Early Rocketry
Extracts from
Touchpaper

The buildings suffered no war damage and have since been upgraded regarding facilities. It is now a very popular and desirable area and over 1,500 people of a cultural mix live and work there. In 1980 the GLC gave tenants the right to buy and now almost half of the flats are owner occupied. Other previous tenants who took part also agreed that it was a very caring community. How many areas of London are there today where this spirit of togetherness occurs? Many thanks to Minnie for her part in this informative and enjoyable programme.

Suzanne Leeson.

Early Rocketry and Rocket Propellant

This note was originally written as a quick reference to early rocketry for the Archive researchers
The focus of exhibition work on the site is shifting to rocketry and readers of Touchpaper might find the summary of some use as a reminder of what went before the exhibits in L168.
The second part will deal with Germany, the USA and Britain.

In common with most other technological discoveries, the story of rocketry is one of a progression from the failures and successes of early visionaries working in isolation through gradual improvement and recognition to full scale commercial and where appropriate Governmental involvement.

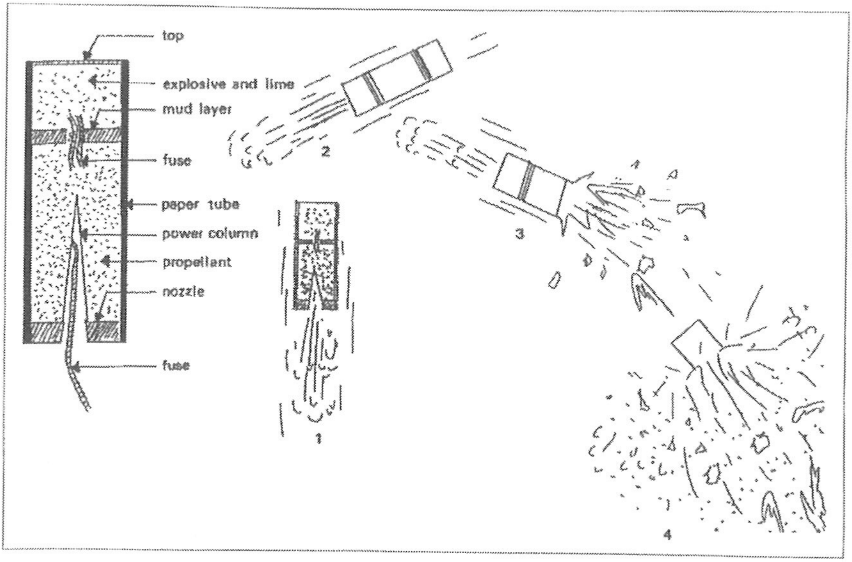
This skeleton summary briefly traces the development of rocketry and rocket propellant up to around the early 1950's in the form of the careers of some of the early pioneers.

Part 1

1. China

China is generally acknowledged as the place of origin of gunpowder, in the 10th Century AD, arising from the experiments of alchemists seeking to find an elixir of immortality or more prosaically how to make gold.

Military interest in its explosive properties led to the first guns and rudimentary military rockets.



WAI 482 / 2 Earliest reliable reference to use of rockets. P'i - li – p'ao thunderbolt missiles used by Admiral Yu – Yun – wen in Battle of Ts'ai-shih 1161. Describes paper tube filled with gunpowder exploding with a noise like thunder propelling a bomb upwards then dropping down.

2. India

Possibly arising from the Chinese connection via Mongol invaders, Indian states adopted the military rocket. The East India Company's army came up against them in conflicts in the 18th.century. In one battle their opponents had as many as 5000 rocketeers.

Not surprisingly the weapon made a strong impression and reports of its existence were sent to England.

3. Britain

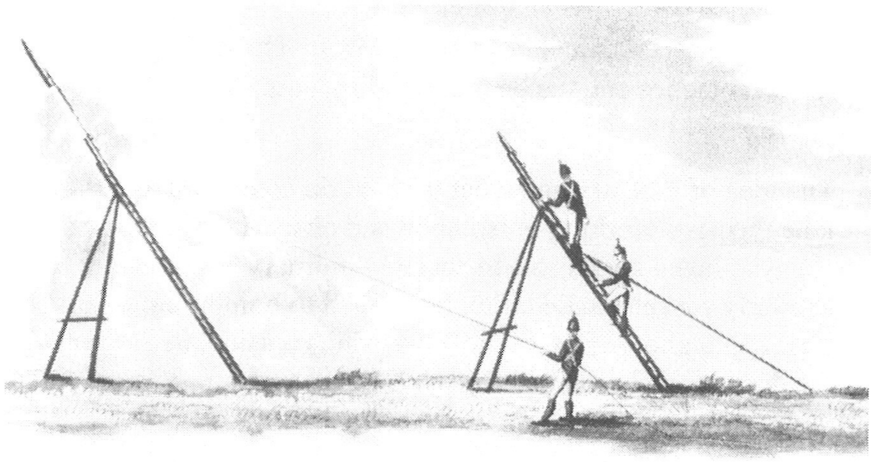
First Phase 18th / beginning 19th. Century - William Congreve

These reports impelled the military technicians to commence rocket experiments which were continued by Major, later Lt. General, William Congreve, Deputy and later Comptroller of the Royal Laboratory at Woolwich Arsenal, the centre for the study of all aspects of Army equipment and materiel.

This ambience of military experimentation would have strongly influenced Congreve's son, also William, and also later Comptroller of the Royal Laboratory. Possibly arising first from an interest in fireworks, which were a significant element in public and Royal displays at the time, Congreve developed a concept of rockets as a complete artillery system. These contained Waltham Abbey gunpowder, both as propellant and as the filling for the warhead.

Congreve proved the exception to the rule of obscurity. He was a dedicated self publicist and his work captured the imagination of the general public. Enjoying the patronage of the Prince Regent, Congreve obtained his sanction for the formation of a Rocket Brigade within the Royal Artillery. Similar units were formed in other European armies.

Within the limitations of the technology and materials of the time



WAI 40 / 14 Congreve Rockets being fired
Details of the Rocket System Wm. Congreve 1814

Congreve took the gunpowder filled war rocket as far as it could go. They had a few successes – against Napoleon at the Battle of Leipzig and various bombardments and in America in the War of 1812 a barrage of Congreve rockets at Bladensburg in Maryland caused American regiments to 'break and flee in wild disorder'. However overall in artillery use they did not achieve the success Congreve hoped for, with aspects such as unpredictability of path of flight causing particular problems. The Royal Artillery Establishment viewed them and Congreve with less than enthusiasm, favouring the gun. Hale later took the concept forward and achieved a stickless rocket which entered European service. The last instance of the use of the Congreve type war rocket was by Russia in Turkestan in 1881.

Nevertheless Congreve had immense vision and his idea of a complete artillery system might yet come to pass. Perhaps he should be called the grandfather of rocketry.

Second Phase 20th. century up to 1930's - The theorists, the rocket societies and the beginning of success

The idea of rocketry and what it might do continued to attract lone theorists working in isolation and obscurity. Explosives have always played a dual role in society – military and civil and similarly rockets could either be applied to bombardment or to civil applications. One of the latter which particularly appealed to the dreamers was the possibility of space travel, particularly to the moon.

The conclusion they all reached was that the only vehicle which could achieve their objective was the rocket – a reaction motor utilising the Newtonian principle expressed in the Third Law of Motion – for every action there is an equal and opposite reaction. Put simply by pushing against the thrust of its expelled exhaust gases the motor propels the rocket forward.

4. **Russia** - Konstantin Eduardovitch Ziolkovsky

Of the early theorists none was more isolated or obscure than Konstantin Ziolkovsky, buried in a lowly teaching position in the Russian educational system. Yet astonishingly working from first principles in physics, chemistry and astronomy he worked out a plan for a space travelling rocket and vitally was the first man to conclude that this would only be possible with liquid fuel. At that time referring to the fuels available in Russia, simple kerosene.

He managed to get his treatise published in a Russian scientific journal, Science Survey, in 1903, where it was met with a deafening silence from the Russian scientific establishment.

Undeterred Ziolkovsky continued his writing and gradually achieved some degree of recognition. After the Revolution he was

Konstantin Ziolkovsky and his grandchildren

supported by the authorities and when a rocket study group was formed under Professor Rynin in the 1930's their indebtedness to the pioneer was acknowledged.

Ziolkovsky died in 1935, by that time regarded in Russia as a scientific hero.

5. France - Robert Esnault - Pelterie

Although less well known as a rocket pioneer, Esnault-Pelterie deserves recognition as an important figure in the early days of European rocketry.

Like Congreve breaching the rule of obscurity, he was a prominent industrialist and also highly influential theorist.

Esnault-Pelterie was a successful aviation innovator and manufacturer and in World War 1 was an important supplier of aircraft to the French Forces. Among other aircraft devices he had invented the control stick – 'the joy stick', which greatly simplified flight control. Combined with his industrial success he was an influential writer on aviation matters, including his book 'L'Astronatique' which gave the science of astronautics its name.

When therefore he turned his attention to rocketry he brought to it a solid record of industrial and scientific achievement. He was responsible for impressive mathematical calculations of rocket efficiency and complex navigational data for inter-planetary flight.

As well as providing other rocketeers with this important theoretical backing his importance lay in the way he used his influence to promote rocketry amongst the Establishment and support the rocket societies which were becoming established in Europe and the USA. For example, he persuaded the wealthy French banker Andre Hirsch to join forces with him to offer an international prize for achievements in astronautics. At a time when rocketry and space travel were still often regarded as the province of dreamers and the deluded the fact of the prize and the willingness of some of the most prominent scientists in France to act as judges was an enormous boost to the credibility of rocket studies. This was further enhanced when the first award went to Hermann Oberth, the pioneer in Germany, see later.

To be continued.

Les Tucker

Early Rocketry and Rocket Propellant Part 2

America - Robert Hutchings Goddard
Theory becomes practice

Whilst the lonely theorists in Russia, Germany and France were producing their feats of theory a researcher in America was engaged in work which offered the prospect of practical success.

From an early age Robert Goddard had been fascinated by the upper atmosphere and the idea of investigating what was happening up there by sending sounding rockets up into the stratosphere and ionosphere.

What differentiated him from the theorists was the fact that as well at being adept at theory he also had great mechanical ability which he was able to turn to building experimental rockets in his own laboratory.

After gaining a doctorate whilst holding a research fellowship at Princeton University, he made extensive calculations and concluded that a rocket with a practicable fuel load could take a light load of instruments to great heights.

The first breakthrough came when he confirmed by practical experiment in a combustion chamber he had built that a rocket needs no air to push against it and would in fact develop more thrust when fired in an airless space, a vacuum.

At this point Goddard, by now an Assistant Professor, in 1916 wrote a report which was specifically directed to obtaining funding for an actual rocket. In it he set out his calculations, including demonstrating the determination of velocity, and therefore how high the rocket will go before its fuel is consumed, based on mass ratio and exhaust speed. For the highest altitudes, drawing on the practice in existing life saving rockets he advanced the idea of the step rocket with a second stage being set off as the first reached its peak velocity. At this juncture Goddard's interest was confined to carrying meteorological instruments to heights greater than those being achieved by current sounding balloons. He was deeply interested in space travel but this prospect was beyond his theory at that time.

His report went the rounds of various scientific foundations without success until it reached the Smithsonian Institution in Washington. Here fortune favoured him and the Institution agreed the sum he requested, to be paid in stages as the project progressed.

Goddard's first action was to research a better combustion chamber for a dry fuelled rocket. The alternative was liquid fuel but this was considered impracticable. In order to achieve a steady thrust he concluded that the fuel would be stored separately from the combustion chamber, to be fed in at a predetermined rate, easier said than done. By then it was 1917, America was entering the War and the US Government was funding military research, including a grant to Goddard for the study of rockets as weapons. He was enabled to transfer his workshop to the Mount Wilson Observatory at Pasadena, California. As assistants he took with him two graduate students, C.N. Hickman and H.S. Parker. Almost 30 years later this was to have momentous consequences for Hickman and American rocketry.

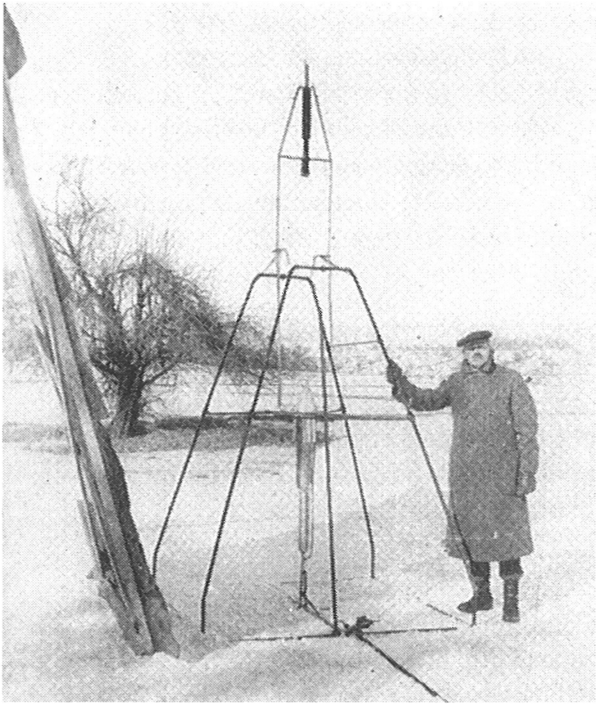
A first model was built, feeding pellets of dry fuel into the combustion chamber in a kind of machine gun action, designed to be fired from a gun like a shell. This was found to be too complicated for military use. A second was produced, eighteen inches long, this time a short range weapon propelled by a solid stick of dynamite type fuel, designed to be fired from a light launching tube. The idea worked and was the basis for the standard US infantry anti-tank weapon of WW2. WW1 ended. The Government decided not to pursue rocketry studies and Goddard returned to his civilian experimentation. In 1920 he produced a further report. This had several crucial features – proof that rockets operate at greater efficiency in a partial vacuum, a description of mechanisms for feeding dry charges into the combustion chamber, tables showing starting weights to achieve heights over 400 miles and momentously for the first time including calculations demonstrating that a step rocket could attain a velocity high enough to escape the earth's gravity and ' fall onto the moon '.

Goddard was still encountering problems with the mechanism for feeding dry charges and he turned to the possibility of liquid fuel. This would require a separate oxygen source. He settled on liquid oxygen with petrol as fuel. To force these into the combustion chamber would require pressure. After two false starts he devised a system in which an 'alcohol stove ' boiled the oxygen to produce pressure.

World's first liquid fuelled rocket ascent

On 16th March 1926 Goddard took his trial rocket to a field on the farm of Miss Effie Ward at Auburn, Massachusetts. It had a two foot motor and overall with fuel tanks was ten feet high. To ignite the motor involved turning on the oxygen and fuel taps and applying a blowlamp to the top of the rocket. Judiciously attaching the blowlamp to a pole, Goddard ignited the motor. The rocket surged upwards with a roar. Two and a half seconds later its fuel was exhausted and it fell to earth. It had covered a distance of 184 feet at 60 miles per hour. The world's first liquid fuelled rocket ascent had been achieved.

The goal remained the carrying of meteorological instruments and by 1929 he had advanced to the stage of a 60 foot launch tower from which he sent up a rocket carrying a barometer, a thermometer and a recording camera which would trip a parachute via its shutter release. The experiment was a complete success with the instruments landing unbroken. By this time Goddard's work was attracting considerable press publicity and the wealthy Daniel Guggenheim offered funding for further work via the Guggenheim Foundation. This enabled a move to a desert test ground near Roswell, New Mexico with a full scale research centre and workshop.

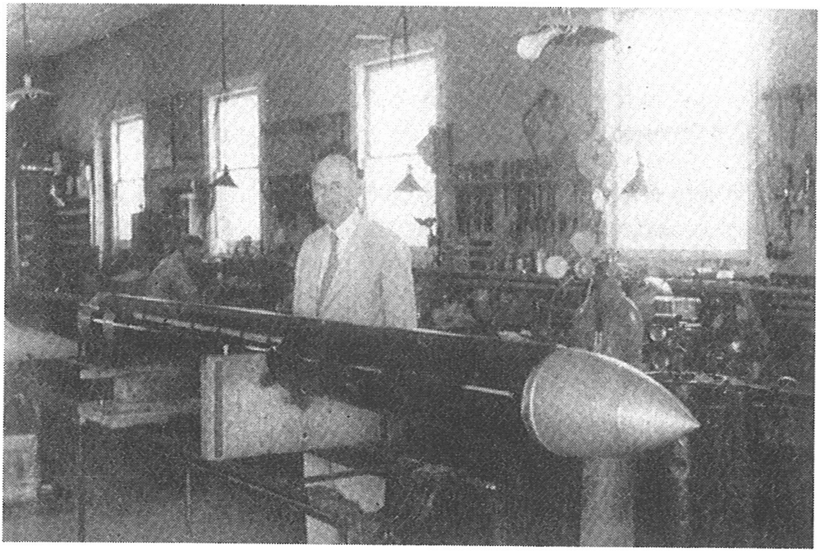


R.H.Goddard with the the world's first liquid fuelled rocket to achieve an ascent, on 16 March 1926

The next few years were devoted to cracking the problem of satisfactorily steering the rocket. Large fins attached to the rear of the rocket were unsuccessful. Goddard then correctly deduced that the steering medium would have to involve placing small moveable vanes directly in the exhaust blast deflecting it to one side or the other. But how to control the vanes; a gyroscope appeared to be the answer, but first attempts failed. Pendulum control was then tried, again without success. After many trials he finally succeeded in perfecting gyroscope control.

Problem number two was the question of forcing the fuel into the combustion chamber. An inert gas such as nitrogen under high pressure had been used, but this had the disadvantage that the whole system is under that high pressure and therefore the tanks containing it had to be very strong and heavy, imposing a weight penalty. The answer was to design pumps made as light as possible, which meant in its turn that the oxidant and fuel, no longer under high pressure could be contained in lighter tanks.

The next problem was how to prevent the chamber and nozzle being destroyed by the heat of the motor. Lining the combustion chamber with heat-resistant clays, the refractory material used to protect blast furnaces, was unsuccessful. Water cooling would add too much weight, air cooling would be insufficient. Finally Goddard concluded that the only way to cool a rocket motor would be to use its own fuel. The method he devised was to allow an excess of oxidant or fuel to be introduced along the walls of the of the combustion chamber creating a thin film protecting the metal from the heat of the blast. Prophetically this was the system used in the V2.



R.H.Goddard with one of the rockets which he built at Roswell, New Mexico ca.1939

He was now achieving his dream of a high altitude meteorological instrument carrying rocket, but by now war was threatening. In 1941 Pearl Harbour brought the US into the War and the Government revived its interest in rocketry, which had completely lapsed after WW1. From a standing start by 1945 the US Army was spending 150million dollars a year on rockets and the Navy eight times as much.

At this point events took a completely unforeseen turn, in which Goddard unwittingly influenced the entire US rocket programme. As far as direct work was concerned he spent the War working with the Navy on a variety of rocket matters, such as further improving pumps, rocket assisted take-off etc. However entirely separate from this his 1917 graduate assistant C.N. Hickman had been working for the Bell Telephone Laboratories. His superior Dr. F.B. Jewett was appointed to a senior post in the new National Defense Research Committee and Hickman remembering his days with Goddard wrote to Jewett with a report on his work. This resulted in Hickman being appointed to head a section in the NDRC – called Section H after Hickman, which became the starting point for the ultimately massive US rocket development programme.

Goddard had never enjoyed good health, but had driven himself relentlessly and he died in 1945, following a throat operation.

Whilst the German effort in military rocketry led them to a commanding position, the fact remains that almost all of the solutions which they had arrived at were also achieved by Robert Goddard and he richly deserves the title of one of the fathers of rocketry, in the last year of his life still dedicated to solving ‘the most fascinating problem in applied physics’.

However this was by no means the whole early American rocketry story. From initial obscurity another group was forging a path to great things.

To be continued.

Les Tucker

Early Rocketry and Rocket Propellant Part 3

America - The American Rocket Society
From Wonder Stories to Reaction Motors

At a time when Robert Goddard had achieved his first successful launch from his new test site in New Mexico enthusiasts in New York inaugurated a rocket study group with the title the American Interplanetary Society. Their goal from the outset was to develop the rocket as a means of getting into space.

They met in the apartment of G.E.Pendray and the link which connected them was that all contributed stories to the magazine 'Wonder Stories'.

This highly unlikely group amply qualified for the description dreamers and theorists.

Publicity

With this background it is not surprising that the Society's first activities were in the realm of publicity. They agreed that only rockets could propel a space ship but their effort was directed not to any practical work but to writing numerous papers which were read out at Society meetings and circulated in duplicated form in what was initially called the 'Bulletin', later 'Astronautics', and in its final form much later 'Jet Propulsion'.

The Bulletin did begin to attract attention from the European rocketeers and the Society was jubilant when the Frenchman Esnaut-Pelterie sent it an autographed copy of his book 'L'Astronautique', (see Touchpaper Autumn 2012). The December 1930 Bulletin contained a letter from the German Interplanetary Society assuring America that it had 'not gone to sleep'.

The Society's appetite for promotion was significantly whetted when Esnaut–Pelterie announced his intention to visit America. Without much hope of success the Society invited the rocket oracle to speak at a meeting to be arranged by the Society. To their surprise he accepted. The auditorium of the Museum of Natural History in New York was booked. This held 1500, but at its most optimistic the Society expected about half that. What transpired fully conveys the flavour of the early antics of this group of young idealists. When they arrived at the hall they were startled to find a crowd of about 2500 impatiently waiting to get in to see the film which had also been arranged. To their consternation this was followed almost immediately by a hand written note from the Frenchman that he had contracted a severe cold and was unable to attend. One can't help having the suspicion that he hadn't quite realised how amateurish the Americans were and when he did he felt it beneath his status to address their meeting. However they did have a copy of his speech and Pendray decided to press on and read it out, to not one but two 'performances'.

Somehow the audience got hold of the idea that Pendray was in fact the Frenchman and at the end of the speech there was a surge eagerly seeking his autograph. Pendray decided to continue the illusion and blithely signed with the Frenchman's name and so many went out into the night happy in the thought that the programmes they were clutching had been autographed by a famous person.

The first seeds of practicality

In 1931 Pendray and his wife decided to visit Europe. They were particularly impressed by the German Interplanetary Society (see forthcoming Early Rocketry Part 4) and their small liquid fuelled motor.

The scene was therefore set for a move however tentative into practical rocket building and as can happen the person to do it was there – Hugh Franklin Pierce. Although he had taken a desk job connected with the New York subway system, Pierce was an eminently practical man, having served as a mechanic in the US Navy in WW1, and constructed mechanical objects as a hobby. He was therefore strongly attracted to the Society and announced that he was willing to devote his entire resources to building a rocket, including finding a suitable workshop. Pendray appears to have had the ability to formulate a design.

By this time the Society had contacted Goddard for advice. It wasn't forthcoming. He had expended a considerable effort to get to New Mexico and it was perhaps rather naïve to expect him to hand over all the fruits of his labours.

Despite this by February 1932 Pierce had succeeded in producing the Society's first rocket.

To reflect this the Society was renamed the American Rocket Society.

American Rocket Society Rocket No.1

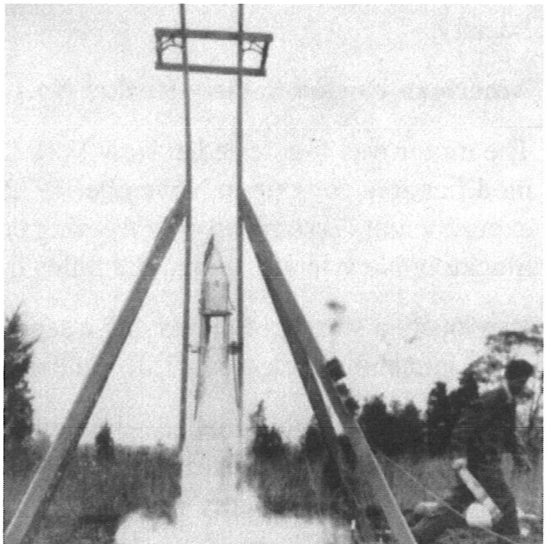
The motor was first tested at New York University and the resultant modifications took up to November 1932, when the intrepid experimenters assembled on a freezing cold day at a farm near Stockton, New Jersey, about 100 miles from New York.

Previously a small group had dug a sand bagged observation trench and a launching rack – two 15ft. timber uprights.

The rocket was liquid fuelled – liquid oxygen (lox) and petrol with electrically actuated valves. A nice touch of domesticity was provided by Mrs. Pendray who had stitched the rocket's parachute.

The idea was first to establish the thrust with a tethered test. The test was successful. A thrust of 60 pounds was indicated – equivalent to an altitude of about 19,000 feet.

G.E.Pendray. Mrs. Pendray and Franklin Pierce at preparation of Rocket No.1 for static test



Rocket No.1 Static Test

The next test was to determine whether the rocket would actually take off and fly in a coherent course, i.e. straight up. At this point the trouble started. The rocket would not move freely in its timber guides. In the effort to free it it fell to the ground and was irretrievably damaged - so ended Rocket No.1.

However most of the components were undamaged and were taken back for reassembly within a strengthened casing.

ARS Rocket No.2

Designations had now been abbreviated to ARS. An important modification concerned valve operation. Electrical actuation had given some trouble so this was substituted by the simple expedient of opening the valve by pulling on a cord from the operating dugout.

On 14th. May 1933 the test party assembled in Marine Park on Staten Island in New York Harbour.

Twenty five feet from the launch rack was a dugout for three men – the fuel lighter, the valve man and an assistant. Actual observers were further back at 95 feet.

As before the fuel was petrol and the oxidant lox. The petrol was forced by nitrogen under pressure in the petrol tank.

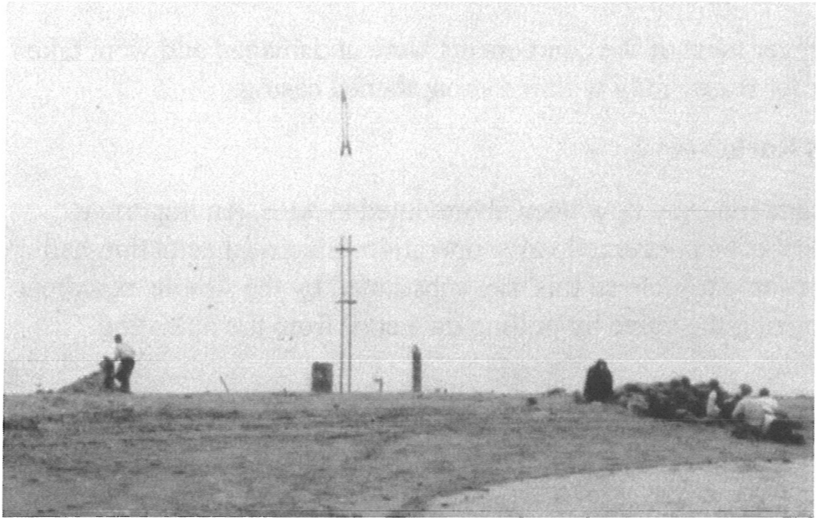
First the fuel was ignited by the fuel man with a torch applied to the wick, who then 'retired' i.e. ran for cover.

As soon as he was in the dugout the valve man pulled the cord. The motor blazed into life – for only eight seconds before expiring.

Undeterred the experimenters decided to make a second attempt.

Do not attempt this at home.

Again the wick was ignited and again the valve cord was pulled. But no flame, the handle had fallen off the valve. Before anyone could say anything Smith the valve man leaped out of the dugout, ran to the rocket, containing an oxygen tank which might explode at any moment, replaced the handle and just before jumping back in pulled the valve cord.



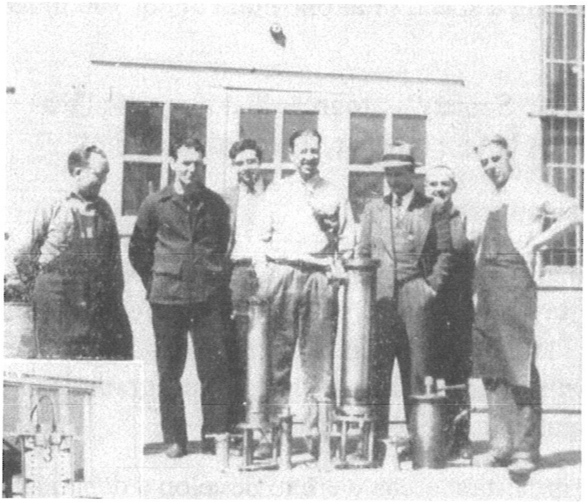
Rocket No.2 First liquid fuel rocket fired by the American Rocket Society
On left - Valve man Bernard Smith running for safety after very dangerous release of valve

This time the motor roared into life. But the rocket reached only 250 feet before the oxygen tank gave way and exploded and the rocket fell into the water, to be retrieved by two excited small boys who had witnessed the proceedings from a rowing boat despite being warned away.

However the Society had achieved flight. Its cash reserves now amounted to four dollars and twenty cents. But importantly it was beginning to attract vital trained engineers and technicians and a properly constituted technical committee was formed.

The dreams begin to turn into reality

One outstanding recruit was John Shesta, the son of a Russian who had originally come to America as a purchasing agent for the Czarist government. Shesta was later to become a bright star in the American rocket firmament. He had been fascinated by rockets since boyhood and had constructed his own powder fuelled examples (independently he had arrived at the conclusion that the powder should be wetted - first originated by Congreve).



Entire staff of Reaction Motors in 1943

3rd.,4th.,5th., from left James Wyld, John Shesta, Franklin Pierce

ARS Rocket No. 4

Shesta and a small team was charged with designing Rocket No.4. No.3 was allotted to a team led by Pendray and including Smith, the valve man who had risked his neck on Rocket 2.

Shesta's was ready first. Beautifully constructed and robust it was seven feet long and three inches in diameter. There was a single combustion chamber with four highly polished brass nozzles which would throw the blast clear of the tanks.

On 9th. September 1934 again at Marine Park the rocket was fired. At first it climbed several hundred feet vertically then two of the nozzles burned out. Its flight flattened but it continued on the remaining two nozzles, before dipping downwards into the bay, having been aloft for fifteen seconds.

It had risen almost four hundred feet and travelled four times that horizontally, reaching a speed of at one point about 700 miles per hour.

It is a measure of the Society's progress that this speed was achieved six months before Goddard reached this point.

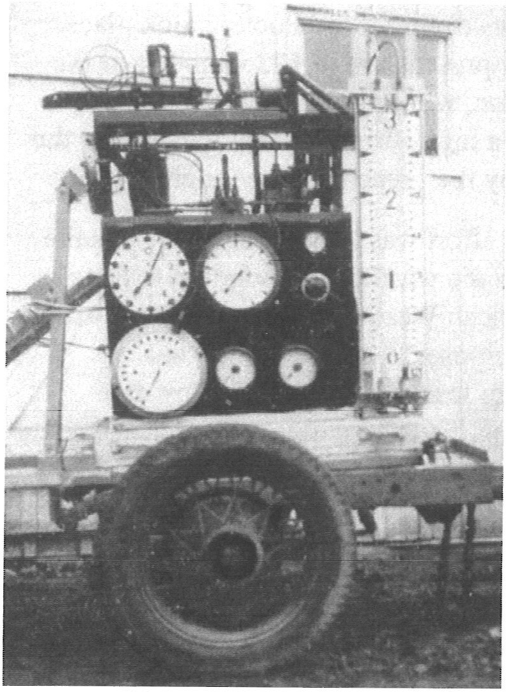
Ten years of development

It was apparent that the days of firing off rockets merely in the hope that they would stay aloft were over. What was now needed was a coherent research and development programme to identify all areas which needed further study within a coherent programme of scientific investigation and experiment.

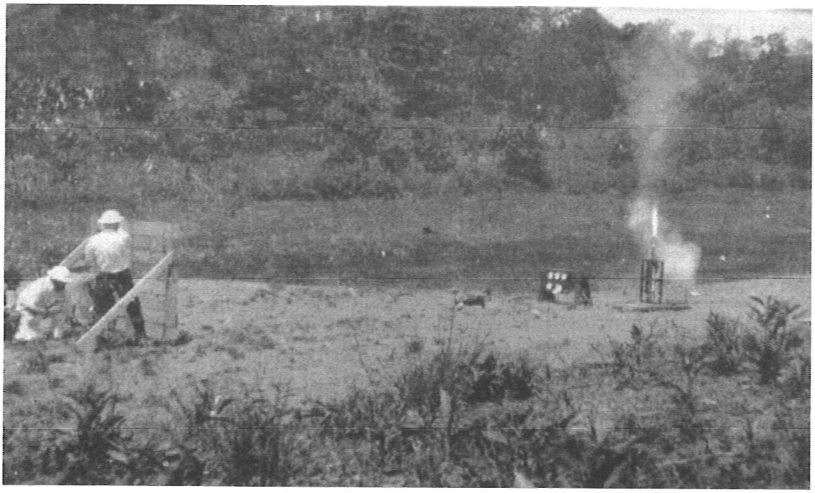
Two of the most important areas were to develop a dependable motor and to develop an efficient test stand which could withstand the conditions which would arise with more powerful motors and which would permit better study under increasingly demanding operating conditions.

John Shesta took on the test stand. In this he was assisted by another rising star in the firmament – James H. Wyld. This partnership was later to have important implications for the American rocket industry.

What resulted was a stand of great strength with a full complement of gauges for measurement of fuel combustion, combustion chamber pressure, temperature and motor thrust. All had a large face to enable sight at a distance. There was an extremely accurate timing clock and a second by second camera.



John Shesta's test stand



Test stand in use in 1935. John Shesta standing pulling valve cord

In the meantime a momentous event for the Society took place. Thoughts of space were ever present and in 1936 another of the Society's stars Alfred Africano, working from the Society's experimental data, designed a high altitude rocket which won the REP-Hirsch prize awarded by the French Astronomical Society.

However the Society's main effort was still directed towards the lower altitudes – i.e. study of the weather by sounding rockets as they were termed. The American Weather Bureau had been using upper air balloons for this purpose. They had significant disadvantages – liable to drift, loss of instruments, slow rise preventing quick observations. The alternative, aeroplanes, was unsatisfactory – expensive and limited by adverse weather, the very time when observation was most required. A rocket, if it could be made dependable, would not have any of these disadvantages.

To meet the challenge the Society formed a new Technical Committee with sub-committees to study the whole spectrum of rocketry science – the motor, the shape of the rocket, launch devices, the parachute, the instruments, controls and so on. By this time they had attracted an impressive array of enthusiasts, many with science or engineering qualifications, who were able to provide the necessary expertise for the committees.

James Wyld made the motor his speciality. At twenty six years old he ultimately produced a motor of outstanding quality. It reflected all the desirable characteristics of good engineering – simplicity of design, inherent lightness, practicality and economy of manufacture. Of paramount importance was the cooling system. The motor was cooled by incoming fuel. The idea was not new but Wyld refined it to a level not previously achieved. Again the design was simple but effective – the combustion chamber was one small tube fitted inside a larger tube with a space of one eigth inch between the two walls. The incoming fuel swirled through this space, absorbing much of the heat from the combustion chamber, before entering the combustion chamber inlet nozzle. The motor was thus cooled and at the same time high efficiency was achieved by the pre-heated fuel. By this time – 1941 ethyl alcohol had replaced petrol as fuel with liquid oxygen continuing as oxidant.

Astronautics reported 'A reliable motor for astrological sounding rockets has at last been designed, built and tested'.

By this time war was intervening. The US Navy offered Wylde 5000 dollars for the motor design and a six month development contract for the production of a series of experimental motors ranging from 100 to 1000 pound thrust. The team consisted of Wylde, Shesta, Hugh Pierce who had laboured faithfully since the early days and a new man Lovell Lawrence reflecting the growing influence of electronics on controls.

Reaction Motors

A week after Pearl Harbour, using the Navy's 5000 dollars as capital, one of the world's first rocket production companies was formed – Reaction Motors, Incorporated

The Navy's particular interest was assisted take off and the liquid fuel RM motors performed perfectly in tests. Ultimately the medium adopted was the JATO dry fuelled unit, but the RM test results were of significant benefit in their development.

Reaction Motors went on to achieve impressive firsts. In 1946 it built a four motor unit with a thrust of 6000 pounds which powered the Bell Aircraft X-1 faster than the speed of sound. The same engine type drove a Douglas Skyrocket plane sixteen miles into the stratosphere with the pilot streaking through space at twice the speed of sound. RM powered the Navy's Viking when it ascended 150 miles.

But as often happened the pioneers were uncomfortable working in what had been become an administrative capacity in an expanding corporate entity increasingly dominated by production men. The first to leave was Franklin Pierce who sold his shares and disappeared from the scene. The company reached the stage of requiring a fresh capital injection and was bought into by the Rockefeller interests. Reorganisation followed and Lawrence departed.

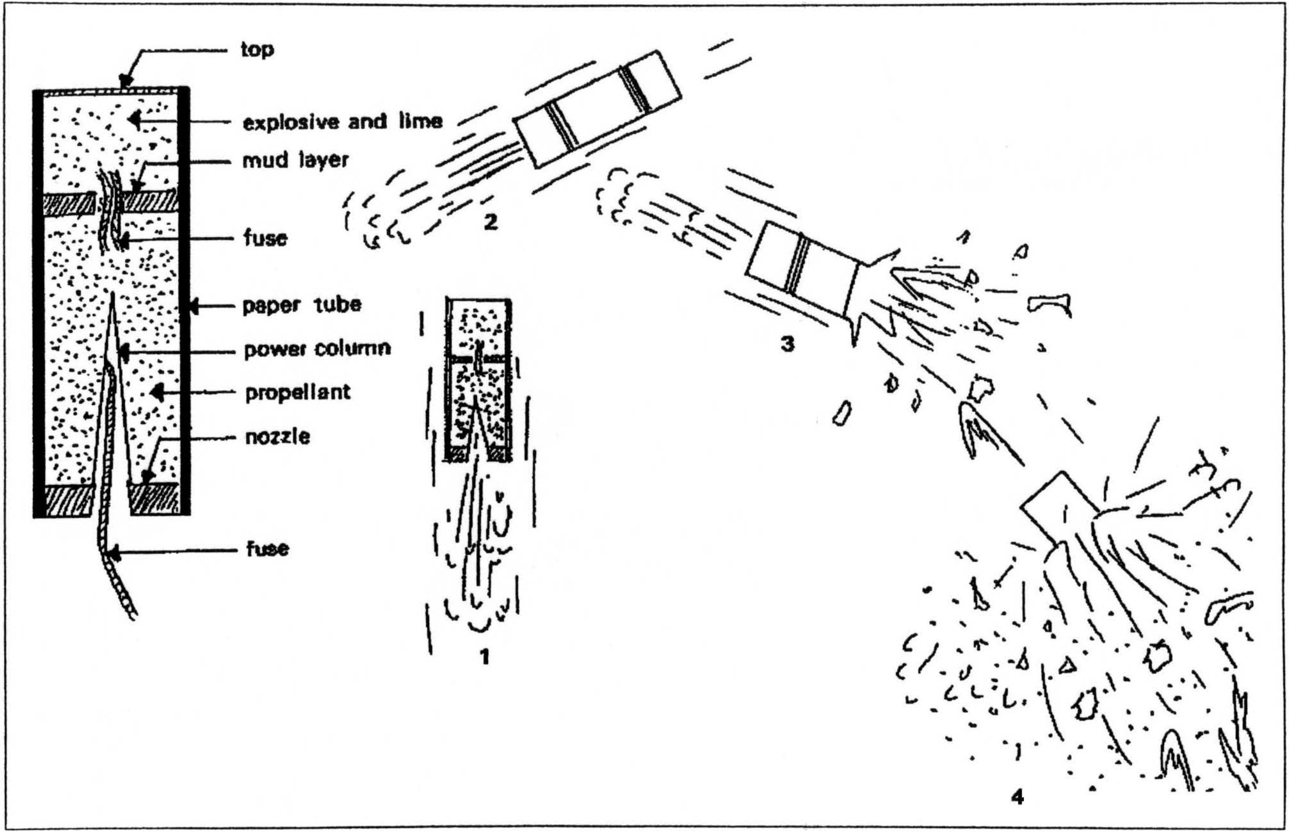
Wyld was seconded for a time to the Atomic Energy Commission at Oak Ridge where he was happy doing what he did best, solving new problems in a research atmosphere. Shesta had remained at Reaction Motors as Chief Engineer, but he finally decided the new set up was not for him and resigned.

Wyld returned from Oak Ridge, the last of the four. He had decided to resign when tragically he died, in 1953 aged forty one.

With James Wyld's death American rocketry lost one of its brightest stars.

One wonders whether amongst personal effects somewhere there is still a faded programme from a 1930's meeting bearing a signature which the owner fondly believes is of the rocket oracle Esnaut-Pelterie.

Les Tucker.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propellant
nozzle
fuse
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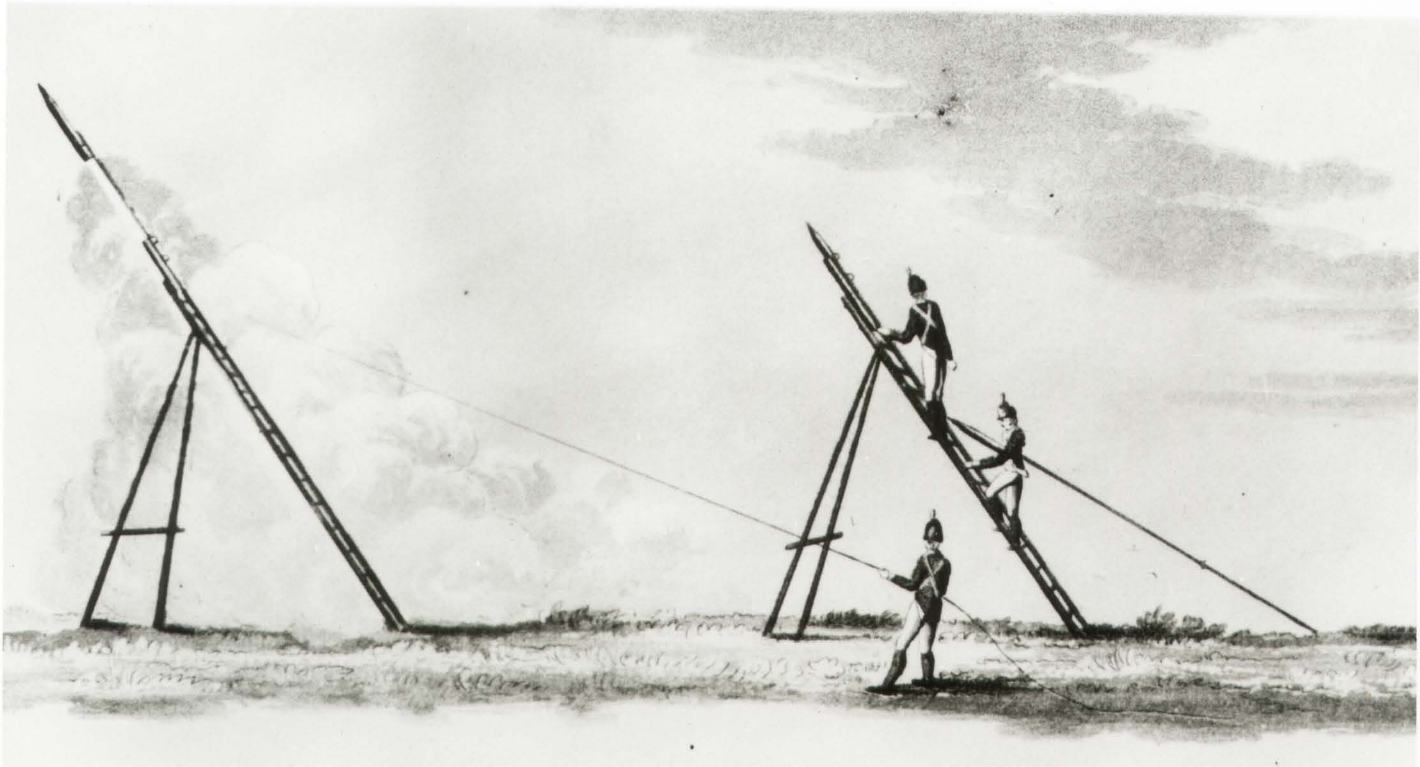
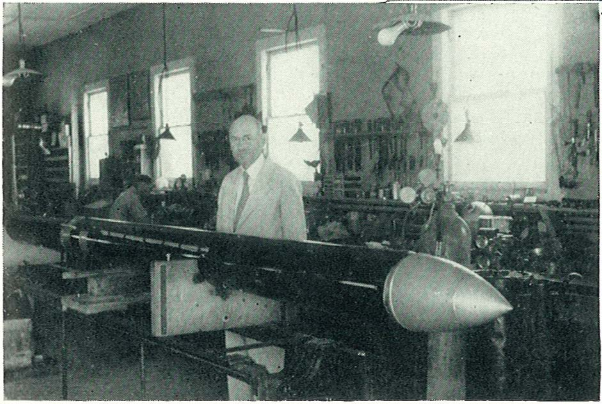
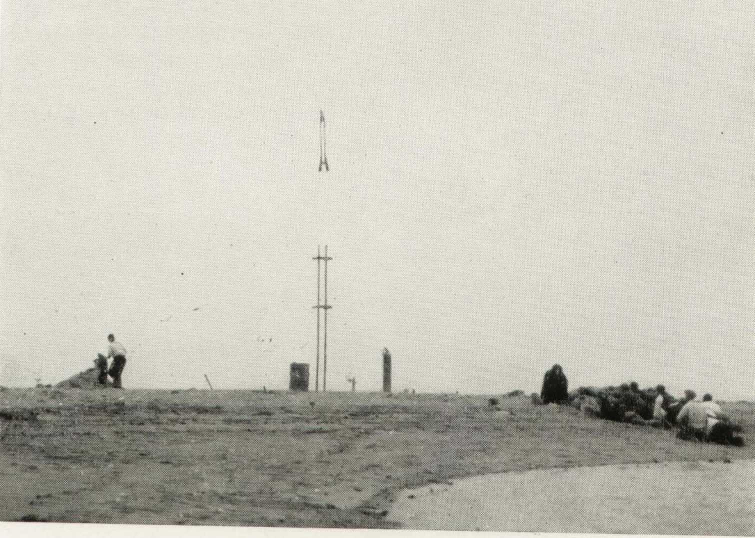




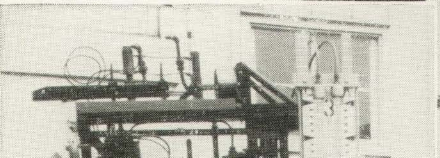
Left to right: G. Edward Pendray, his wife Lee Gregory Pendray, and Franklin Pierce, members of the American Rocket Society, trying to keep warm while they prepare the first ARS rocket for its first static test, November 12, 1932, at Stockton, New Jersey. (*Planet News photo*.)

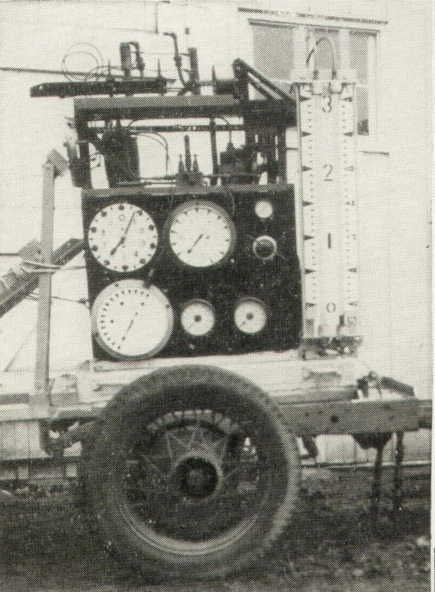
The static test of the ARS rocket No. 1, November 12, 1932. (*Courtesy* G. Edward Pendray.)

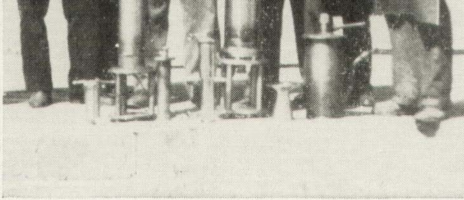


The first liquid fuel rocket actually shot by the American Rocket Society, at Marine Park, Staten Island, May 14, 1933. ARS member, Bernard Smith, is running for safety after having released a jammed valve. Other ARS members watch from behind sand-bag protection. (*Planet News photo.*)

The entire staff, minus one, of Reaction Motors in 1943. Third, fourth and fifth from the left are James Wyld, John Shesta and Franklin Pierce. The missing member of the group is Lovell Lawrence, who took the picture. (*Courtesy* John Shesta.)







Test stand on wheels used by Reaction Motors before the company had a permanent proving ground. The stand's mobility was of special value when it was necessary to leave a test area before the police arrived to investigate the source of a neighbourhood-arousing roar. (*Courtesy* John Shesta.)

John Shesta's stand being used to test a liquid fuel motor at Crestwood, New York, in 1935. Behind the barricade are John Shesta, standing, pulling valve cord, and G. Edward Pendray and Alfred Africano, kneeling. (*Courtesy* American Rocket Society.)