A "radically new method": balloon buoy communications of the Baldwin–Ziegler Polar Expedition, Franz Josef Land, June 1902

P.J. Capelotti

Division of Social and Behavioral Sciences, Pennsylvania State University, Abington College, Abington, PA 09001, USA

Keywords
Franz Josef Land, Alger Island, aeronautics, archaeology, balloons, Baldwin–Ziegler

Correspondence
Division of Social and Behavioral Sciences, Pennsylvania State University, Abington College, Abington, PA 09001, USA. E-mail: pjc12@psu.edu

doi:10.1111/j.1751-8369.2008.00045.x

Abstract

The history of lighter-than-air operations in the Arctic between 1896 and 1930 has focused almost exclusively upon four expeditions. These are the balloon voyage of the Swede Salomon Andrée in 1896–97, and the dirigible expeditions of the American Walter Wellman in 1906–09, the Norwegian Roald Amundsen with the Italian Umberto Nobile in 1926 and the Nobile expedition of 1928. Largely invisible in this lineage are the aeronautical operations of the Baldwin–Ziegler Polar Expedition on Alger Island in the Franz Josef Land Archipelago in 1902. This article traces expedition leader Evelyn Briggs Baldwin's interest in aeronautical exploration in the Arctic, which began early in life, led to a failed attempt to join Andrée in 1897 and culminated in his use of message buoys attached to balloons in June 1902. These operations, the fate of its balloon buoys and the historical archaeology of Baldwin's operational bases in Franz Josef Land and north-east Greenland are examined. Baldwin's poor planning and bad luck with ice conditions around Franz Josef Land caused him to use his balloon buoys not to reach northwards to the pole, but to send relief messages southwards towards civilization. Like the other polar aeronautical expeditions, Baldwin's left behind a significant archaeological assemblage that continues to provide evidence for the material analysis of the history of polar exploration.

Evelyn Briggs Baldwin (Fig. 1) was born in the American Midwest in 1862, and as a post-graduate travelled widely, first on a year-long tour of Europe and then throughout the American West. Near the end of his life, he tried to explain the motives for his career in exploration to a lecture audience:

> [During] my boyhood days . . . on a western farm I chanced to find a three line advertisement which read "*10,000 miles in a balloon* for 10 cents, address such and such a company." I entrusted my little 10 cent piece to the mail and sure enough in the next few days I received "*10,000 miles in a balloon*."
>
> *10,000 miles in a balloon* was an appeal to the imagination . . .
>
> This happened about the same time that people were talking about Simm's [*sic*] Hole. Simm's hole was the possible location of a point where the waters of the Arctic Ocean flowed into the earth, or the North Pole.
>
> Therefore, my interest in life became two-fold. Aviation and Polar investigation. (Baldwin 1930)

Assuming that Baldwin read his ballooning pamphlet as a 10-year-old boy, the year would have been 1872. By this time, the ideas of the Ohio theorist John Cleve Symmes—that the Earth was hollow and made up of concentric spheres that could be explored through holes at both poles—had been thoroughly discredited for more than half a century. If the idea was discussed at all, it was with the derisive nickname "Symmes's Hole" (*New York World*, 1896).

This was also the same time period when Thomas Scott Baldwin (who may have been a cousin of Evelyn Briggs Baldwin) was making his first ascents in balloons on the county fair circuit across the US Midwest. Thomas Scott Baldwin went on to become an internationally recognized balloonist, parachutist, dirigible pilot and heavier-than-air pilot (Scamehorn 1957: 10–12). In 1901, it was to Thomas, and Thomas's two brothers, that Evelyn

Mr. Baldwin.

OFFICERS AND CREW OF THE "AMERICA," TAKEN AT DUNDEE JUST BEFORE SAILING.

Fig. 1. Evelyn Briggs Baldwin (centre, left) and his crew on board the steamship the *America* in Dundee, prior to the expedition (from Baldwin 1901a).

Briggs Baldwin would turn for the messenger balloons he would use in the Arctic—and for his first ascent in a passenger-carrying balloon.

After his youthful travels, Baldwin found work as an assistant observer for the US Weather Bureau and later as an inspector with the US Army's Signal Corps. Baldwin used his experience as a meteorologist to gain membership in Robert Peary's second expedition to North Greenland, where he kept notes on weather and aurora phenomena from 3 August 1893 to 1 August 1894 on the shores of Bowdoin Bay. For reasons that are not clear, Baldwin fell out with Peary, and nursed a grudge against him for more than 20 years.

Seeking to raise money for his own polar expedition, in 1896 Baldwin published *The search for the North Pole*, a long fund-raising tract woven into a treatise on Arctic exploration. The penultimate chapter of Baldwin's book described the just-announced polar balloon expedition of the Swedish engineer Salomon A. Andrée. Andrée proposed to use drag lines and sails attached to an otherwise free-floating hydrogen balloon in order to "guide-rope" it from Svalbard to the North Pole. He had announced his intentions before the Royal Swedish Academy of Sciences in February 1895, and soon found an enthusiastic group of financial patrons in Sweden. Outside of his native country, however, the Swede was met by a less fulsome reception. As Jennifer Tucker points out in her analysis of the career of the British balloonist James Glaisher, attempts to transform the balloon into a kind of flying scientific laboratory during the half-century after 1840 were fraught with dangers that were by turns theoretical, practical, cultural and even spiritual. "Many who commented on the 'balloon craze' in Regency and Victorian England expressed tremendous moral ambivalence about balloon ascensions, symbols not just of discovery, innovation, and exotic travel, but of excited crowds, riots, humbuggery, French decadence, reckless endangerment of passengers and spectators, and the loss of reason and moral propriety" (Tucker 1996: 146).

Andrée suffered from some of this same scorn for his project. "This Mr. Andrée," wrote an Austrian paper, "who wishes to go to the North Pole and back by means of an air balloon, is simply a fool or a swindler" (Swedish Society for Anthropology and Geography 1930: 38). Such comments, along with the obviously fantastical aspects of a scientific balloon expedition, especially in the Arctic, had the effect of making any such proposed expeditions seem eccentric, if not outright insane. In the case of Andrée, they also obscured for more than a century the real and dramatic transformation in polar technology he had wrought. In Wråkberg's (1999a: 67) analysis of Andrée's flight, he writes that previous polar expeditions had struggled over the ice at a rate of barely 5 km per day, whereas Andrée's balloon—in the first hours after it was launched on 11 July 1897—had covered this distance every 5 minutes and 30 seconds.

In the summer of 1896, Andrée had built an elaborate base camp on Danskøya (Danes Island) in north-west Svalbard, complete with a large-scale apparatus for making hydrogen gas in the field. When hoped-for

southern winds did not materialize, Andrée postponed the expedition to the summer of 1897. Baldwin entered into a one-sided correspondence with Andrée in the fall of 1896, as Andrée prepared to return to Svalbard the following year. Andrée's two brief responses to Baldwin—bluntly stating that there was no place for him in the expedition—did not dissuade Baldwin in the summer of 1897 from trying to reach Andrée's base camp on Danskøya. He apparently intended to talk his way into the car of Andrée's balloon, *Örnen*, offering his skills as a meteorologist for qualifications.

When Andrée's balloon disappeared into the Arctic in July 1897, its whereabouts became an international mystery. Baldwin, who arrived at Andrée's launch point a few days after the expedition lifted off, began to claim that had he arrived in time he would have been in the basket of the balloon with Andrée and shared his fate. This story, which claimed a relationship to the expedition that did not exist, became an integral part of Baldwin's resume as an explorer. Despite Andrée's curt responses to his attempts to join the balloon—the kind of routine dismissals employed by all organizers of expeditions—Baldwin, to the end of his life, insisted that only his late arrival at Danskøya prevented his participation in the expedition. (For some of the various versions Baldwin told of this story, see Capelotti [2006: 157–159].)

His failure to join the Andrée balloon expedition, combined with the harsh economy of 1896–97 that curtailed both his travel and fund-raising, led Baldwin to join Chicago journalist Walter Wellman's 1898–99 expedition to Franz Josef Land (Baldwin 2004). This expedition started its work with a search for the missing Andrée. When this was unsuccessful, Wellman then entrusted Baldwin with the construction of an advance camp, from where a "dash" to the North Pole would be staged in the spring of 1899.

Baldwin's failed leadership of this advance journey led to a falling out with Wellman, and the following spring, after Wellman's attempt at the pole ended off the east coast of Rudolf Island, Baldwin was given a sideshow journey to explore the eastern edges of the archipelago. In the ensuing sledge expedition Baldwin discovered Graham Bell Island, the only significant result of the expedition (Capelotti 2006). Baldwin would later use this experience, as well as his attempt to join Andrée, in a successful effort to convince American business magnate William Zeigler to finance a new polar expedition with Baldwin as leader.

The Wellman expedition of 1898–99 was the first of three American expeditions that attempted to reach the geographic North Pole from Franz Josef Land between 1898 and 1905. Each went to extraordinary and expensive lengths to reach the pole, but none ever travelled out of sight of the archipelago. Beyond the discovery of Graham Bell Island in 1899, and some further delineations of the complex geography of the Franz Josef Land Archipelago, the three American expeditions accomplished little. Of all three expeditions, the Baldwin–Ziegler Polar Expedition of 1901–02 stands out as both the greatest opportunity for Americans to reach the pole and as a bizarre and largely unexamined failure. And nowhere was it stranger than in the operations of Baldwin's "Aeronautical Section" in June 1902. Unlike John Cleve Symmes and the many other theorists who speculated about the nature of the North Pole and how to explore it, Baldwin actually brought his ideas of Arctic communications into the field. The system failed in its objective to summon relief to the expedition. But, in seeding the Arctic with hundreds of message buoys, it ensured that Baldwin would return to the columns of newspapers each time one of the buoys was discovered. Such discoveries would continue for 30 years, almost until Baldwin's death.

The polar balloon prior to the Baldwin–Ziegler Expedition

Fridtjof Nansen considered the use of captive balloons flown from the deck of the *Fram* prior to his 1893–96 expedition, but rejected the idea on account of the cost and weight of the required cylinders of hydrogen (Berson 1896). With hydrogen-filled cylinders being prohibitively expensive, Andrée's expedition produced its hydrogen in the Arctic, using a process that had remained essentially unchanged for more than a century (Capelotti 1999a: 145–161; 1999b). This method, known as the "vitriol" or "acid-metal" process, was used almost exclusively for the generation of hydrogen until the First World War, when cheaper and more direct electrolytic and steam contact processes became the norm. Andrée arranged for such an apparatus to be delivered to Virgohamna (Virgo Harbour), Danskøya, that would combine zinc and sulphuric acid to produce hydrogen gas. The process had to be fairly simple, as workers skilled in producing hydrogen that would or could also join an expedition to the Arctic were few (Lundström 1988: 62).

Andrée had filled his balloon using this method in 1897, and then disappeared over the polar ice pack. The expedition took place at the start of a technological transformation in Arctic exploration. It has even been argued that the Andrée expedition was the vanguard of this transformation (e.g., Wråkberg 1999b). Whereas Fridtjof Nansen could only report progress of his 1893–96 expedition across the Arctic on the research vessel *Fram* after he returned home, Andrée sought to communicate news of his expedition while it was underway. To accomplish

this task, Andrée picked two methods: carrier pigeons and cork buoys. Both could be fitted with messages and released from the car of the balloon, the birds flying back to Sweden and the buoys being dropped to the polar ice pack where they could drift out of the Arctic to be picked up by fishing boats. Thirty-two carrier pigeons were placed in baskets under the balloon's carrying-ring and several buoys were also carried. The relative speed of his chosen methods of communication was dramatically illustrated just four days after launch when one of the carrier pigeons was shot by the captain of a Norwegian vessel. The pigeon carried a note from Andrée reporting that at 12:30 on 13 July 1897 the *Örnen* was at 82° 02′ N.

No word of the expedition appeared for two years thereafter, when the skipper of another Norwegian vessel found Andrée's "polar buoy" on the coast of Kongsøya, an island in the Kong Karls Land group, eastern Svalbard, and about 160 km from Andrée's launch point.

In a bizarre variation of Andrée's balloon operations, an Italian polar expedition led by Luigi Amadeo of Savoy, the Duke of the Abruzzi, in 1899 proposed using small balloons to lift his sledges off the ground so that they would be easier for the sledge dogs to pull. More than 5% of the expedition's budget had been spent in developing this "aeronautic outfit" (Savoy 1903: 36) at the Duke's advance expeditionary base at Teplitz Bay on Rudolf Island in northern Franz Josef Land.

As Wellman retreated from Franz Josef Land in the summer of 1899, Luigi Amadeo was just arriving in the archipelago. The two expeditions met, and Wellman and his team rowed over to Amadeo's ship, the *Stella Polare*, and it may have been then that Baldwin learned of the Duke's plans to use hydrogen balloons on his way to the pole (Wellman 1911: 117–118). Added to his existing fascination with Andrée's expedition, this would have only fueled Baldwin's determination to return north with an "aeronautic outfit" of his own. The Duke's balloon plan had already aroused much comment, with an article commenting that "[g]reat interest is being taken in the possible results to be arrived at by the use of the two balloons, which the party is taking with them" (*New York Times*, 28 May 1899).

On 25 April 1900, the Italian expedition outdid Fridtjof Nansen's farthest north of 86° 14′ N by 32 km, establishing a new farthest north of 86° 34′ N (Savoy 1903: 491–492). Prior to this, the *Stella Polare* was almost wrecked in Teplitz Bay. During the fight to save the ship from sinking, the steel hydrogen generating apparatus was dragged ashore and the balloon experiment abandoned. Given that Baldwin's later inflation of his slightly larger balloons on Alger Island only produced an average net ascension force of 46.93 lb (21.28 kg) (Rilliet 1902a: Reference Sheet), the Duke's balloons would not have made much difference in lightening the load of his 13 sledges, each of which carried over 500 lb (226 kg) of food and equipment (Tenderini & Shandrick 1997: 59).

As with the hydrogen generating apparatus of Andrée on Danskøya, the steel generator of the Italian polar expedition was left behind on Rudolf Island. The third American expedition to Franz Josef Land found it there in 1903, and made use of it as a steam boiler when their ship sank in Teplitz Bay in January 1904 (Fiala 1906: photograph facing p. 75).

As the Italians made their way back to mainland Europe in 1900, Baldwin announced that he had been in contact with Ernst Andrée, who revealed that several expeditions were heading north in search of his lost brother (*New York Times*, 8 July 1900). Baldwin was eager to join them in the search, so as to add his own chapter to the early history of aeronautics in the Arctic and solve the mystery of the Andrée expedition at the same time. "At this very hour," Baldwin dramatically told a reporter "several of [Andrée's] buoys may be lying on the shores of the Atlantic or floating on its waves or be within the course followed by the *Fram*, Dr. Nansen's famous ship, buried in the sea or sands awaiting liberation. I firmly believe that discovery will reach us this summer, and that we will have news of the lost explorer, living or dead, and of the missing balloon" ([Chicago] *Times*, 4 July 1900).

In the summer of 1900, at the age of 38, Baldwin finally tied together all of his personal fascinations into one great romantic quest (Fig. 2). All he required was an open-handed millionaire to make his dream come true.

Preparations, 1900–1901

As if on cue, soon after his return from the Wellman expedition, Baldwin met William Ziegler, who had made a fortune over the previous 30 years in the baking soda market. Ziegler himself was too old for the expedition. But he possessed a firm belief that there was no problem, from baking soda to polar exploration, which could not be solved by American capital. He pledged to spend a million dollars in pursuit of the North Pole. As Baldwin wrote, Ziegler offered him "unlimited means to carry out my plans" (Baldwin 1901a: 59) (Fig. 3). In the end, by his own accounts, Baldwin would use $142 000 of Ziegler's money (see Anonymous n.d.). For all this, he would advance no closer to the pole than Wellman had in 1899.

In news interviews after his arrangement with Ziegler, Baldwin was reluctant to offer many details of the expedition beyond its near-limitless financial resources. This was too much for reporters, especially at a time when the plans of polar explorers made regular appearances on the

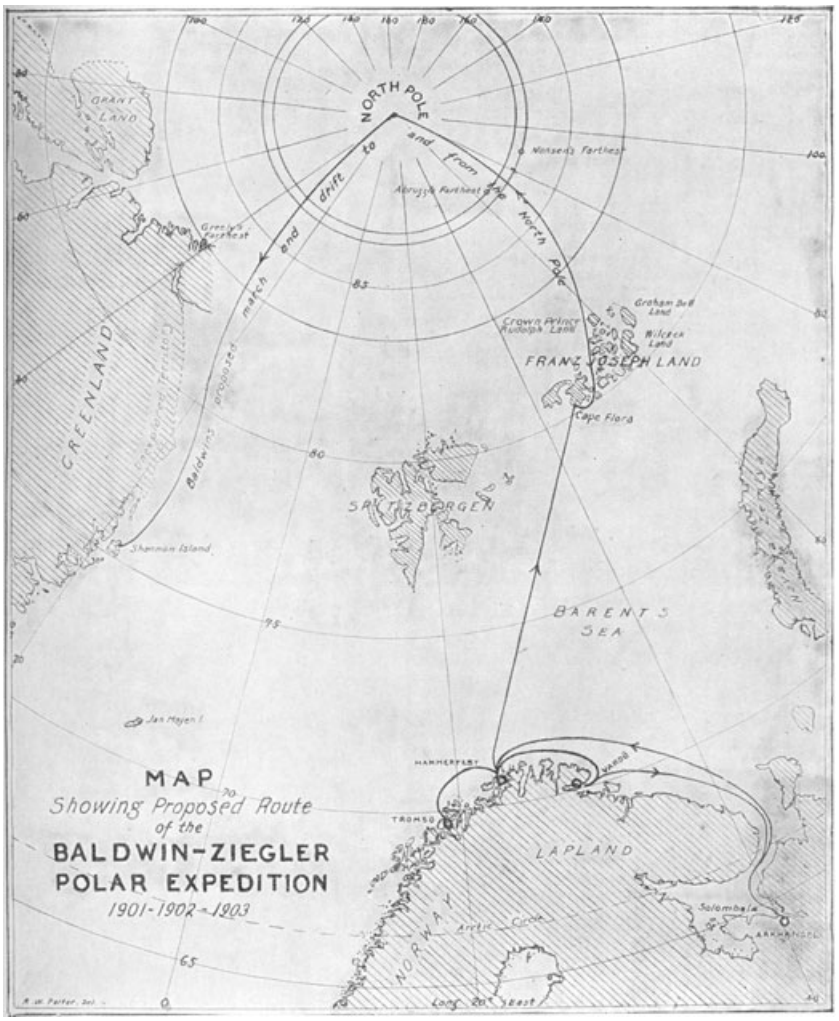

Fig. 2. Baldwin's proposed expedition route, showing the *America*'s sail from Tromsø to Franz Josef Land, the sledge route from Franz Josef Land to the North Pole and the retreat from the pole to the relief station emplaced at Shannon Island off the eastern coast of Greenland (from Baldwin 1901a).

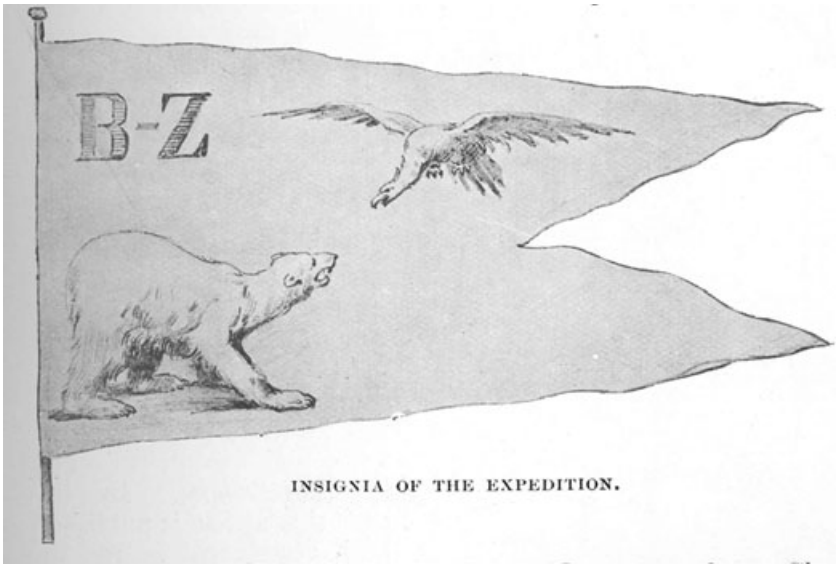

Fig. 3. Pennant of the Baldwin–Ziegler expedition, perhaps symbolizing Baldwin's conception of dual ground–air operations (from Baldwin 1901a).

front pages of major newspapers, where "the public could be intoxicated by exciting reports about heroic struggles to master nature, particularly in what were perceived as her most dangerous environments, Africa and the Arctic" (Riffenburgh 1993: 196). Predictably, such reticence led reporters to draw their own conclusions. "The impression created by this secrecy is that Mr. Baldwin will resort to some radically new method" ([Chicago] *Times–Herald*, 1 November 1900). In 1900, there were only two such potentially "radically new methods" available to polar explorers. The first was under the ice, with a submarine, as was proposed as early as 1901 by a German engineer by the name of H. Anschutz-Kampfe. The other was through the air, in a balloon.

By the end of 1900, Baldwin was liberally using Ziegler's accounts to secure supplies and ships for the expedition. But as for any possible aeronautical element to his plans, Baldwin would only offer vague hints. He was clearly trying to conceal the scope of his aeronautical ambitions in the Arctic (and perhaps his own lack of training to carry out any such plan). In the middle of his buying spree, Baldwin found little time for practical testing and orientation. A gasoline-powered launch was not tested before the expedition, even though the friend Baldwin purchased it from all but begged him to visit the company so he could "spend a few hours in showing him how to run the launch to the best advantage possible" (Sintz 1901). This appeal was written less than a month before the expedition sailed for Europe.

Baldwin fended off questions about whether balloons would be used on his own expedition, while at the same time obliquely confirming it. "I don't care to say anything about my experience as a balloonist or whether balloons will be employed in conjunction with the steamers" ([Chicago] *Times–Herald*, 1 November 1900). His reluctance to address his experience as a balloonist was understandable, as he had none, very much unlike his hero S.A. Andrée, who had several cross-country balloon flights to his credit before attempting the North Pole flight. Baldwin's first (and only) flight in a balloon would come eight months later, when he made an ascent near St. Louis with the famous aeronaut (and possibly his cousin) Thomas S. Baldwin.

Anxious to avoid any pre-expedition scrutiny of his plans, with their inevitable (and negative) comparisons with Andrée's experience, Baldwin also sought to avoid similar comparisons with Andrée's apparent fate and, with it, the label of "balloonatic". "I will say, however, that the expedition will be practical in every way and the work will be done on practical lines only" ([Chicago] *Times–Herald*, 1 November 1900). This approach put Baldwin in a bind: balloons in the Arctic were his obvious fascination, yet he could not talk about his foremost obsession if he was to avoid both scientific scrutiny of his research plans, and potential editorial scorn of his lack of aeronautical experience.

In early January 1901, Baldwin was in Göteborg, Sweden, visiting Ernst Andrée "regarding the researches of the forthcoming expedition" ([Elizabeth, New Jersey] *Journal*, 8 January 1901). These "researches" included a continuation of the search for Ernst Andrée's brother. Back in New York in May, Baldwin made a round of farewell dinners. The *New York Times* announced that Baldwin would in fact be searching for Andrée, especially considering "the narrow escape I had from sharing his fate . . . Our crew will include a number of Swedish sailors who have at various times served on expeditions sent out for his relief" (*New York Times*, 17 May 1901).

Baldwin made a last-minute visit to relatives in the Midwest in early June. It was only at this moment that he called on his cousins(?), who ran Baldwin Brothers Balloon Company in Quincy, Illinois. On 6 June 1901, after posing for a photograph with Thomas S., Samuel and Ivy Baldwin near their giant balloon, *Mars*, Evelyn Baldwin made the very first (and apparently only) balloon ascent of his life. He then arranged for the shipment of 40 balloons, as well as two hydrogen generators, and a dozen small message-carrying buoys to Norway (Fig. 4). A series of larger buoys, modelled on the buoys used by Andrée, had already been ordered from the Wiklunds Mekaniska Verkstad (Wiklund's Engineering Firm) in Stockholm, Sweden (Rilliet 1902a: 16) (Fig. 5). It is likely that Baldwin had placed his order for these larger buoys during his trip to Sweden earlier in the year, possibly before he knew quite what he would do with them.

Perhaps emboldened by his first taste of aerial exploration, Baldwin let slip some of his plans, albeit in a small local newspaper, the *Princeton* (Illinois) *Republican*. Or perhaps one of his cousins or a worker at their factory leaked the news to the press. In either case, 13 June 1901 stands as the first public notice of Baldwin's plan to combine balloons and message buoys into a single balloon-buoy system. This system, the article made clear, would not be used to explore northwards, but to carry expedition publicity southwards. The unmanned balloons would "mark the path of the expedition. To each will be attached ten [large, Swedish] buoys, hanging one below the other, weighing ten pounds [4.53 kg] each, and arranged with a liberator for detaching the buoys one at a time as they strike the Earth. Each buoy will contain a message, showing the latitude whence the balloon was sent up, and such other word as the explorers care to leave behind" (*Princeton* [Illinois] *Republican*, 13 June 1901). With a total of 40 balloons, 400 large buoys could be set adrift carrying messages of progress from the expedition. The mechanism of the "liberator" (Fig. 6) would

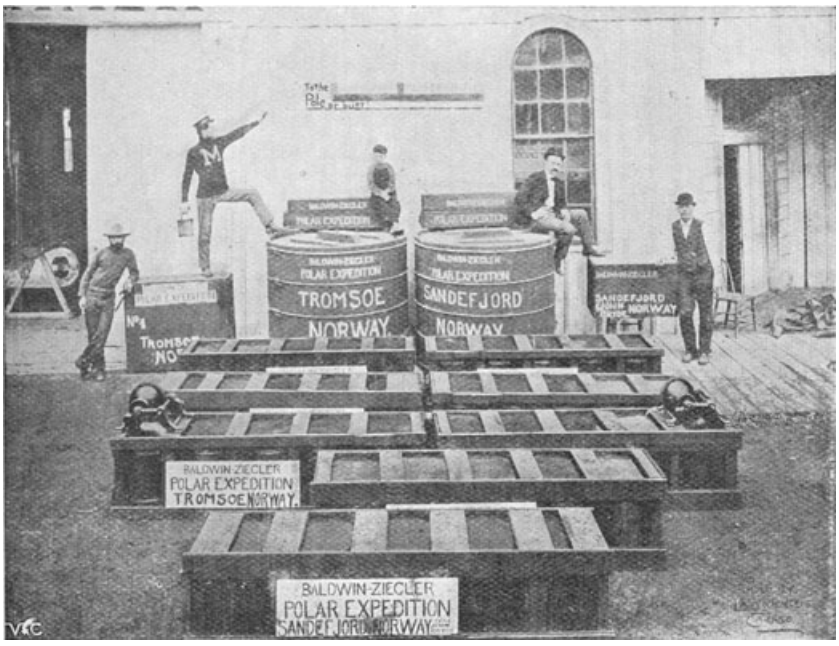

Fig. 4. The expedition's balloons, packed at the Baldwin Brothers factory for shipment to Tromsø and Sandefjord (from Baldwin 1901a).

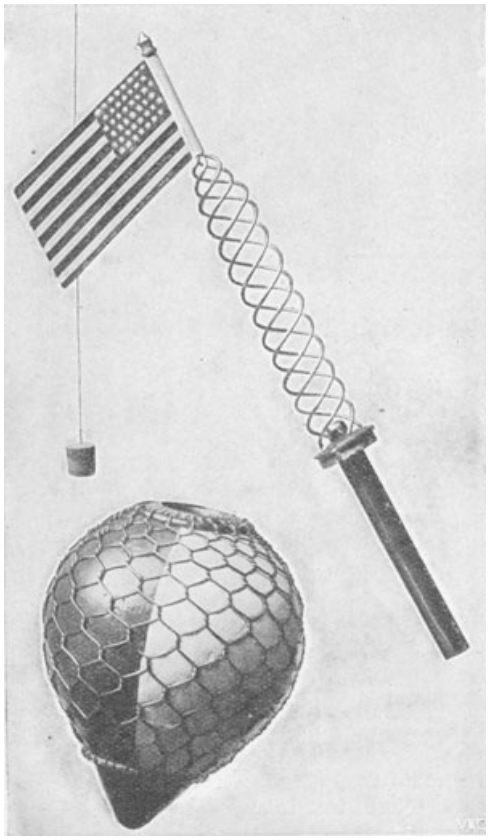

Fig. 5. One of the large Swedish buoys, showing the tube for Baldwin's messages (from Baldwin 1901a).

theoretically distribute message buoys across the Arctic, to be found by the Arctic sealing and whaling fleet, or passenger liners, in the North Atlantic, and their contents would then be delivered back to civilization.

For all of the elaborate care Baldwin took with the balloons, the buoys and with the liberator system, he does not seem to have thought very deeply on the operational barriers to producing hydrogen in the Arctic. The hydrogen generator he ordered from Baldwin Brothers was made of "one and one-half inch [3.81 cm] Louisiana Cypress wood bound with five one-half inch [1.27 cm], round iron clamps or hoops. Its dimensions inside were three feet eleven inches [1.19 m] by four feet nine inches [1.44 m] diameter holding five hundred and nineteen gallons [1964 l]" (Rilliet 1902a: 17). Though this was nothing like the steel generators made for the Andrée and Amadeo expeditions, the size and weight of such an apparatus, not to mention the balloons and buoys, rendered it useless for sending messages from an expedition on the move across the polar ice cap. It could have only been used at a fixed base camp or on board a ship, and then only if Baldwin planned to send back relay teams to his base camp, as Amadeo had done in 1900.

Given Baldwin's recent experience in Franz Josef Land, and his falling out with Robert Peary after the 1894 Greenland expedition (as well as Peary's insistence that no other explorer could use the area of north-west Greenland to stage a polar expedition), Baldwin chose Franz Josef Land for his base camp. Baldwin hoped to establish his camp near the site of the Italian base camp at Teplitz Bay on Rudolf Island, the northernmost land in

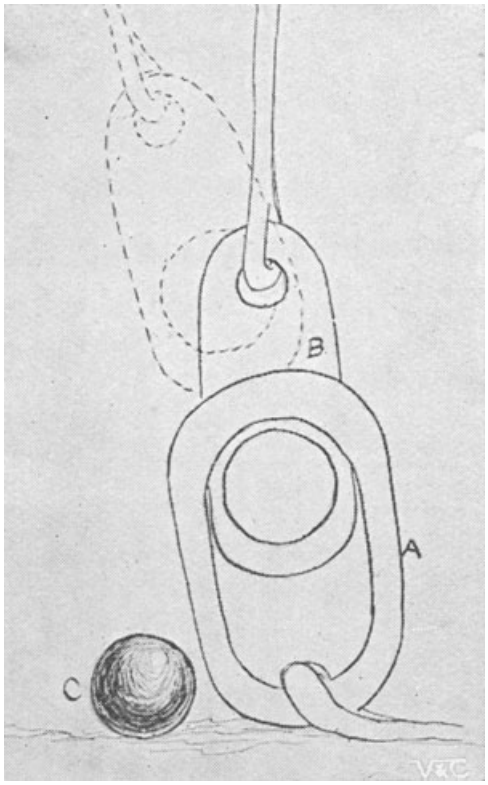

Fig. 6. A sketch of the "liberator" system for releasing the buoys from the communications balloons (from Baldwin 1901a). The liberator was an ellipse of steel with a slot in the top through which slid a disc. This disc in turn had a hole in it large enough to fit a small steel ball, cut with a slot to fit into the ellipse. When a certain volume of gas had escaped from the balloon, the weight of the buoys would pull it down. Once the first buoy touched down, the steel ball holding the disc in place would be released, and the buoy would become detached from the trail of buoys. Freed from this weight, the balloon would regain its buoyancy and begin another ascent (Baldwin 1901a: 62).

Franz Josef Land. (Cape Fligely, the nearby northern point of Rudolf Island, where Amadeo kept watch for his returning sledge teams, would eventually be revealed as the northernmost point of all land in the European Arctic.)

With Nansen having demonstrated the westward drift of polar ice, Baldwin planned to take advantage of this drift by starting his attempt on the pole from Rudolf Island, then retreating south from the pole in a south-westward direction, thereby taking advantage of the ice drift to end his expedition somewhere on the eastern coast of Greenland. (This is essentially the same route that would later be used by the Soviet Union's *NP-1* drift-station expedition from the North Pole to Greenland in 1937.) Baldwin chartered a Norwegian vessel, the *Belgica*, which had just returned from Adrien de Gerlache's 1897–99 Antarctic expedition. As Baldwin, and his main group on board two vessels—a converted Scottish whaling steamer renamed the *America* (Fig. 7) and a Norwegian sailing vessel called the *Frithjof*—established the Franz Josef Land camp, Norwegian skipper Johan Bryde on the *Belgica* would sail for the north-east coast of Greenland, to establish relief depot stations on Shannon Island and Bass Rock (Baldwin 1901b). Baldwin ordered that the stations in both Franz Josef Land and in Greenland be supplied not just with food and shelter, but also with dozens of balloons, message-carrying buoys to be attached to these balloons and hydrogen generators (Baldwin 1901a: 67–68).

Baldwin had also purchased two larger balloons from Baldwin Brothers: these balloons were capable of carrying one observer/photographer aloft (Fawcett 1901: 481–487). Baldwin envisioned these observation balloons as flying from the deck of the *America*, or perhaps even from Cape Fligely, in order to give the team a better look at the pack ice of the Arctic Ocean. Such an operation had been proposed by Arthur Berson in the *Geographical Journal* several years earlier. He had written that a relatively small captive balloon "can raise a car containing one or two persons, and enable them, from a height of say 1600 feet [487 m], to survey many square miles of country" (Berson 1896: 541). Berson thought such an operation, mounted from a ship in the polar region, could be particularly effective. Such an operation was carried out by the British Antarctic explorer Robert Falcon Scott, who used a small observation balloon during the *Discovery* expedition in 1901–04. The method of inflation in this case was gas from cylinders (Fiennes 2003: 58). In late January 1902, first Scott and then expedition member Ernest Shackleton ascended in this balloon, *Eva*, to try to see over the great Ice Barrier and into the heart of Antarctica. Shackleton reached 250-m elevation in the balloon, and even took aerial photographs, but the thick fog, combined with serious technical faults with the balloon and its valves, caused Scott to pack it away as a useless death trap. However, if one could ascend several hundred metres in a tethered balloon on a clear day at Cape Fligely—a dicey proposition on this windy, misty cliff overlooking the vast Arctic Ocean—one could gain a superior view of the sea-ice conditions ahead.

It was not until December 1901, when Baldwin was in the middle of a Franz Josef Land winter and out of contact with the outside world, that the "only announcement to the public of the plans and purposes of the Baldwin–Ziegler Polar Expedition" appeared, in the *Windsor Magazine* in the UK (Baldwin 1901a: 59). Baldwin's choice of a popular journal to detail his plans, rather than the more formal setting of the *Geographical Journal*, is perhaps another indication that Baldwin did

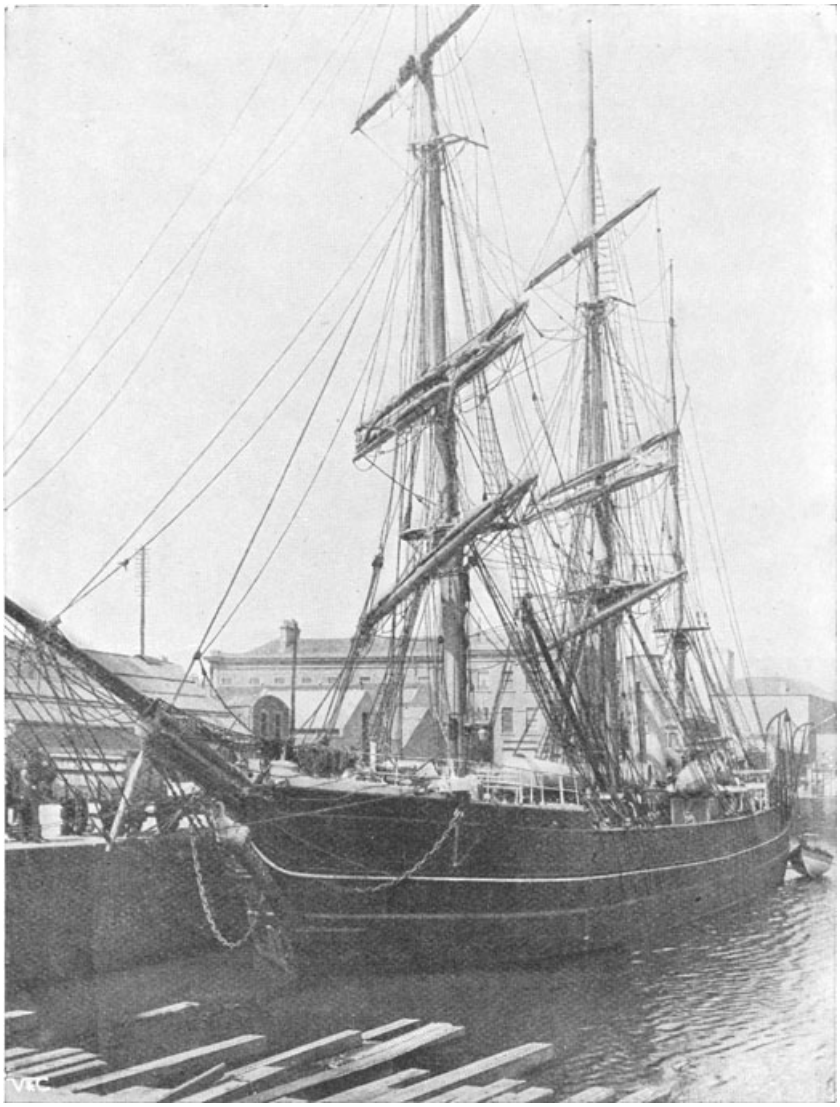

Fig. 7. The *America* moored in Dundee prior to the expedition (from Baldwin 1901a).

not believe the concept could hold up under professional scrutiny. A key component of the expedition was to be the ability to relay news of its progress via message balloons. "No previous expedition to the North has ever made such complete arrangements for the transmission of news back to civilization," Baldwin wrote (1901a: 68).

What Baldwin may or may not have known is that his balloon plans had already been announced in October, in an illustrated article written for the *Metropolitan Magazine* in New York by writer–photographer Waldon Fawcett (Fawcett 1901). Whether Baldwin planted this article or Fawcett scooped Baldwin's *Windsor* piece, the Fawcett article—hopefully entitled "By balloon to the North Pole"—contains several photographs of the balloons under construction and testing, as well as the only known photograph of the passenger-carrying balloon observation car. The car weighed 13 lb (5.9 kg) and was made of "Italian rope and wood" (Rilliet 1902a: 15). The obvious flimsiness of the observation car led "many of his intimate friends, who had supposed themselves conversant with most of the details of the project [to believe] that the plan to include the balloons among the paraphernalia must have been an eleventh-hour decision" (Fawcett 1901). The implication here is that Baldwin also kept these plans from his expedition financier William Ziegler, perhaps out of fear that he might be seen as frivolously using the funds supplied by the hard-headed capitalist.

The reasons given by Fawcett for the use of balloons were also different from that given by Baldwin. Fawcett wrote that they could be used for aerial photography, as well as for scouting the ice conditions ahead, and claimed

that Baldwin would use all 40 balloons "for observations", with the clear implication that these would be passenger-carrying observation balloons. But as we have noted, only two of the Baldwin Brothers balloons were large enough to attach to an observation car. The rest were only large enough to lift the balloon buoys constructed in Stockholm and at the Baldwin Brothers factory in Illinois.

The smaller balloons, Fawcett wrote, would be of value "in determining the direction and velocity of air currents" (Fawcett 1901: 486), which was the first suggestion that the aeronautical project was as much for science as for publicity. In a notable understatement in his otherwise enthusiastic commentary about the new technology, Fawcett noted that the "character of the locality will place some limitations upon the use of balloons in the Arctic" (Fawcett 1901: 485–486).

Baldwin's article in *Windsor Magazine* was almost the reverse of Fawcett's article, suggesting that the two articles were not coordinated. Baldwin includes no mention of using the balloons for passenger-carrying observation operations, and instead focuses on the use of the balloons as unmanned, message-carrying devices. The crated balloons pictured in the *Windsor Magazine* article were addressed to the *Belgica*'s port in Sandefjord, southern Norway, and the rendezvous point for the crew with the *America* in Tromsø, on the Norwegian Arctic coast. "It is intended that some of these balloons will be released at intervals during the Arctic night, and each will be freighted with a number of the news-buoys, containing messages inscribed upon parchment. The buoys will be fastened to a pendant line, one beneath the other" (Baldwin 1901a: 68). Baldwin was as clear as he could be as to the messages that would be contained in these buoys. The expedition "was organized *to reach the Pole*. Neither scientific research, nor even a record of 'Farthest North', will suffice; only the attainment of that much-sought-for spot where one can point only to the south can satisfy our purpose" (Baldwin 1901a: 68; italics are Baldwin's). With his elaborate plan in motion, Baldwin was determined to bring his vision of lighter-than-air communications into the Arctic.

The Baldwin–Ziegler Polar Expedition, 1901–02

Baldwin and his expedition left Vardø, the north-easternmost point of Norway, on the *America* on 27 July 1901. The ship was heavily overloaded with 42 men, along with coal and food supplies, 15 ponies, more than 400 dogs and, as Baldwin wrote "the heavy cases of acid to be used in the generation of hydrogen gas for the balloons" (Baldwin 1903: 396). At Franz Josef Land, the *America* made a rendezvous with the *Frithjof* near Cape Flora on Northbrook Island, and from there Baldwin hoped to steam directly for the Italian base camp at Teplitz Bay on Rudolf Island.

For two months Baldwin tried to force the *America* up the main channels leading through the islands: the British Channel in the west and Austria Sound in the east. Both were heavily iced and proved impassable. By early October, Baldwin was resigned to building a camp on Alger Island, more than 160 km farther south than he had planned, leaving a skeleton crew in charge and returning to Norway for the winter. As for using the observation balloons and their small passenger-carrying basket to scout conditions ahead, either from the ship or from Rudolf Island, there was no point. They had not made it far enough north even to consider such a possibility. The scientific rationale for the large balloons was therefore rendered moot even before the expedition set up its main encampment.

Almost from the moment the expedition landed on Franz Josef Land, dissension broke out in the ranks as Baldwin began to exhibit behaviour by turns eccentric and dangerous. Baldwin demanded that the expedition members resign from the Baldwin–Ziegler Expedition and sign an oath of loyalty to him personally. Then he attempted to gather up the oaths and destroy them (Thomsen 1993). He was unable to control a conflict between the Swedish captain of the *America* and the Norwegian ice pilot, and refused to explain at any point throughout the winter exactly how he proposed to reach the North Pole in the spring of 1902 (see Vedoe 1902: 23). To compound his problems, before the expedition took a step northwards in the spring, more than half of the dogs were dead, apparently from an internal parasite.

Initially, two camps were set up on Alger Island: one on the eastern end and a smaller camp at the south-western corner. In the spring of 1902, Baldwin abruptly removed the smaller camp to Greely Island, in the approximate centre of the archipelago, and renamed it Kane Lodge after the American Arctic explorer Elisha Kent Kane. Two other main depots were established farther north, on Coburg Island and at Cape Auk on Rudolf Island, the northernmost point reached by the expedition, and still about 1.6 km south of where the Italians had started their polar expedition in 1899.

Between the end of January and the end of March 1902, Baldwin led a near-continuous pack train of humans, dogs and ponies between Alger Island and Rudolf Island, establishing depots that, when completed, he decided not to use. For a man in command of his first polar expedition, Baldwin seems to have absorbed all the wrong lessons from his earlier experiences with the hyper-controlling Robert Peary and the inchoate Walter Wellman.

During all this maneouvring, Baldwin decided to start his dash to the pole from the east side of Rudolf Island, in an attempt to avoid the polar ice carrying his party too far to the west, as had happened to the Italians on their return (Baldwin 1902a: 24). From his farthest north point, Baldwin could see the Italian base camp across Teplitz Bay. He decided not to attempt a crossing of an intervening glacier in order to reach it. Instead, upon completion of his supply depots—including the one on Rudolf Island where more than 15 metric tons of equipment and food were left behind—Baldwin decided it was too late to attempt the pole in 1902, and turned his attentions to other interests.

These included a brief expedition to seek out the spot on Jackson Island where Fridtjof Nansen and Hjalmar Johansen had spent the winter of 1895/96 after their attempt to reach the pole from the *Fram*. Baldwin found Nansen's hut on 14 May, and spent a day at the site photographing and sketching its remains and retrieving the message Nansen had left behind. From the time he spent at the site to his prominent mention of the note at the hut in his balloon messages, it is clear Baldwin considered this discovery the signal triumph of his efforts in 1901–02. He held onto the message for much of the rest of his life, before he finally handed it to the Norwegian Legation in Washington, D.C., nearly 30 years later, in December 1930 (Barr 1995: 88).

Returning to the base camp at Alger Island, Baldwin found the *America* freed from the ice of the winter but forced to use much of its coal to keep from being crushed by shifting ice floes. By late May, no ice-free escape channel had opened to the south. Fearing that the expedition might be entrapped for a second winter, Baldwin turned to his "Aeronautical Section". With the *America* running short of coal, and the remaining dogs and ponies in need of food, he ordered his aeronautical team to use the hydrogen balloons not to send news, but to call for help.

Launch operations, Alger Island, June 1902

On Saturday, 24 May 1902, with his polar dreams in tatters and the *America* still trapped by flow ice around Alger Island, Baldwin ordered the head of his "Aeronautical Section", Charles Rilliet, to begin the construction of an area from which the message balloons could be launched (Rilliet 1902a: 1) (Fig. 8). Rilliet was 24 years old and a "stationary and aeronautical engineer" from St. Louis, Missouri (Anonymous 1901: 8). This was the first time during the expedition that the balloons and the buoy message system had been unpacked from their crates on board the *America*. The hydrogen generator and the containers of acid were already ashore, having been moved off the ship while Baldwin and his sledge teams were away during the spring.

On Monday, 26 May 1902, while Rilliet and crewmember Anton Vedoe began assembling the hydrogen purification tank, three other crewmembers—including a cousin of Baldwin named Leon F. Barnard, who had just resigned as expedition secretary after a row with Baldwin—picked a spot to the west of the base camp huts and began to dig a large pit in the snow. The next day, Rilliet asked the ship's captain for spare masts to set up a windscreen behind the balloon pit. By 29 May, to speed up the work, three Russian crewmembers were given over to assist in digging the balloon pit. Other crewmembers came ashore to dig holes for the spare masts (Rilliet 1902a: 2). The launch area was completed the next day. The balloon pit was finished, the hydrogen generator was placed into it and the masts were anchored into the

Fig. 8. Charles Rilliet in front of a hydrogen balloon about to be released (from Baldwin 1903).

ground with guy ropes. Spare sails and canvas from the *America* were spread between them to create the windscreen. It had taken more than a dozen men five days to finish the job. As this work neared completion, Rilliet and Vedoe tested the buoy liberator system and found the release mechanism to be working well.

On Saturday, 31 May 1902, Rilliet's tests to generate hydrogen were initially unsuccessful. The lead cases holding the acid had been used on shore during the winter to anchor rope lines holding the dogs, and Rilliet feared that the very low temperatures might have somehow spoiled the acid. He finally decided that the acid had been corrupted with lead from the cases. The water in the water bath that would be used to wash the emerging gas froze solid. The generator finally began producing gas when Rilliet mixed one part sulphuric acid to four parts seawater and poured the combination on the iron filings (Rilliet 1902a: 2).

On Monday, 2 June 1902, one of the balloons was brought ashore from the ship and the generator "charged" with seawater and acid. "No. 1, June 3, 1902, Baldwin–Ziegler Polar Expedition" was stenciled in red across the fabric of the balloon (Rilliet 1902a: 18). At 09:00, Baldwin gave Rilliet the order to inflate the balloon. The top joints of the generator leaked so badly that it was nearly noon before gas finally started to enter the envelope. When the balloon was half-full at 16:00, the gas pressure dropped sharply. Over the next three hours, Rilliet recharged the generator with 200 lb (90.71 kg) of iron and 119 lb (53.97 kg) of zinc.

Inflation continued into the early hours of 4 June 1902, when Rilliet disconnected the gas hose and, attaching the balloon to a spring balance, found that it had an ascension force of 123 lb (55.79 kg) (Rilliet 1902a: 3). The envelope weighed approximately 35 lb (15.87 kg) and the netting another 3 lb (1.36 kg) (Rilliet 1902a: 15), so this first balloon could carry an effective payload of 85 lb (38.55 kg) of buoys and messages. The wind had picked up, so two ropes were attached to the load ring of the balloon: one directly underneath the balloon in the pit, and the other on the north side of the pit to keep the balloon away from the windscreen guy ropes as it ascended.

As the balloon rose out of the pit, the buoys were attached at intervals of 6 ft (1.8 m). Each buoy held a small note, identically worded, modified only for the date: the number of the balloon and the number of the buoy attached to that balloon. The notes read:

80° 21′ N 56° 40′ E
Camp Ziegler, Franz Josef Land
Field Headquarters
Of the
Baldwin–Ziegler Polar Expedition
June –, 1902

To the nearest American Consulate—
Cargo coal required quickly. Yacht "America" in open water (Aberdare Channel) since June 8th. This year's work successful—enormous depot placed on Rudolf Land by sledge, March April and May; collection for National Museum, record from and paintings from Nansen's hut, excellent photographs and moving pictures, etc., etc., secured. Five ponies and one hundred fifty dogs remaining. Desire hay, fish, and thirty sledges. Must return early August, baffled, not beaten. Northeasterly winds prevailing. Northwesterly winds 25th, 26th and 27th. All in health.
Balloon Buoy No. —
[signed] Baldwin, Signal Corps, USA

(Baldwin 1902b)

When the first balloon reached the top of the windscreen, the sudden exposure to the wind caused it to jerk up and down, shaking all of the buoys loose. The balloon was brought back into the pit and men were stationed around it, each holding a buoy and being instructed when to let it go. This method was tried twice, but again when the balloon lifted above the windscreen it began to jerk its buoys loose. One buoy barely missed a sailor's head as it fell back to earth (Rilliet 1902a: 4). On the fourth attempt, the men holding the north rope inexplicably gave the line a jerk as the balloon lifted above the windscreen, and again all the large Swedish buoys fell back to the ground. As five crew members attempted to reel in the balloon, the wind had increased even more. The netting surrounding the gas bag began to tear, until at last the balloon, with no buoys attached to it, broke free, causing three sailors who were still holding onto the rope to fall back into the balloon pit. The only messages carried aloft were 10 small copper floats bundled into an empty sandbag labelled "MANUFACTURED BY BALDWIN BROS., QUINCY, ILL., U.S.A.". Rilliet watched the balloon ascend to 750 m before it "passed out of sight a mere speck to the S.S.W." (Rilliet 1902a: 4).

After this first experience, Rilliet and Baldwin modified the launch operations. Balloon no. 2 was wrapped in two nets, and the liberator connections were wrapped in paper to hold the steel balls in position during lift-off. Rilliet thought that when the balloons finally descended in the ocean, the paper would dissolve and the buoys would be released. But Rilliet's biggest concern was the time it was taking to inflate the gas bag, which he put down to the "great amount of leakage through the wooden joints of the generator" (Rilliet 1902a: 5). On an expedition that could purchase anything it required, Baldwin was now paying the price

of bringing a substandard hydrogen generator into the Arctic.

The generator was charged again, and inflation of the second balloon began just after midnight on 5 June 1902. Inserting acid into the generator at longer intervals led to hydrogen entering the balloon that was both moist and hot. The moisture condensed as it cooled and formed a pool of water at the bottom of the balloon. Rilliet added ice to both the generator and the gas purifier, lowering the temperature of the resulting gas, and inflation proceeded until it was completed at 05:00 (Rilliet 1902a: 5).

In addition to the paper wrappings around the liberators, the large buoys were strung around the balloon in various configurations. Ten of them were attached to a length of oceanographic sounding wire at 1.5-m intervals, and four others were attached by separate wires of various lengths. Ten small copper floats were put in a tin can punctured in several places so water would flow into it (Rilliet 1902a: 5).

Rilliet attached a heavier rope to the balloon, and had several sailors stand 20 m to the leeward of the balloon's upward path, hoping to avoid the kind of sudden jerks that wrecked the first ascent. The result, however, was similar to the first attempt. The balloon swayed in the wind, tangling the various sounding wires in the retaining rope and dropping buoys to the ground. At Baldwin's suggestion, the retaining rope was removed. Now, as soon as the balloon was cut free of its mooring cord, it would ascend without any chance to bring it back. Rilliet asked Baldwin to do the honors, and took a position away from the pit where he could study the ascent. Baldwin slashed the mooring cord and the balloon leapt free, carrying all but one of the large buoys and all of the small buoys with it. "When clear of the ground," wrote Rilliet, "and a realization came to us that success was indeed ours, cheer after cheer rose from the crowd" (Rilliet 1902a: 6). Like the first balloon, the second drifted away rapidly to the south–south-west, in the direction of the coast of northern Norway (Fig. 9).

With the expedition ship preparing to move away from her anchorage near the Alger Island shore on Thursday, 5 June 1902, all of the remaining balloons except one were taken ashore. An attempted inflation on 6 June had to be aborted when the generator was found to be leaking water. It took all day to empty the generator of its "charge" of zinc, iron, tin and water, repair the generator and dig the balloon pit deeper.

On Saturday, 7 June 1902, a third balloon was inflated and readied with buoys. By mid-afternoon, the kites employed to indicate the direction of the wind had fallen to the ground in the calm air. When the gas flow from the generator fell in the evening, Rilliet detached the hose and decided to "let the balloon go with what gas it had" (Rilliet 1902a: 7). Again, Baldwin cut the mooring cord connecting the balloon to its sand bags, and the balloon rose slowly and steadily. In the calm conditions, Anthony Fiala, the expedition photographer, was able to take a series of photographs of the ascent. "The night was beautiful," wrote Rilliet (1902a: 7), as nearly three dozen men stood and gazed at the balloon as it carried 16 buoys away (Fig. 9). "I have never witnessed a more beautiful and more perfect ascension than was this, whether passenger, dispatch or meteorological" (Rilliet 1902a: 7). Rilliet continued to watch the balloon through field glasses as it slowly made its way westward across Alger Island. Before it disappeared from view, the balloon turned slightly towards the north, a course Rilliet thought might carry it toward Svalbard, where it might be seen and retrieved by a sealing vessel there.

Rilliet had further reasons to be happy with the third ascent when he cleaned out the hydrogen generator in preparation for recharging it on Sunday, 8 June 1902. Unlike the first two inflations, he discovered that all of the metal had been acted upon by the acid. During the first two efforts to produce hydrogen—when he had laid pieces of sheet zinc on top of iron filings—the acid had worked on the zinc, but underneath a black mass of iron, largely untouched by the acid, remained. These compact iron residues become the most visible archaeological

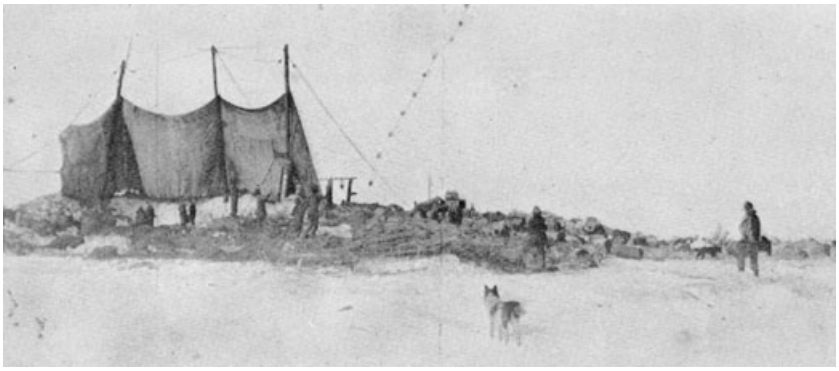

Fig. 9. Attached to an unseen balloon, a series of balloon buoys lifts off from Alger Island in June 1902 (from Baldwin 1903).

remains of these attempts to use hydrogen in the Arctic (Capelotti 1997: 71–84).

To obtain more complete action of the acid on metal, for the third inflation Rilliet had gathered up empty tin cans from the base camp's garbage. These he used to create alternating layers of metal—zinc, iron, tin cans, zinc, etc.—in order to hold the metals apart and allow the acid to get at them (Rilliet 1902a: 8). Rilliet complained that none of these improvisations would have been necessary had he been supplied with the kind of wrought iron filings used by Andrée, instead of the corrupted material supplied to Baldwin. The iron was mostly soft machine shop turnings, and Rilliet found large quantities of steel turnings and dust in it, along with "small pieces of belt lacings, wood, leather . . . evidently the sweepings from the floor under and about the machines in the machine room" (Rilliet 1902a: 18). Baldwin had been warned by his British acid supplier that they could not vouch for the quality or the electrolytic action of the iron, because the metal supplier would not make any practical trial of the process (Cross to Baldwin, 24 May 1901).

Like the letter from the supplier of his small gas-powered boat, this letter supports the notion that Baldwin left fundamental operational questions to such a late date that he was left with no choice but to improvise in the field. The tests to determine the most effective proportions of iron and/or zinc to acid were not performed until 2 June 1902, the day before Rilliet commenced inflation of the first balloon (Rilliet 1902a: 18). And Rilliet was rebuffed when he asked Baldwin to provide him with a thermograph and some other scientific instruments from the ship. Baldwin "seemed to think we were not equipped for scientific balloon research" (Rilliet 1902b).

Rilliet's improvements to the gas process and the release mechanisms led to a problem-free launch on 9 June 1902, as 18 more large buoys were carried southwards. A snowstorm that interrupted the inflation process, followed by problems with too much pressure in the generator—which at one point was enough to blow a pressure valve off the top of the generator—caused the fifth balloon to lift off with no large buoys, on 13 June. Without a full load of gas, it disappeared towards the west, looking to Rilliet "like a strawberry, rolling about in the distant sky" (Rilliet 1902a: 9).

Thereafter, until the 15th and last balloon ascended on 30 June 1902, each balloon carried a full load of between 10 and 20 large buoys, depending on the lifting force of the gas bag. Rilliet endured a constant struggle with the gas production process, from the loose wooden generator that required him to seek out and plug holes while accepting the low level of gas flow, to finding fresh water for the purifier. At one point, his assistants had to be warned not to use the water that stood in a large pool in front of the pony stable because it was "strongly adulterated" with horse urine (Rilliet 1902a: 11).

The effectiveness of the balloons grew along with Rilliet's experience in generating hydrogen. Only one of the first 218 messages was later found, meaning that only one of the first nine balloons managed to successfully deliver its cargo of large Swedish buoys and small copper floats. On the other hand, five of the balloons, numbered 10–15, delivered buoys that were later found. The higher success rate of the later balloons was perhaps because of the different ascensional power of the two groups of balloons (Rilliet 1902a: Reference Sheet). The average ascensional force of balloons 1–9 was 61.03 kg. Starting with balloon 10, the remainder of the balloons launched from Alger Island had an average ascensional force of 78.24 kg, nearly 30% more than the first group. On average, the balloons disappeared from sight less than 12 minutes after launch, at an average altitude of 2000 ft (609.6 m). Throughout the operations, the launch-time temperature averaged just below the freezing point.

As the expedition ship *America* returned to camp on 29 June from its maneouvring in the loosening ice, Rilliet received a rather extraordinary real-time progress report from the 14th balloon. It had been seen near Negri Channel (between Hall and McClintock islands, and about 25 km from the launch site) about an hour after lift-off. "It came down to within fifty feet [15.24 m] of the water, moved toward the glacier on McClintock Island, moved slowly up the side of the glacier, disappeared over its top, came back in about an hour, then came down the side of the same glacier and finally rising, disappeared again moving down Negri Fjord [*sic*]" (Rilliet 1902a: 14).

After the 15th and last balloon was away, the Aeronautical Section packed away the remaining nine balloons, stowing them in the west hut of the base camp. The remaining metals were placed in the balloon pit, and the acid was left in containers west of the pit. The generator and purifier were cleaned of their last charge and left in place in the pit, and then the wind break and the masts were taken down (Rilliet 1902a: 15). In all, some 398 lb (180.53 kg) of zinc, 2961 lb (1343.1 kg) of iron and 3546 lb (1608.4 kg) of acid were left at the base camp on Alger Island.

At last, Rilliet had some time to contemplate the "many difficult circumstances" he had encountered in attempting to deliver messages attached to balloons sent from a shoreline in the Arctic. His operational report, delivered to Baldwin on board the *America* on 1 July 1902, as the ship began a two-week-long effort to break out of the ice

around Alger Island, should have struck Baldwin as more than slightly ironic. Unlike his hero Salomon A. Andrée, Baldwin had left nearly everything to chance in his balloon operations, and Rilliet knew it. Rilliet identified the prime cause of the difficulties faced throughout the month of June as the lack of a generator similar to that used by Andrée.

> We had no such an outfit as did Mr. Andrée, the ardent apostle of the aerial conquest of the North Pole, whom physicists say had most everything that Chemistry and Physical Science has invented for the scientific observation of gases . . . [Had] we a similar apparatus and the instruments that the Andrée Expedition had, with our numerous inflations extending over a period of twenty-seven days with various conditions of weather, the results that could have been obtained would have been invaluable to the Science of Aeronautics. (Rilliet 1902a: 18)

This was a considerable indictment of an expedition that, unlike Andrée's, had virtually limitless funds at its disposal. Based on an intensive month of experience, Rilliet rated the Swedish buoys and the acid and zinc from the UK as "excellent", the balloons and generator and small copper floats supplied by Baldwin Brothers as "good", and the iron filings from the UK and the gas purifier from Baldwin Brothers as "poor" (Rilliet 1902a: 19).

How Baldwin reacted to this report is not known. But he evidently believed he had accomplished something of merit with his balloon-buoy system. Before he left Franz Josef Land for the last time, Baldwin left behind a message at the base camp. It read, in part:

> To-day we dispatch Balloon No. 15, all together more than three hundred (300) messages [by Rilliet's count it was 422 messages] having been carried from this point by this means. Northwest winds prevailed until the 25th of June when for three days we had a gale from the northwest to west–northwest followed by a strong wind from the south on the 28th and 29th . . .
>
> Look for signals carefully wherever possible, as also the buoys carried by the balloons. Should any be found including the balloons themselves, carefully note the locality as well as date, time of day, atmospheric conditions; also whether in water or upon the ice. Please also instruct any ships which you may meet to keep a sharp lookout for us, as also for the messages by balloon already sent.
>
> (Baldwin 1902c)

The *America* finally broke out of the Franz Josef Land ice in mid-July, and the expedition returned quickly to Tromsø. Baldwin had expended an enormous effort to send 422 balloon-borne messages southwards, pleas for help that, in the end, he did not require. None of the messages preceded the *America*'s arrival in northern Norway. With his attempt to emulate Andrée in a great Arctic aeronautical operation not being the breakthrough he had envisioned, Baldwin would spend the rest of his life receiving reminders of it.

"Cigarette smoking dudes": the expedition's aftermath

Even though Baldwin's balloon-buoy message system did not lead to the resupply of his expedition, William Ziegler had already dispatched a ship from Norway on 7 July 1902, to find Baldwin and learn of his progress. When that news turned out to be far less than Ziegler had hoped (and paid for), he was upset. When criticism of the expedition, begun by the crew during the winter, exploded across the newspapers of New York, Ziegler was both enraged and embarrassed.

Instead of making a dash to the pole in the spring of 1902, Baldwin had alienated much of his crew and obsessed over locating new islands within Franz Josef Land, recovering the Nansen message and sending messages in balloons. Newspapers were merciless. Headlines such as "Baldwin–Ziegler Expedition fails" (*New York Times*, 1902) and "Baldwin denies he led a fiasco," (*New York Herald*, 1902), only increased the ire of his patron. When it was learned that Baldwin had not only recovered the Nansen message but had spent several hours at the site to give the expedition artist time to paint the scene, the *Brooklyn Standard–Union*—whose editor was perhaps Robert Peary's closest ally—needled Ziegler even more. In an editorial entitled "Mr. Ziegler's expensive picture", the paper all but called Baldwin a swindler while casting Ziegler as Baldwin's fool.

> Nansen himself would have been able to have furnished a painting of his Franz-Josef hut for a good deal less than the million which Mr. Ziegler generously paid for it. More than that, the Nansen work would have been an original from the hand of the master, a painter and artist of no mean ability, while Mr. Ziegler's acquisition must at best be but a second-hand expression of an observer . . . Provision packers, coal dealers, ship brokers, dog drivers, balloon makers, in fact, almost every sort and condition of man throughout the northern portion of the civilized or half-civilized world, have shared in Mr. Ziegler's generous bounty.
>
> (*Brooklyn Standard–Union*, 1902)

When the expedition ship returned to Tromsø, several members of the expedition were finally free to denounce Baldwin as an incompetent martinet. With his large

expenditure gone for naught, William Ziegler quickly relieved Baldwin of further command. "All I want is to reach the North Pole", Ziegler exclaimed to a reporter, explaining.

> I don't care how much money it costs. If I can plant the Stars and Stripes there I'll be the happiest man in the United States. I'm not after scientific research, although I know we will get as much as anyone. It doesn't matter if one expedition has failed. I'll send another. It won't be a lot of cigarette smoking dudes this time . . . I sent [Baldwin] to discover the North Pole, not to eat pie or smoke cigarettes. The bone and sinew of this nation is not in its pie eaters or its cigarette smokers. (*Kansas City Star*, 1902)

These last comments—somewhat odd from a man who made his money in baking soda—show how expedition patrons at the turn-of-the-century were obsessed over the morality, or at least the public perception of morality, of the explorers they financed. With Baldwin's character in ruins, Ziegler turned to the expedition's photographer, the pious naïf Anthony Fiala, to lead the next American attempt to the North Pole from Franz Josef Land. Making use of the caches laid down by Baldwin, Fiala's expedition would spend two years advancing little more than a few miles beyond Rudolf Island, before retreating in failure (Fiala 1906). In the end, none of the three American polar expeditions launched from Franz Josef Land would pass beyond sight of Rudolf Island, still more than 800 km short of the North Pole.

For Baldwin himself, the balloon operations of June 1902 were the end of his polar road. The rapid development of technological systems after the turn of the century soon rendered his system of sending messages by balloon buoys obsolete. In 1906, his estranged expedition companion Walter Wellman (another explorer who employed technologies far beyond his personal competence) deployed a wireless transmitter to send dispatches from Svalbard to Norway, and thence on to his newspaper in Chicago. The dirigible Wellman launched from Virgohamna in 1907 also marked the first use of an airship in the Arctic (Capelotti 1999a).

Baldwin gained a small measure of vengeance on William Ziegler, when he testified against his former patron in a lawsuit charging Ziegler with anti-trust violations in his attempt to corner the baking soda market. Baldwin spent the remaining three decades of his life agitating on behalf of various schemes meant to give him a third chance at the Arctic. He repeatedly proposed polar drift voyages that would use airships (*New York Tribune*, 1909), and suggested harnessing the electricity of the aurora borealis, which he claimed could light the world (*New York Herald*, 1899). But no more patrons rallied to his side.

Of balloon buoys and base camps: the archaeology of the expedition

The archaeology of the Baldwin–Ziegler expedition is a complex of balloons, buoys, depots and base camps strewn between Franz Josef Land and Greenland. Pieces of it have been discovered at various times over the past century.

On Saturday morning, 9 May 1903, a shepherd living on an arm of the Vopnafjördur in north-eastern Iceland found Baldwin's 52nd buoy, sent from Alger Island early in the morning of 13 June 1902 (Johansen 1903). The note inside the buoy eventually found its way to the American Consulate in Bergen, Norway, with a request for a "small gratuity" for its impoverished finder.

On 16 October 1903, buoy no. 146—which had been attached to the 12th balloon that was launched on 23 June 1902—was picked up along the shores of Siglufjördur, the northernmost port in Iceland (Knudtzon 1903). It, too, was sent to the consulate in Bergen with a request for a reward. On 12 November 1903, a third buoy, no. 160, launched with the 13th balloon on 24 June 1902, was picked up at sea off the northern tip of Norway in Finnmark (Bordewich 1903).

This was enough for the US Department of State. In January 1904, the American consul in Bergen, E.S. Cunningham, wrote to Francis B. Loomis, the Assistant Secretary of State, that it was incumbent upon the United States to begin offering rewards for the finding of the buoys. This "would prevent the impression getting abroad that the finders of buoys thrown out by American Polar Expeditions must not, not only not be rewarded, but must bear the expenses of the transmission of the message" (Cunningham 1904). The State Department tracked down Baldwin, now living in Edna, Kansas, and he quickly responded with $15 in cash, and instructions that the money be divided equally between the three people who had found the buoys (Baldwin 1904). Two more unrecorded messages were washed up in northern Norway in January 1904, and were forwarded to Baldwin by the American Consulate in Trondheim (Berg 1904).

An Arctic sealing vessel did finally retrieve one of the buoys, but not until 10 July 1906. A Captain Stenerson of the *Gottfred* found buoy no. 229 "badly crushed" and bobbing in the lagoon at Moffen Island off the north coast of Svalbard (Cunningham 1906). Stenerson did not believe the buoy had been there the previous season, as he or one of the other vessels of the Svalbard sealing/walrus fleet would have noticed it and retrieved it. Two more buoys, nos. 128 and 176, were found off the coast of Finnmark in the fall of 1907 (Bordewich 1907a, 1907b), and another was found in Van Mijenfjorden in Svalbard on 18 August 1910 by a Swedish expedition (Harris 1911).

After the Swedish find, no more buoys were found for almost exactly 20 years. Then, on 10 August 1930, a Russian expedition on the icebreaker *Sedoff* announced that it had located a buoy in Novaya Zemlya. Like three earlier buoys, this one came from the 12th balloon, thereby tying it with no. 13 for being the most successful balloons, each with four buoys found. The expedition on the *Sedoff* also visited Baldwin's base camp on Alger Island, but it is not clear if *Sedoff* visited before or after they found the buoy and, if after, whether the buoy pointed them towards the site.

When the *Sedoff* expedition searched the Alger Island site, they found that it had been heavily disturbed. A number of buildings were explored, and inside was a confusion of expedition gear, medical supplies and cans of spoiled food. The Russians decried the looting apparent at Baldwin's old base camp, and implored the Soviet government to protect these artifacts that were "of great historical interest" (*New York Times*, 1930a: 18).

Both the renewed interest in the balloon messages and the base camp allowed the aging Baldwin another moment of glory. The *New York Times* immediately sent a reporter to interview the long-forgotten explorer in Washington. "On my return I offered a prize of $5 for the return of any of these", Baldwin noted, without mentioning that he had been requested to pay out these rewards by the US government (*New York Times*, 1930b: 5).

Then, in the final irony of Baldwin's career, less than two weeks later, the buoy find on Novaya Zemblya was completely overshadowed by far more spectacular news. In late August 1930, the bodies of Andrée and his two companions were discovered on Kvitøya (White Island) in north-eastern Svalbard. The news was an instant sensation around the world (e.g., *New York Times*, 1930c: 1). Amongst the interesting aspects of the expedition recalled to the public, was the fact that Andrée had sent news of his expedition in metal tubes enclosed in buoys dropped from his balloon.

The very next day, the other advocate of the balloon-buoy messages in the Arctic repeated his personal mythology to an Associated Press reporter. Now 68 years old and "a white-haired veteran of the frozen North", Evelyn Briggs Baldwin explained that only "a delay of forty-eight hours prevented his going on the ill-fated North Pole expedition of Salomon-August Andrée, whose body has been found in the Arctic after a lapse of thirty-three years" (*New York Times*, 1930d: 2). The circle of Baldwin's aeronautical ambitions in the Arctic was now complete.

Since 1930, Baldwin's camp on Alger Island appears to have been steadily eroded by the harsh environment, by visiting bears, and probably by visiting Soviet military and scientific personnel and, more recently, by groups of Arctic tourists carried on Russian icebreakers (Figs. 10, 11). Little if anything has been done to preserve the area.

Interestingly, the huts on Bass Rock and Shannon Island in north-east Greenland did eventually provide relief for a member of the Baldwin–Ziegler expedition, but not until a decade after the expedition! Ejnar Mikkelsen, who had been a 21-year-old Danish volunteer on Alger Island in 1901, was by 1909 a seasoned Arctic explorer, having co-led an expedition to the north coast

Fig. 10. The ruins of Camp Ziegler on Alger Island, photographed in the summer of 2006 (photo courtesy of Robert K. Headland). The main expedition buildings are exposed to the elements. Given the increase of tourism in the area, interpretive panels arranged to explain the history of Camp Ziegler would seem a wise investment.

Fig. 11. Spent iron filings in their barrels, remains from the balloon operations of 1902, photographed at Camp Ziegler on Alger Island in the summer of 2006 (photo courtesy of Robert K. Headland).

of Alaska with fellow Baldwin–Ziegler veteran Ernest Leffingwell. In 1909, Mikkelsen organized an expedition to north-east Greenland to search for the bodies and journals of the 1906–08 *Danmark* expedition under Ludvig Mylius-Erichsen. Mikkelsen found Mylius-Erichsen's journals, but was himself trapped with a companion in north-east Greenland for three winters. Taking refuge finally at the Baldwin hut on the south-eastern point of Shannon Island in the winter of 1911/12, Mikkelsen and a companion were rescued by the Norwegian sealer *Sjøblomsten* on 19 July 1912 (Mikkelsen 1922: 136–139; Schledermann 1991: 352–354).

Baldwin himself wrote about the use of these huts for the relief of expeditions after the initial news arrived about the *Danmark* tragedy. "It is interesting to note that at the Baldwin–Ziegler station are ten of the balloons manufactured by Captain Thomas Sackett Baldwin and his brother Samuel Yates Baldwin for the transmission of messages concerning the progress or welfare of an expedition" (Baldwin 1908). It is not certain which station—Shannon Island or Bass Rock—holds the remains of the balloon-buoy system. But Mikkelsen found the Shannon Island depot "in comparatively good order" when he first looked in on it during the fall of 1909 (Mikkelsen 1922: 13), and the contents helped save the lives of himself and his companion for the next three summers. A window pane had been broken, and snow had blown in, making it a winter den for foxes. On Bass Rock he found "ample provisions and coal in the two houses" when he reached them in November 1911 (Mikkelsen 1922: 136). During his last visit to the Shannon Island site in April 1912, Mikkelsen found that animals had broken in "and foxes had dragged books out through the window and left them scattered all over the snow" (Mikkelsen 1922: 139).

Given Mikkelsen's descriptions of the two sites, the Shannon Island depot at Cape Philip Broke would seem to be the likeliest spot for Johan Bryde to have placed the balloons, buoy, acid and metals in the summer of 1902. There is both flat ground and high basalt cliffs to the north that could have served as wind breaks for any launch operation.

The most recently discovered artifact that is likely to be of Baldwin–Ziegler origin is a broken ski found in the summer of 2006 on Champ Island, just north of the Alger Island base camp (Capelotti 2007). If any of the remaining balloon buoys are ever found, they would be worth much more than the $5 Baldwin gave as a reward for them in 1903. One of the large Swedish buoys was recently auctioned in New York for $7500 (Swann Galleries, pers. comm. 18 May 2007).

Conclusions

The use of the balloon buoy in Arctic exploration lasted five years, from the launch of Andrée's *Örnen* from Danskøya on 11 July 1897, to Baldwin's last balloon buoys sent from Alger Island on 30 June 1902. Their success as a means of communication was mixed. Over the two years from 1898 to 1900, five of the 11 buoys dropped by Andrée were eventually found. (There were apparently a dozen buoys on board the balloon, one of which was never dropped [Swedish Society for Anthropology and

Geography 1930: 258]). Between 1903 and 1910, a total of 12 of Baldwin's 422 buoy messages were eventually found: a success rate of only 2.8%.

Baldwin's buoys were found in a triangle enclosed by Moffen Island in the north, Siglufjördur in Iceland in the west and Finnmark in the south (one of Andrée's buoys also washed up in Finnmark [Swedish Society for Anthropology and Geography 1930: 64–65]). If we add the 1930 Baldwin buoy find in Novaya Zemlya—discovered just a few weeks before the discovery of Andrée himself—we get a diamond-shaped area where some of the remaining 410 messages may yet be found.

As for why Baldwin tried to send urgent messages with such a seemingly hopeless technology, it must be remembered that the balloon-buoy system would not be overtaken as a means of communication in the Arctic until the introduction of wireless technology by Wellman in 1906. Andrée had disappeared in his balloon, and several of his buoys had been found. In 1900, as Baldwin was planning his expedition, it would have seemed the only way to send news of his expedition southwards in anything close to real time.

The inattention shown by Baldwin to operational detail is common to all three American expeditions to Franz Josef Land. Each took their respective successes in financing and publicity as substitutes for operational expertise. Baldwin took the opportunity afforded by Ziegler's money to order tonnes of equipment for the expedition from friends, as well as possible relatives like the Baldwin Brothers, but seems not to have taken much of their advice on how to make the best use of it in the field.

Baldwin's cousin(?), Thomas Scott Baldwin, an accomplished balloonist, had not in 1901 pushed beyond the fairground amusement stage in his ballooning. He had encountered innumerable delays in his search for an internal combustion engine both light and powerful enough to drive a small dirigible. It was not until 1904 that he could add the construction of dirigibles to his existing balloon construction business, and go on to greater fame with his dirigible the *California Arrow* (Scamehorn 1957: 16). In the hands of a skilled aeronaut like Thomas Scott Baldwin, even Walter Wellman's polar dirigible might have stood a far better chance of success.

After the 1902 deployment of his "radically new method", Evelyn Briggs Baldwin never received another chance to return to the north. Three years after his brief return to public notice in August 1930, he was dead. Baldwin was struck by a passing car as he tried to cross a busy street in Washington, D.C., on the evening of 25 October 1933 (*New York Times*, 1933). His skull was fractured and he died en route to the hospital, aged 71. It is tempting to believe that his attention was distracted as he stepped into the road that night, his mind floating somewhere above the Arctic landscape, maybe in the Swedish balloon that had finally found a place for him.

Acknowledgements

This research was supported by the Anthropology Fund and the Associate Dean's Research and Development Fund at Pennsylvania State University, Abington College. The author is grateful to Dr. Peter Pincemin Johnstone at Pennsylvania State University; to Mr. George Simon; to Michael Suever for discussions of Arthur Berson's work; to Ms. Naomi Boneham of the Scott Polar Research Institute; and to the staff of the Manuscript Reading Room of the Library of Congress.

References

Anonymous (probably E.B. Baldwin) n.d. Summary of work done by Evelyn Briggs Baldwin in the Arctic regions. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 13, Folder "EBB—Typescripts—Polar Subjects". Washington, D.C.

Anonymous 1901. Biographical sketches of the members and crew of the Baldwin–Ziegler Polar Expedition. S.S. *America*. Unpublished typescript. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 8, Folder "Biographies—Baldwin–Ziegler Expedition". Washington, D.C.

Baldwin E.B. 1896. *The search for the North Pole*. Chicago: printed privately.

Baldwin E.B. 1901a. How I hope to reach the North Pole. *Windsor Magazine 15*, 59–69.

Baldwin E.B. 1901b. Letter to Johann Bryde. 5 July 1901. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 13, Folder "Supplies, 1901". Washington, D.C.

Baldwin E.B. 1902a. Spring sledge work of the Baldwin–Ziegler Polar Expedition, April and May, 1902. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 9, Folder "Notes & Journals". Washington, D.C.

Baldwin E.B. 1902b. Balloon buoy messages. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 12, Folder "Correspondence re: Balloon Buoys, 1902–1925". Washington, D.C.

Baldwin E.B. 1902c. Letter left behind at Camp Ziegler, 30 June 1902. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 9, Letter Binder. Washington, D.C.

Baldwin E.B. 1903. The Baldwin–Ziegler Polar Expedition. Parts I, II and III. *Wide World Magazine 10*, 396–402; *10*, 432–436; *10*, 587–593.

Baldwin E.B. 1904. Letter to Herbert H.D. Peirce, Third Assistant Secretary of State. 16 February 1904. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 12, Folder "Correspondence re: Balloon Buoys, 1902–1925". Washington, D.C.

Baldwin E.B. 1908. Drifting across the pole. *New York Herald* (magazine section), 6 September.

Baldwin E.B. 1930. Some gleamings of the twi-light days of aviation. Unpublished lecture notes dated 17 September 1930. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 13, Folder "EBB—Typescripts—Polar Subjects". Washington, D.C.

Baldwin E.B. 2004. *The Franz Josef Land Archipelago: E.B. journal of the Wellman Polar Expedition, 1898–1899*. P.J. Capelotti (ed.). Jefferson, NC: McFarland & Company.

Barr S. 1995. The history of western activity in Franz Josef Land. In S. Barr (ed.): *Franz Josef Land*. Pp. 59–106. Oslo: Norwegian Polar Institute.

Berg C. 1904. Letter to Hydrographic Office, Washington, D.C. 26 January 1904. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 12, Folder "Correspondence re: Balloon Buoys, 1902–1925". Washington, D.C.

Berson A. 1896. The use of balloons in geographical work. *Geographical Journal 7*, 541–544.

Bordewich H. 1903. Letter to Francis B. Loomis, Assistant Secretary of State. 2 December 1903. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 12, Folder "Correspondence re: Balloon Buoys, 1902–1925". Washington, D.C.

Bordewich H. 1907a. Letter to Assistant Secretary of State. 2 October 1907. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 12, Folder "Correspondence re: Balloon Buoys, 1902–1925". Washington, D.C.

Bordewich H. 1907b. Letter to Assistant Secretary of State. 2 October 1907. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 12, Folder "Correspondence re: Balloon Buoys, 1902–1925". Washington, D.C.

Brooklyn Standard–Union 1902. Mr. Ziegler's expensive picture. 3 August. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 10, Scrapbooks. Washington, D.C.

Capelotti P.J. 1997. *The Wellman polar airship expeditions at Virgohamna, Danskøya, Svalbard; a study in aerospace archaeology. Meddelelser 145*. Oslo: Norwegian Polar Institute.

Capelotti P.J. 1999a. *By airship to the North Pole: an archaeology of human exploration*. New Brunswick: Rutgers University Press.

Capelotti P.J. 1999b. Virgohamna and the archaeology of failure. In U. Wråkberg (ed.): *Centennial of S.A. Andrée's North Pole Expedition. Proceedings of a conference on S.A. Andrée and the agenda for social science research of the polar regions. Bidrag till Kungliga Svenska Vetenskapsakademiens Historia 28*. Pp. 37–52. Stockholm: Royal Swedish Academy of Sciences.

Capelotti P.J. 2006. E.B. Baldwin and the American–Norwegian discovery and exploration of Graham Bell Island, 1899. *Polar Research 25*, 155–171.

Capelotti P.J. 2007. Century-old ski found at Mys Triest, Ostrov Champa, Zemlya Frantsa-Iosifa, Russia. *Polar Record 43*, 272–275.

(Chicago) *Times* 1900. Revived interest in the fate of Andree. 4 July. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 10, Scrapbooks. Washington, D.C.

(Chicago) *Times–Herald* 1900. Two Americans planning a great polar expedition. 1 November. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 10, Scrapbooks. Washington, D.C.

Cross C.F. 1901. Letter to Evelyn Briggs Baldwin. 24 May 1901. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 3, General Correspondence, Folder "May 15–May 31, 1901 (Baldwin-Ziegler Expedition)". Washington, D.C.

Cunningham E.S. 1904. Letter to Francis B. Loomis, Assistant Secretary of State. 7 January 1904. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 12, Folder "Correspondence re: Balloon Buoys, 1902–1925". Washington, D.C.

Cunningham E.S. 1906. Letter to Assistant Secretary of State. 29 September 1906. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 12, Folder "Correspondence re: Balloon Buoys, 1902–1925". Washington, D.C.

(Elizabeth, New Jersey) *Journal* 1901. To search for Andree. 8 January 1901. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 10, Scrapbooks. Washington, D.C.

Fawcett W. 1901. By balloon to the North Pole. *Metropolitan Magazine 14*, 59–69.

Fiala A. 1906. *Fighting the polar ice*. New York: Doubleday, Page & Company.

Fiennes R. 2003. *Captain Scott*. London: Hodder and Stoughton.

Harris E.L. 1911. Letter to Secretary of State. 18 April 1911. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 12, Folder "Correspondence re: Balloon Buoys, 1902–1925". Washington, D.C.

Johansen S. 1903. Letter to E. S. Cunningham, American Consul in Bergen. 20 May 1903. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 12, Folder "Correspondence re: Balloon Buoys, 1902–1925". Washington, D.C.

Kansas City Star 1902. Cigarette smoking dudes. 17 September. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 10, Scrapbooks. Washington, D.C.

Knudtzon B. 1903. Letter to the American Consul in Bergen. 11 November 1903. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 12, Folder "Correspondence re: Balloon Buoys, 1902–1925". Washington, D.C.

Lundström S. 1988. *Andrée's polarexpedition. (Andrée's polar expedition.)* Gränna: Wiken.

Mikkelsen E. 1922. *Alabama-Expeditionen til Grønlands Nordøstkyst 1909–1912 under ledelse af Ejnar Mikkelsen. (The Alabama Expedition to Greenland's north-east coast 1909–1912 under the leadership of Ejnar Mikkelsen.) Meddelelser om Grønland 52*. Copenhagen.

New York Herald 1899. Aurora borealis will furnish world's light. 1 October 1899. Evelyn B. Baldwin, Scrapbooks, 1898–1929, Western Historical Manuscript Collection, Columbia, Missouri.

New York Herald 1902. Baldwin denies he led a fiasco. 3 October. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 10, Scrapbooks. Washington, D.C.

New York Times 1899. In search of the pole. 28 May 1899, p. 19.

New York Times 1900. To seek for Andre [*sic*]. 8 July 1900, p. 8.

New York Times 1901. Baldwin will seek Andree [*sic*]. 17 May 1901. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 10, Scrapbooks. Washington, D.C.

New York Times 1902. Baldwin–Ziegler Expedition fails. 2 August 1902, p. 3.

New York Times 1930a. Find Arctic cairn left by American. 5 August 1930, p. 18.

New York Times 1930b. Red explorers find air message of 1902. 10 August 1930, p. 5.

New York Times 1930c. Bodies of airmen lost 33 years found near where balloon fell in Arctic; Andree and comrades frozen at camp. 23 August 1930, p. 1.

New York Times 1930d. American just missed joining Andree trip. 24 August 1930, p. 2.

New York Times 1933. E.B. Baldwin dies when hit by auto. 26 October 1933, p. 12.

New York Tribune 1909. E.B. Baldwin's plan to drift across the Arctic Ocean. 27 June 1909, pp. 4–5.

New York World 1896. Is the North Pole a yawning hole? 1 March 1896. Accessed on the internet at http://ku-prism.org/polarscientist/hollowworld/mar11896nyhw.html on 31 January 2008.

Princeton (Illinois) *Republican* 1901. Baldwin and dogs. 13 June 1901. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 10, Scrapbooks. Washington, D.C.

Riffenburgh B. 1993. *The myth of the explorer*. London: Belhaven Press.

Rilliet C.E. 1902a. Detailed report of the aeronautical section. Letter to E.B. Baldwin, 1 July 1902. (Includes an unsigned "Reference Sheet, Aeronautical Section, Baldwin–Ziegler Polar Expedition, Franz Josef Land, June, 1902".) Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 9, Folder "Notes & Journals". Washington, D.C.

Rilliet C.E. 1902b. Extracts from personal notes of Chas. E. Rilliet, June 1902. Scott Polar Research Institute Archives, Baldwin–Ziegler Polar Expedition Papers, MS 1514/3/9. Cambridge, UK.

Savoy L.A. 1903. *On the "Polar Star" in the Arctic Sea*. 2 vols. London: Hutchinson.

Scamehorn H.L. 1957. *Balloons to jets: a century of aeronautics in Illinois, 1855–1955*. Chicago: Henry Regnery.

Schledermann P. 1991. Einar Mikkelsen (1880–1971). *Arctic 44*, 351–355.

Sintz C. 1901. Letter to Baldwin–Ziegler Expedition, 3 June 1901. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 3, General Correspondence, Folder "June, 1901 (Baldwin–Ziegler)". Washington, D.C.

Swedish Society for Anthropology and Geography (ed.) 1930. *Andrée's story: the complete record of his polar flight, 1897*. New York: Viking Press.

Tenderini M. & Shandrick M. 1997. *The Duke of the Abruzzi: an explorer's life*. London: Bâton Wicks.

Thomsen A. B. 1993. History of the Baldwin–Ziegler Expedition. Library of Congress, Manuscript Division, Papers of Leon F. Barnard, 1901–1993. Washington, D.C.

Tucker J. 1996. Voyages of discovery on oceans of air: scientific observation and the image of science in an age of "balloonacy". *Osiris* (2nd series) *11*, 144–176.

Vedoe A.M. 1902. Journal of Anton M. Vedoe. 1 January 1902. Library of Congress, Manuscript Division, E.B. Baldwin Papers, Box 8, Folder: "Journals, June, 1901–March, 1902". Washington, D.C.

Wellman W. 1911. *The aerial age*. New York: A.R. Keller & Co.

Wråkberg U. 1999a. Andrée's folly: time for reappraisal? In U. Wråkberg (ed.): *Centennial of S.A. Andrée's North Pole Expedition. Proceedings of a conference on S.A. Andrée and the agenda for social science research of the polar regions. Bidrag till Kungliga Svenska Vetenskapsakademiens Historia 28*. Pp. 56–99. Stockholm: Royal Swedish Academy of Sciences.

Wråkberg U. (ed.) 1999b. *Centennial of S.A. Andrée's North Pole Expedition. Proceedings of a conference on S.A. Andrée and the agenda for social science research of the polar regions. Bidrag till Kungliga Svenska Vetenskapsakademiens Historia 28*. Stockholm: Royal Swedish Academy of Sciences.