"Gear (Belt) Reduction System"

By Tom Guglielmo

Some of the reasons for going with a gear reduction system are:

1) More torque to your prop
2) Less AMP draw from your motor
3) Longer run times
4) Can run bigger pitch props

Some of the drawbacks are:

1) Less RPM at your prop
2) Gear noise (Mostly if using metal gears only)
3) Maintenance (More moving parts)

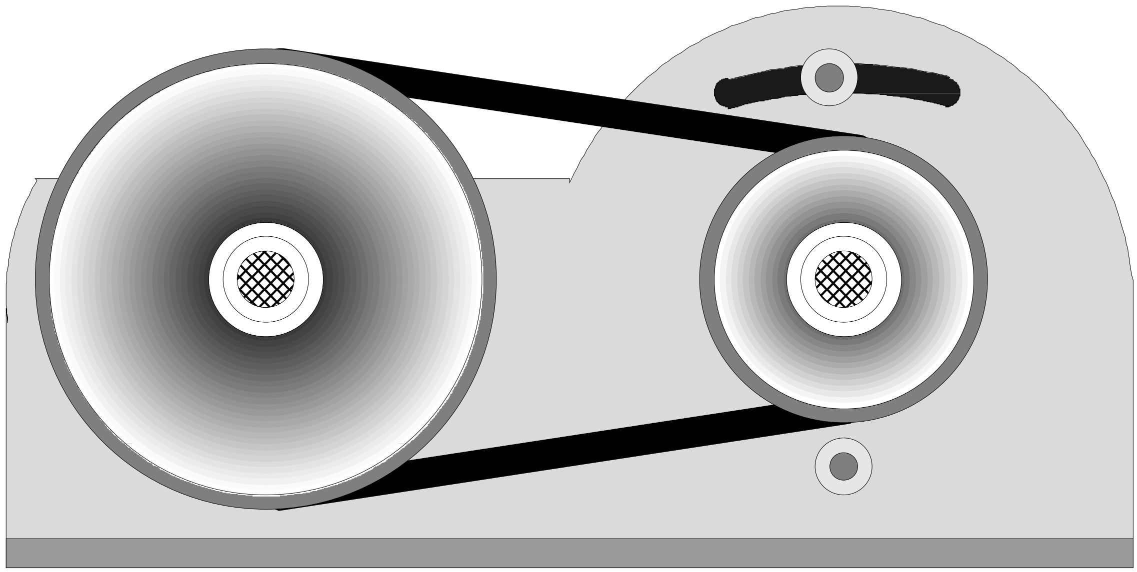
Fortunately for us, since we're not out for speed but searching for more torque at the prop, longer running times and maybe more lowspeed control. Since the pluses outweigh the minuses and the design I'm going to propose will do away with the gear noise problem as this design is done with cog belts and gears.

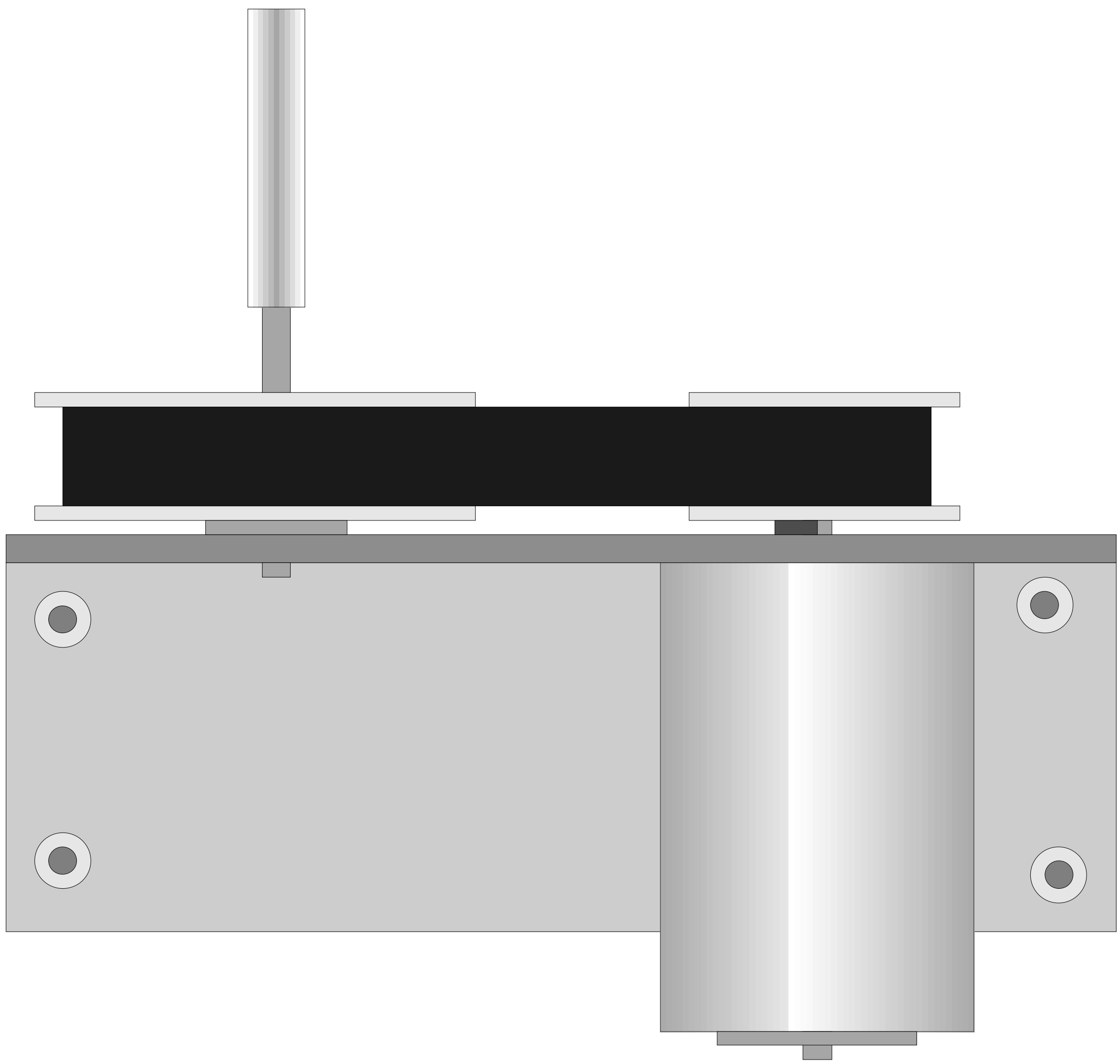
Designing your system

In designing this setup the first step is to know what your constraints are: How much area do you have and what kind of gear ratio do you need. Diagram 1 is what I'll be showing you how to make. Depending on how wide your hull is, if you're running twin screws or a single shaft, how much of a reduction you want (Size of gears) will all come into play, when designing this system.

This design is for a 2:1 gear reduction (motor turns twice for every one revolution of the prop) however changing ratios is "very" easy as I'll explain later. Diagram 1 is a breakdown of this design.

There's five parts to this system 1) Motor 2) Motor gear (Spur gear) 2) Support bracket 3) Prop shaft gear 4) Prop shaft 5) Prop shaft support bearing





Motor:

Highspeed, high torque motors typically draw a lot of Amps which result in shorter running times but also result in some fast and powerful runs.

Low speed low torque motors draw very little amperage which result in long running times but very slow speeds and not much power.

Finding a happy medium is what we're looking for. i.e. Medium speed, medium torque which if we do a good job in designing our reduction system will result in good scale speeds, plenty of power and longer running times.

Attached is a chart of some motors with RPM's, Amp draw and dimensions.

Motor gear / Prop shaft gear

This is the section that requires some planning and some thought as to what you want to get out of this system.

There are several variables that you need to take into account: 1) Motor speed, prop diameter as well as prop pitch. Since I knew that I was looking for a ratio of 2:1 to 3:1 I calculated what types of gears I needed to purchase. My approach was to experiment. I purchased several different prop shaft gears and three different drive gears. I also purchased several different belt sizes, all from Stock Drive Products. Attached is a sheet listing the stock numbers and the price I paid for them about one year ago.

The prop shaft end rides in a bearing so that any side pressure from the belt is not transferred to the stuffing box.

Motor mount and shaft support bracket

I built this from aluminum 2" 90° angle stock. The prop shaft support hole was drilled out to accept a bearing also ordered from Stock Drive products. (See attached)

Once you have the gears and belt you can accurately calculate the center distances between the prop shaft and the motor shaft. This is the section that requires some planning and some thought as to what you want to get out.

Positioning motor/shaft bracket in hull

The next step is to figure the angle of the motor/shaft support bracket so the face of the bracket is 90 degrees to the prop shaft. This is to allow the prop shaft to spin freely inside the bearing in the support bracket as well as allowing the belt to seat squarely in the gear pulley. To do this use a square with the long edge resting on the stuffing tube, using a small block of wood sitting on the bottom of the hull draw a line from the square to the block of wood. This will give you the angle you need. What you should end up with is a small wedge that you will slide underneath the bracket which will tip the bracket at an angle so the face of the bracket is perpendicular to the prop shaft.

Planning cut-outs on bracket

Once you know where the prop shaft meets the bracket (with angle wedge) you know where to mount the prop shaft bearing. Once this is drilled and the bearing installed slip the prop shaft pulley onto the prop shaft and the slip this assembly into the bearing. Using one of the belts place the drive (motor) pulley inside the pulley and mark the motor cutouts. To adjust the tension on the belt I slotted the upper mounting hole and slotted the center mounting hole also. This allows you to move the motor sideways to tighten and loosen the belt.

Assembly

Once the cutouts and mounting holes are cut/drilled slip motor through mounting holes leaving mounting bolts loose. Slide motor pulley onto motor shaft and tighten securely. Position mounting bracket assembly into the hull and using epoxy glue in place. (Make sure that prop shaft lines up with shaft bearing).

Once the glue has dried, pull out prop shaft enough to slip the prop pulley and belt in place. Tighten shaft pulley and slip belt over motor pulley. Tighten belt by “lightly” pulling on motor and tightening motor mounting bolts.

Stock Drive gear numbers and ratio combinations

Ratio	Drive Gear	Main Gear
3.6:1	10	36
3.0:1	10	30
3.0:1	12	36
2.5:1	12	30
2:01	18	36
1.6:1	18	30

* Prop shafts: .185 (3/16)

.125 (1/8)

GEARS

Gear Teeth	Stock #	Shaft diameter
10	6A6-10 DFO 1804	0.125
12	6A6-12 DFO 1804	0.125
18	6A6-18 DFO 1804	0.125
30	6A6-30 DFO 1806	0.1875
36	6A6-36 DFO 1806	0.1875

BELTS

6B6-060 018

MOTORS

16RPM D.C. Gear motor 12V 3Z16-0160C

Note: Stock Drive items should be verified before ordering.
Stock Drive has a online catalog at http://www.sdp-si.com