

### 3 Miniature to Monster

Solid state lasers can range in size from something that could be built into a pistol shaped enclosure to fire a bug zapping laser pulse (a fraction of a joule every few seconds) or the laser pointer mentioned above, to a football STADIUM sized monster. The [National Ignition Facility](#) is a solid state laser/amplifier array comprising over 7,000 optical elements, some more than a meter across, and producing megajoule pulses to be used for inertial confinement fusion research and nuclear bomb physics simulation. (So they say – actually we all know that the laser engineers just want to be able to play with a very large toy! :)

Unlike HeNe and Ar/Kr ion lasers, there is little standardization of solid state laser components. Laser rods come in all shapes and sizes – some not even rod-shaped :) with or without mirrors (for use with external mirrors and Q-switch optics). They are also relatively expensive as despite their deceptively simple appearance – partly due to the fact that they are a lot fewer of them than laser diodes or HeNe tubes. A price of \$300 for a 75 x 5 mm Nd:YAG rod could be a bargain.

The most common type of solid state lasers to have shown up on the surplus market are the laser head assemblies and pulse forming networks from some versions of the M-60 and M-1 tank rangefinders. Yes, if you come across a blown up M-60 or M-1 battle tank in your local junk yard, there may be a laser in there you can salvage! But don't worry, most of the time, you just have to take the laser. :)

- The M-60 ruby laser has appeared in many surplus catalogs and their corresponding Web sites for prices ranging from about \$50 to \$300. It includes the ruby rod and flashlamp, mechanical Q-switch mirror and motor, energy storage capacitor/pulse forming network and trigger for the flashlamp, and machined housing including cavity optics. All one needed to do was connect it to a capacitor charging power supply (a few disposable camera flash inverters in series would probably even work) and provide a means of powering the Q-switch motor and triggering the flashlamp synchronized with the delayed pulse from a position sensor on the motor shaft. Some people replaced the ruby rod with a Nd:YAG rod for higher output. See the section: [Hughes Rangefinder Ruby Laser Assembly](#).
- The M-1 Nd:YAG laser has appeared more recently from Meredith Instruments and elsewhere for \$150 to \$300. It includes the rod, flashlamp, and mirrors, in a compact premanently aligned cavity assembly. A compatible pulse forming network is also available. All that is needed is a capacitor charging power supply and external trigger circuit. See the section: [A Small Nd:YAG Laser – SSY1](#).

In fact, building a solid state laser if you have a Nd:YAG rod with integral mirrors in-hand is very easy – just add a linear flashlamp of with enough energy in close proximity wrapped in degreased aluminum foil! For small rods, a single-use (disposable) pocket camera flash will even work. See the paper: [Micro-Laser Range Finder Development: Using the Monolithic Approach](#).

My first contact with lasers was in the late 1960s when I inherited a student built ruby laser based on a design from Popular Science magazine archived on the Modern Mechanics blog Web site at [Popular Science: PS Builds a Laser and so can you](#). This used a ruby rod with integral dielectric mirrors about

1/4" x 3" (this is all from memory) and a linear flashlamp with an energy input of up to 400 W-s. Regrettably, I don't know if it ever worked – the lamp fired fine but I was too chicken to turn the capacitor voltage up to its maximum setting for fear of blowing up the flashlamp! Oh well. :( At least, shortly after that, our high school acquired a \*real\* 1 mW HeNe laser so I played with that some and used it to view the hologram that was part of an issue of, I believe, Scientific American. Not the same as exploding balloons or drilling holes in razor blades, however. :(

The [Laser Equipment Gallery](#) has many detailed views of various solid state lasers from the M-60 Tank rangefinder to a high power arc lamp powered system putting out over 100 W CW.