


Home
Honda
Subaru
News
Photos
Customer Info
Manuals/Updates
Contact
About Company
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IVO Propeller Notes

IVO Propeller

IVO PROPELLER INSTALLATION / OPERATION NOTES

A little history on the IVO propeller. It has been around for years and was the propeller of choice if you wanted variable pitch, at an economical price. However, it developed a reputation for not lasting a long time on some installations. The reason was tracked down to the way the blades are mounted to the hub. Each blade has two seriously heavy duty AN-8 bolts, securing the blade to the hub. More than enough beef, by any standard, however not immune to slight movement from a harsh, direct drive aircraft engine. A service bulletin was made to have customers check the bolt torque at regular intervals. It finally came down to that the propeller was not well suited for these engines. So, then why use it? Because nothing related to the above issues relate to the geared auto conversion engines. Several thousand accumulated hours have been flown, using geared auto conversion engines, and it was found that re-torquing the blades, does not cause the bolts to tighten further each time. So, in effect, the propeller is made for this application :) It should, however, be mentioned, that proper bolt torque is the most important part of the propeller installation and that it should be verified regularly.

The below pages are directly from the installation instructions provided with the propeller as delivered from IVO. Most of this information is accurate, with exception to the additional information provided below, that is specific to the installation on an Eggenfellner engine propeller flange. If you are reading this as a paper copy, be sure to go to the www.Eggenfellneraircraft.com web page for the latest info and to see the pictures full size.

We have found the following hints helpful:

- The propeller is precisely machined and rely on a tight fit of all parts. However, some things are initially just too tight. Carefully test your parts with each other and carefully de-burr anything that is too tight for a easy push fit.
- Install the stainless gearbox bushings as a separate step, using the procedure outlined below.
- Plan out and construct a propeller assembly table. It would be nice to have something padded, with a hole in the center for the motor and support for each blade 120 degrees apart.
- Carefully build the propeller as shown (but upside down from the picture) then install the completed assembly to the engine at the end.
- Keep all parts in alignment during assembly and a plastic hammer to tap the bolts in as you go. I found a metal spray paint cup handy to put the partially completed assembly in when it could not be layed down on a flat table.
- Page 1, below, is correct, with the exception that the "Thick Back Plate" and "Allen Head Bolts" are not used. The "6 Mounting Bolts", with appropriate amounts of washers, stainless steel gearbox flange inserts and nylon lock nuts, are instead used to bolt the propeller directly to the engine gearbox propeller flange.
- Also, the "Brush Housing" and mounting, is done differently than shown.
- And there is a front spinner bulkhead, with spacers, behind the "6 washers" designation and a rear spinner bulkhead right behind the "Electric Plate"
- Brushes only last a few hours with a new setup, until carbon has been deposited onto the slip rings. Order a few spares from IVO now.
- VERY IMPORTANT: The motor shaft has been shortened 0.100" and plate facing the gearbox front nut counter bored the same amount, for the propeller to fit the G3 (Red) reduction drive unit. If you ever replace the motor assembly with a new one, be sure to shorten this shaft the same.

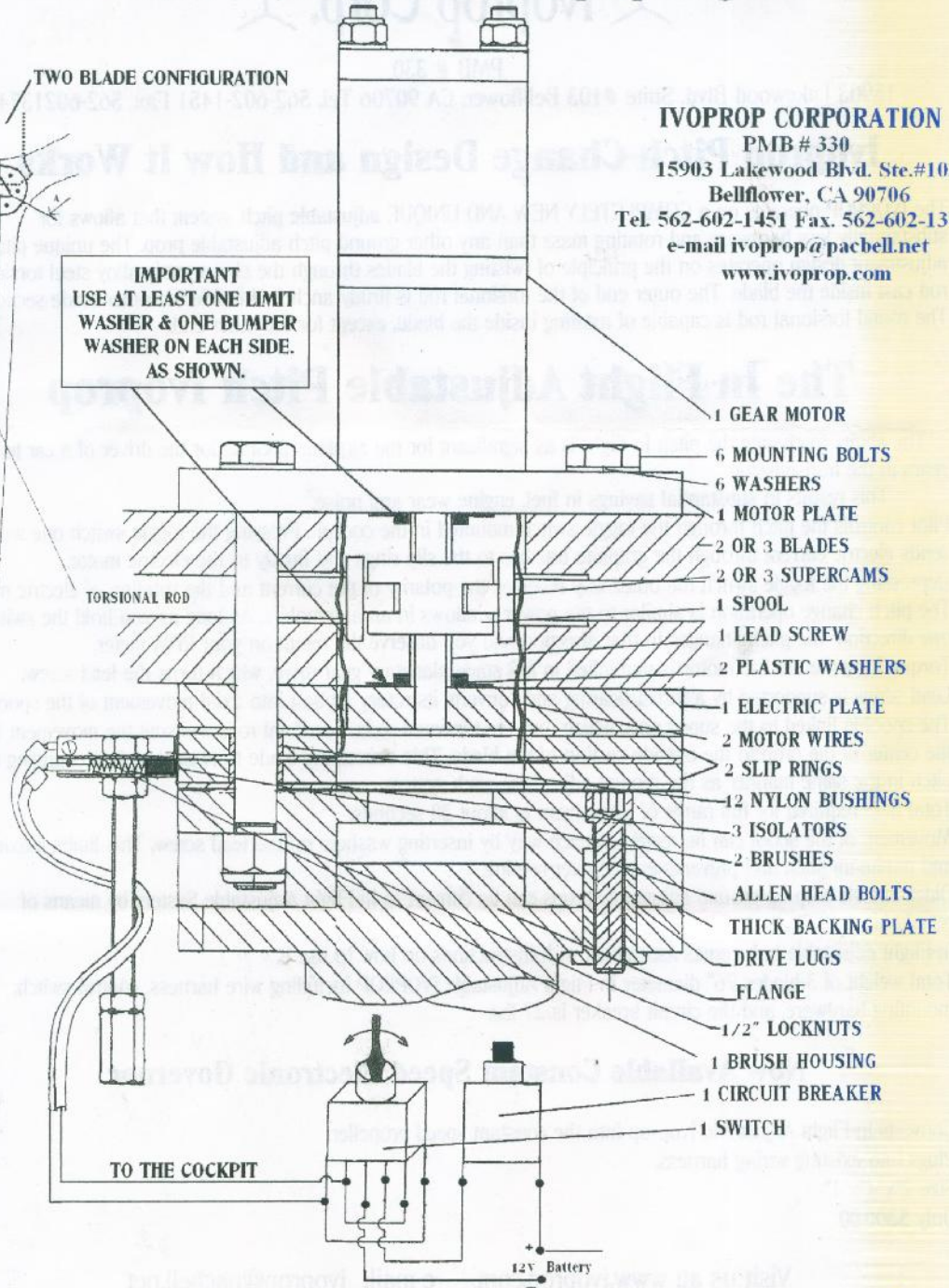
In-Flight Adjustable Pitch Ivoprop Magnum

TWO BLADE CONFIGURATION



IMPORTANT
USE AT LEAST ONE LIMIT
WASHER & ONE BUMPER
WASHER ON EACH SIDE.
AS SHOWN.

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- 1 GEAR MOTOR
- 6 MOUNTING BOLTS
- 6 WASHERS
- 1 MOTOR PLATE
- 2 OR 3 BLADES
- 2 OR 3 SUPERCAMS
- 1 SPOOL
- 1 LEAD SCREW
- 2 PLASTIC WASHERS
- 1 ELECTRIC PLATE
- 2 MOTOR WIRES
- 2 SLIP RINGS
- 12 NYLON BUSHINGS
- 3 ISOLATORS
- 2 BRUSHES
- ALLEN HEAD BOLTS
- THICK BACKING PLATE
- DRIVE LUGS
- FLANGE
- 1/2" LOCKNUTS
- 1 BRUSH HOUSING
- 1 CIRCUIT BREAKER
- 1 SWITCH

TO THE COCKPIT

12V Battery

Ivoprop Magnum Assembly

- Mount the thick plate on the flange. Use Allen head bolts and blue loctite or lock nuts. Torque 8mm bolts to 16.6 ft x lbs, 3/8" bolts to 30ft x lbs, 7/16" bolts to 45ft x lbs, 1/2" bolts to 65ft x lbs.
- Insert the mounting bolt with the washer through the motor plate in one of the bolts holes closest to the two motor wires.
- Insert one blade on the mounting bolt. Flat airfoil side towards the electric motor for pusher. Curved airfoil side towards electric motor for tractor.
- Rotate the blades so that the supercam goes into the groove in the spool.
- Insert second bolt through the motor plate and blade.
- Insert electric plate (The one without nylon bushings on the boltholes)
- Run the motor wires through the holes in the electric plate.
- Insert isolator.
- Insert slip ring on the bolts. Do not push out the nylon bushings.
- Bend one motor wire in right angle radially outward on the slip ring.
- Insert second isolator.
- Bend second motor wire the same way like the first one on the isolator.
- Insert second slip ring
- Insert third isolator
- Bolt prop loosely on the thick plate.
- Insert remaining blade (s) between plates and torque mounting bolts to 65 ft. x lbs.
- Mount the brush housing "somehow" next to the flange so that brushes will contact slip rings. The mount must be rigid. There should also be a small clearance between brush housing and slip rings.
- Brushes should point directly towards the center of the prop.
- Install switch and circuit breaker in the cockpit in a place where you can easily reach but not accidentally activate.
- Attach 3/16" connectors to the brush housing.
- Attach battery connectors to the battery. Circuit breaker wire belongs to the positive pole.
- Write next to the switch direction of the pitch change. By interchanging brush connectors you can change the direction of pitch change.

Example:

Pitch up	Pitch down
R.P.M. down	R.P.M. up
Cruse	Climb

- Caution: Brushes are brittle- Do not break them.
- If you wish to use the spinner. The spinner backing plate shall be inserted between the electric plate and the isolator.

Magnum Ivorpop

Setting Your Own Pitch Limits

- The pitch change operation in flight can be greatly simplified by restricting movement of the spool therefore limiting the pitch change from your best climb pitch to your best cruise pitch.
- Land with the prop in your best climb pitch.
- If it is a 2-blade prop, remove the blade blocks (missing pieces of pie) and look inside to determine how many limit washers you need to put on the lead screw. If it is a 3-blade prop, look through the gap between blades using a flashlight.
- Land with the prop in best cruise pitch and repeat the above procedure.
- Bring prop to the neutral position (You can hear it – no load on the electric motor).
- Take prop apart.
- Insert the limit washers on the lead screw so that spool can not travel beyond your measurements.
- **Very important** not to forget to insert **plastic washers** on each side of the spool. Failure to do so will immediately lead to the destruction of the gears in the planetary drive.
- Note: the thickness of plastic washer under load is about ½" of it's original thickness.

How To Fly With It

- Run the prop W.O.T. on the ground and adjust pitch to your maximum hp. RPM (W.O.T. "means, wide open throttle")
- As you accelerate, start adding pitch to keep the engine from over revving.
- Climb W.O.T. and adjust the pitch to maximum climb rate. (Do not exceed maximum allowable R.P.M. for your power plant).
- Remember your R.P.M. at Your best climb pitch.
- After reaching cruising altitude, refer to your engine manual for recommended manifold pressure and R.P.M. adjust the throttle and pitch accordingly.
- Before landing, go for a moment into W.O.T. and start decreasing the pitch by short pulses until you reach your best climb R.P.M. which you remember from the take-off.

Magnum Ivorpop

Important

- Assume that In-flight pitch adjustment can quit on you anytime in which case the pitch stays where it is. Therefore do not pitch prop up for cruise more than you need to slightly climb. So you can bring your plane back where you came from.
- Do not run the prop without the circuit breaker, which is supplied with it.
- If you hold the switch for a few seconds after reaching the pitch limit, the motor will stall. This will cause the circuit breaker to pop out and you have to wait several seconds to reset it.
- The system will not run reliably on regulated DC current from regulator, therefore you need a battery.
- Before disassembling the prop always bring the pitch to the neutral position.
- Never engage pitch adjustment on one blade only or on two blades spaced 120 degrees.
- Do not remove carbon deposit from the brushes on slip rings.
- Do not rely on a spring, which returns the switch lever to the neutral position.
- If you can not change the pitch In-Fight, try it in idle R.P.M. or try to move the switch lever back and forth.
- Do not shorten 12' wires or circuit breaker will pop out sooner.
- Keep the grease away from plastic and limit washers.
- Keep oil away from slip rings.
- Make sure that there is no electric continuity between slip rings and the engine frame otherwise you could destroy your regulator rectifier when changing the pitch while engine is running.
- After you are done with setting the limits and final installation seal the gaps between the blades with silicon.
- Tie down or put tape over the brush connectors so they will not come loose in flight.
- Use only the hardware supplied with the prop. Never drill or modify the boltholes in the blade.
- Maintain the 65ft. x lbs. Torque on the bolts.
- Make sure that there is at least 4" of clearance between the blade tips and trailing edge of the wing, radiator, rudder, or whatever, because the blades are designed to flex back and forth more than wooden blades.
- Do not slide your fingers along the trailing or leading edge of the blade, fibers may pierce your skin.
- If you are going to use other than skull cap type spinner make sure that there is at least ¼" clearance between blades and cut-outs in the spinner.
- If your aircraft holds U.S. experimental airworthiness certificate, you are supposed to contact the FAA FSDO before flying the aircraft. When notified, the FAA inspector can determine if the procedure was major change (As defined per far 21.93 and listed in appendix a part 43) and if any additional inspections or operating limitations are needed prior to the flight.
- Enjoy flying with Ivoprop.

Ivoprop Corp.

PMB # 330

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Ivoprop Pitch-Change Design and How It Works

The IVOPROP operates on a COMPLETELY NEW AND UNIQUE adjustable pitch system that allows for substantially less hardware and rotating mass than any other ground pitch adjustable prop. The unique pitch adjustment design operates on the principle of twisting the blades through the chrom-moly alloy steel torsional rod cast inside the blade. The outer end of the torsional rod is firmly anchored inside the outer blade section. The round torsional rod is capable of rotating inside the blade, except for the outer end.

The In-Flight Adjustable Pitch Ivoprop

The ability to change the pitch in flight is as significant for the airplane pilot as for the driver of a car to shift gears in the transmission

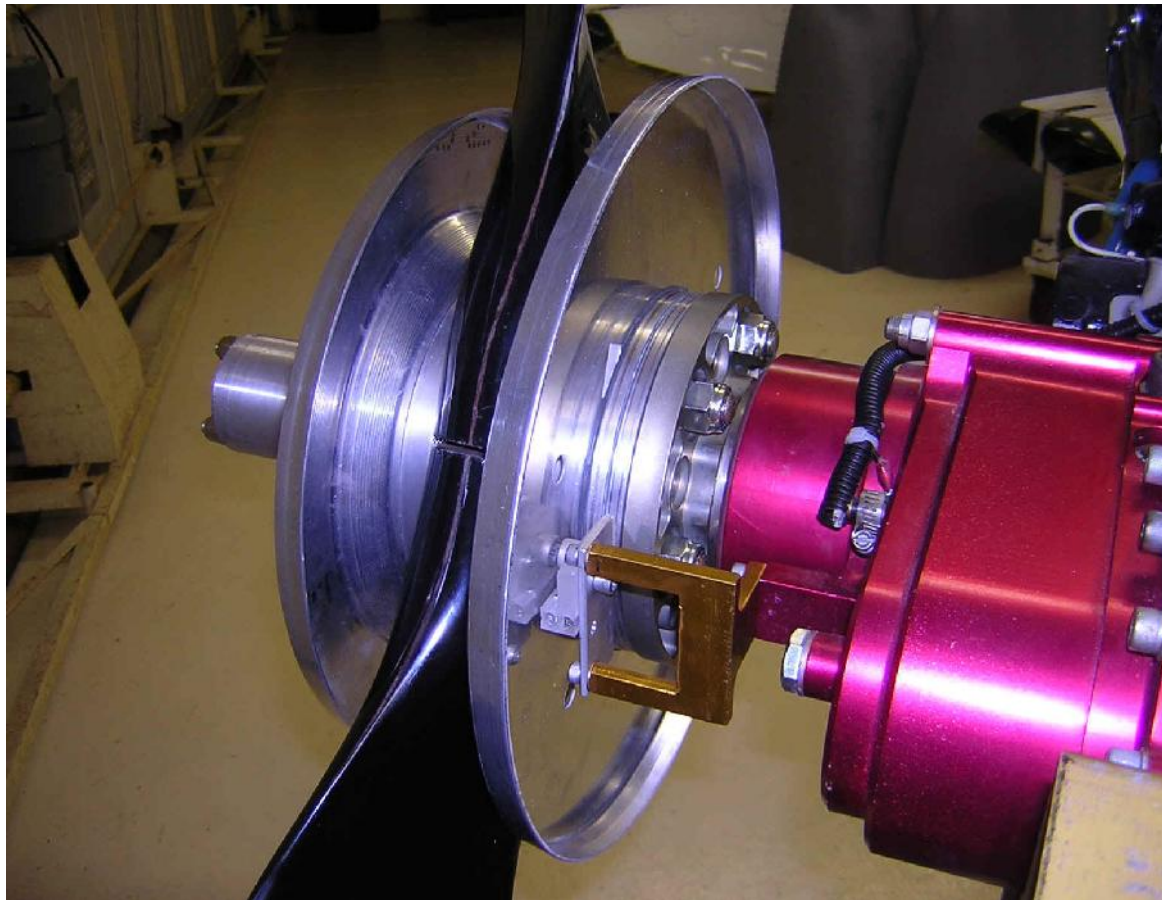
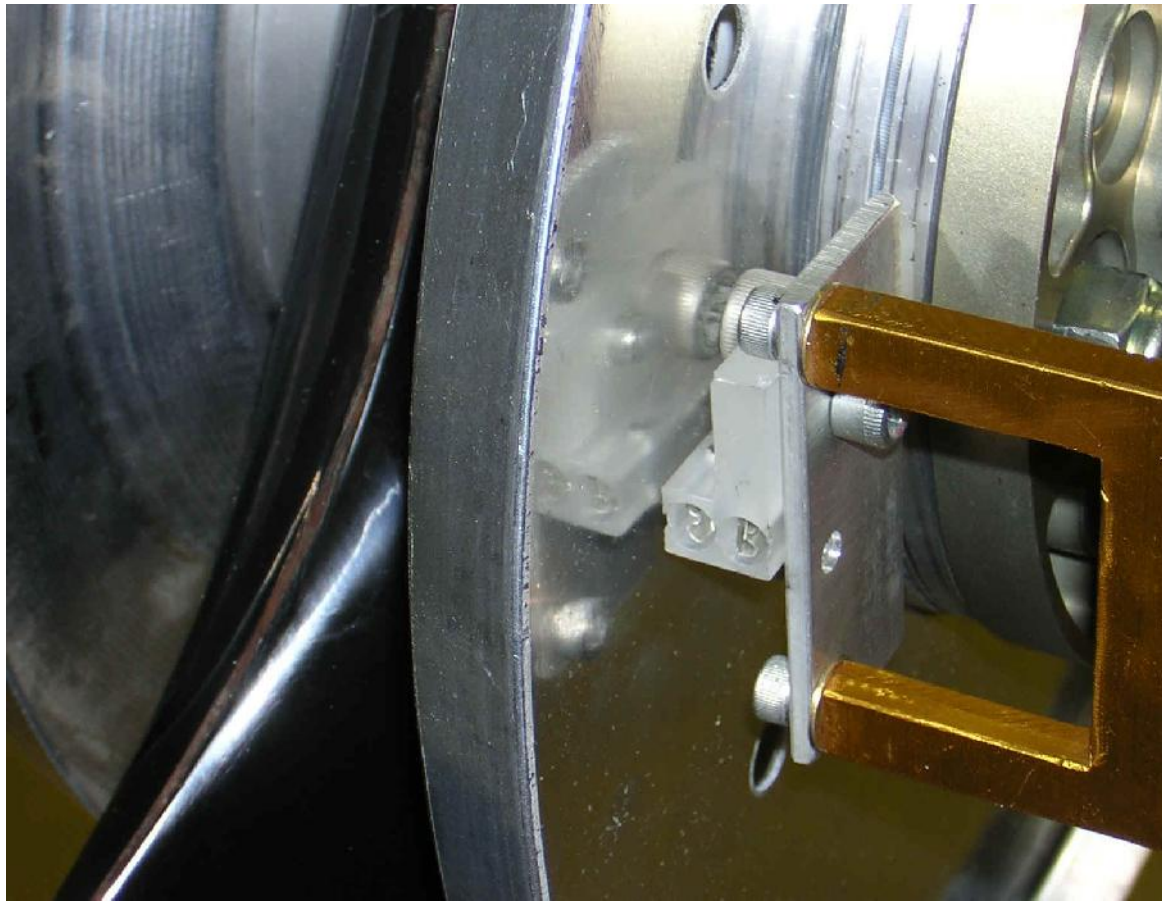
This results in substantial savings in fuel, engine wear and noise.

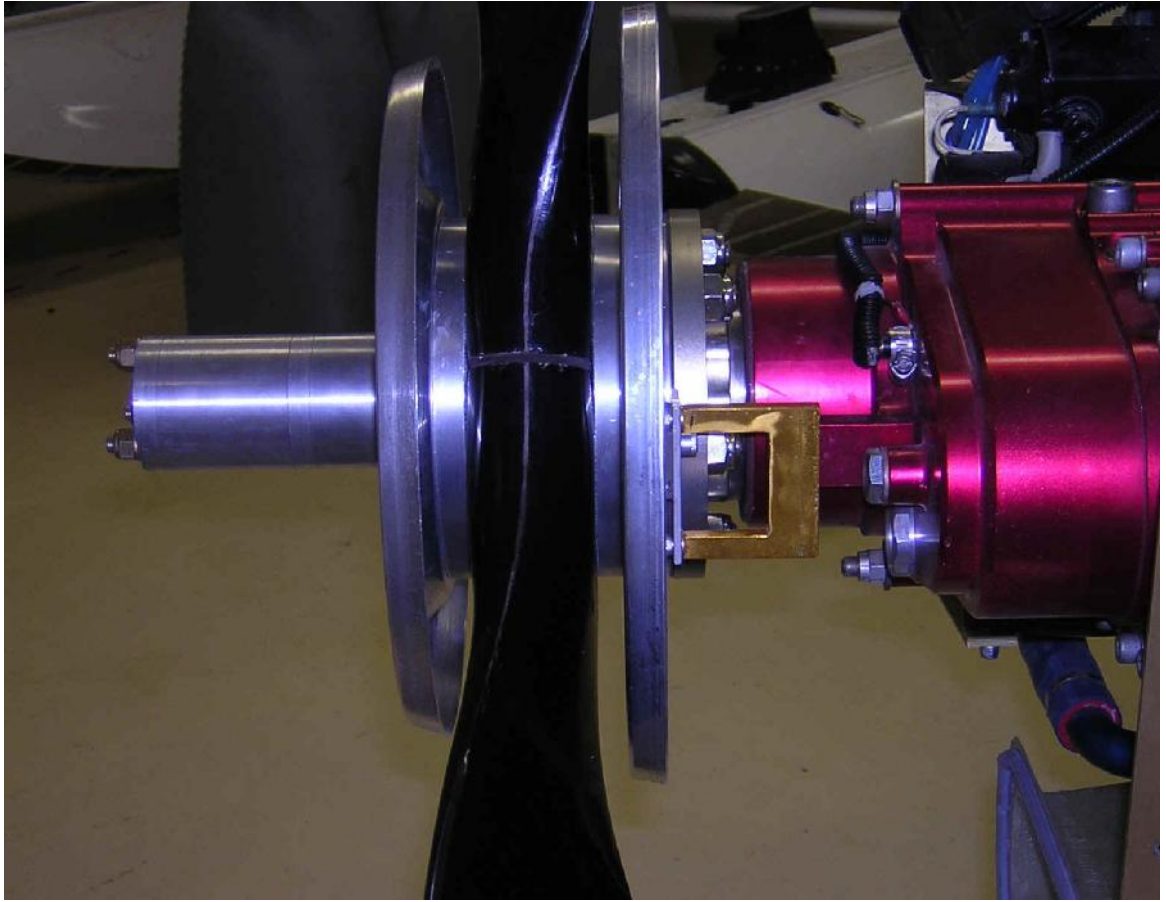
- Pilot controls the pitch through the toggle switch mounted in the cockpit. Pressing the toggle switch one way sends electric current through the graphite brushes to the slip rings and finally to the electric motor.
- Depressing the toggle switch the other way reverses the polarity of the current and the rotation of electric motor. The pitch change operation is similar to the power windows in an automobile. As long as you hold the switch in one direction- the pitch changes in that direction and you observe the result on your RPM meter.
- Torque from the electric motor is multiplied in a 3 stage planetary gear drive, which turns the lead screw.
- Lead screw is supported by a thrust bearing and converts its rotary motion into axial movement of the spool.
- The spool is linked to the supercams, which turn the torsional rods. Torsional rods transmit the movement from the center of the prop to the outside section of the blade. This causes the blade to twist therefore changing the pitch in the same manner as the ground adjustable pitch system.
- Total time required for full range of adjustment is about 20 seconds.
- Movement of the spool can be restricted each way by inserting washers on the lead screw. This limits maximum and minimum pitch and prevents engine over-revving.
- Older models Ivoprop ground adjustable props can be convert to In-Flight Adjustable System by means of retrofit kit.
- In-Flight adjustable hub comes assembled with instructions on how to use it.
- Total weight of 3-blades 76" diameter In-Flight Adjustable IVOPROP including wire harness, control switch, mounting hardware, and the circuit breaker is 27 lbs.

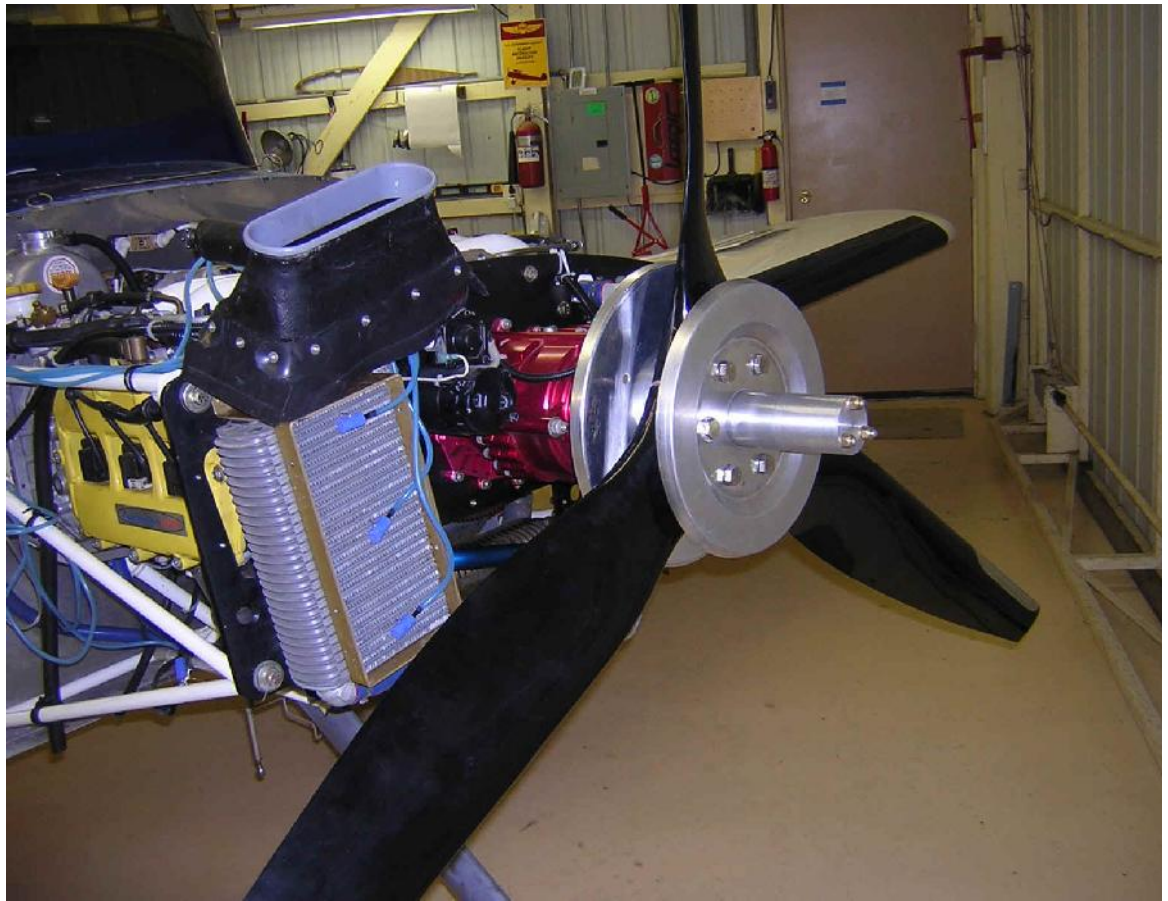
Now Available Constant Speed Electronic Governor

- Converts In-Flight Adjustable Ivoprop into the constant speed propeller.
- Plugs into existing wiring harness.
- Size 2"x 4"x 1"
- Only \$300.00

Visit us at: www.ivoprop.com e-mail: ivoprop@pacbell.net



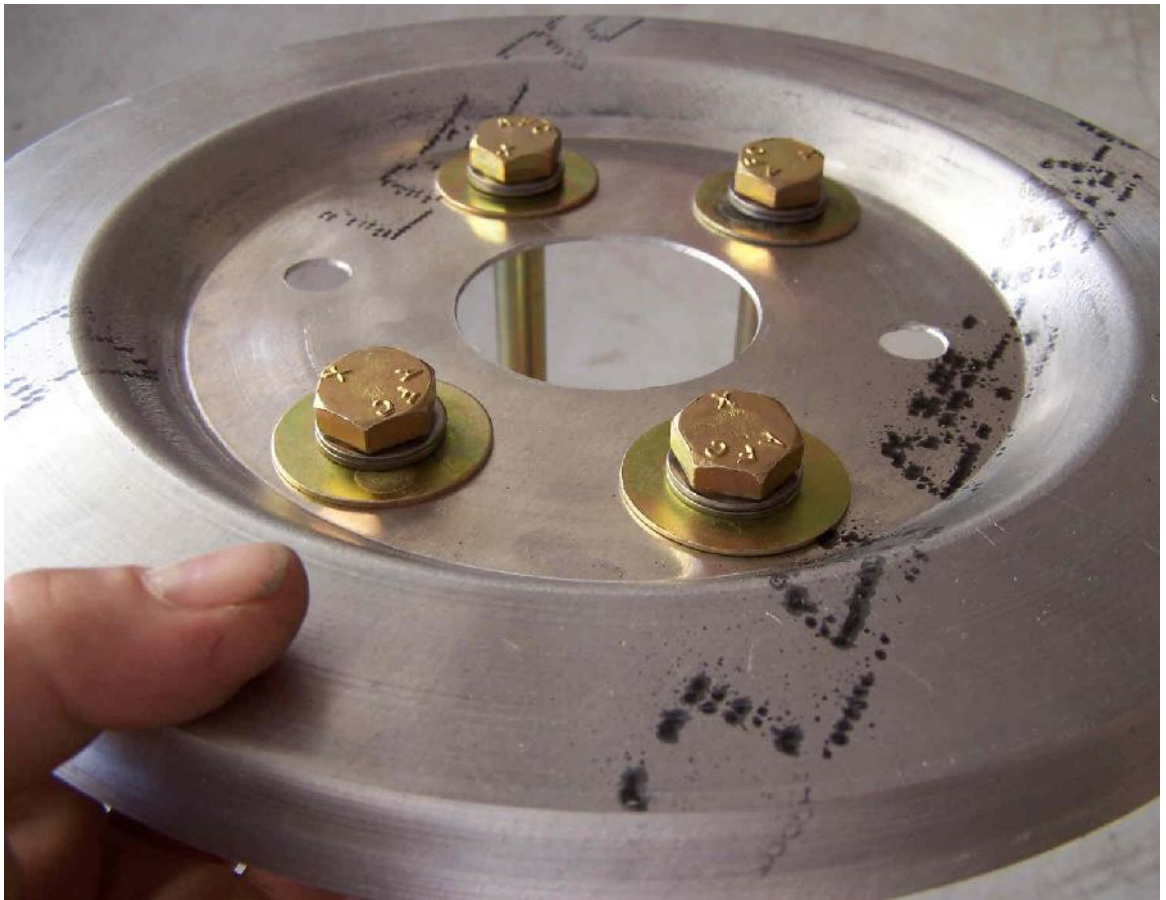




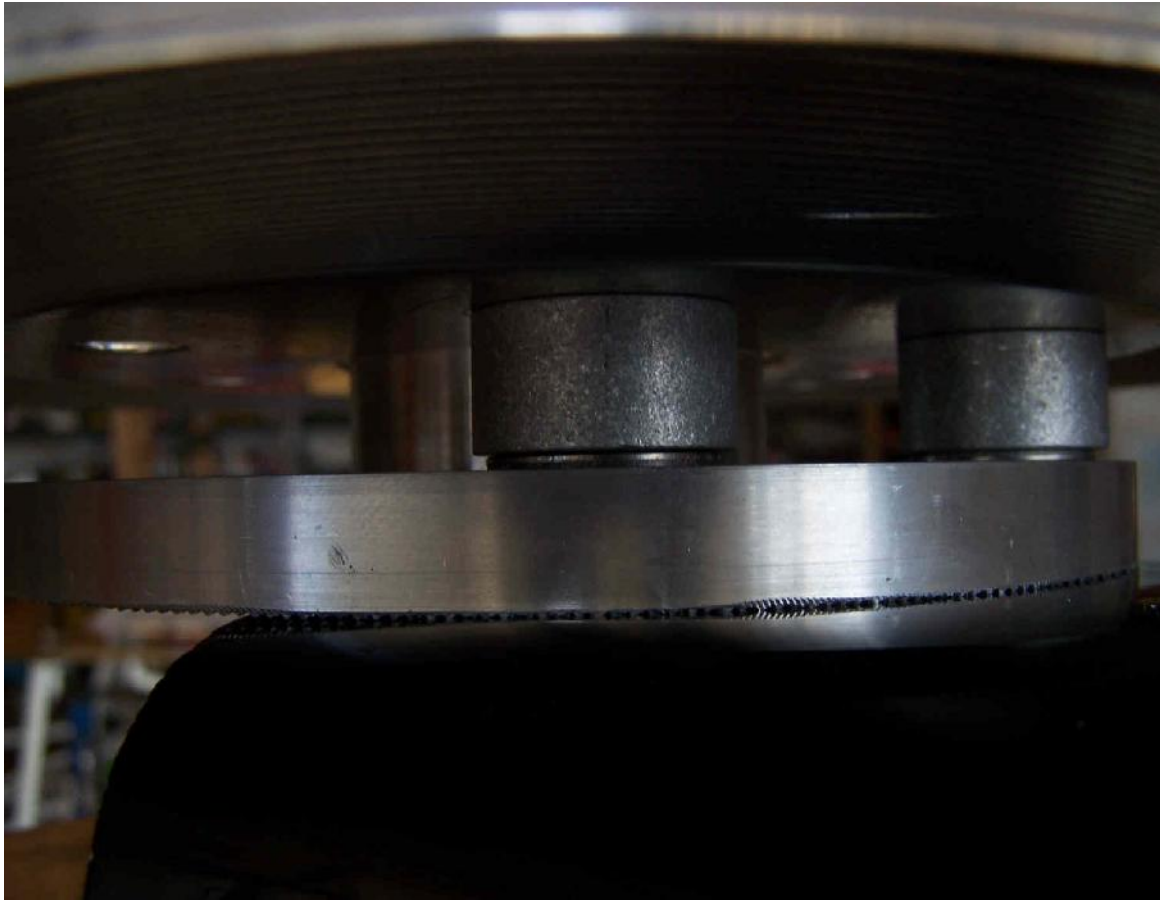


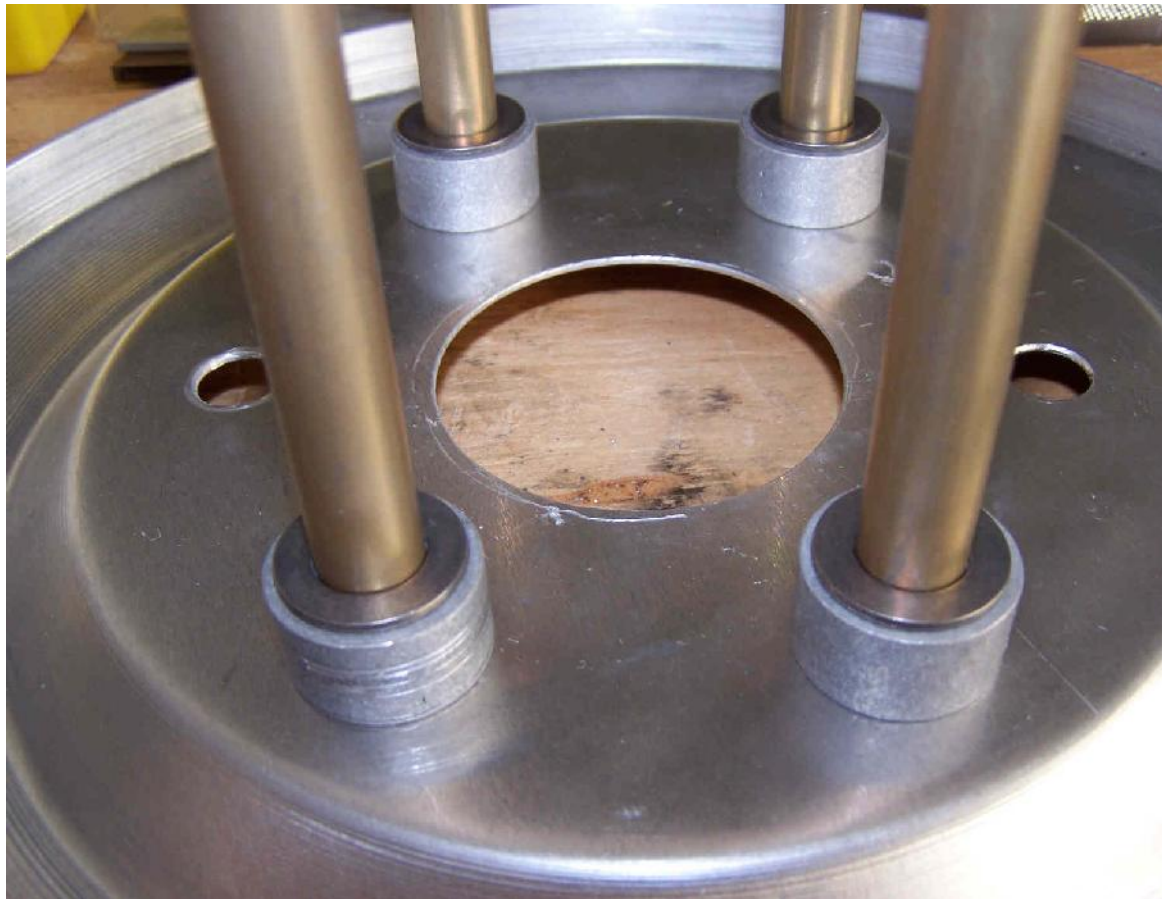




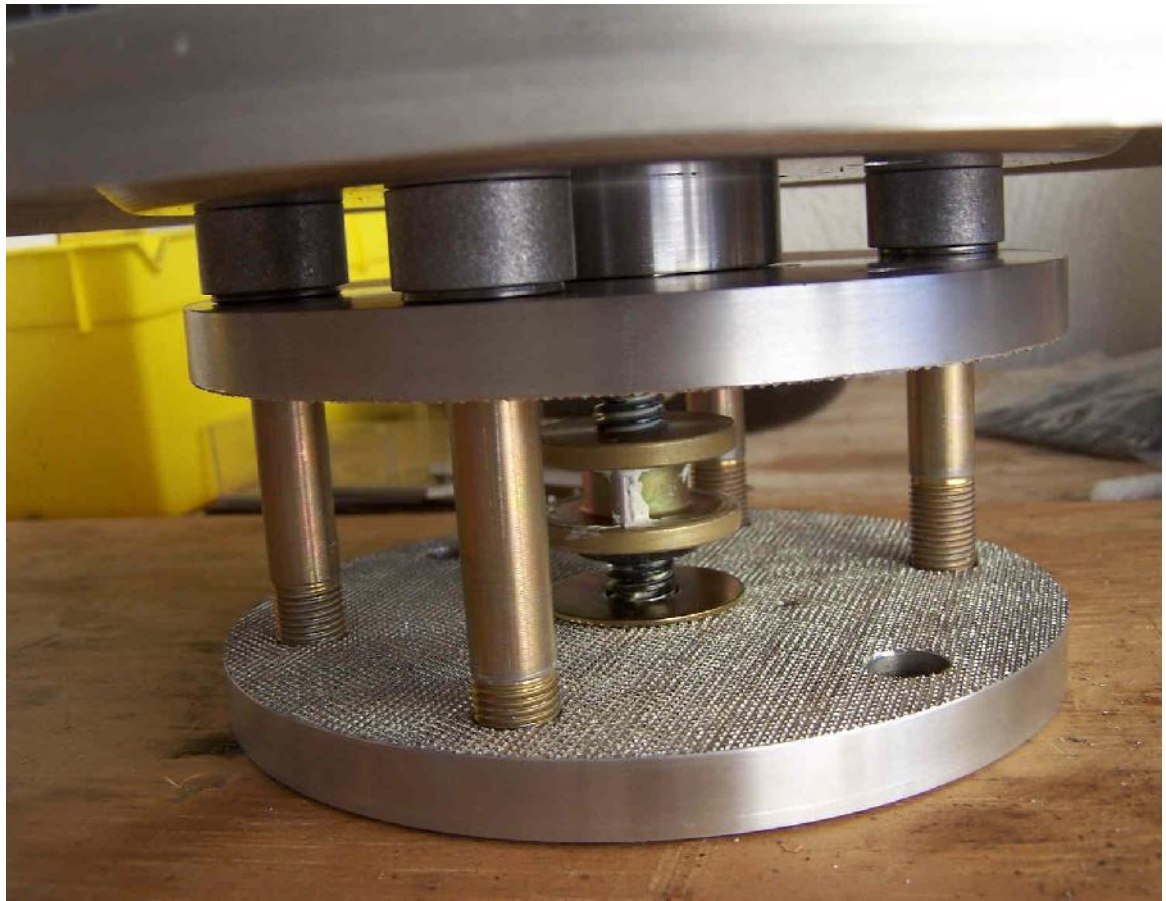


Ajust amount of washers for 2+ threads showing after propeller is tight. Be SURE to torque the nuts and not the head of the bolt, for final assembly.

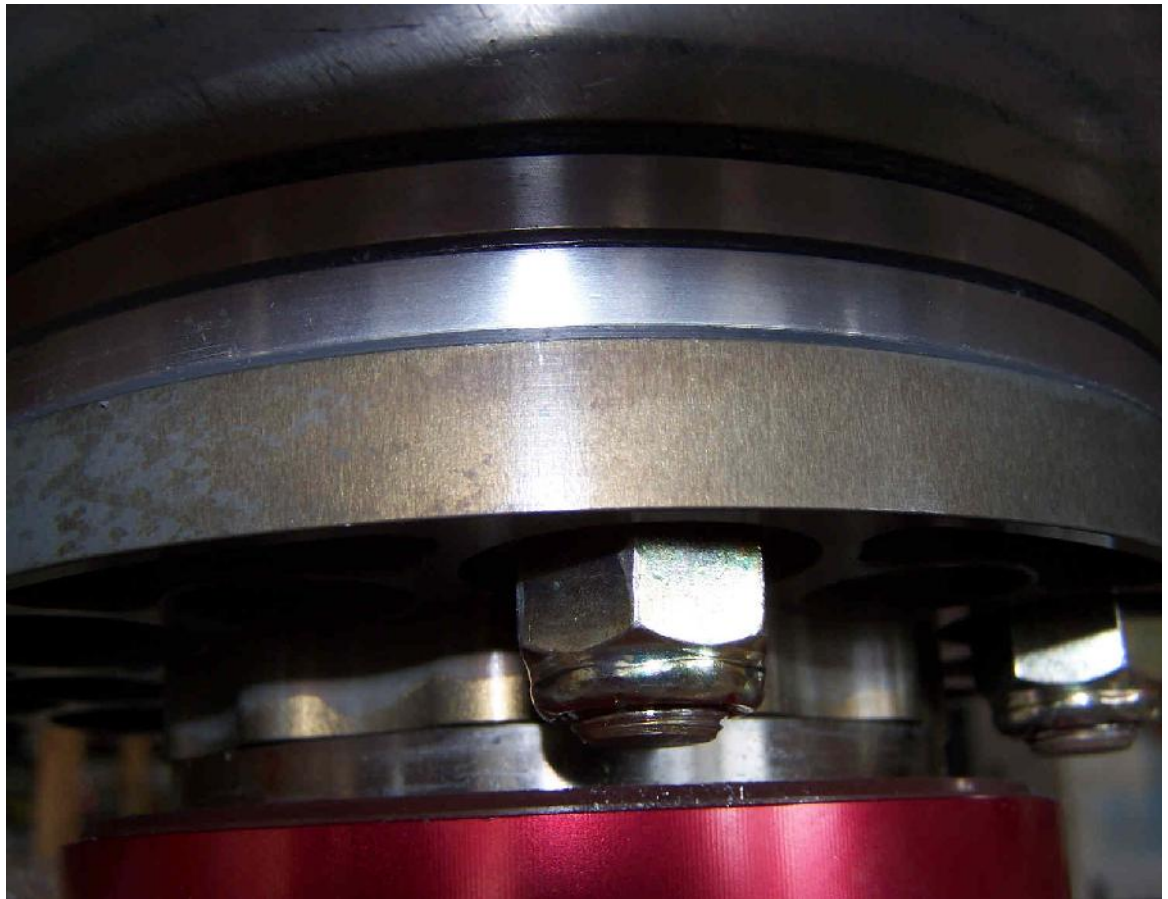




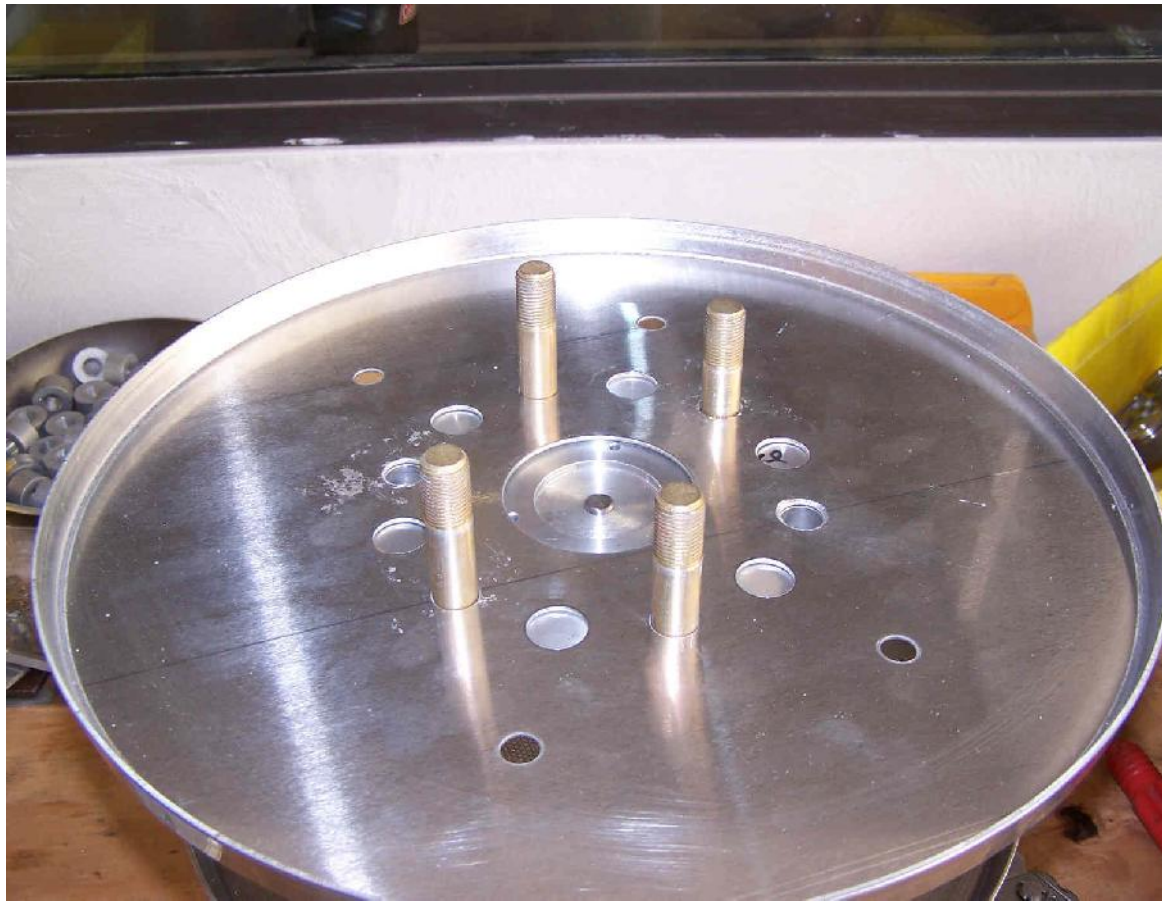
0.60" spacers between front bulkhead and propeller(one spacer + one washer)



Blades installes between knurled disks



If one or two washers are used here, the nut is pushed out and it is easier to install a crow foots adapter to the torque wrench and get full engagement on the nut. Do not just torque the bolt head, it will not be tight enough, due to friction in the assembly.



Rear spinner bulkhead. This picture also show a modification done to the propeller, in order to fit on the gearbox. The center area has a 0.1 deep pocket machined, and the propeller jack screw tip has been shortened 0.025"



Next, the isolators and slip rings are installed with the wires installed between them. It is a good idea to trim the isolators, with scissors, so they are just slightly smaller than the slip ring disks. This will prevent them from wiping out the brushes that will ride on them.





Install spinner loosely and make sure it runs centered before drilling and installing nut plates. You need to trim around to clear the blades with 1/8" (or more) everywhere. You do not want the spinner to cut into the propeller while operating. It is also possible, due to the smooth running of this engine, to omit the front bulkhead, however, you would have to buy new, shorter bolts, from IVO, if you want to go this route.

Some more notes about the propeller: The output shaft has been shortened by 1/4" so that it clears the nut in front of the reduction drive. A small pocket has also been machined in the aft knurled disk, for the same reason. The reason the aft slip ring disk does not short to the propeller hub, even though it is touching the centering boss on the hub, is due to the hard anodized coating being non conductive on the propeller hub. There has not been any issues with this, but you have the option of grinding away this

centering ring on the gearbox prop flange, since it is not used for the IVO anyhow. Or, the ID of the first slipp ring can be made larger, to clear the prop flange.