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Chapter 10

The Rocket in Britain, 1900–1939*

John Becklake† and Mali Perera†

Abstract

Following a hundred years of rocket development in the 19th century, termed the First Golden Age of Rocketry by Frank Winter, in which Britain played a major role, the first four decades of the 20th century saw relatively little original rocket activity in Britain. Certainly when compared with rocket development in Germany, the United States, and the Soviet Union, Britain's contribution in the period under consideration was minor, but there were pockets of activity and a surprising amount of work did take place in certain fields. This chapter will look at the use of rockets in lifesaving and postal rockets in Britain, with the work of Zucker from Germany, which raised the ire of British officialdom. Also covered will be the work of a small number of amateur experimenters—some linked to the British Interplanetary Society that was formed in 1933—as well as the large-scale development of the solid fuel cordite rockets, code named UPs, which saw major use as anti-aircraft and mass bombardment missiles during World War II.

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† BIS History Committee, United Kingdom.

I. Introduction

These years cover a period when British rocket development, which shone so brightly during the 19th century, with the work of Congreve, Hale, et al., is generally felt to have ground to a halt at least until 1935. Britain in 1900 was still the powerhouse of the world and had an Empire on which "the sun never set." But she was living on the dying embers of the Industrial Revolution, and her interest in new technologies like electricity and the internal combustion engine was lukewarm at best. As I hope to show in this chapter, however, there was still quite extensive use of the rocket in the British Isles during this period.

II. The Lifesaving Rocket

The use of rockets to establish a link between the shore and a ship in distress, and vice versa, had been active in Britain from the 1820s. By the turn of the century, thousands of lives had been saved by its use in the shore-to-ship mode [1]. The main element of this Life Saving Apparatus (LSA), as the system was called in the late 19th century, was the two-stage Boxer rocket, produced at the Woolwich Arsenal, which had superseded the Dennett Rocket in 1865 and totally replaced the Manby mortar by 1878. By 1901, it was in use at some 300 lifesaving stations around the British coastline, and the Boxer rocket system was not totally replaced until 1948, although a more modern version made by Schermuly was being introduced by then. Although cumbersome, the Boxer system was effective for wrecks within a few hundred meters of the shore. It was officially under the auspices of HM Coastguard, but by the mid-19th century, the Coastguard had become in effect a Naval Reserve. The "slack" was then taken up by groups of volunteers. In December 1860, the first Volunteer Life Brigade (VLB) was formed at Tynemouth, soon to be followed by other VLBs or Companies (VLC) around the country. These groups worked closely with HM Coastguard, who supplied training and equipment at each of the stations, but the volunteers in the Brigades or Companies basically took over day-to-day operation of the actual rocket lifesaving system. When a shipwreck near the shore was reported, the VLB/VLC would travel to the scene with a cart, or lorry in later years, that was preloaded with all the equipment necessary. This cart normally carried up to 8 Boxer rockets.

The Boxer rocket, as described in the 1927 HM Coastguard publication [2], consisted of:

> "a drawn steel casing in two sections—Each section is filled separately with slow burning composition, by means of 'hydraulic machinery,' under the

pressure of approximately nine tons to the square inch. After being filled each section has a conical shaped cavity bored in the composition. The sections are then joined together by means of screws. When the First section of the rocket has expended its force the second stage is ignited and an additional impulse is thus given to the projectile. The rocket is 25¾ inches in length, 3 inches in diameter and about 16 pounds in weight. The stick is six feet nine inches in length and is attached to the rocket by a spring catch."

The rocket, attached to a thin line, was fired from a launcher on land over the distressed vessel. The line and the following stronger rope would be hauled in by the ship's crew, attached firmly to the ship, and those onboard the shipwreck winched to the shore and safety via a bosun's chair. In 1901, this system was still going strong. For example, on 7 November 1901, an Italian Barque *Concezione* traveling from Nantes with a load of pit props for Swansea was shipwrecked near Bude in Cornwall in a gale. A line was established by the sixth rocket fired by the local VLB and nine survivors were rescued.

This system, for all its faults, remained in place until 1948 when the last Boxer rocket was tested.

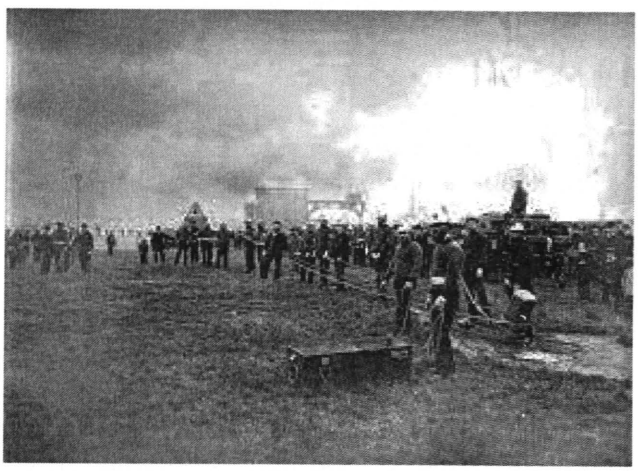

Figure 10–1: Practice demonstration of the Boxer Life Saving Apparatus with the rocket cart on the right among the crowd. The rocket is on the left. This shows the complexity of the system plus the interest by the public as shown by the numbers watching. The date and place of this picture are not known but is probably at South Shields and the late 1800s.

II.1. Schermuly Lifesaving Systems

Much of the information in this section is taken from [3], a rather publicity-oriented biography of William Schermuly.

By 1900, change was on the way, not in basic rocket technology but in its application to the problem of lifesaving from shipwrecks. It had long been thought that it would be better for the rocket to be based onboard the ship rather than on land. This idea had been tried before by, for example, Trengrouse and Carte [1] but never brought to fruition. It had two main advantages—the shore was a bigger target than a bucking ship in a storm and usually the rocket would have the assistance of an onshore wind not to say gale meaning that a smaller rocket could be used. It had another advantage in that it could be used in ship-to-ship rescues. But it was vital that any shipborne system be relatively small and simple to set up and fire—the cumbersome Boxer system would be completely impractical on a chaotic shipwreck.

Onto the scene arrived William Schermuly (1857–1929). Born in England of Dutch background, Schermuly had been a practical seaman and had spent nine years at sea from 1871 to 1880 on sailing ships, followed by several years in miscellaneous jobs, including dockyard policeman and the London Fire Brigade. His time at sea had convinced him of a need for an improved lifesaving system, specifically for a ship-to-shore method of establishing a line between a ship in distress and the coast to replace the existing shore-to-ship system of the Boxer rocket. He began work on his idea in the late 1880s and by 1897, this had come to fruition as the "Schermuly Ship's Line Throwing Apparatus," and a factory had been established at Cheam in South London to produce this apparatus, although the actual date when this factory opened is unknown. This was very little improvement, in theory, on that proposed by Trengrouse and others nearly a century before, but it was "user friendly." It used a small gunpowder rocket still with a cardboard tube that, to say the least, was not ideal for use aboard a ship in a storm. But it was practical, compact, and simple to deploy—a vital characteristic for use on a pitching, distressed vessel. The whole apparatus could be carried, installed, and fired by one person. The line and launch tube were contained in suitcase-sized boxes [Figure 10–2]. Also, rather than the rocket and its launching trough being mounted solidly on the bucking deck of a ship, it was hung from what might best be described as a washing line. This tended to negate much of the ship's motion.

But the system took a long time to be accepted, because the wheels of officialdom turned very slowly. It is said to have been awarded a gold medal at the Diamond Jubilee Exhibition in 1897, but 10 years later there were hardly any sales at all, although Government Departments were "considering the matter." The year 1912 appears to have been the turning point in the story. The Schermuly Ship's Line Throwing Apparatus received its first large order from the Royal Mail Steam Packet Company who decided to equip their fleet with the system,

although some foreign governments had for some time been using the equipment. Also, at about the same time, it was recommended by Robert Scott, the Antarctic explorer, and it is said to have been carried by Shackleton on his ship the *Endurance*, which perished in the Antarctic in 1915 [Figure 10–3].

Figure 10–2: William Schermuly carrying the complete package of his early Ship's Line Throwing Apparatus.

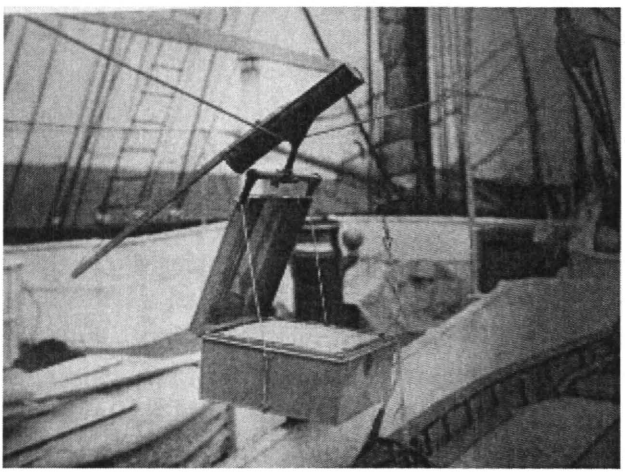

Figure 10–3: Schermuly Ship's Line Throwing Apparatus aboard *Endurance*, Shackleton's Antarctic exploration ship shown ready to use hung from its "washing line" mount.

World War I had a large influence on the Schermuly Company. The company offered all existing stocks of its lifesaving apparatus to the Admiralty. Initially this was refused, but the unfortunate loss of a hospital ship, the *Rohilla*, off the Yorkshire coast in October 1914, had a galvanizing effect. In a storm in October 1914, the ship, enroute to France to pick up wounded soldiers, hit a reef 400 yards (the actual distance varies according to different references) from shore and 1 mile from Whitby. In front of many witnesses and despite the valiant rescue attempts by the local lifeboat, some 83 lives were lost. The existing Boxer lifesaving rocket apparatus was unable to reach the ship in the teeth of the gale. One outcome of this was that the inquest jury recommended that all passenger vessels carry rocket appliances rather than rely on rockets from the shore to ship. Orders from the Admiralty then began to arrive, but there was still no compulsion by law to have every British ship carry such equipment. This did not occur until 1928 with passage by Parliament of the Merchant Shipping (Line Throwing Appliance) Act to come into force on 1 January 1929—which said, "Every British ship exceeding five hundred tons gross register when going to sea from any port in the United Kingdom shall be provided with a line throwing appliance approved by the Board of Trade."

Other uses for such a line-throwing device were also considered for use during World War I (these are covered in section 3)—and the Schermuly factory was kept busy.

II.2. Schermuly Lifesaving Systems

The Schermuly Company was nothing if not inventive and looked for an even simpler device. In 1920, it produced the embryo SPRA (Schermuly Rocket Pistol Apparatus). This was a handheld device based on the principle of the Very pistol. It basically comprised a large-bore, long-barrel pistol, which first fires a short blank cartridge, similar to that used in a sporting gun only smaller. A rocket in a steel case filled with propellant was inserted on top of the cartridge and attached to the end of the line to be thrown. On firing, the gases generated by the cartridge ejected the rocket (and line) and also ignited the rocket, which continued on its way [Figure 10–4].

In a good propaganda exercise, which would not be allowed under health and safety today, he arranged for it to be fired by his grandson, age eight at the time [Figure 10–5]. This SPRA was very effective and way ahead of competing rocket pistol types of the day, and it became Schermuly's staple product until World War II arrived. Finances were much improved, and they moved in 1926 to a larger factory at Cheam in South London, and business had expanded so much

by 1936 that the firm moved out of London to a site at Newdigate, near Dorking in Surrey.

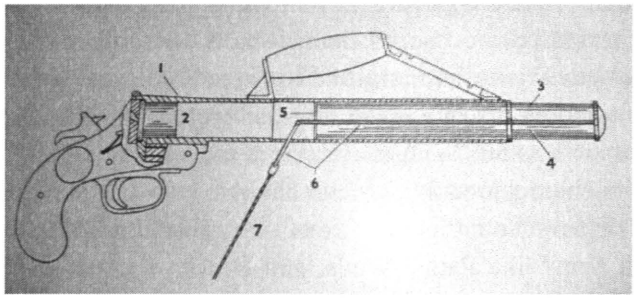

Figure 10–4: Diagram of SPRA. The large bore pistol [1] fires a short blank cartridge [2]. The rocket [3] in a weldless steel case containing the propellant [4] and a waterproof disc seal [5] is inserted into the pistol's barrel. Fixed to the rocket [6] is a direction bracket attached to a short length of steel wire [7] attached in turn to the end of the line to be thrown.

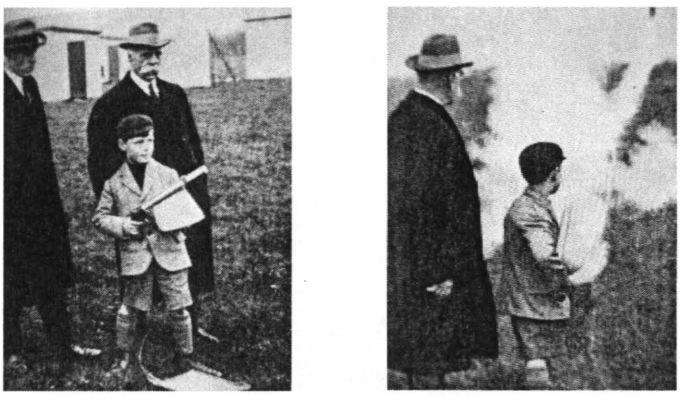

Figure 10–5: SPRA being fired by Willian Schermuly's grandson (age 8) in the early 1920s.

III. World War I and Signaling Rockets

Rockets were used to a limited extent by the British in World War I, mainly for signaling purposes, but there were other minor applications. These included messaging rockets, telephone line carrying rockets and grapnels for countering barbed wire obstacles. Sound signal rockets were also issued to some Police and Fire Brigade stations to be fired as air raid warnings. In 1916, the Frenchman Yves Le Prier used a type of firework rocket as an air-to-air weapon against observation balloons and airships, initially on a Nieuport biplane. This idea was

taken up by the British by putting such rockets, with a range of a few hundred meters, on their Sopwith Cub and Farman aircraft for example. There is, however, no record of any successes with this weapon against airships. The Schermuly Company also proposed the use of their rockets to send messages along the trenches in Northern France and attached to grappling irons to demolish barbed wire defenses. It should also be noted that the breech-loading Vickers QF Gun Mk 11, widely known as the "Vickers-Crayford rocket gun" of World War I, was a conventional machine gun with no rocket involved.

Millions of parachute signal rockets, etc., were ordered, however, from British firework firms like Pains, Wells, and Brocks for use in the trenches in France. Many, if not most, of them had to be rejected early in the war, however, because of swollen cardboard cases and the rocket failing to ignite. On one occasion in December 1916, out of 16,320 rockets submitted by Messrs. Pains and Wells, 9,942 were rejected. Another note says that the supply of "message carrying rockets was being held up for want of tubes in respect of which aircraft have priority." This applied to the metal-tubed rockets introduced late in the war [4].

Figure 10–6: British signal rockets in the trenches.

IV. Postal Rockets

Much has been written about this cul-de-sac of rocket history. Britain's involvement, although small and not carried out by British nationals, is interesting, because it gives an insight into the official attitude toward rocket experiments in the 1930s. On 7 May 1934, a German, Gerhard Zucker, attended the International

Air Post Exhibition (APEX) in London. Together with C.H. Dombrowski, he formed the British Rocket Syndicate Ltd. to further his rocket mail experiments and to handle the money made by selling the rocket-flown postal covers. Zucker, from the Harz Mountains, had been demonstrating postal rockets in Europe for a while and making a sort of living by selling such flown postal covers. He met representatives of the BIS—including Phil Cleator and A.P. Low—at APEX, and in an article in the *News Chronicle*, it was said that Zucker "would like to fire a rocket from a field on the outskirts of London" but could not meet the cost of the experiment [5—most of the source information for this section of the chapter can be found in this reference].

IV.1. Zucker at Brighton

In the end, Zucker's first postal rocket launch in the United Kingdom took place on 6 June 1934 at South Downs, near Rottingdean. Some of Zucker's rockets were large, up to 5 meters long, but the propulsive element was much smaller gunpowder rockets, mainly standard fireworks or lifesaving rocket charges. Zucker was forever complaining about the quality of the gunpowder he could get in England, possibly to explain why his experiments often failed. Zucker's rocket on this occasion was about 3 feet, 6 inches long and 8 inches in diameter, and it flew about half a mile. Zucker said the Post Office had no objections to such firings, but the Home Office, which was to play a major role in limiting such rocket work in Britain, made no comment [Figure 10–7].

Figure 10–7: Grainy picture purporting to be of Zucker's rocket at Rottingdean—6 June 1934.

IV.2. Zucker in Scotland

Zucker then moved his activities to the Isle of Scarp, Scotland, which lay in the constituency of a Wilson Ramsey, who had already asked a question in Parliament on the subject of rocket mail. The intention was to fire the rocket from the shore of Scarp to the Island of Harris less than a mile away. There were two launches in Scotland on 28 and 31 July 1934 using, it appears, the same type of rocket he used at Rottingdean. Neither of these rockets worked as planned—the first, watched by a local Postmaster General and Wilson Ramsey, exploded on the launcher, spewing the 4,800 (reported) postal covers all around. These were collected, dusted off, and sent to be sold in the usual way. Zucker blamed insufficient compression of the explosive charge in the rocket. This was one of four he had bought from Vickers Armstrong, whom he said had no previous experience of powder manufacture. This, if true, begs the question of why he did not stick with the Brocks charges that seemed to have worked at Rottingdean, although they might not have been strong enough for the Scarp adventure.

ROCKET MAIL TEST.—Herr Zucker, the inventor (right), with the apparatus destroyed during attempts to rocket mails from the island of Scarpa to Harris.

Figure 10–8: Explosion on Scarp—Zucker inspecting the remains of his rocket—after no doubt collecting the "rocket mail" for sale.

There is a story, possibly apocryphal, that one reason for Zucker choosing this stretch of water was that in January 1934 a Mrs. Maclennan had given birth to a baby on Scarp. She was still poorly next day and, as there was no telephone on the island, an islander rowed across to the mainland only to find that the telephone on the mainland was out of order. The postman's son was sent to fetch a

doctor at Tabert (17 miles away). When the doctor, after crossing to Scarp, saw Mrs. Maclennan, he decided to take her to the hospital. So, tied to a stretcher in an open boat, Mrs. Maclennan crossed to the mainland in rough seas. When she finally reached the hospital—a second child was born. This was widely reported in the press and is said to have come to the eyes of Zucker. But Zucker only came to England in May, four months after the incident—and it is more likely that it was Wilson Ramsay, the local MP who indicated the site.

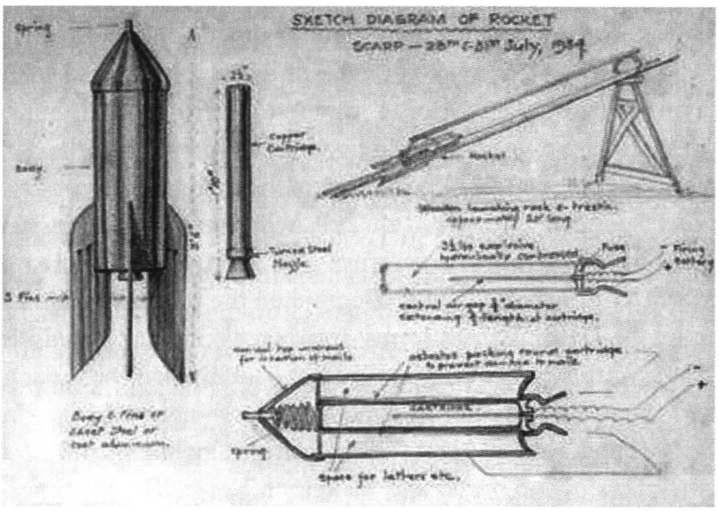

Figure 10–9: Lochmaddy's postmaster sketch of Zucker's Scarp rocket.

Zucker's second firing in Scotland, on 31 July 1934, was announced as a proving trial and was also a fiasco. The rocket ignited correctly at the launch site at Amhinnsuide Castle on the Isle of Harris, but it got stuck on the launcher.

Despite the publicity and explosions of Zucker's Scottish exploits, the Home Office did not complain. They did not invoke the 1875 Explosives Act, which basically said that gunpowder must be manufactured only at licensed premises and kept only in existing magazines or on registered premises. The Post Office, however, were beginning to wonder if it was quite right for so much money to be made by selling "rocket mail" when the launches were failures. It is also interesting to note that many stamp collecting enthusiasts were beginning to question the morality of such "rocket post" activities.

IV.3. Zucker in Hampshire

Zucker appeared undismayed, and the British Rocket Syndicate wrote on 5 December 1934 to the Home Office on Zucker's behalf saying, "As the next

stage of our experiments with our Mail Rockets we would like a trial next week between the mainland and the Isle of Wight."

The launch site was to be on the Lymington Golf Course (no longer in existence) in front of Hurst Castle, with the Isle of Wight less than a mile away. The alerted Home Office contacted the Admiralty and the Air Force, and the Syndicate had also contacted the Chief Constables of Hampshire and the Isle of Wight. None of these groups were particularly happy but raised no concrete objections. The two Chief Constables, for example, indicated that, while they were not happy, it was in the words of Major Cockburn CC Hampshire "not his responsibility." The Home Office sat on the fence and wrote to the Syndicate on 15 December saying it had no authority to sanction the experiment, but "as the experiment appears to involve risk of injury and property, he [the Secretary of State] considers it ought not to be carried out in the manner proposed."

More correspondence followed quickly with the Syndicate asking for permission to fire and the Home Office refusing to give permission but equally refusing to ban it. Dombrowski himself telegraphed the proposed firing date to the Home Office on 17 December, forlornly I guess, asking for permission. Again, they would not give this but equally would not actually ban the launch. Two policemen turned up at the site after hearing that the launch would take place that afternoon. They found a small group of spectators, including the Postmaster of Lymington, members of the press, and Pathetone News. The postmaster had approved the flight of 600 postal packages on the rocket, a decision for which he later received a mild rebuke. Zucker turned up at 3 P.M. with all his equipment. Things then got complicated. Word came by telephone that the Home Office had given permission (this is very unlikely), then at 3:15 P.M. a messenger came from Lymington saying permission had been refused. Despite pressure from the onlookers, Zucker packed up and took his rocket away.

Two days later, on 19 December, the *Evening Standard* [6] announced, "Herr Zucker posts his letters." Zucker had indeed fired his rocket but again without success. It landed about a mile away (some sources say two miles) but not on the Isle of Wight, on stony ground in Keyhaven Marsh. Appearing undeterred, Zucker took his 600 letters away to be sold. After all was over, Major Cockburn of the Hampshire Police made the commonsense comment that "the equipment ought to have been 'fathered' by some authority if considered likely to be of value or otherwise absolutely banned."

IV.4. Falling Foul of the Law

This firing in defiance of Home Office wishes, if not instructions, finally appeared to mobilize the power of the British Civil Service against Zucker and his activities. In fairness to Zucker, neither the Home Office, the Police, the Admiralty, nor the Air Ministry had banned the experiment, and Zucker had what he saw as tacit approval from the Post Office. In January 1935, Zucker asked for an import license for two rockets (charges) that he had bought from Germany and were held in customs. Zucker said his Lymington rocket was powered by a rocket bought from Vickers Armstrong (so its composition was probably not "Herr Zucker's secret," because he had told the press). He also admitted that the Police had not given permission to fire but had told him he did so at his own risk.

The Post Office and the War Office had disclaimed by now any interest in such experiments (if they ever had any), and the way was clear for the Home Office and Director of Public Prosecutions (DPP) to bring Zucker's activities to an end. The DPP was clear that a misdemeanor under common law had been committed by firing the Lymington rocket and not storing the rocket in premises licensed for the purpose—as required by the good old 1875 Explosives Act. This was not a serious crime, and the penalty was estimated to be a small fine and forfeiture of the rocket. But the Home Office and the DPP were, to put it mildly, annoyed with Zucker's activities and recommended that Scotland Yard tell Zucker and his associates, under threat of criminal proceedings, to desist from any further rocket firing in this country.

On 16 January 1935, Scotland Yard met Zucker and Dombrowski and passed along the message. Dombrowski asked if there was anywhere they could carry on their experiments, but Scotland Yard could offer no suggestions except to say it would not be in this country. On 22 January, the Home Office wrote to Zucker saying that as he had been admitted to Britain for a "brief visit last November" (probably they meant November 1933) the Government could not agree to his prolonging his stay. On 22 February, there is a Home Office minute saying, "Zucker seems to have gone to ground and they have so far been unable to serve him any invitation to leave the country." But he must have left, because he was allowed to re-enter on 22 March as a witness in a case between a Mr. Armstrong, a philatelist, and the *Daily Express* as to who had the rights to cover the Lymington firing. Zucker left our shores for good on 4 April 1935.

IV.5. Firings across the Channel

At about this time, spring 1935, the Mayors of Folkestone and Dover received a proposal from a Dutch Company—Nederlandse Rakattenbouw—to fire a rocket across the Channel from their towns. These were not strictly postal rock-

ets, but the problem for the Home Office was the same. The company explained that such firings had regularly occurred from Katwijk, Holland. Folkestone appears to have been alerted to Home Office views on the matter and would not give permission. The Home Office immediately wondered if their bogey man Zucker was involved—he was not. But Dover had replied to Nederlandse Rakattenbouw saying their request was being considered. Dover was sent details of the rocket in question—made of aluminum, 2 meters long, weighing 10 kilograms. At the end of the flight, it would be lowered to earth by parachute. On 9 May, Dover had agreed to the flight but quickly changed their mind following contact with the Home Office, and when the company asked for an explanation, the Major directed them to the Home Office. The Home Office was asked "for which reason rocket flights are forbidden in your esteemed country."

Basically, the reply was "no comment." But the Company were not put off easily. By 15 May, they had asked the Prefect of Calais if a rocket could be fired from Cap Gris Nez (near Calais) to England. This caused a flurry of diplomatic activity—if the authorities were fearful of firing a rocket from England, they were doubly worried of being on the end of a rocket barrage from France. Things got complicated, but it appears that the initial idea had been scrapped—possibly by the French. Then on the 12 September, the *Daily Mirror* reported that a firing would take place from Calais at 10 A.M. on 13 September and could impact at Dover, Folkestone, or Deal. This was proposed by a different Dutch Company. This rocket was to be 5 feet, 9 inches long, 20 inches in diameter and would fly the Channel in 40 minutes. No launch happened, however, because the French authorities had finally refused permission.

This marked the end of prewar postal rocket launch attempts in Britain or to Britain.

V. Amateur Rocket Activities

Again, compared with Germany, the United States, and the Soviet Union, little amateur rocket experimentation was carried out in Britain during the period under review. The British Interplanetary Society (BIS) was formed in Liverpool in October 1933, and the first issue of its *Journal* appeared in January 1934. The Society moved to London in 1937. It might have been thought that the BIS, like the VfR (German Rocket Society) and the American Rocket Society would act as a catalyst for amateur rocket experimentation. At the start, the intention was there—in January 1934 plans for a rocket car to act as a test bed for solid and liquid fueled rockets appeared in the press [7].

The UK government stance, based on the 1875 Explosives Act, tended to be anti-amateur rocketry. The conventional historical view is that blinkered officials simply ignored rocketry and blindly banned any attempt to develop them either by amateurs or even professionals. This is not wholly correct, because the British government, by 1935, had begun serious development of the rocket as an anti-aircraft weapon, but it must be said that officialdom was certainly not supportive of amateur rocket work. It appears that amateur enthusiasts in Britain suffered because of the experiences of the Home Office and other government departments in dealing with Zucker and his exploits.

V.1. Ralph Morris and His LOX/Petrol Rocket

The first direct involvement of the Home Office with British amateur rocketry came in January 1936. BIS member Ralph Morris, who lived in East London, wrote to the Inspector of Explosives at the Home Office explaining his plans to build and fire a series of liquid fueled rockets using LOX/petrol. He even enclosed a stamped addressed envelope for reply. Morris must have been aware of the problems that had arisen with Zucker, because he tried to reassure the Inspector by saying that the casting of the motors and the whole task of constructing the rockets would be undertaken by a firm of experimental engineers from a half-scale constructional plan that already had been drawn up [8].

Morris's drawings had been submitted to the BIS and to Pendray of the American Rocket Society. Cleator from the BIS said that Morris had sent early plans to him and together they had evolved a "fairly decent design." Morris and his colleagues (although we have no record of who Morris was working with) intended to fire their rockets "out in the country." This he said, combined with the facts that the rocket would be fired remotely and that it would be provided with wings to ensure a safe return to earth, would allow maximum security. He also said, "We thought it wise to inform you of our plans in case there are any restrictions on such plans."

This letter caused a flurry of minutes within the Home Office, and they replied on 7 February 1936 by warning Morris that the manufacture and storage of explosives and fireworks was subject to the 1875 Explosives Act, but they could give him no guidance of the application of these provisions without more detailed particulars of his proposal. But the letter also said, "The Secretary of State desires, however, to say at once that, on the information given in your letter, the experiment is not one which he would be prepared to allow to be carried out in this country."

Morris responded by saying that the explosives and fuels (LOX/petrol) definitely would not be manufactured or stored by them but would be brought only

when the rocket was ready to fire. A meeting was then arranged between Morris and the Inspector of Explosives, and Morris was told in no uncertain terms that there was little, if any, likelihood that he would be allowed to carry on. Further interventions from the BIS produced no shift in their position.

As a postscript, the *Daily Telegraph* got hold of the story, no doubt prompted by the BIS. A reporter met the Inspector of Explosives and asked him outright whether the Home Office was absolutely prohibiting any experimental work on interplanetary travel. This was denied, but the Inspector admitted there were problems associated with the Explosives Act to be overcome. This meeting was reported in a very mild article by the *Daily Telegraph* under the headlines "Home Office and Stratospheric Rockets. Why Experiments are held up. Danger to public."

V.2. Manchester Interplanetary Society

At around the same time, a group of young space enthusiasts entered the fray. In June 1936, a group of youngsters led by Eric Burgess, then age 16 and still at school, formed the Manchester Interplanetary Society. They began experimenting, mainly at home, with small commercial firework and homemade rockets. They too contacted the Home Office in October 1936, asking where they could purchase propellants for their rockets and, unlike the experience of Morris, they received what seems to have been an encouraging reply listing several suppliers. The MIS and BIS were obviously in touch, and the correspondence between the BIS and the Home Office seems to have been brought to Burgess's attention, because MIS member J. Broadbent contacted the War Office in January 1937 explaining that he and his colleagues had been informed it was illegal under the Explosives Act 1875 to experiment with liquid fuels, such as petrol and LOX. Broadbent said they had studied the Act and had been unable to find any clause prohibiting such experiments. Broadbent's letter was forwarded to the Home Office who, by now must have been fed up with such approaches. Broadbent was told that the position had been fully explained to the BIS in August 1936 and suggested that the MIS get in touch with the BIS. But the Home office also said, "A rocket is an explosive within the meaning of the Explosives Act 1875. A mixture of petroleum and oxygen is also an explosive. The filling of rockets may, therefore, be carried out only in a licensed facility."

Despite this, the MIS continued with their experiments, but only with solid fuels. By March 1937, it had 16 or 17 members, "three of which were girls" and whose average age was 17 years [8]. With the naivety of youth, this group quickly achieved notoriety among the Home Office and the local police by organizing a homemade rocket competition at Clayton Vale near Manchester [Figure 10–

10]. Nine rockets made by the group were brought to the site on 27 March 1937, and firing began at 2:30 P.M. Six rockets were fired: four made it off the ground, one nosedived, and the sixth exploded, injuring Malcolm Wade, age 16, and Herbert Snelsdon, age 14. At this point, the police intervened and stopped the demonstration. These events were widely reported, and typical of them was the *Sunday Express* headline "Rocket that was meant for Mars exploded in Manchester."

Figure 10–10: Rocket demonstration—27 March 1937. Near rocket (left to right) Eric Burgess, Bill Heeley, Trevor Cusack, and Harry Turner.

The group also made their own gunpowder, and the rockets were quite substantial. Five were made of cardboard and were 2.5 feet long, 2 inches in diameter, and the one that exploded was made of aluminum, 18 inches long, and 2 inches in diameter. Asked if he was aware of the 1875 Act, Burgess said he did consult the Government in January last and did not think they were doing anything wrong. Wade and Burgess were warned against carrying out further experiments and told there might be legal proceedings. The Chief Constable of Manchester was uncertain of whether to prosecute, but the Home Office told him to prosecute for the illegal manufacture of explosives. The hearing was held on 14 June 1937 when the summons was withdrawn upon a suitable undertaking by Burgess that neither potassium sulphate nor sulphur would be used again by him or any other member of the MIS. It was all a bit of a fiasco, but the point had been made that the Home Office were not going to look favorably on any freelance experiments with rockets in Britain.

V.3. The Paisley Rocketeers

It appears to have been different in Scotland. From 1935 until the outbreak of World War II, a group at Paisley, now a suburb of Glasgow, managed to fire small solid fuel rockets without falling foul of the Home Office. The rockets were mainly modified fireworks that could be bought in shops across Britain. This, together with the fact that the Paisley rocketeers went about their experiments without much publicity and press coverage, probably explains their escaping the attention of the Home Office.

The Paisley Rocketeers was founded in 1936 but was preceded, at the end of 1935, by the experimentation of John Stewart, a 14-year-old student who later became a leading light of the society. Stewart had already begun firing and modifying fireworks with a group of school friends. They removed the "star shells," etc., from the front of the rockets and replaced them with "payloads" like rocket post, stabilization, and recovery systems. The Paisley Rocketeers also clustered rockets together and, in August 1938, flew a camera that succeeded in taking a picture of a cloud.

V.4. Harry Grindall Matthews (1880–1941)

If ever there was an example of a shady scientist, it was Harry Grindall Matthews according to the Admiralty who, after experiencing one of his "demonstrations," described him as a "good example of the charlatan species" [9]. He was infamous for trying to sell "scientific inventions" mainly to British Government bodies. He was nicknamed Death Ray Matthews because of his attempts to sell a death ray weapon to the Air Ministry in 1924, but his interest in the rocket dates from the mid-1930s. After being declared bankrupt, Matthews turned up just north of Swansea in South Wales. It was here that he announced he was working on rocket torpedoes and aerial mines. The idea, as reported in the press, was to fly large rockets—12 to 15 feet long—to heights of between 10,000 and 30,000 feet when they would release a series of two-pound bombs on the end of a long steel wire, which would slowly descend by parachute. But the only evidence we have for these rocket experiments are two press articles, effectively released by Matthews, and some BIS correspondence. The conclusion must be, until proven otherwise, that Matthews's rocket torpedoes where just paper studies and that he did no practical rocket work. But his PR skills obviously worked—as he is sometimes quoted as being the man with the idea behind the later PAC (Parachute and Cable) rockets used quite extensively by the British for small-area defense during World War II. The British establishment had, in fact, been looking at such a system since 1935.

V.5. Ernest Welsh

This elusive inventor from near Hull in Yorkshire burst into the news in 1924 when two articles appeared in *Popular Science Monthly* and *Science and Invention* [10]. Both articles obviously used the same source material, probably from Welsh himself. Welsh claimed he was experimenting with rockets that could reach heights of five miles with a warhead that would spread "molten pellets" over an area of 100 square yards in front of oncoming aircraft. The rockets would reach such heights by exploding charges at intervals to give fresh impetus. One article shows Welsh with a three-finned rocket measuring some 3 feet long, and he made the perennial claim of most inventors that the propelling charge was a secret explosive discovered by him and known only to the British Army. Winter [11] gives this compound as Melonite, but I suspect it was Melinite, a propulsive material like Lyddite that was discovered in the 1880s.

VI. The Cordite Up (Unrotated Projectile) Rocket

The British gunpowder war rockets of Congreve, Hale, and others had held sway over other rocket weapons for most of the 19th century. But, by 1900, developments in artillery, particularly the rifled barrel and breech loading, had rendered the old gunpowder rockets obsolete, although the Hale spinning rocket was kept on the British military's inventory until 1919.

For the first three decades of the 20th century, the British had little involvement, indeed little interest, in rocket development. Millions of rockets were produced by firework firms, like Brocks and Pains, for use as signal rockets or flares, particularly during World War I (see section 2), but official development and involvement was minimal except to complain when the cardboard tubed rockets failed in the rain in the trenches.

But things began to change in the 1930s. Britain, along with France, had been strongly pacifist, with disarmament rather that rearmament being the watchword, driven it must be admitted partly by the Treasury. By 1933, the League of Nations had been discredited (the United States never joined). The International Disarmament Conference was to meet for the last time in 1934, and Hitler had been installed as Chancellor in Germany and openly began rearming. Britain took notice and in the 1933 Annual Review of Imperial Defence, it was stated that "the assumption governing the estimates for the Defence Services, that from any given date there will be no major war (for 10 years), should be cancelled" [12].

One of the big defense worries was the bomber. In 1932, Stanley Baldwin, who would become Prime Minister again in 1935, made the statement that "the bomber will always get through." In 1934, Britain's anti-aircraft (AA) defense was shaky—the 3-inch AA gun of World War I vintage was not particularly effective, and the 3.7-inch replacement under development would take a long time to reach operational status and was expensive to produce. In December 1934, a meeting was called by the Committee of Imperial Defence (CID) at the War Office, with the Master General of Ordnance in the chair, to investigate the possibility of using high-velocity rockets as a cheaper, easier-to-produce method of AA defense. It was also around this time, in true British fashion, that two important committees were set up that would have an influence on the development of the AA rocket. These were the Committee for the Scientific Survey of Air Defence under the chairmanship of Henry Tizard and a subcommittee of the CID called the Air Defence Research (ADR) subcommittee.

The information that follows in this section relies heavily on [13]. The December 1934 meeting, of which I can find no record, was followed by another at the War Office, in April 1935, to "discuss the rocket as a possible means of defense against hostile aircraft." At the meeting were representatives of the Research Department (RD) of the Royal Arsenal at Woolwich, including Dr. Alwyn Crow, who would later become synonymous with British rocket work during World War II [Figure 10–11].

Figure 10–11: Dr. Alwyn Crow, right, with Winston Churchill and Lord Cherwell in 1941. Crow headed the development of the British WW2 AA rockets at the Royal Arsenal Woolwich.

The RD was asked to investigate among other factors:

- The velocities that could be reached—could rockets achieve 3,000 f/s?
- Possible propellants
- Accuracy and stability of flight
- Ceilings, weight and time of flight to 10,000 feet.
- and to reply within a month.

This they did—saying they could probably meet the 3,000 f/s requirement and reach 10,000 feet in 5 seconds. Crow's team were aware of the work of Goddard in the United States (but decided not to contact him at the time) as well as that of Tilling, Zucker, and Sanger in Germany. There was, in fact, a halfhearted attempt to enlist the help of Sanger in 1935 but, although correspondence and some technical information was exchanged, this approach was abandoned in 1937 [14].

Things moved swiftly at first and, while it might have seemed a relatively easy task to produce a basic, high-velocity rocket, there soon appeared many problems facing the team at Woolwich in 1935. Many of these involved logistics and capacity. Space needed to be made available, together with staff to carry out the work. This was not easily solved because of budgetary problems and the presence of competing claims on the supply of qualified scientists and engineers. The problem of lack of space for testing and development of relatively large rockets at Woolwich was eventually solved by the move of the Projectile Development Establishment (PDE), as the team became known, to Fort Halstead in Kent in 1938. But then, because of Halstead's susceptibility to German bomber raids, it was moved again in 1940 to Aberporth in Wales.

Another problem for Crow's team at Woolwich was the increasing number of suggested uses for such rockets, which demanded attention and distracted from the main aim of producing a viable AA rocket. Liquid fueled, long-range ballistic missiles were investigated for a while and other uses for simple solid fuel rockets, such as RATOs, air-to-air missiles, rocket flares, and wire barrage rockets, appeared on the agenda over the years. This did distract from the main purpose of producing a simple AA missile.

Meanwhile, back at Woolwich, it had effectively been decided by December 1935 to go for a solid fuel rocket, a sensible decision bearing in mind the urgency of the problem, with cordite as the propellant. Cordite had been tried before in rockets, by Unge in Sweden for example, but had not really been pursued. Initial theoretical investigations had indicated that the required performances could be met with a 2-inch-diameter charge, and the largest charge that existing cordite presses could extrude had a diameter of 3 inches—so these became the base lines for the development. There were many pragmatic decisions that had to

be made. The ratio of propellant weight to total weight needed to be high, resulting in as thin a motor tube as possible and with the length very long in proportion to the diameter. This ruled out spin stabilization, so fins had to be used and probably became the inspiration for the code name for the rockets—UPs (Unrotating Projectiles).

The Research Department at Woolwich started reaction experiments using a 2-inch cylinder filled with cordite in a vented vessel with a view to gaining experience using the available facilities, before moving later on to the 3-inch rocket when they moved to a larger site (Fort Halstead). At that time it was generally accepted that in such a rocket, charge burning must be restricted to the inner surface only and that the space between the cordite charge and the metal rocket tube be sealed with a plastic material.

By the summer of 1936, several events of note had taken place. As hinted above, the investigation of the use of rockets for AA defense was officially extended to include the use of rockets as long-range offensive weapons, air-to-air and air-to-ground weapons, and for assisted take-off units, although the AA rocket remained the main priority. But this put more stress on the staffing levels, and efforts were made to recruit suitable scientists and engineers—this recruitment progressed slowly—as did the move for space at Fort Halstead. On the organizational side it was confirmed that "future rocket development should be dealt with by the Ordnance Committee with the aid of an in house Advisory Committee on Rocket Propulsion which would meet monthly at the War Office" also "The research (into rockets) will be undertaken under the Research Department (at Woolwich) and be reported by CSRD (Chief Scientist Research Department) through the Ordnance Committee who will arrange the trials and direct the development as in the case for other Service stores. CSRD will forward as soon as possible his revised requirements for new buildings."

As work developed, it became clear that the bigger rocket would be needed to fulfill the requirements for AA work, and the site at Woolwich simply did not have enough room to undertake even static tests of such a rocket. As already noted, it was decided to proceed with the 2-inch version as an experimental device before facilities and staff could be found for the bigger rocket. I do not intend to go into the detail of the various negotiations for staff and facilities, suffice to say that the system progressed very slowly. I will only consider here the two main technical problems encountered, and for more details the reader is referred to [13].

VI.1. Case Bonding

As already noted it had been thought that it would be necessary to "case bond" the cordite to the rocket tube and allow burning only on the inner surface. Many different materials had been tried to "glue" the charge to the tube from late 1935 on but none proved effective and all were difficult to apply. Rocket tubes would split at hot spots where adhesion was poor. This search continued until the spring of 1938 when someone, possibly Dr. Poole, suggested a loose charge held in place within the rocket tube by a steel grid. This unfortunately resulted in a smaller propellant charge and hence a degradation in performance. This was tried and, with later a refractory lining deposited on the inside of the tube, proved successful with many fewer failures. It was also noted that when the refractory lining was used there was less dispersion of rocket trajectories. This was probably because the lining reduced uneven expansion in the tube which had resulted in misalignment of the nozzle.

VI.2. Case Bonding

One of the deficiencies of the rocket compared with the AA gun was dispersion. This problem was never solved but could be alleviated by making the tubes as straight as possible. The initial specification was for a thin steel tube which proved impossible to straighten—it buckled. This was followed by a thicker carbon steel in the form of a solid drawn tube, but these proved to be oval in cross-section. Eventually, around mid-1937, it was decided that drawn tubes were not practical, especially for large scale production, and in the end butt-welded tubes were used. These proved satisfactory.

Large scale trials of the 2-inch UP began in late 1937 and of the 3 inch in 1938 when access to the more spacious accommodation at Fort Halstead became available. These included test firing campaigns at Shoeburyness and Fort Blacknor on the Isle of Portland in England and in addition there were some 2,500, 3-inch UPs fired in Jamaica in the beginning of 1939. The 3-inch rocket could reach some 20,000 to 25,000 feet in altitude and it was felt that the seeing conditions would be much better in Jamaica than in England. They were.

By the start of World War II, the 3-inch rocket was working satisfactorily but was not considered ready for immediate service use. The Project Development Establishment was moving to Aberporth from Fort Halstead to, as its name implies, look towards improvements to the basic design, but we are now moving outside the time frame of this chapter. Suffice to say the 2- and 3-inch UP was eventually used extensively and with great success during World War II in the British Z batteries as an AA barrage weapon, as well as in mass bombardment systems [15, 16].

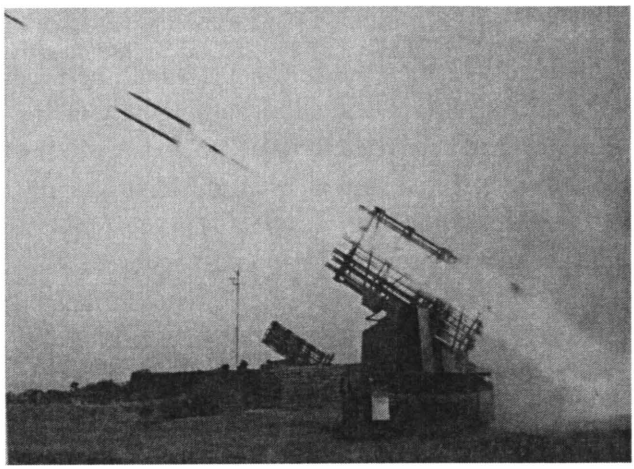

Figure 10–12: Multi-barreled 3-inch UP projector in action on the south coast of England in 1944.

Figure 10–13: A 3 inch UP being loaded onto an early single barrel projector. The final rockets were some 76 inches long with shell, 3.25 inches diameter and weighed some 50 pounds.

Acknowledgments

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