Early Rocketry

Part 6 (Final) Britain (2)

The word early is defined as the 19th century interim after Congreve when the Hale rocket was developed and in the 20th century the years from 1937 to the end of WW2 in 1945.

In the latter period British rocket development was entirely military.

In the civil field Britain did not follow the pattern evident in Germany and the US in the 1930's – where initial activity by amateur enthusiasts became progressively more sophisticated, producing viable rockets, with, in the case of the US, members eventually founding commercial firms,

In Britain whilst the enthusiasts of the British Interplanetary Society were able to produce competent designs for rocket powered space vehicles they were prevented from any experimentation with actual rockets by the provisions of the 1875 Explosives Act.

The Hale Rocket 1844

In 1844 William Hale introduced his rocket which improved on the Congreve design.

He eliminated the deadweight of the Congreve cumbersome and inaccurate guide stick, replacing it with a system in which part of the thrust gases were led through exhaust holes which, in conjunction with tail fins, produced a spinning effect, markedly improving stability in flight.

A number of foreign armies took up the design, particularly in Europe the Austrians. Beyond this the Americans took an early

interest, to the extent that they bought manufacturing rights from Hale and shortly after formed a rocket brigade to serve in the Mexican-American War 1844-1846, which operated effectively in major actions.

In Britain consideration of the new design was slow. Use in the Crimean War was still only experimental and the Hale rocket was not officially adopted until 1867. It was employed widely in colonial engagements. Particularly useful in the terrain often involved was the suitability of the 24 pdr. version for carrying in packs by mules.

A significant Government contract followed adoption, easing Hale's financial difficulties.

However by the 1890's the rockets were becoming increasingly outmoded, and official interest was waning. Storage in overseas conditions was a problem, with gunpowder separating from casings. Conventional artillery development was proceeding apace, particularly after the introduction of breech loading and the rifled barrel, with significant improvements in power, range and accuracy.

In 1919 the Hale rocket was officially declared obsolete and military rocketry disappeared from the scene.

Late 1930's - Rocketry reappears

In the 1930's there was a resurgence of official interest in rocketry. The War Office became aware that the German military, taking advantage of the omission of rockets from the weapons banned by the Versailles Treaty, had commenced a rocket programme. As it became obvious that war was looming, the threat of mass bomber attack and means of defence was a major preoccupation. Large numbers of anti aircraft guns were needed, placing a strain on productive capacity. The Government turned to the rocket as a supplement to the gun.

Just in time

As early as 1935 work had started in the Explosives Branch at Woolwich Arsenal on an anti aircraft rocket, transferring to Ballistics Branch in 1936. By 1937 a 2” calibre weapon had been devised and a 3” version was being worked on.

In the meantime the 19th. century Victorian defence mobilisation centre, Fort Halstead, had been identified as suitable for use as an experimental outstation.

Elements of the Rocket Section of Ballistics Branch moved to the Fort in 1937 – the precursor to what was ultimately to become the Fort Halstead Research and Development Establishment.

In 1939 the Projectile Development Establishment covering military rocket development was formed under the direction of Alwyn (later Sir) Crow.

The Anti Aircraft Rocket

(1) The 2" Rocket - AA Ground to Air

It was envisaged that a rocket of 2 inch calibre could parallel the performance of the current AA gun.

The design produced held a cordite charge within a thin steel tube (weight was important). To inhibit the effect of the hot gases from burning on the motor tube the charge was secured and separated from the body by plastic material. Further, the charge was centrally pierced in a star shaped configuration. This produced an almost constant burning surface, giving a relatively constant thrust.

Whilst the theory was sound, in practice it proved impossible to find a satisfactory plastic material. Over the temperature range involved it it became fluid at one end and at the other it lost its plasticity and became tacky.

The drastic step was taken to abandon work on a plastic surround and adopt a loose charge consisting of a plain cylinder of cordite supported on a steel cross fixed at either end of the motor, with burning taking place on all exposed surfaces.

After much experimentation it was found that spraying the inside of the motor tube with a suspension of finely ground alumina in a solution of sodium silicate provided sufficient insulation of the walls of the motor tube from the effects of hot gases.

There was some reduction in performance from the original parameters, but overall, somewhat to the surprise of the scientists, the modified design worked satisfactorily.

(2) The 3" Rocket – UP3 (Unrotated Projectile)

A year after the development of the 2” rocket the new 3.7 inch anti aircraft gun was brought into service, leading to a call for a rocket to match it.

The result was the 3” rocket. This continued with the loose charge of cordite – a solventless grade produced at the new ROF at Bishopton and from 1942 at the ROF at Ranskill.

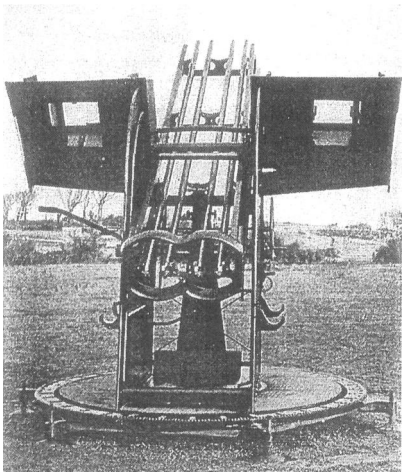
The UP3 design was successful and from 1940 operated as a supplement to the anti aircraft guns.

Originally the projectile was fired from single launchers and detonated by a proximity fuze. The fuze did not perform well and salvo firing was adopted.

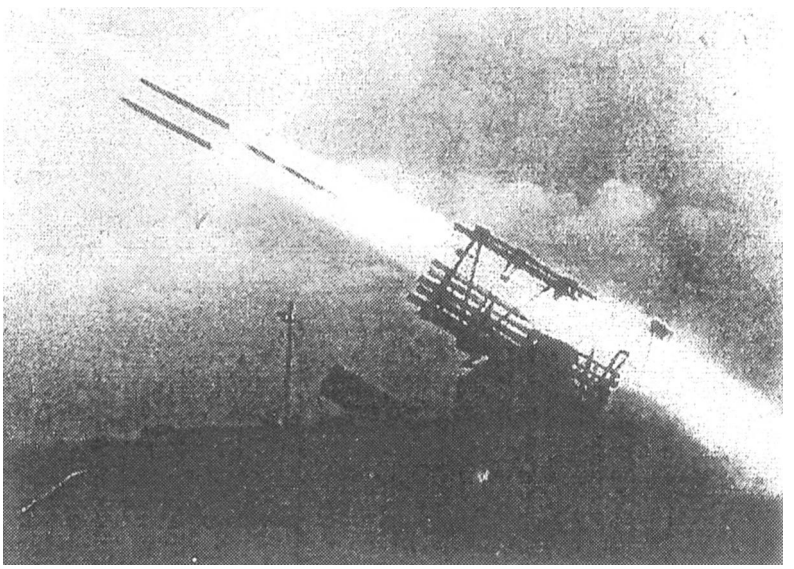
The Z Batteries

The salvos were fired by units termed Z Batteries. These units, largely forgotten, consisted mainly of Home Guard personnel, who on the whole achieved a high standard of performance.

Each Z Battery consisted of 64 launchers, each firing two rockets giving a salvo of 128, resulting in a cube of fire one quarter of a mile wide.



Twin barrel 3” rocket launcher



3” rocket launcher firing

The Z batteries were a useful addition to AA capacity but their radar could not cope with the later 1944 flying bomb offensive and they were disbanded in 1944.

Air to ground / sea application

In the meantime the 3” rocket with explosive warhead became an extremely effective airborne weapon, particularly against tanks and road transport.

It was also employed with some success against submarines.

(3) The 5” Rocket
(a) The Rocket Ships - Mattress

Arising originally from an Army requirement, the 5” rocket was developed. This had a charge of eleven sticks of tubular cordite.

The intended use by the Army did not in fact materialise, but the Navy then found that it was eminently suitable in a support role for the amphibious landings in hostile territory which were being planned by 1943.

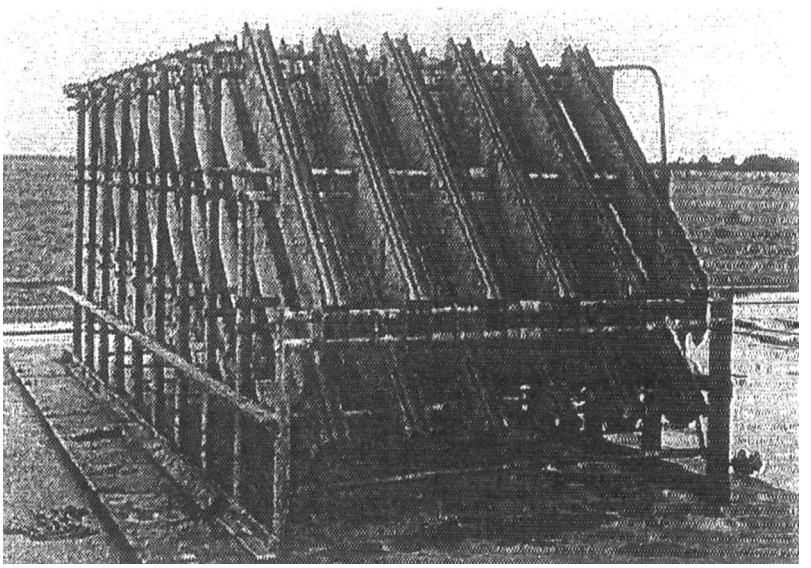
Fitted with a high explosive charge, the rocket motor was arranged in multiple projectors to fire salvos from rocket ships (shades of Congreve), designed to neutralise artillery threatening landings.

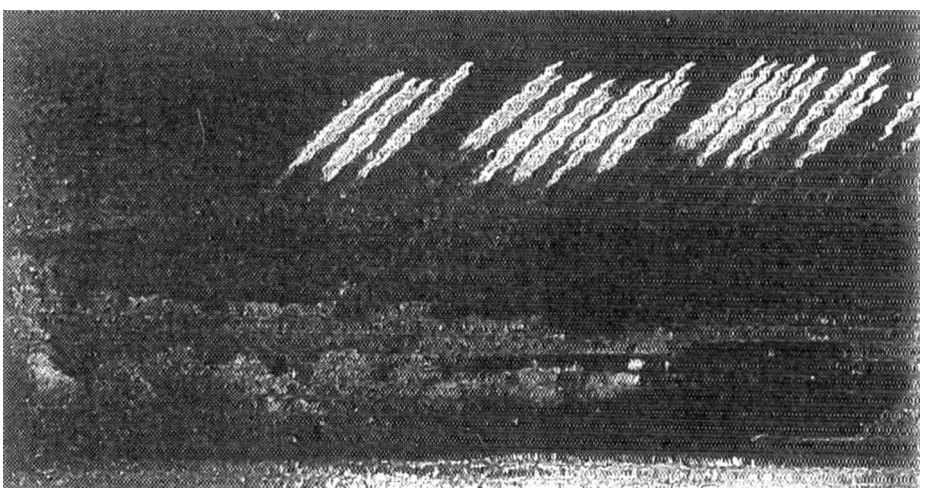
The equipment was given the name “ Mattress”, reflecting its softening effect on artillery positions.

The rocket ships’ first role was in support of the landing on Sicily, where they were a spectacular success.

A ‘Land Mattress' was also developed and was employed in the crossing of the Rivers Scheldt and Rhine.

5" Multiple Launcher – 'Mattress'(b) LAP – 5"





A Mattress salvo

After the earlier tribulations with plastic material, such was the pace of war time development that by 1943 a 5” calibre motor had been designed for development employing plastic propellant, with the designation Light Alloy Plastic – LAP.

Further utilisation of the 3” Rocket Motor – Guided Missile propulsion

Meanwhile other uses were being considered for the AA rocket motors, with implication for the future.

Beginning in 1942 work was started on producing an operational guided missile. – rocket powered missiles which could be guided on their targets.:

Four projects were instituted. Fundamental to missiles was the propulsion unit and the motors which had powered the rockets in the AA role now figured in these.

Brakemine - February 1943 - Ground to air missile.

‘Radar controlled rocket' – beam riding system. A missile guidance system in which the missile flies down a radar beam aimed at the target.

Development by AA Command and private firm A C Cossor.

The AA Command team was led by Major Sedgfield of REME who had written a paper on the concept in 1942. This team was responsible for the missile structure, control, firing and command systems . The A C Cossor team, led by Mr. L H Bedford developed the receiver and guidance system.

Flying control was ‘twist and steer' in which the two main wings were connected to the fuselage by pivots, allowing them to rotate to different angles of attack.

The teams put in a very creditable performance and by September a 1944 test vehicle had flown.

Brakemine achieved operational level and deserves a better place in the dusty annals of early British rocketry applied to missiles, as does Major Sedgfield, what became of him? as one of the original thinkers.

One Brakemine missile has miraculously survived and is displayed in the REME museum.

Brakemine at REME Museum of Technology

Little Ben / Longshot – February 1944

Test vehicle for ground to air systems.

Propulsion by 3" rocket motors.

July 1948 first flight test

Stooge - mid 1945

Ground to air

Powered by four 5" rocket motors and four 3" boost motors

Development by Fairey Aviation

Post war numerous test launches were made up to around 1947.

Lopgap (Liquid Oxygen Petrol Guided Anti-Aircraft Projectile) - September 1943

The only liquid fuel rocket propulsion system under development at that time

Seven 5" boost motors

Post war into the 1950's the 5" Light Alloy motor – LAP was of particular importance as a propulsion unit in test vehicles

I was required to produce (at Waltham Abbey) 100 5" light alloy rocket motors per week for use by Guided Weapons Group. These were used at Aberporth and Larkhill ranges to power test vehicles for guidance systems

Dick Doe writing in Touchpaper September 2001

At the end of the war it was decided to terminate work on Brakemine, in spite of its programme being the most advanced, in order to concentrate on Lopgap as the latter was considered the more suitable for further test work. However Brakemine had made a notable contribution – its ‘twist and steer' control method was employed in the later much more powerful Bloodhound missile.

Test flying of Stooge and Longshot continued into the late 1940’s.

As the RTV1 test vehicle Lopgap played a fundamental part in early post war UK surface to air missile development.

British Rocketry to 1945

Early British rocketry - small calibre solid propellant

To 1943 - anti aircraft weapon

From 1944 main roles were :

(i) An air to ground weapon

(ii) Mass bombardment in support of amphibious operations

(iii) The propulsion unit, main or boost, for flying test beds for guided missile subsystems research

This latter function, together with solid propellant development, laid the foundation for a wide range of solid propellant Service missiles e.g. Bloodhound, Swingfire, Blowpipe, Rapier, Seawolf, Seaslug and for civil application in upper atmosphere and meteorological research – Skylark, Petrel, Skua.

By 1953 solid propellant motors had become, with one exception - the sustainer

engines in Red Duster, the sole means of propulsion for British guided missiles – a monopoly position maintained until the mid-1960’s.

Whilst the solid propellant rockets were successful in these roles, it is open to question whether the original development programme instituted in the 1930's was sufficiently ambitious in scope and range. However in the final analysis it could not go beyond the resources available to it.

Les Tucker

This article has taken 1945 as the cut off point for definition of early. This might be extended to the late 1940's / early 1950's. It is possible that there are those amongst the Touchpaper readership who have direct knowledge of aspects of development and the rockets involved, solid and liquid propellant, in that period, albeit working somewhat later.

If so, a contribution to supplement this article would be most welcome. - Ed.
