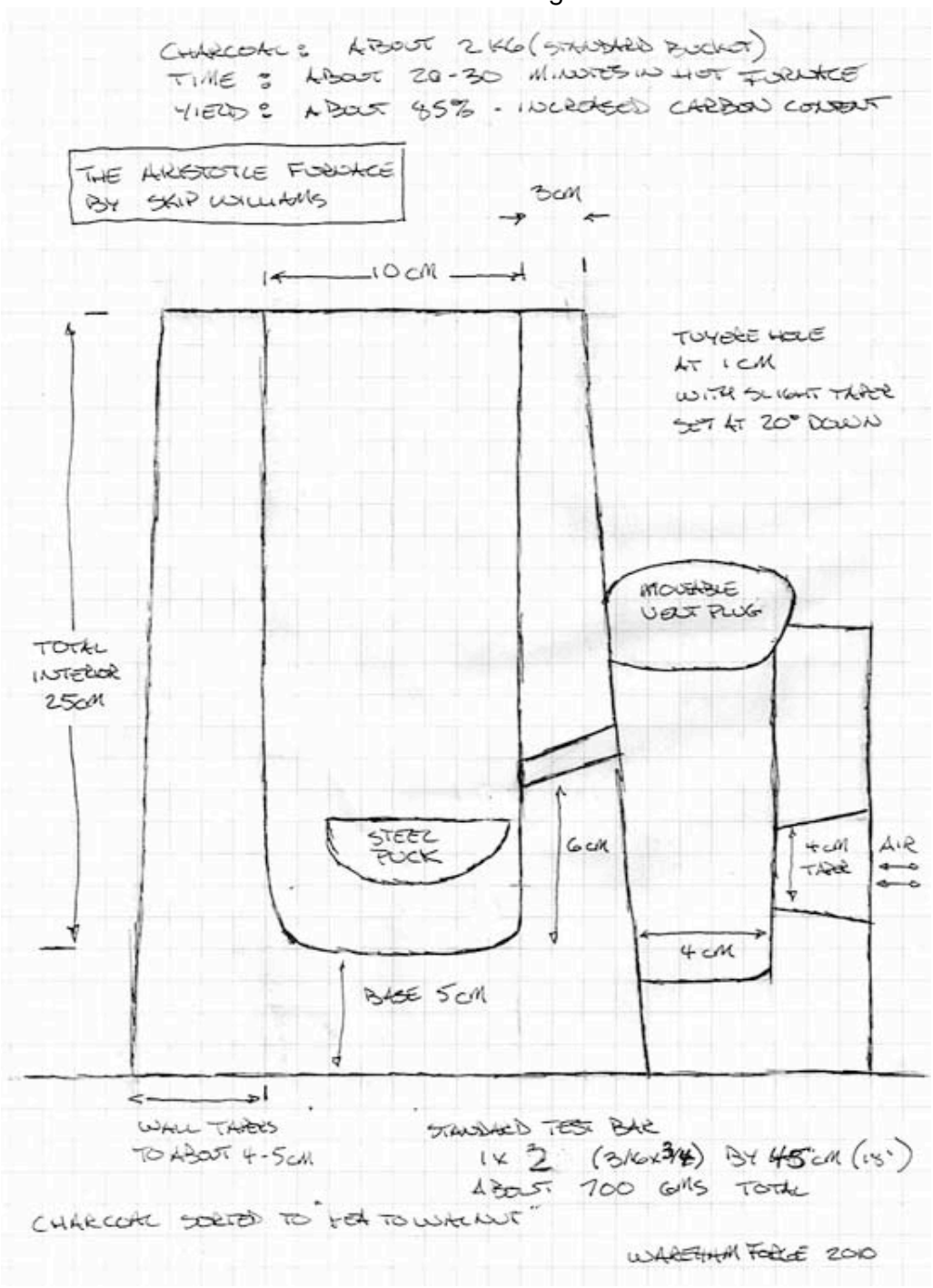
The Aristotle Re-Melting Furnace



A simple way to make bloomery type carbon alloys

This furnace is based on the writings in Aristotle's "Meterologica' and later Ole Evenstad's descriptions in the 1780's.
The original concept belongs to Skip Williams, who then introduced a prototype to the Early Iron group a Lee Sauder's Smeltfest event in 2008. At 2009 Smeltfest, our team concentrated specifically on the working dynamics of the Aristotle Furnace, with over 30 individual test firings.

The furnace is build like a miniature short shaft smelter. A standard 2 litre plastic pop bottle makes a good

internal form. The ideal material for the walls is a 50 / 50 mixture of dry shredded horse manure mixed with powdered potter's clay.
A standard carpenter's pencil, or a piece of 3/8 rod is used to make the blast hole.
Critical measurements are :
1) the angle of the blast hole - at 20 to 25 degrees down from horizontal
2) the depth of the furnace floor below the blast hole - at 5 - 7 cm
3) height above the blast hole - at about 20 cm

A single firing consumes about 2 kg (standard galvanized pail) of charcoal over 25 - 30 minutes. The fuel should be broken to 2.5 cm or smaller, with dust screened out.

Temperature is determined by consumption rate, in turn modified by volume of the air blast. Ideal consumption is roughly 200 gms every 4 - 5 minutes (determined by timing a standard measure - a standard coffee holds about 200 gm)

The raw material can be almost any iron source. At first it is suggested that short lengths of standard 3/8 - 1/2 mild steel bars be used. Cut this into roughly 15 - 20 cm lengths, a total of 600 - 800 per firing.

Each bar is placed roughly 1/3 the distance back from the blast hole side, deep enough into the charcoal that the pieces hold it upright in place. The pieces are then allowed to descend as the charcoal level drops. Keeping the furnace full of charcoal, new bars are added as the previous ones drop below the upper surface. The last bar is covered with a last addition of charcoal, then the surface level is allowed to drop, burning the remaining fuel.

At this point a pointed hook can be inserted underneath the 'puck' of collected bloomery steel. It is a good idea to scrape out any slag that has gathered in the bottom of the furnace, then the whole can be re-filled with fuel for an additional process.

The result is a mid to high carbon metal, with the physical texture characteristics of bloomery iron. The created 'puck' typically weighs about 500 - 600 gms (65 - 75% yield). Once consolidated, this enough material to make two 4 - 6 inch long tanged knife blades.

Descriptions and further reading on the Web:

"Teeny-tiny Bloomery"
by Skip Williams
http://iron.wlu.edu/reports/Teenytiny.htm

"A different way to make steel"
by Jesus Hernadez (on 'Don Fogg's Knife Forum')
http://forums.dfoggknives.com/index.php?showtopic=11327&pid=101799&st=0&#entry101799

Aristotle's Steel
by Lee Sauder (PDF download)
http://www.leesauder.com/pdfs/Aristotle%27s%20Steel.pdf

"Steelmaking in a tiny open furnace"
Donald Wagner (This is a photo essay from the same event that Lee's article above was based on.)
http://www.staff.hum.ku.dk/dbwagner/tiny.html

Darrell Markewitz
Prepared as background for the demonstration March 10, 2012
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