC, MG 11 A 34, Box 42, Edmonton and McMurray Base Correspondence, Dickins, "Report on Conditions McKenzie [sic] River District," 20 February 1931.

Perhaps the most significant of these changes was the discovery of radium on the shores of Great Bear Lake. Prospector and mine developer Gilbert Labine had identified the mineral's presence in the fall of 1929 and, over the next two years, Labine's own activities and the investigations of other mining companies, reinforced by government ore analyses, contributed to growing excitement about the area. This interest culminated in a prospecting rush that broke upon the Mackenzie District in the spring of 1932.[10] The prospecting rush caused a sharp increase in passenger and cargo traffic to the area, providing a lucrative route for the northern airline. Indeed, the amount of cargo Canadian Airways carried to Great Bear Lake rose from 10,520 lbs in 1930 to 110,076 lbs in 1932.[11] The growth of radium prospecting and, subsequently, mining, also reconfigured the region's geography, creating a new centre and altering aircraft transport routes. At the eastern end of Great Bear Lake, the mining camps were well off the established Canadian Airways route, which followed the Mackenzie River. To reach Great Bear, planes would either turn east from Fort Norman and fly from the Mackenzie to the lake, or they would head north across Great Slave Lake, through Fort Rae to the eastern arm of Great Bear. The distances between the regular stops on the river were long compared to other bush routes in Canada (averaging 150 miles) but the distances on the legs to Great Bear were even farther. The distance from Fort Norman to McConnell Point on Great Bear was 200 miles, while the distance from Great Bear to Fort Simpson was 460 miles. This development would come to have a significant effect on the Super Universals' fortunes.

The flood of traffic from the Great Bear rush was a boon to Canadian Airways, especially given the economic situation in the rest of Canada. The economic depression that had gripped the country since 1929 had grave implications for the company. Canadian politicians responded to the crisis with a policy of economic belt-tightening. In the face of so much distress, the government-sponsored airmail services that Canadian Airways operated in Eastern Canada and on the Prairies began to seem increasingly unnecessary luxuries and, in keeping with its overall approach, the government began cancelling the services, eventually suspending them completely in the spring of 1932.

The loss of this income, combined with declining general traffic, was a significant blow to Canadian Airways' bottom line and made the airline's remaining airmail contracts and any bush flying business even more

10. Robert Bothwell, *Eldorado: Canada's National Uranium Company* (Toronto: University of Toronto Press, 1984).
11. CALC-AM, MG 11 A 34, Box 63, Statistics, C.M. Forrest to Sigerson, 26 January 1934.

essential to the company's survival (see table 1). In 1931, mail formed 65% of Canadian Airways' operating revenues. This dropped to just under 35% following the airmail cancellations. Of this, the Mackenzie District airmail contract was worth $45,000 per year.[12] As a result, it was vital the airline make as great a profit from the Great Bear Lake rush as possible. Thus, the company needed to be able to handle as much of the traffic as it could. However, the appearance of competition in January of 1932, in the form of Mackenzie Air Service, had complicated the situation. It was this combination of economic developments, competition, and geography that would alter Canadian Airways' evaluation of the Fokker Super Universal by redefining the managers' views on the aircraft's capacity, performance, and comfort.

Table 1. Canadian Airways Traffic.

	1931	1932	1933
Mail (Mackenzie)	42,829 lbs	71,432 lbs	53,842 lbs
Passengers (Mackenzie)	961	1,405	882
Express (Mackenzie)	138,626 lbs	408,561.75 lbs	403,756 lbs
Hours (Mackenzie)	2,061.50	4,093.25	3,270.40
Miles (Mackenzie)	208,653	408,192	329,735
Total Passengers	6,370	4,501	5,362
Total Express	647,596.12 lbs	1,427,114.12 lbs	2,106,109 lbs
Total Hours	13,889.13	8,942.40	8,633.05
Total Miles	1,318,621	856,584	810,751.2

Source: AM-CALC, MG 11 A 34, Box 63, Statistics, C.M. Forrest to W.C. Sigerson, 26 January 1934.

Founded by Canadian Airways' former employee, W.L. Brintnell, this competitor's presence would buttress Canadian Airways' preoccupation with cargo capacity and efficiency. To begin with, Mackenzie Air Service's emergence reinforced Canadian Airways' need to accommodate the growing levels of Great Bear Lake traffic.[13] Now, if Canadian Airways could not accommodate the traffic, the business would not wait until the airline could carry it. Instead, it would go to the competition, resulting in a loss of income for Canadian Airways.

12. AM-CALC, MG 11 A 34, Box 64, Statistics, CAL Statistics 1931-1933, 1934, Sigerson to R.W. Finlayson, 13 February 1933 (Accounting and Statistical Data, All Lines); AM-CALC, MG 11 A 34, Box 28, Commercial Airways, "Transfer of Contract," 24 September 1931; AM-CALC, MG 11 A 34, Box 23, Annual Report, "Annual Report, Canadian Airways Limited, For the Year Ended December 31, 1932"; NAC, MG 30 E 243, vol. 5, J.A. Wilson Papers, Specific Correspondence, 1920-1942, J.A. Wilson to Charles G. Grey, 20 May 1932.
13. AM-CALC, MG 11 A 34, Box 63, Statistics, Forrest to Sigerson, 26 January 1934.

Moreover, early in 1933, reports reached Canadian Airways management that Mackenzie Air Service was engaging in rate cutting in order to draw traffic away from the more established airline.[14] Mackenzie Air Service was a smaller company with lower overheads and a second-hand fleet that required a lower initial investment. This meant it could afford to offer lower rates. However, given that the airline operated similar aircraft to Canadian Airways, CAL's officials were convinced that the only way Mackenzie Air Service could be making a profit was by overloading their aircraft—carrying a larger load than they were licensed to carry. According to C.H. Dickins, Brintnell was claiming that Mackenzie Air Service's Super Universals could carry up to 2200 lbs—nearly twice the licensed 1200 lbs payload of Canadian Airways' Supers. However, Dickins pointed out, these aircraft were older than Canadian Airways' and were not licensed to carry loads as high as 1200 lbs. Dickins suggested, "the fact that they have been carrying larger loads is due entirely to gross overloading."[15] In addition, Dickins claimed that Mackenzie Air Service flew with no gas reserve, substituting the weight of cargo for the weight of gas in order to increase the amount of cargo they could carry.[16] This was a dangerous strategy in a region whose environment was so unforgiving of mistakes.

As traffic declined in 1933, this competition became even more upsetting for Canadian Airways. Traffic levels to and from Great Bear Lake continued to rise, but the initial boom had finished and the rate of increase was levelling off. In addition, traffic along the Mackenzie as a whole was declining. In 1933, Canadian Airways' Mackenzie fleet carried 17,590 fewer lbs of mail, 4,805 fewer lbs of express cargo, and 523 fewer passengers than in 1932.[17] In the context of the Great Depression, Mackenzie District traffic was essential to the airline's health, but the amount available was decreasing and the competition was engaging in activities that damaged Canadian Airways' ability to compete for the remaining, vital business. Thus, it was deeply important that the fleet had the largest capacity possible. As a result, payload capability became one of Canadian Airways' highest priorities.

The airline had several possible responses to the situation. For instance, it too could have engaged in overloading and, in fact, this had been a common practice in the company right up until 1932. However, company

14. AM-CALC, MG 11 A 34, Box 28, Competitors' Activities, G.A. Thompson to Dickins and Sigerson, 13 January 1933.
15. AM-CALC, MG 11 A 34, Box 14, Airmail, Great Bear–Resolution, Dickins to Thompson, 13 April 1933.
16. AM-CALC, MG 11 A 34, Box 34, Mackenzie Air Service Ltd, 1932-1940, Dickins to Thompson, 6 April 1934.
17. AM-CALC, MG 11 A 34, Box 63, Statistics, Forrest to Sigerson, 26 January 1934.

managers realized that if they could keep their poorer competitors to their aircraft's licensed loads, the competition would not be able to make a profit.[18] That said, if the company pursued this policy, they could not continue to overload their own aircraft. As R.H. Mulock pointed out to W.C. Sigerson, "I expect very shortly this whole question of overloading will be checked up by the Mounted Police, and it will be rather hard luck on any company which infringes on the overloading regulations."[19] Moreover, Pratt & Whitney, the engine manufacturer, had identified overloading as a potential cause of a 1931-series of engine failures in Canadian Airways' Mackenzie fleet. Thus, Canadian Airways focused on pressuring the government to enforce weight regulations along the Mackenzie, hoping to reduce Mackenzie Air Service's advantage, but geography would also have a role to play in this part of the story.

In order to restrict the competition's ability to overload, Canadian Airways would need the government regulators to improve their inspection and enforcement efforts along the Mackenzie and company officials began lobbying the government to take such action. C.H. Dickins suggested to G.A. Thompson, "You may be able to take some action in the matter of having the Department check up on loadings of aircraft in the Mackenzie Valley frequently… It is suggested that the RCMP could be instructed to carry out examinations to see that air regulations are being observed."[20] In the spring of 1933, J.A. Wilson, Controller of Civil Aviation, announced that the RCMP had indeed been asked to include aviation inspection in their northern work. In addition, R.H. Mulock was able to report that the government had instructed its inspectors to intensify the frequency of inspection trips to Fort McMurray.[21] This seemed to be good news for Canadian Airways.

However, the promised action had not materialized by the end of the summer of 1933 summer. In September 1933, Dickins noted that the Department of National Defence's District Inspector had not visited McMurray; nor was there "a single instance of checking the total loaded weight of any commercial aircraft operating throughout the District either by the R.C.M. Police or any representative of the Department of Civil

18. AM-CALC, MG 11 A 34, Box 22, Overloading, W.E. Gilbert to H.C. Ingram, 10 May 1933.
19. AM-CALC, MG 11 A 34, Box 22, Overloading, Sigerson to R.H. Mulock, 8 September 1933; AM-CALC, MG 11 A 34, Box 14, Airmail, Great Bear-Resolution, Mulock to Sigerson, 29 April 1933.
20. AM-CALC, MG 11 A 34, Box 14, Airmail, Great Bear-Resolution, Dickins to Thompson, 13 April 1933.
21. AM-CALC, MG 11 A 34, Box 22, Overloading, Wilson to Sigerson, 8 May 1933; AM-CALC, MG 11 A 34, Box 22, Overloading, Mulock to Sigerson, 5 June 1933.

Aviation."[22] In fact, things only began to change in the spring of 1934, when Gilbert reported that the competition was becoming increasingly peevish and that Brintnell was accusing Canadian Airways of persecuting him through the government. Gilbert concluded that this reaction could only be the result of increased government inspection restricting Mackenzie Air Services' overloading.[23]

Although the RCMP had increased their surveillance, there were indications that there was some confusion about the regulations. For instance, Thompson reported that, "when examining Mr. Gilbert's machine at Resolution for overloading, the police advised him that he was 500 pounds underload. I am quite sure that Gilbert would not fly with 500 pounds less payload than he could carry, particularly at the busiest time of year and the only conclusion to draw is that the RCMP do not know how to check up on loads."[24] In fact, full government enforcement of air regulations would await the Department of Transport's creation in 1937.

The delay in government enforcement partially reflected the preoccupations of the Department of National Defence, which was responsible for civil aviation in this period, with military aviation. At the same time, the delay was a product of the logistical difficulties created by the geography of aviation in the Canadian North. In 1935, Wilson, who was the top civil servant responsible for aviation, outlined some of these obstacles, emphasizing the difficulties created by expansive distance. Most basically, the North lacked qualified inspectors. For instance, the inspector responsible for the Mackenzie was stationed in Regina. Moving the inspector from Regina to Edmonton, which occurred in late 1933 or early 1934, was an improvement. However, he was still a day's travel away from McMurray and further still from points north. Moreover there was still only one inspector, who could not hope to blanket a region as large as the Mackenzie by himself. As we have seen, inspection duties were devolved to the RCMP in an effort to improve this, but their efforts were only partly effective. Regulators were compelled, therefore, to rely on second-hand reports, but they encountered difficulties in convincing witnesses to report on their employers or competition.[25] Geography, in combination with limited resources, created a situation where it was difficult for government regulators to effectively police adherence to air regulations in the Mackenzie.

22. AM-CALC, MG 11 A 34, Box 28, Competitors' Activities, Dickins to Thompson, 23 September 1933.
23. AM-CALC, MG 11 A 34, Box 37, Mackenzie Air Services Ltd, Gilbert to Dickins, 18 March 1934.
24. AM-CALC, MG 11 A 34, Box 6, Correspondence, Thompson to Sigerson, 1 May 1934.
25. NAC, MG 30 E 243, vol. 8, J.A. Wilson, "Inspection–Northern Bases," 28 June 1935; NAC, MG 30 E 243, vol. 7, J.A. Wilson Papers, Special Correspondence, "Overloading of aircraft," J.A. Wilson, 14 May 1934.

Thus, while they waited for government regulation to restrict the competition's overloading, Canadian Airways' main strategy for responding to Mackenzie Air Service's competition was to maximize the efficiency of its own aircraft operations so that it could compete with Mackenzie Air Service's rates and still achieve a profit. In this period there was little slack in the Mackenzie fleet's operating capacity. As early as 1932, with the advent of the Great Bear Lake rush, district managers were using the aircraft to the fullest and were requesting an increased fleet from head office. A year later, in early 1933, Canadian Airways actually contemplated the prospect of subcontracting business to Brintnell and his company. The obvious solution would be to add aircraft to the Mackenzie fleet, but it was not so simple. The whole of Canadian Airways' western lines were experiencing an equipment shortage. Moreover, the airline's financial difficulties, caused by the Depression, meant it could not simply purchase more aircraft.[26] Thus, Canadian Airways' managers needed to use their existing fleet as efficiently as possible in order to extract maximum profits from the routes that still brought income during the Depression. Management, therefore, began to evaluate its aircraft in these terms. The situation would not flatter the Super Universal.

Re-examining the correspondence surrounding the Fokker Super Universal's initial introduction reveals that efficiency had not been a central consideration. Bush flying called for certain features in an aircraft, particularly versatility, manoeuvrability, range, reliability, convenience, and year-round performance. Though originally conceived as an American transport, the Fokker Super Universal had many of these characteristics. To begin with, the aircraft was versatile. Canadian Airways' Mackenzie traffic would be made of a range of cargos, including fur, prospecting supplies, medical emergencies, and passengers. Thus the airline needed an aircraft that could carry a wide variety of loads, both freight and passengers. Fokker's Universal and Super Universal were designed to achieve this kind of versatility: the seats could be removed to allow the plane to carry large pieces of freight and the designers had included an additional cargo hold for passenger baggage. These features meant the plane was able to carry different types of cargo, an important consideration given Canadian Airways' projected Mackenzie traffic.

26. AM-CALC, MG 11 A 34, Box 5, Correspondence, Thompson to Sigerson, 15 October 1932; Thompson to Sigerson, 13 February 1933; AM-CALC, MG 11 A 34, Box 31, Fairchild Aircraft, Individual Fairchild Aircraft, Sigerson and G.C. Drury to Thompson and Forrest, 15 February 1933; AM-CALC, MG 11 A 34, Box 64, Statistics, Sigerson to Hutchins, 23 February 1933 (Accounting and Statistical Data, All Lines); AM-CALC, MG 11 A 34, Box 37, Mackenzie Air Services Ltd., Thompson to Dickins, 21 February 1934.

When it came to manoeuvrability, bush pilots needed a plane that would enable them to reach difficult locations and that could do so with substantial loads. This was vital if the airline was to offer charter services to prospectors and field parties. Good lift was an essential component of manoeuvrability as it meant the aircraft could get into and out of small lakes, even if fully loaded and the Super displayed solid lift with a rate of climb of 850 feet/minute at sea level.[27] Finally, the pilot and crew needed to be able to load cargo and passengers from awkward shorelines and the Super's high wing meant it could pull up close to northern shores without becoming entangled in the brush.

In the North, range was also crucial in order for the aircraft to span the distances between northern communities and points of call. In day-to-day operations this translated into the ability to fly from fuel depot to fuel depot. Along the Mackenzie these were generally associated with the settlements and were an average of 150 miles apart. The longest stretch between airline stops along the river was the 200 miles between Fort Good Hope and Arctic Red River. These were all distances well within the Super Universal's maximum range of 700 miles or 4 hours flying time. By contrast, the Fairchild FC-2, with a payload of approximately 700 lbs, had a range of 520 miles and the Fairchild 71C, introduced in 1928, had a range of 625 miles.[28] Because Canadian Airways began its Mackenzie service in the absence of competition, the Super's range was initially sufficient.

That said, there were several transport options for those who wanted to enter the North. Individuals and small groups continued to use canoes and smaller boats equipped with outboard motors. These were flexible methods of transport, allowing one to reach deep into the interior. However, these routes required difficult portages and limited the amount of supplies one could carry. For larger loads, there was an established network of larger river boats. While these river barges could carry much more freight than the aircraft, they did so much more slowly. In winter, however, these water-borne methods were denied to the traveller. With the rivers and lakes frozen, the other major alternative to the aircraft, the dog team, could not compete as a freight carrier in either speed, capacity, or cost.[29] Measured against these competitors, the Super Universal's

27. Fokker Super Universal Manual, CF-AAM. By comparison the Fairchild FC-2 had a rate of 580 feet/minute and the Fokker Universal could make 800 feet/minute. The Bellanca Pacemaker could achieve 900 feet/minute. Molson, *Pioneering*, 276, 285, 290.
28. Donald Morrison Bain, *Canadian Pacific Airlines: Its History and Aircraft* (Calgary: Kishorn Publications, 1987), 57.
29. AM-CALC, MG 11 A 34, Box 1, Correspondence, C. Bourget to Western Canada Airways, 2 March 1929.

performance was more than adequate. Aircraft transport was also much easier than overland travel and much more comfortable. Nevertheless, because it offered much greater speed than the other forms of travel, passenger comfort was not as central an issue on the early bush runs. However, as additional competition appeared, both of these factors would become increasingly important.

To promote their services, especially in an environment where the travelling public was still sceptical of air travel, air service operators needed to offer safe, reliable service. In the North, the fact that equipment failure could leave the pilot, passengers, and crew stranded far from a repair shop and perhaps caught in an unfriendly environment added an extra degree of importance to an aircraft's reliability. Making repairs in these circumstances was even more costly than usual, as replacement parts often needed to be ferried to the downed aircraft by plane, which took two aircraft away from regular company business. Thus, reliability was an important feature of Canadian Airways' Mackenzie fleet. Happily, the company's previous experience with the Fokker aircraft indicated they could withstand demanding flying, as demonstrated by their operation on the Hudson Bay airlift and Barren Lands flight.[30] The experience of other bush airlines reinforced Canadian Airways' own evaluation. Between the new design features and the company's successful experience with the earlier Universal, the airline believed it had an aircraft that would enable it to expand down the Mackenzie River and into the Northwest Territories.

In general, the Fokker Super Universal had the attributes necessary to a northern workhorse: a substantial payload, good speed and range, and versatility. Furthermore, it had demonstrated its reliability on Canadian Airways' 1927 Hudson Bay freighting contract and C.H. Dickins' 1929 Barren Lands flight, as well as on less spectacular routine flights in northern Manitoba and Ontario. With the requirements of bush flying in mind and given the evidence of the Super's previous northern performances, it seemed a reasonable choice to use the aircraft to establish Canadian Airways' Mackenzie service. However, four years later in the new framework of economic pressures, aerial competition, and extended routes, efficiency became the watchword for Canadian Airways. Within this new environment, the Super Universal would be judged inadequate.

Canadian Airways' rates were calculated based on an average gross load of 1200 lbs per flight.[31] Achieving this load in the Super Universals

30. Looking back, W.J. McDonough recalled the Super Universal as "reliable and steady but slow." NAC, R 2383-0-5-E, Arthur George Sims Fonds, W.J. McDonough, "Canada's Aircraft Industry," Address to Canadian Section, Society of Automotive Engineers, Toronto, 15 November 1944.

31. AM-CALC, MG 11 A 34, Box 5, Correspondence, Thompson to Sigerson, 11 January 1932.

operating along the Mackenzie River was difficult. In order to allow these aircraft to carry 1200 lbs, pilots had to reduce the amount of gas carried. This in turn meant refuelling at each stop. However, the unbroken stretch between Fort Rae and Great Bear Lake on the eastern route to Great Bear was too long for anything less than a full tank. With the gas required for the journey, Super Universals used on this leg could carry only 800lbs of cargo.[32] With the reduced cargo capacity, Canadian Airways obtained a smaller profit on these loads as the operating cost per pound of freight was higher.

In the summer, the Supers' performance was even worse. When equipped with floats, the maximum payloads of the four Super Universals in the Mackenzie fleet ranged between 560 lbs and 725 lbs. Eliminating the engineer or mechanic, who usually accompanied the pilot as flight crew, increased the payload by a maximum 195 lbs. By comparison, the Bellanca Pacemakers in the fleet could carry 900 lbs. Dickins' assessment was that the Super Universals could not carry an efficient load on floats in a region where the average trip was at least 150 miles and called for nearly full tanks of gas. Thus, he judged the planes unsuited to the Mackenzie and better suited to districts were short trips where the norm and a pilot the only crew required. Instead, Dickins wanted to replace his Fokkers with Bellanca Pacemakers, because of their higher payloads and ability to manage the greater northern distances, and Fairchild FC-2W-2s, with their good float performance and payload of 1200 lbs on floats.[33]

The Super Universal's value further diminished in the eyes of Canadian Airways' Mackenzie managers when it became apparent that faster machines were more economical to operate over the long distances. The quicker aircraft produced cost savings because they allowed the company to make more trips within a given period of time, thereby bringing in greater revenue. Although of the same era as the Fokkers, with their 300 hp Wright Whirlwind engines, the Bellancas had a cruising speed of 140mp (compared to the Super Universal's 118 mph), in addition to their greater cargo capacity.[34] While originally overlooked, these considerations had achieved new significance in a context where the competition for traffic was increasing and rate-cutting was an issue.

Given that competition and rate-cutting were Canadian Airways' main concerns, one of the most important points of evaluation was cargo capacity. Since the airline could not afford to purchase new aircraft, the

32. AM-CALC, MG 11 A 34, Box 5, Correspondence, Dickins to Thompson, 9 January 1933.
33. AM-CALC, MG 11 A 34, Box 42, Edmonton and McMurray Base Correspondence, Dickins to Thompson, 13 January 1933.
34. AM-CALC, MG 11 A 34, Box 42, Edmonton and McMurray Base Correspondence Dickins to Thompson, 13 January 1933; AM-CALC, MG 11 A 34, Box 5, Correspondence Thompson to Sigerson, 17 March 1933.

managers evaluated the Fokker Super Universal against the other bush transports already part of its fleet, namely, Bellanca Pacemakers, Fairchild 71s, and Junkers W 33/34s. Like the Super Universal, these aircraft were all mid-sized transports developed in the second half of the 1920s. However, all three offered higher payload capacities than the Super.

The W 33/34 presented the sharpest contrast. While older, slower, and possessed of a shorter range, the W 33/34 was capable of carrying between 2 and 3 times more payload than the Super Universal. The Fairchild 71 was also slower than the Super, but it too had a higher payload capacity. The smaller Bellanca had a higher payload, faster cruising speed, and longer range, despite having a weaker engine. Although the Super Universal was faster than the W 33/34 and the 71, and had a longer range, the Mackenzie District's context encouraged Canadian Airways to value payload capacity most highly. A higher payload meant the company could handle more of the cargo available and could maximize profits from each pound of freight. In other words, payload translated into profits. Since the Super Universal had the lowest payload capacity, company management judged it outmoded (see table 2).[35]

Table 2. Comparative Performance Figures.

	First Flight	Payload	Power	Speed	Range
Fokker Super Universal	1928	750 lbs	400 hp P&W Wasp	118 mph	700 miles
Bellanca Pacemaker	1928	1050 lbs	300 hp Wright J-6 Whirlwind	140 mph	850 miles
Fairchild 71	1928	1025 lbs (float) 1365 lbs (skis)	425 hp P&W Wasp C	102 mph (float) 110 mph (skis)	650 miles (float) 750 miles (skis)
Junkers W33/34	1926	1608 lbs (float) 2125 (skis)	400 hp P&W Wasp	100 mph (float) 108 mph (skis)	490 miles (float) 530 miles (skis)

Payload and performance, however, were not the only fronts of comparison. With greater competition, the company began to see passenger comfort as significant. For instance, in 1932 W.E. Gilbert, one of the Mackenzie pilots, commented that compared to the better insulated

35. AM-CALC, MG 11 A 34, Box 5, Correspondence, Dickins to Thompson, 13 January 1933.

and heated Fairchilds, the Fokkers were uncomfortably cold in the winter. While this difference might not have caused much discomfort on other routes, Gilbert commented,

> Passengers dressed for ordinary Winter travel are not likely to experience much discomfort even in under-heated machines in flights of less than an hour's duration… The average flight in this District over a year's time is in excess of 50 minutes duration, while the usual 'legs' in our 'through' traffic to Great Bear Lake are all in excess of 2 1/2 hours (McMurray to Fitzgerald: Fitzgerald to Rae: Rae to Cameron Bay). Conditions of cold or cramped sitting which may be endured for an hour are much aggravated when met for 8 hours in one day, in stages of 2 1/2 hours each.

While Canadian Airways' flights in other bush districts averaged, at most, 79 miles, the average flight distance along the Mackenzie was 150 miles.[36] Gilbert went on to say,

> I do not think that the Company has ever given enough thought to the psychological effect of petty discomforts on the passenger's general attitude toward the Company, especially when the passenger happens to be an important customer for freighting.[37]

Gilbert's comments highlight changing passenger expectations and, at the same time, point out the impact of changing geography on passenger experience. His assessment was apparently confirmed by G.A. Thompson, who noted in 1933 that the company was receiving a growing number of complaints about the discomfort of its bush services in comparison to the services available on southern trunk lines.[38]

Closer to home, Mackenzie Air Service's aircraft presented a study in passenger comfort. In December of 1932, Gilbert reported that Brintnell's airline had introduced a Super retro-fitted with "an exceptionally good heating system, a toilet, and a lot of other 'frills', which, while they don't mean much in fact, are going to be the means of causing the passengers that ride with him to find ground for a great deal of comparisons unfavourable to our equipment."[39] Brintnell reinforced this unflattering contrast by broadcasting "a considerable amount of very sarcastic criticism" of Canadian Airways' aircraft.[40] The concern for Canadian Airways' managers was how to respond to this assault.

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36. AM-CALC, MG 11 A 34, Box 60, Statistics, "Winter Season December 1, 1929–April 30, 1930," [ca. May 1930].
37. AM-CALC, MG 11 A 34, Box 5, Correspondence, Gilbert to Thompson, 29 Dec. 1932.
38. AM-CALC, MG 11 A 34, Box 5, Correspondence, Thompson to Sigerson and Dickins, 7 March 1933.
39. AM-CALC, MG 11 A 34, Box 5, Correspondence, Gilbert to Thompson, 29 Dec. 1932.
40. AM-CALC, MG 11 A 34, Box 14, Airmail, Great Bear–Resolution, Dickins to Thompson, 13 April 1933.

Dickins proposed replacing two Supers with two Junkers as a means of counter-acting perceptions of the fleet as weak and outdated in the hope that placing the Junkers, with their metal skins, greater payloads, and more powerful engines, alongside Brintnell's aircraft would highlight the inadequacies of the competition's machines.[41] The airline also created a special passenger service that ran between Fort McMurray and Great Bear Lake. The company wanted this to be a deluxe service that had "every comfort possible… provided for passengers in an endeavour to give them a speedy and comfortable service."[42] In addition to comfort, speed was another important consideration. Thompson felt that a higher speed would reduce the time passengers spent in the plane, minimizing their discomfort.[43] This special passenger service used Bellanca and Fairchild aircraft exclusively and the company sought to confine freight to other machines as much as it possibly could.

This decline manifested itself in another way: the Super's apparent age became a sticking point as company officials became interested in the aircraft's newness. Gilbert noted that the machines' structures were deteriorating under the constant pounding they received on northern operations and believed the deterioration would only increase as the aircraft's metal aged.[44] Both Joseph Corn and Eric Shatzberg discuss in detail the place of progress ideologies in the history of aviation, pointing out the close association between aviation and ideas of progress.[45] In particular, Schatzberg argues that the 1931 crash of a wooden winged Fokker trimotor spelled the end of Fokker's aircraft in the American passenger airline industry. Although this event likely influenced American airlines' fleet choices, there is no evidence that it had any direct bearing on Canadian Airways' fleet composition. That said, it may have contributed to the management's perception of the Fokker Super Universal as outmoded. From Canadian Airways manager's comments, it appears that at least some concern about modernity had penetrated the Canadian North. The desire for new aircraft and a willingness to equate new or new-looking machines with better technology had definite echoes of the cultural links between technical newness and progress which Corn

41. AM-CALC, MG 11 A 34, Box 14, Airmail, Great Bear–Resolution, Dickins to Thompson, 13 April 1933.
42. AM-CALC, MG 11 A 34, Box 5, Correspondence, Thompson to W.A. Scott and Sigerson, 18 February 1933.
43. AM-CALC, MG 11 A 34, Box 5, Correspondence, Thompson to Sigerson, 17 March 1933.
44. AM-CALC, MG 11 A 34, Box 5, Correspondence, Gilbert to Thompson, 29 Dec. 1932.
45. Joseph J. Corn, *The Winged Gospel: America's Romance with Aviation, 1900-1950* (New York: Oxford University Press, 1983); Shatzberg, *Wings of Wood, Wings of Metal*.

and Shatzberg identify. These associations and management's perception of the public's preferences encouraged the administrators to re-evaluate the Super Universal's suitability for the Mackenzie. Thus, Canadian Airways sought to respond to the perceived demand for modernity their by reconfiguring the Mackenzie District's fleet composition and substituting Fairchilds, Bellancas, and Junkers for the Fokkers. Though of the same age as the Supers, these aircraft avoided its Spartan discomfort and dated appearance.

Conclusion

These considerations, payload, efficiency, comfort, and newness, prompted Canadian Airways' managers to revise their assessment of the Super Universal. By 1933, in their opinions, it was no longer the aircraft best suited to the Mackenzie and the company began withdrawing the aircraft from the district and by the end of 1933, only one Super Universal remained in Canadian Airways' Mackenzie fleet. Looking behind these events reveals that this was not simply an instance of a newer model replacing an older, outdated one. Instead, the Super Universal's decline and replacement was the result of a multifaceted set of historical circumstances. First, the discovery of radium on the eastern shores of Great Bear Lake created a prospecting rush and altered the geography of aviation in the Mackenzie District. By establishing a new destination, the formation of mining camps encouraged Canadian Airways to develop new regular air routes that necessitated longer flight distances.

Unfortunately for Canadian Airways, this rush also supported Canadian Airways' new competition, Mackenzie Air Services. Competition was an issue because the economic conditions of the Great Depression made Mackenzie District traffic essential to Canadian Airways' health. Mackenzie Air Services' willingness to overload its aircraft in order to be able to charge much lower rates further complicated the situation. Prevented by geography from having weight regulations enforced in the North, Canadian Airways focused on maximizing the efficiency of its own operations in order to maximize its profits from the lower rates it was forced to charge in order to compete with Mackenzie Air Services. Given the new emphasis on efficiency, particularly on payload, and the inability of the Fokker Super Universal to carry the necessary loads of cargo over the longer distances required to reach Great Bear Lake, the Fokker Super Universal's suitability for the Mackenzie seemed much less certain. These distances also highlighted the discomfort of passengers flying on Supper Universals in winter. At the same time, the economic situation meant Canadian Airways needed to secure as much of the Mackenzie traffic as

possible. By 1933 the Super's faults became significant enough that Canadian Airways retired the aircraft from the district. Beneath the details of payload and speeds, what this case study reveals is not just the deep connection between historical circumstances and users' evaluations of technologies' value. It also highlights the significant role of geography in the history of Canadian aviation and points to the importance of considering physical geography in the history of technology more generally.