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Thai Rockets Part 1 - Paul Moulder



ong and slow wins the race

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Black powder rockets have been made in Thailand, particularly in the North East (Issan) area of the country and in the bordering provinces of Laos, for hundreds of years. Other areas within Thailand where rockets are made are Sakgeow and Prajinburi provinces in the South East. The major Thai Rocket Festivals are held during the second week of May, and coincide with the beginning of the rice planting season, but groups of enthusiasts can be found almost throughout the year in some provinces, making and gambling on rocket launches during weekend meets.

Called Bang Fai or Bong Fai in Thai; ‘Bong’ is a kind of bamboo pipe and ‘Fai’ means fire

The origins and purpose of the rocket festivals have been obscured by time but are rooted in stories from Buddhist scriptures.

Rockets were launched to ask the Gods Phaya Thean and the Naga to produce rain for rice farming and as a blessing for a happy life. The ritual combines fertility rites important to agrarian society with Buddhist concepts of making merit. While there are no precise records of when this ritual began, some sources believe it originates with Tai or Dai culture in the Yunnan province of China.

Ask most Thais and they will tell you the object of the rockets is to bring on the start of the rainy season which coincides with rice planting time in the north east of the country. Gambling on the rockets flight time is immensely popular and the reason one can find groups of rocket lovers gathered in the countryside on most weekends regardless of the rice growing season to socialize and spend an afternoon's fun with their bought or self-made rockets.

Most festivals take place in North East of the country, and the province of Sakgeow in the South East near to the Cambodian border, as well as in Laos. A day before the rockets are launched, elaborately decorated Bamboo rockets are paraded through the streets on ox carts or more often on floats.

These rockets are made as were the traditional rockets from centuries ago and are seldom capable of flight. Many are decorated with garlands of flowers and brightly painted Naga heads.

Rockets in various forms were also used in warfare between the 15th and 16th centuries against Elephants during the Burmese Siamese wars of Ayuttaya between 1592 and 1605. There are many descriptions in old texts of rockets being fired in salvos and as incendiary devices against Burmese forces laying siege to Ayuttaya. Spanish mercenaries were also employed during this period for their knowledge of cannon and gunpowder manufacturing.







Rockets have a flight time from 3 to well over 5 minutes and the bigger ones can reach an altitude of over 30,000 feet. In recent years moves have been made to try and restrict the size of the rockets and the unofficial events where they are launched due to fears regarding aviation safety and the serious accidents that occur each year from returning spent rockets or rockets exploding on or after launch

Rockets come in many sizes ranging from small bottle rockets made from tissue paper and banana leaves to giants weighing over 1000kg Size designations are given that follow the Thai words for thousand, ten thousand and million. Rockets under 10 Kg are known as Bong Fai Noi, and bigger ones Muen 20 to 100 kg, Sen 120 to 300 kg and lann 700 to over 1000 kg.

Materials

Rockets of bygone days were made from bamboo tubes wrapped with layers of burlap-type cloth and hemp rope soaked in glue to give them strength, though these days all sizes are made using PVC water pipes of various diameters. Stabilizing sticks are still made from Bamboo as in the past.

Propellant Composition.

The composition used in all rockets weighing over a few hundred grams is a very slow burning rough mix of Potassium Nitrate and Charcoal. The mix contains no Sulphur. Using Sulphur as in a true gunpowder composition, or use of a fine Nitrate/Charcoal mix would result in the rocket exploding on launch or shortly after lifting off from the launch ramp.

Small rockets, in what we would call the one, two and three pound sizes, do contain Sulphur but the mix is far coarser than that which we are used to and all have a core drilled into the composition.

Both the Nitrate and Charcoal are very coarse in all rockets over 1 inch ID. The exact mesh breakdown is given in the building tables for a 2 inch ID size.

On rockets 2 inch ID and over, apart from the main composition, 2 special mixtures are also loaded into the tube before the main propellant mix.

These special mixtures serve 2 purposes. The first delivers a burst of hot fast gas production that is designed to clean out some of the residual solid combustion products from the tube to make the tube as light as possible. Since the competitive side of the rocket's launch is to attain the longest flight time, a lighter spent tube will in theory return to earth at a slower rate resulting in a longer flight time. The second special mix is designed to cause the rocket to slow down in the final 15 seconds of ascent and coast so as to adopt a horizontal position once the main propellant fuel is spent. Thais call this mixture ‘the brake’, and this is a slower burning mix than the ‘cleaner’ or main propellant.





Large press for the pressing of 300kg and larger rockets

In the days before hydraulic presses, rockets were rammed using wooden or steel rammers and sledge hammers.

These days all rockets, even the small ones, are made using hydraulic presses, some capable of exerting over 100 tons per square inch on the composition.

The plastic pipes are first inserted into the center of an oversized steel pipe, and the pipe filled with fine dry sand.

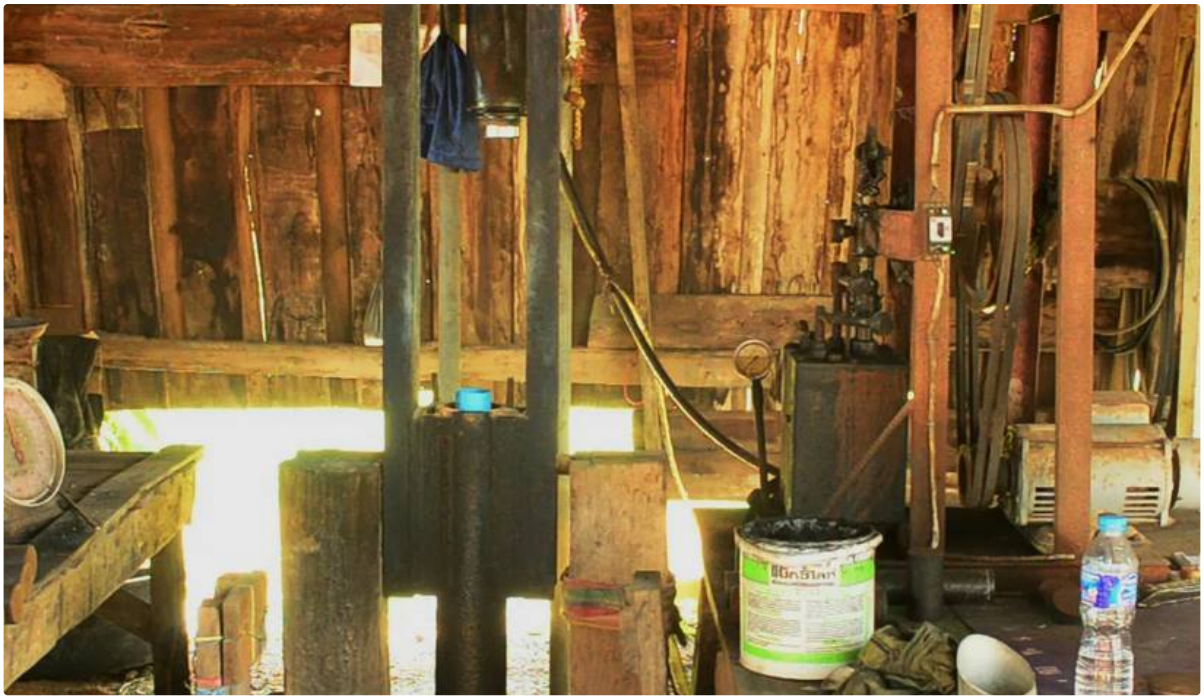
This tube support keeps the PVC tube from overstretching or splitting.

The grade of PVC used for these rocket tubes is the same as is used for water pipes and has a large percentage of plasticizer. As such it not as brittle as many other types of PVC pipe.



Workers sit on a gantry where the press ram is located. The base of the sand filled pipe sits on steel plate bolted to the floor below. The rammer are inserted and removed from the PVC pipe between increments using a chain and pulley.

Rockets in the Lann category, 700 to 1000kg in weight, can take a week or more to press while a 7 kg Bang Fai Noi takes just a couple of hours.



This is a typical arrangement for a smaller press unit capable of exerting around 8000 PSI on the composition. The ram piston is usually in the 2-1/2 to 3-1/2 inch diameter range. This size of press is used in the 2 inch ID rockets. The ram is located on a sliding gantry so it can be moved away from the top of the rammer each time the rammer is removed to put a new increment of composition into the tube.

Nozzles.

Rockets have a ‘double nozzle’ arrangement.

First an increment of Bentonite clay is pressed into the tube, followed by a tight fitting wooden nozzle usually made from Teak wood or less commonly Mai Deang, which means ‘red wood’ in Thai.

Teak is used not only for strength but also its fire resistant qualities.

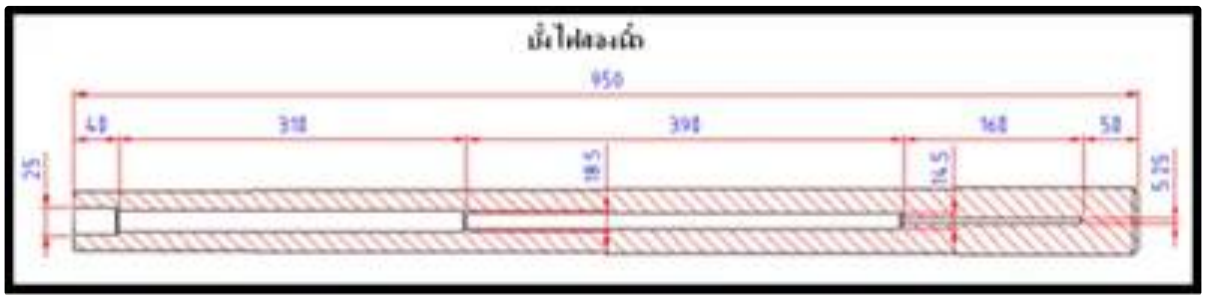




View of Teak nozzle pressed into place; the Bentonite clay layer is visible inside and needs to be drilled out along with the propellant's core.

Drill bit used for the Clay layer

Drilling Out the Core



The core is drilled out throughout the length of the pressed tube in 3 steps, each step larger than the previous as shown in the diagram.



A 1/8 inch pilot hole is first drilled almost to the end of the bore to guide subsequent drill and spade bits.

A 1/4-inch drill is then used to enlarge the hole to a depth of around three-fourths of the propellant's length.

These initial holes are drilled using an electric hand drill.

The rocket is placed in a jig, at the head of which is placed a water cooled guide device to keep the drill bit straight and the drill-bit/comp wet and cooled so the friction produced does not ignite the composition.



Lots of variations of the drill bit jig exist. An enclosed type is shown above, where water is gravity fed into the enclosed cylinder that guides the drill

They all serve the same purpose of keeping the drill straight and cool.



The larger holes comprising the 3 stepped core are drilled out using a spade bit welded to the end of a steel rod. The tube is positioned over the bit and held in place loosely by a couple of rings welded to the support post. The tube is held firmly and turned while applying downward pressure till the correct depth is achieved.

This step is repeated for each of the bit sizes 1/2 – 3/4 – 1 inch.





Drilling the main core sizes by hand with a spade bit.

Stabilizing Stick

Sticks are always made from Bamboo. The bamboo is first baked inside a large PVC or steel tube, then charred in a charcoal pit. This heat treatment serves two purposes, the first is to dry the stick and make it lighter, the second is to remove bends in the length and straighten the stick. Sticks are typically 2 ½ times the length of the rocket body. The stick is balanced in such a way that once the fuel is spent, the rocket will not come down nose first but rather float down in a horizontal position.



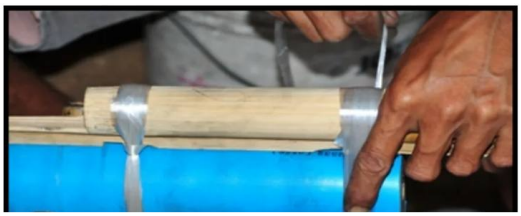


Attaching the Stick

The rocket is first fitted with a shaped piece of Bamboo the length of the tube on which the stick sits. A combination of wire and synthetic string is used to bind it to the tube. Once bound tightly to the rocket body a thin piece of poly/cotton string is laid all along the junction of the stick and rocket body and this string is soaked in super glue.









Cleaning the Bore



This is a critical step in the rocket's construction. Wooden rods of different diameters are wrapped in wet cloth (fabric taken from a monk's robes) and the rough surface of the composition inside the bore is smoothed out so there are no tiny cracks or pinholes on the surface of the core. The steps between each sized hole within the core are given a connecting taper.

During these cleaning procedures the amount of water used varies from builder to builder. Some only wet the cloth used, while others pour quite large amounts of water into the bore. One would have thought this wetting would render the composition un-ignitable, but the composition is so highly compressed as to absorb very little of the water used in the process. Some rocket makers use condensed milk and other substances to wet the cloth instead of, or as well as water. The cleaning process is always carried out just prior to the rocket's launch. Rockets left for a long time before being launched after the cleaning process often fail.



IGNITION SYSTEM



A small wad of steel wool is tied onto the end of a thin Bamboo stick long enough to reach a point ¾ up the inside the bore to the point where the 1/8 inch holes starts. Thin electrical wires are positioned on adjacent sides of the steel wool, and a small plastic bag containing

around a gram of gunpowder is tied around the steel wool. The wires run down the length of the stick and out of the rocket's nozzle. At ignition time the wires are touched to the plus and minus terminals of a 12 volt car battery, the wire wool glows red hot and the powder ignites.

Launch Method.

Rockets are launched from a ramp inclined at a 70 to 80 degree angle. Often they are just made from lashed together lengths of Bamboo to make a crude frame.

Larger permanent steel framed launch ramps are also seen at venues where the launch is a yearly event, or the rockets are too big and heavy to be supported by a bamboo framework.

Pulleys, winches and sometimes cranes are used to pull the rockets onto the launch ramps.





The rockets are lashed to the framework using chains, rope, and grass or Banana leaves, and held tightly enough that some considerable thrust is allowed to develop before the rocket overcomes the constrains of the ties and lifts off



Often washing-up liquid is poured over the tied-on vegetation to provide lubrication and just the right amount of slip



Competition Rules.

Rockets are entered into competition classes based solely on the size of the PVC tube used in their construction. The tubes for each class of rocket must all be the same length and ID; other than that anything goes.

Stabilizing sticks can be as long or as short as you like and double sticks, although never seen, could also be used. Any kind of propellant mixture can be used, as can any kind of bore, pressing pressure, and nozzle arrangement. Parachutes or other mechanical braking devices are not allowed.

The rocket flight time is recorded from the moment of ignition to the moment when the judges deem the rocket to have returned to earth. At every festival a number of Judges can be seen sitting in deck chairs armed with binoculars and stopwatches. The longest time recorded wins.

Flight times vary from size to size, but range from around 4 minutes to over 6 for some of the larger rockets. They can return to earth as far as 5 Km from the launch site.

I only know about the distance because when Jesse Ververka was out here filming for 'Passfire' we hooked up a GoPro camera to a 300 kg rocket along with a mobile phone with a downloaded GPS app and a letter with our phone number offering a reward to the finder.

As soon as the rocket was launched we jumped in my truck and started driving towards where google maps live feed told us it was located.

We lost the phone link around 20 minutes later when it had already come down and were unable to pinpoint the exact location but it was just over 5 miles as the crow flies from the festival site.

Later that afternoon the phone started transmiting a signal again, we called the number, a Cambodian farm worker answered and told us it had come down in the sugar cane field he was working in, Later he came to the rocket festival with the phone and camera intact and claimed his reward.

This picture is of the guy who found it, looking down at the rocket. It was retrieved from the GoPro which was still recording after it hit the ground. A great day for him...the reward was equal to a weeks salary for him.



Here are some examples of the manufacturing process:

Watch the video

Scan the code, or visit https://www.youtube.com/watch?v=LnFy2Rr36i8

Coming in Part 2

Complete and comprehensive step by step instructions on building a 2inch diameter 7 Kg rocket in the traditional Thai fashion with diagrams, videos and composition mesh size analysis.

UNCATEGORIZED

Read it online

With the videos and comments: https://www.westernpyro.org/blog/thai-rockets-part-1-paul-moulder