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# Rocket stoves and rocket mass heaters

Super efficient wood burning devices, with a great name and few if any emissions. What on earth are these rocket things that people are talking about? It all begins with the name, or the sound really. When wood is burnt in a rocket stove, it makes a sound that resembles a jet engine or rocket. Cool sound and hot name! But what are they and why all the excitement?

Firstly we need to start using the correct terminology, so that we are all talking about the same thing. The two main forms of rockets are 'rocket stoves' and 'rocket mass heaters.'

## Rocket stoves

Rocket stoves are wood burning devices used to cook over or heat water with. To be classed a rocket stove the

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shape of the burn chamber should resemble a 'J' or a 'L'. This is known as a J tube. Wood is inserted at the bottom of the J tube and the vertical section acts as an internal chimney. Ideally the internal chimney or heat riser is insulated for best performance. Small diameter wood is used in all rocket stoves.

The two key points that make a rocket stove so efficient and generate the rocket sound are preheated air and an insulated heat riser. On the stove, the heat travels up the heat riser and hits the bottom of the cook pot.

The cooking rocket stoves were developed by Dr Larry Winiarski in the late 1970s and early 1980s for use in aid work. Dr Winiarski stated that "The Rocket Stove is designed to both a) achieve more complete combustion and b) force as much heat into the pot as possible." (*Capturing Heat Two*, Aprovecho Research Center).

One of the people working with Larry at that time was Ianto Evans, the man who went on to form the Cob Cottage Company and spread modern cob building around the United States. Ianto saw the need for a fuel efficient space heater that could be constructed for low cost by handy individuals. Combining rocket stove technology with masonry stove theory and a tinkerer's mind, he created the rocket mass heater.





PHOTOS THIS PAGE: DANI WOLFF-CHAMBERS

## Rocket mass heaters

Rocket mass heaters are wood burning space heaters used to heat interior spaces. The main similarity between the rocket mass heater and the rocket stove is the J tube. In the rocket mass heater, a metal barrel is placed over the top of the riser to force the heat that is used to cook with on a rocket stove downwards into a large mass. Thus the term rocket mass heater.

Some of the heat escapes through the metal barrel and the rest goes into a mass that is typically a bench to sit on. These benches are most often made out of cob, which heats up, creating a very pleasurable sitting place. Metal ductwork in the cob bench directs the remaining heat out of the building.

The idea is to capture as much of the heat out of the burnt wood as possible, while still having enough heat to create good draw. One of the most experienced rocket mass heater builders, Kirk 'Donkey' Mober of SunDog School of Natural Building, recommends 2000F/930C as a minimum exit chimney heat. Any lower and the heater will not draw properly and may backdraft.

*Construction of a rocket mass heater.*

*Top left: Recycled firebricks and flue pipe.*

*Top right and above left: Shaping cob around flue, insulation held in place with chicken wire.*

*Above right: First coat of render complete and drying, ready for first firing.*

The combination of a super hot and clean burn generated by the J tube, coupled with the radiant heat emitting from the barrel and the storage of waste heat in the mass is what makes these heaters work so well. Since the first few rocket mass heaters in the early 1980s, hundreds have been built worldwide.

Many design improvements have been made through trial and error, although surprisingly the basic concept remains the same. Many serious pyromaniacs have gotten interested over the years, thanks to the internet and Kirk's hosting of the Donkey32 ProBoard, an 'Experimenters corner' forum. So much evolution has occurred that now it is possible to buy parts of rocket mass heaters pre-made. Most heaters are still built on site by enthusiastic owner builders out of readily accessible parts.

## Environmentally friendly

The rocket mass heater is so much more than a heater. It is a statement of intent to live in a more harmonious way with the natural world. The heater burns small diameter wood that is often considered worthless. Wood that can be grown at home easily by coppicing, for true heating independence.

The wood burns so hot and fast that the maximum amount of heat units is generated from it and little to no pollution is formed. Most of the available heat is either radiated into the space instantly through the barrel or stored in the mass for gradual release.

Rocket mass heaters are built with local and often recycled components. Clay subsoil that can be harvested almost anywhere on the planet is the largest and least expensive part of the heater. The heaters are built on site with few if any power tools, often by the owners themselves. Being so involved in the process, from construction to daily living with the heater, empowers the users.

As with other types of masonry heater, the rocket mass heater is only run for a



few hours each day. The efficient burn and large mass storage help to moderate temperature swings in the building. Even in summer, the mass component of the rocket mass heater is beneficial for moderating the temperature swings inside the building envelope. Most people run their heater in the evening as part of the daily routine. Running the heater at this time ensures a nice warm bench for an after dinner snuggle. Slowly overnight the bench will cool down, releasing its heat into the building, keeping the chill off the inside air.

### Different heating methods

Rocket mass heaters can be designed and built differently to achieve different aims. Some builders desire a good cooking surface on top of the barrel. Others desire as much heat as possible in the bench for overnight heating. By changing the position of the barrel and deciding how

*From L-R above, including opposite page: Rocket stoves are used to cook on or heat water with. Small diameter wood is inserted at the bottom with the vertical section acting to move the heat up to the cook surface.*

much of the barrel is exposed, these different aims can be achieved.

It should be pointed out here that there is only so much potential heat output from the system. So if you try to do everything, none of them will do really well. Rocket mass heaters have been designed and built to heat water, cook on top of, heat green houses and warm saunas. Each of the heaters had one major focus, rather than many.

Rocket mass heaters appeal to the tinkerers out there as they are cheap and relatively easy to build. Most heaters are built for \$500 to \$1000, crafty scroungers can build them for even less. It is important to realise that fire and smoke are really

very dangerous. Make sure you use good quality components when building your heater! Even at \$1000 a rocket mass heater is a cheap stove.

Is it legal? I don't think so. Not in Australia at this point in time. There have been some legal installations in Oregon USA; these were installed by registered masonry stove builders. The Dragon Heaters kit form rocket mass heater can also be installed legally in the USA.

It should be noted here that all rocket stoves and heaters are back woods, counter culture, survivalist Americana. That kind of thing can appeal to us over-regulated Aussie battlers out bush. But be warned: 'Neither Ianto Evans, Leslie Jackson, nor the Cob Cottage Company can be held in any way responsible for damage, fire or injury from the use of this book. These stoves are experimental, and besides, we don't have any assets. So, enjoy full freedom from fire damage and injuries by exercising common sense.' (Evans, Jackson 2014)





## Construction

Construction of any rocket stove starts with the J tube. This can be formed out of any fireproof material that can handle the thermal shock of an operating rocket stove. Ideally firebrick is used for a long lasting J tube. Steel components have been tried and used in the past for constructing the J tube with satisfactory, but not very long lasting results.

The interior proportions of the J tube are critical for the proper functioning of the rocket. This so called 'Cross Sectional Area' must be maintained throughout the whole stove or heater. Once made, the J tube is insulated all the way around and underneath to allow it to heat up. The hotter the J tube gets the stronger the rocket effect. For insulating the J tube, materials such as scoria, vermiculite, perlite and refractory wool blankets have been successfully used. Different designers and builders have their own ways of constructing rocket components. The main thing to remember when building the mass heater is to make sure the Cross Sectional Area remains the same once the barrel is placed over the heat riser.

When burning a rocket the wood gasses speed up as they travel up the J tube. Upon leaving the top of the J tube the gasses either hit the bottom of a cooking pot or the inside of an upside

*Opposite page L-R and right: Rocket mass heaters are wood burning space heaters used for heating internal spaces. A metal barrel is placed over the top of the riser to force the heat downwards into a large storage thermal mass, usually a cob seat.*

down metal drum. If they hit a drum, much of the heat is lost from the system through the metal and the rest drops down the insides of the drum into the mass bench.

## Manifold

The spot where the hot gasses turn from going vertically down the barrel to horizontally in the mass bench is known as the manifold. Probably the hardest part of the system to visualise, the manifold is one spot where many stove builds go wrong. It is very easy to inadvertently reduce the Cross Sectional Area at the manifold. A clean out cap is also found at the manifold for inspection and cleaning.

Once through the manifold, the gasses flow into metal ducting that runs back and forward through the bench before leaving the building. There is much discussion and theory about the best length of the ducting. As long as the exit chimney has a temperature of 2000F/930C, as stated before, the system should operate. The metal ducting is surrounded by cob to make a nice sitting bench.

So there you have it. A rocket stove to cook on and a rocket mass heater to warm the house with. Did I mention rocket fired pizza ovens, or rocket saunas, or hot water rockets? Where to begin? Educate yourself with the third edition of Ianto Evan and Leslie Jackson's 'Rocket Mass Heaters' and join up with Kirk Mober's Donkey32 ProBoard. Then get some bricks, stomp a little cob and start experimenting. Be safe and have fun! ♦



## Links & resources

### ♦ Henderson Clayworks

Rediscovering and refining the world's great earth building traditions. USA based.

[www.hcworks.org](http://www.hcworks.org)  
[naturalbuildingsupplies@zoho.com](mailto:naturalbuildingsupplies@zoho.com)

### ♦ Rocket Mass Heaters

Book by Ianto Evan and Leslie Jackson. Other resources available.

[www.rocketstoves.com](http://www.rocketstoves.com)

### ♦ Agari Permaculture Farm

Regular workshops for natural building, permaculture, natural health, healing and more! Longwood, Vic.

[www.agarifarm.org](http://www.agarifarm.org)

### ♦ Curvatecture

Superadobe instructor and builder. Melbourne, Vic.

[www.curvatecture.com](http://www.curvatecture.com)

### ♦ Rocket Stoves and Natural Building Forum

[www.donkey32.proboards.com](http://www.donkey32.proboards.com)

### ♦ SunDog School of Natural Building

An educational environment for people looking to build natural structures with earthen materials.

[www.sundogbuilders.net](http://www.sundogbuilders.net)

### ♦ Aprovecho Research Center

Developing appropriate technology solutions for health and environmental problems worldwide. Useful publications and video library.

[www.aprovecho.org](http://www.aprovecho.org)