Peter Larkam

Achieving dreams has long been important to me. Especially dreams related to freedom and personal growth. In 1985, I took the initiative to begin working towards my private pilot's license. As a student with few funds, it took three summers of lifeguard earnings to pay for the lessons required. With turnover of instructors from year to year, it took me longer than it does for some. I earned my Single Engine Land rating in March 1988. In 1990, I first took the controls of a Robinson R-22 helicopter in a "Freedom Flight." I was hooked. Fixed wing flight is fun, but this was amazing!

My aviation dream took a back seat to more pressing life priorities for many years.

All of us have dreams that don't go away. And for me, rotary-wing flight has been one of those dreams. In 2012, I turned much more serious attention to how I would make this dream come true. Would I pursue an Autogyro? For several months, I thought this would be my solution. And then I discovered the Helicycle. I spent many hours looking at photos and reading stories on this Helicycle.com website.

I learned there was a Helicycle owner less than an hour north of me -- and his ship was for sale! So I called Dave Keck and made arrangements to see his Helicycle in person. There's nothing quite like the excitement of hearing the turbine in this sleek flying machine roar to life. Here's Dave Keck (builder of Kit 2-16) starting up his turbine...

We talked for a while, and he encouraged me to build my own if I were willing. His own workmanship was impeccable. "I wanted it to look like it came out of a factory." Looked to me as though he succeeded at that. It was truly a beautiful machine.

I was not in a big hurry, so I decided to follow this plan, and put myself on the waiting list for Eagle R&D production run #7.

For the next several months, I made contact with current owner / builders to find out if they had any reservations about the project, or would do it again. Most everyone I communicated with was friendly, helpful, and most importantly, VERY HAPPY with their Helicycle. I heard no builder regrets. It was obvious from my due diligence research that several people had purchased a kit and then sold it after spending some time on the project. Given my track record, I knew if I committed to the project, I would complete it.

New year's eve 2012, one of the builders I had been communicating with forwarded a for sale notice from a current kit owner. I called the owner immediately. I still well remember the excitement of the conversation, and the awakening possibility that this might be my chance to own a Helicycle. New Year's Eve 2012.

The next several days and few weeks were a blur of talking with the existing owner, the Eagle factory, and lining up cash for the purchase. I rented a trailer, and drove it empty from Austin to Farmington, New Mexico to take the next step... So far, I'm grateful to have taken that step. Here's what I've accomplished on the build during the two years. My hope is that If you're looking at the Helicycle as I was, that my story encourages you to pursue YOUR dream.

Click here to view a video of Peter telling his Toastmasters club about his good fortune acquiring the Helicycle kit.

2013 Progress of a Builder!

Kit 6-06 at its first home in Farmington, New Mexico. The airframe box was 14 feet off the ground. All parts stored in a climate-controlled warehouse...

Owned by a machinist, but not a single hole drilled yet. Flawless condition in original packing crates from Eagle...

January 25, 2013

Loaded for the trip to Austin, Texas.

Leaving Santa Rosa New Mexico the next morning. The beginning of a dream that had been dormant for many years ...

Arrived in Austin just before complete darkness set in... Time to unload for the night.

Part of the unloading crew the first day in it's new home... Shipments 1 and 2 from Eagle. Shipment 3 is finished, and waiting at the factory.

Unpacking the crates and inventorying the parts. The fun begins!!

More parts....

February 2013

This is a long building project. Installed some carpet to minimize scratches, and high intensity lighting so I can work late at night if I want...

The truck lid left serves at a place to put Eagle prints related to the part of the job I'm working on at the time...

That's better...

Off to the Powder Coat shop. In hindsight, it would have been better to complete all drilling of holes before this step. One of many small lessons learned along the way.

The smaller airframe parts...

Tracing the cabin cut out lines...

After the first trip through all the DVD's, the level of effort to complete this project is much more clear. Not quite like assembling a lego kit. First, you have to build many of the lego blocks. Then you assemble them. BJ and I are getting to be good friends, based on how many hours I have spent with these "here's how you do this" instructional DVDs. Special thanks to the builders who created the index and detailed listing of sections. It's a lot easier to build a group 6 kit than it would have been for the pioneers in the first couple of groups... Thanks guys!

Added a 4x8 sheet of plywood and a couple of saw horses to make room for laying out small parts, and eliminate the need to do everything squatted down. It's very clear that some builders have very well equipped machine shops. I'm a newbie, but several builders with flying ships assured me it's possible to do a good job on the project, just using the types of tools BJ discusses in the videos...

Airframe is back from the powder coating shop. Time to seal off the openings in the airframe to prevent moisture from rusting the inside of the 4130 tubes.

More hindsight lessons. If I were to do this again, I'd do a better job of masking portions of the airframe to stop the drip of the 5-minute epoxy as it hardened. Just means I'll need to spend more time later cleaning up the excess glue in some spots...

Not pretty, but it's sealed, and I'm not expecting too many people to be looking closely on the under side of the hood bracket...

March 2013

Grinding off some length at the front of the airframe. Dremel can do the job but it takes more time than the grinder BJ recommended. 4130 is tough stuff...

Polished the aluminum control tubes. I'll paint them later, but for some reason, the manufacturer's stamping and dull finish had to go.

I suppose it's possible to spend a lot fewer building hours than most of us will spend, but it sure is fun seeing things take shape...

The tail fin tube and collective / throttle stick were powder coated, but they look similar to the aluminum in this photo with low light.

All of the hardware comes very nicely organized from the Factory. Just cross-reference the parts on the prints, and you're likely to to do fine....

One of the builders took several photos at a Helicopter Meet and posted them on the builder's site.

This is Serial number 1-1, still flying. The Helicycle Builder's forum is a wealth of helpful information and inspiration... So cool!

Prick punching the airframe gear tubes before drilling through the 4130 shoe and one of the skids...

Cheating in the back (stool to hold up the tail), but it's starting to look like a helicopter airframe! A few angles and heights have to match the print. So far, so good...

April 2013

Looks level to me. OK to fire up the hand drill and bolt the airframe to the gear tubes. This is a very cool project, and I'm still in the garage. Can't wait to fly it!

Using inch-pound torque wrench to tighten the bolts that hold the skid tubes in place. Every bolt gets a specific torque, either specified by Eagle, or based on the diameter of the bolt...

Preparing the fuselage halves. First used sabre saw to cut out most of the material, and then used a sanding drum to get close to the scribe line.

Not a bad fit, although I learned later that many builders remove most of the back of the cabin. Once the transmission and fuel tanks are installed it's very challenging to get a screw driver in to access the screws.

Blake at the factory sent me a photo of his, so I could see how much fiberglass to remove.... The way it looks here is as originally designed and discussed in the videos...

Amazing what you can do with tape. No holes yet drilled in the fuselage, but I wanted to see how the parts fit. The neighbors are starting to get curious at this point.
Don't have to use too much imagination at this point to figure out what I'm up to...

Time to pretend and check the comfort of the seating arrangement ...

Preliminary fitting of the instrument pod.

Clecos holding the halves together temporarily.

And one of the aluminum covers on the bottom. The fiberglass scratched the powder coat. Some of the other builders protected their airframe with foam to prevent scratching.

I've of course done that now, but a little too late. Another hindsight lesson and one more reason not to paint or powder coat the airframe early in the process...

Dozens of nut plates to pop rivet onto the fuselage parts.

May 2013

Eagle recommends rounding the edge of a plug of wood for the ends of the tail trim fins. Some builders leave the wooden plug flush with the end and screw an aluminum plate to the wood. I choose the contoured wood and filled with a very strong light substance - Fiber Fil.

Constructing the aluminum tail fins.

Checking for proper tail fin alignment.

June 2013

Fitting of the windscreen and high density seat foam.

Zinc Chromate to treat the inside of the aluminum tail fins.

Braces for the tail fins.

Just wanted to see what this thing looks like, since it’s dis-assembled most of the time.

July 2013

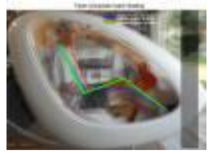
The fuel tanks require a lot of sanding to ensure leak-free seals.

Directional Control foot pedals.

Checking for the appropriate cable travel.

All of the small metal parts need to be primed and painted to prevent oxidation.

Lots of choices for seating position. This was some early analysis. I ended up sanding more away from the seat back foam insert than shown in these photos.



Eagle supplies as an option, a ready-made seat. I choose to make my own. Lighter pilots can use a back insert to position them forward for better CG balance. I glued two 2” thick blocks of foam together, and used 60 grit paper to contour for better comfort and fit. Encapsulated the foam in contact paper.

Car seats have a headrest so I decided my Helicycle should also have support for the back of the head. The stock seat tapers back several inches. I got this idea from other builders who made their own seat. I will work with a custom upholstery shop once the fit is how I want it. I use Eagle’s recommended high density foam.

Future flying area in southern Canada. It’s not healthy to stay in the garage and work on the Helicycle all the time!

One of the Eagle test pilots gets a view like this from his Helicycle.

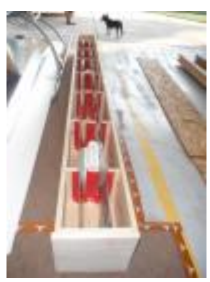
August 2013

Picked up the blades from Eagle on the way back from Canada. Blake did an awesome job wrapping them to keep water out. We went through a few showers on the way from Nampa to Texas.

Eagle Shipment 3 back home and unloaded.

September 2013

Custom box to keep the blades safe. Thanks to a few other builders for the idea on how to do this.



Main transmission with plumbing removed for painting. Take LOTS of photos so you know how to put it back exactly how you found it!

Blade box painted and with hardware installed.

October 2013

Tail Rotor Scissors.

Drilling holes in the fuel tank access port covers.

Parts in progress.

More work on the tail fins. Still not perfect yet...

November 2013

My original transmission lift strut, and the upgraded version from Eagle. Some builders did their own version of the upgraded strut.

Filing some door hinge parts. This is too much fun…

More work on the door hardware.

Drilling holes for the main transmission bearing.

December 2013

Broke several 1/16” drill bits before learning how to successfully drill a hole in a Dash 8 bolt. Sure makes you appreciate the pre-drilled AN hardware supplied in the kit. I wondered if BJ specified this bolt just so builders would have to drill a hole in it… This project has LOTS of holes in lots of places.

Tip: Use oil and the drilling goes much smoother. As a non-machinist, there’s a lot to learn, but the other builders are very helpful with their advice.

The kit is quite complete, but there are a few parts omitted. If one of their third-party suppliers discontinues a part, they may just instruct the builder to find his own replacement. I used a Harley Davidson throttle grip. It fits nicely, but it’s a 1” grip on a 1 1/8” 4130 tube, so it took some persuasion to get it seated properly.

Throttle and collective stick preliminarily fitted.

More seat adjustment. Headroom with a helmet may be a challenge. I plan to get a windscreen that has more headroom. A few builders have implemented solutions for this.

One draft idea, but I'm told it can't be easily constructed… Sharpe lines on cabin are an idea for more visibility. One of the test pilots has implemented a solution similar to this.

Like all builders, I'm required to document the construction process to receive my FAA Airworthiness Certificate. This web page contains a small sample of the hundreds of photos I have taken so far. Obviously, I have a lot of work left to do, but don't recall any project I've enjoyed as much as the Helicycle.

I hope you enjoyed the pictures and I wish you happy building and happy (and safe!) flying.

Building a Helicycle is not for everyone, but if it's right for you, you'll know, and along the way, you'll learn and grow... Good Luck!

January 2014

The next two photos represent a lot of time spent. In hindsight, I'd say the time was wasted. Which leads to this observation shared by many builders:

It's probably best to build the Helicycle as it was designed with very few changes, and it's important to get those changes approved by the factory and test pilots before you make any changes at all. If you enjoy the build process at all (and most builders enjoy it a lot), there's a temptation to innovate, and this effort doesn't get you any closer to having a flying helicopter.

On the construction DVDs, BJ discusses his reasons for having a large post area between the door openings and the relatively narrow windscreen. His reasons are (1) to provide a good horizon reference and (2) to lead to a feeling of enclosure — since the Helicycle is such a small ship.

A number of people have experimented with different cabin designs — especially leading to a more open view with fewer obstructions. Almost none of these "experimental cabins" have made it into a flying Helicycle.

I made contact with a person who builds aircraft canopies for a living and serves the experimental / home-built market. He could make a windscreen for me, but he needed dimensions for the fuselage. Since it would cost me more to ship the fiberglass cabin to him than to buy his windscreen after he was finished, I searched for a way to create a template for the new windscreen.

I failed miserably with my approach and wasted a couple of weeks. Here was my approach at more headroom to allow a helmet. Looks cool, but it can't be built from a single windscreen…

I used spray foam to create a form for the windshield. Seemed like it would work, but getting the foam to cure properly wasn't so easy - especially in the winter. I'll spare you the photos of the mess I made, but you can tell what I had in mind…

Back to something more practical - something actually required to finish building the Helicycle. I drilled holes in all of the control rods and secured the bolts at the required torque.

Here is one end of each of the control rods.

Next, I mounted the cyclic clevis over the cyclic stick. There are several steps that need to be finished before the control system can be completed.

Sanding fiberglass door tracks smooth.

February

Smoothing sharp edges of plexiglass doors to prevent stress cracks.

Note – my goal with these photos isn't to show you what I look like. The FAA needs evidence that I actually built the helicopter – technically, that I did at least 51% of the total work involved. The Helicycle has been evaluated by the FAA and is on a list of aircraft meeting the "51 Percent Rule." To determine eligibility, the FAA requires kit providers to produce a very detailed listing of construction tasks and prove that the hours required by the amateur builder exceed the total hours the kit manufacturer invested in creating the components. Many of the low-tech, mundane tasks, such as sanding, grinding, cutting, drilling, trimming, etc. help the Helicycle qualify under the amateur-built experimental category.

March

Glued and riveted doors. I over-sanded the fiberglass initially. One of several “hindsight lessons” in my 2014 build experience. Although a few builders probably start with very well honed construction skills, most builders commit minor blunders. Fortunately, almost all “mistakes” are easily correctable with patience and ingenuity. In a few rare cases, you just purchase that part again and start over. Advice from the factory and other builders informs the decision, but the builder is the legal manufacturer of the aircraft, and is ultimately responsible for overall quality. In my case with these doors, I’ll show how I solved the “problem” of over-sanding later...

The back side of each of the rivets needed to be ground down flush with the fiberglass so the doors could fit flush against the fuselage.

April

Both doors after attaching plexiglass to fiberglass. The Helicycle doors are very light in weight, strong and easy to put on or take off. They are not particularly easy to build quickly. Many builders report spending at least 40 hours constructing the doors.

Initial “fitting” of the upper and lower instrument pod aluminum pieces. Cardboard serves as a useful template before cutting the aluminum.

Using the Dremel to cut off some length from a door latch so there will not be any space between the top of the latch housing and the bottom of the knob handle when the latch is closed. Details, details, details…

I had ordered the ground handling wheels from the factory along with several other “options.”

I got this idea for attaching the wheels from Stan Foster, a Group 5 builder.

Some advice:

It’s hard to know in advance which factory options are a good value and which are not. The wheels were not a good value at all. I paid several times what I would have paid had I purchased these components locally, and probably ended up with more robust and useful ground handling wheels.

My recommendation is that if possible, check with other builders about the options they recommend before committing to purchase options from the factory.

In my case, I chose virtually every option available (except the seat). In doing so, I spent more money than is necessary to end up with a good functional helicopter… My overall opinion at this point is that if the "option" involves a third party component, purchasing from Eagle is not the best approach. If the option is for an Eagle-designed and Eagle-manufactured part, the value is much higher. I am personally very impressed with the quality of design and manufacturing finish for the Eagle-built options. As I have mentioned previously, any deviation from Eagle-supplied components should be pre-approved by the factory and the test pilots.

Grinding a door latch screw to be more flush with the inside of the door track.

Checking fit of front right door latch. Note the cabin fiberglass doesn't match up with the door fiberglass. These edges are an example of the finishing work involved. Some builders ignore these minor cosmetic issues, and others work towards cosmetic perfection. I traced along the cabin fiberglass with a pencil and sanded the edges to match.

All three door latches installed. This is the right door. The building plans call for the left door to be operable, and the right door bolted in a fixed closed position. I elected to have the right door open for safety. In the (I hope unlikely) event of a left-side rollover, I wouldn’t be faced with breaking fiberglass to exit the right side.

Checking to be sure the instrument pod is appropriately centered in the fuselage. The exact fit is adjustable by the builder. This view also shows the view from the pilot’s perspective. The thick side posts are what I was seeking to avoid in my pursuit of a more open, expansive windscreen.

May

Initial adjustment of hinges on the left door. I got this idea of using a rod to line up the hinges from a Group 2 builder, Dave Keck, the original owner and builder of the first Helicycle I saw in person. I am hoping that my build photos provide some good ideas for an existing or future builder – maybe even you.

Laying out the door hinge hardware. Each hinge is cut out from supplied aluminum. The pieces are then sanded smooth, bent, and drilled.

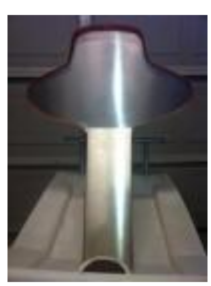
Checking left side door fit. The exact curvature of the plexiglass is selected before drilling holes into the plexiglass and fiberglass door track. These “half doors” decrease air drag and increase forward flight speed by approximately 7-9 mph.

Checking alignment of hardware on the two doors.

Installing nut plates to hold cyclic boot retaining ring.

Sample notes from the construction DVDs. The Helicycle kit includes several construction prints and around 17 hours of instruction from the designer, BJ Schramm. I typically watch a DVD and take detailed notes in Excel that I later refer back to and put a date when I complete that step. In many cases, a general overview of the construction objectives is provided, and the builder needs to do the more detailed action step planning. Some of this is easy to do “in your head.” Other steps are involved enough that it helps to break the project into several discreet steps...

Initial fit of upper aluminum panel. There is a wide range of fit quality amongst the builder groups. Achieving a near-perfect fit usually involves fitting more than one piece of aluminum panel. The factory can supply replacement parts, or builders can source the parts locally.



Instruments are mounted in 3 1/8" or 2 1/4" holes. Some builders draw the panel in a computer CAD program, and have a laser or water jet shop cut out their holes. I chose the low-tech drill press solution as shown in the construction DVDs.

This was my initial panel. I later moved these two instruments slightly lower to avoid the back top of the instruments rubbing against the top fiberglass of the instrument pod.

I spent quite a bit of time researching options for instrumentation. There are many considerations for panel layout including reliability, sunlight readability, instrument function redundancy, etc.

Here's how I "solved" the problem of over-sanding the fiberglass door tracks: I used SuperFil - a two-part very light and strong material similar to Bondo, but MUCH lighter.

The SuperFil needed to be applied in two steps - first to the front side, and after that portion had dried (over night), I applied more to the backs side of the doors.

Another fit-check for the instrument pod. Small adjustments are required to ensure the pod is not skewed slightly to one side of the other. When I got to this point, I spent some time just sitting in the seat looking at the bare aluminum in front of me, and imagining the instruments. With my left hand, pretending was easy, since I had a cyclic stick to grab onto. With my right hand on the virtual cyclic, a bit more imagination was required…

After the door epoxy had dried, I sanded it to shape to fit the curvature of the fuselage door indentation. The small spots are where I covered the rivets so they are not visible after painting...

June

First of a few trips to a paint store that carries DuPont Imron Elite paint. There are MANY options for painting, and I spent (way too many) hours investigating options and corresponding with a custom motorcycle airbrush artist. I will probably use an industrial paint shop.

A few of the color options I’m considering...

July

Door after sanding down excess fill compound.

I had ordered Zinc Chromate primer to “slosh” the inside of the main rotor blades. I was approaching the shelf life of the primer so I wanted to get this task completed before the expiration date. The blade ends need to be well sealed to avoid leaks. Zinc Chromate is very effective at inhibiting corrosion of aluminum. The construction DVDs describe the procedure.

Zinc Chromate was also poured inside of the aluminum tail rotor drive shafts.

Here is some excess glue from bonding the “doublers” (multiple layers of aluminum stair-stepped from the blade towards the root with increasing thickness) on the root end of the main rotor blade. This glue needed to be removed to allow the root end plug to fit properly.

Trimming corner of root end of blades. BJ says to use a hacksaw. I used a Dremel. The Dremel is the first tool I bought for this project, and one I find myself using quite a bit. It’s faster than hand tools but not as fast as some other cutting or grinding tools, so it’s easier to avoid removing too much metal. As BJ says on the DVDs, “It’s easy to remove metal, but it’s hard to add metal back.”

Several wood pieces need to be cut out from supplied templates. Some of them are shown here. The wood is multi-layer laminated plywood to minimize splitting risks.

I used a scroll saw to cut out the wooden pieces. Precise, but VERY slow. When cutting, I also used ear protection (not shown in this “posed” photo).

Most of the bolts on the Helicycle should be torqued using a calibrated inch-pound wrench. This bolt helps hold the root end blade grip surfaces in place although this specific bolt is not load bearing and does not go through the spar.

The wooden tip end plugs need to be very closely fit so that when the skin is screwed into the plug (from the top and bottom) the blade airfoil retains its shape. The fit here is better than it looks, since I have some taper towards the front end. The bolts were temporarily installed to allow me to remove the very tightly fitting piece of wood without damaging it.

After final shopping the wooden pieces, I sprayed them a few times with an oil-based primer to seal the wood from moisture. The piece in the left foreground isn’t used in construction, but is left over from the piece immediately above it. The middle one is used for setting the initial pitch on the main rotor blades, and the unused piece mirrors the top shape of the main rotor blade airfoil.

Then several coats of high gloss enamel paint

Here are the pieces after several coats of oil-based high-class white paint, and then a couple of coats of a urethane sealer. The single and double stripes on the root and tip end plugs tell me which specific blade the piece goes in. Most blade components are marked with one or two “prick punch” dots to ensure components from the two sides are not interchanged. Components are machined to EXTREMELY close weights at the factory so that each builder receives a matched set of components. This is the type of precision that makes the Helicycle a very attractive option to many builders.

Screw holes for the root and tip end plugs need to be countersunk so the screw heads are as flush as possible on the surface of the airfoil. Root end is less critical than tip end. Per the designer, the outer 10% of the blade creates 90% of the lift.

Checking the fit of my “pitch setting template” and all 10 holes (5 top and 5 bottom) properly countersunk and deburred for installation of the tip end plugs. Final installation of the tip weights is done during the factory check out.

Creating six “notches” in the tip weights. This is not specified by the construction videos, but a few builders have done this. I explain why later and with another photo.

Oops. After properly notching the tip weights, I needed to cut threads in three through holes. A 1/4-20 screw is inserted through the top skin into the tip weight to lock it in place. Two such screws are installed from the bottom of the blade. With no previous experience tapping a hole, and hardware grade taps, I managed to break off a tap in each of the tip weights. Taps are made of VERY hard (but brittle) material, and removing a stuck tap is its own art form. In my case, it was less expensive just to order new tip weights from the factory and start over. The original owner of my kit was a machinist, and graciously educated me about the types of taps, tapping technique, and even gave me a web link to order a much higher quality tap that would be suitable for tapping these six holes in steel. I had previously only tapped aluminum on the Helicycle, and those holes are much easier to tap than steel...

August

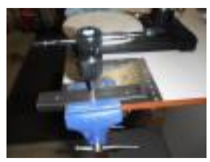
Part of what I learned is that while light oil is better than no lubrication for tapping a hole, there are specific fluids intended to lubricate metal being cut. In this case, I am reaming a hole in the drag link brackets installed at the root end of each blade. These three holes are among the most critical in the build. Ideally, there should be NO elongation of any of the three holes through the brackets and all layers of the blade doublers. The construction videos show BJ hand-drilling these holes, but using a spotter to ensure the bit is completely perpendicular in all dimensions. A mill or drill press results in a better outcome.

Another interim plan for the upper panel instrument placement. A few Helicycle pilots use the Garmin AERA GPS units. While very user-friendly and bright, sunlight readability can be a challenge in some conditions. I eventually opted not to go this direction.

A handful of instruments for which I needed to determine a mounting location. I evaluated several different positions before settling on a final instrument layout for my upper and lower panel.

I don’t think I can make this fit... One of the several GPS units and configurations I considered.

Let’s try again - second attempt at tapping the holes in the tip weights



Success! All six holes successfully tapped and no broken or stuck tools. Very relieved... The expense in dollars was modest, but another builder refers to these learning experiences as “tuition.” In most cases, the biggest expense is personal time, and in my case, I’m not likely to use many of these building skills in the future... If you count your time, the Helicycle is quite expensive but when I was evaluating my purchase, I did not talk with a single builder who regretted embarking on the project, nor any pilots who were not happy with the outcome and the relative absence of expensive maintenance.

Checking to see how much metal I removed (negligible) and also to ensure that the two tip weights are perfectly balanced. I balanced them to within 0.1 g.

Here is the screw in the top of the blade that holds the tip weight in place. In this photo, it's too high; I had to countersink slightly deeper to get it flush before deburring the hole.

The "chord-wise CG" of a helicopter blade is critical for flight stability (and therefore for pilot safety). This 3/4 lb. weight "weighs" approximately 750 lbs. at normal rotor RPM. The weights bump against the inside of at least 3 rivets on the top and bottom of the inside of the blade spar. The designer's approach is to "compromise" by gently filing away a small part of these rivets, and then scooting the tip weight as far forward as possible. Some clever builders decided it would be much more effective to leave the rivets untouched, and instead remove a small amount of material from the tip weight to allow it to be positioned even farther forward in the spar. You can see the rivets recessed into the top weight in this photo. Of course, as with all deviations from the standard construction instructions (print or DVD), I cleared this change with the factory. This solution improves the chord wise CG of the blades.

A new project - not formally part of the instructions - installing a larger mouth opening in the upper fuel tank. Most Jet A nozzles at airports will not fit in the original side tank opening shown to the right. Some pilots carry an adapter that transitions the delivery nozzle to a smaller size that fits in the standard Helicycle tank. Other pilots cut a larger opening in their tank. I opted for this solution, but wanted to do it in a way that I did not give up any usable fuel capacity. The only way to do this is to position the hole way up at the top of the tank. This is not practical when the tank is “final installed” in the airframe - which it must be before the transmission can be installed. So I removed my “finally installed” tank to allow me to make this modification. I then ordered new bolts from the factory to re-install the tank later. The factory provides special aluminum bolts with O-rings that seal up against the inside of the tank and hold the tank onto the airframe. These aluminum factory-supplied bolts were slightly chewed up removing the tanks and while I could probably have used them safely and with no problem, I wanted them to be “new” so I ordered a new set from the factory.

September

All six mounting holes have been tapped so that the fuel shouldn’t be able to seep up through the holes. This risk would be greater if the holes were opened up enough that bolts could just slip through the holes. Even though this tank opening is above the full-tank fuel level, I didn’t want any seeping leaks. Several builders have added a tank opening like the one I chose, and at least one of them tapped threads in the tank so the screw threads would help minimize any fuel leaks. One advantage of being a Group 6 builder is that you can copy the clever building techniques of prior builders. Fortunately many of the builders are very free in sharing their good ideas (and cautioning against copying their bad ideas).

To provide even more leak protection I used a Viton gasket. I ordered a 1/8”thick 12”x 12”Viton gasket sheet and created custom gaskets for all of the fuel tank openings.

Here’s the completed opening after fighting the mounting screws and trimming away the excess gasket. It looks nice, solves the intended problem, is located at the top of the tank above the fuel level, and should not ever leak.

To receive the FAA Airworthiness Certificate, a seat restraint system is required but none is provided with the kit. One of several important but minor things left to builder discretion. Some people have used restraint systems designed for auto racing. While more expensive, I plan to use a restraint manufactured by a supplier of certified aircraft restraints. Another builder paved the way with the supplier (AMSAFE) but I’ll go a bit further and have retractable top belts for additional convenience. The AMSAFE engineers create a product number and modify their drawings, and then certify the restraint. This isn’t a legal requirement in an experimental / sport aircraft, but safety is an area I’m not wanting to compromise at all...

Drilling out mounting holes in the upper instrument panel.

Here's a test-fit of some gauges. I ended up returning this specific airspeed instrument and custom ordering from another manufacturer, a gauge with the color markings applied directly to the face of the instrument. The top right instrument is custom made for the Helicycle. It shows engine and rotor RPM on a single instrument. The factory provides a digital "Red Lion" gauge that displays engine RPM and they also supply an analog instrument showing rotor RPM. This gauge shows both engine and rotor RPM on the same instrument face. If the needles "split" during normal flight, you know you have an immediate problem to address. The Helicycle turbine cannot be re-lit in flight, so if the turbine "flames out" the pilot auto-rotates to the ground.

This photo is looking inside the instrument pod upside down. The fiberglass rubs on the top back portion of the gauge. Not ideal, since vibration would wear a weak spot in the fiberglass over time.

My solution solves two other problems in addition to providing more headroom clearance for the gauge. I positioned the top of the upper instrument panel slightly further back than originally specified in the pod. This required me to remove all of the previously installed steel pop rivets holding the angle attachment brackets in place. It's a bit more work to remove a steel rivet than to remove an aluminum rivet. I also had to fill these original holes in the fiberglass.

By moving the top of the panel further back, the viewing angle of the upper panel is closer to perpendicular to my eyes. This reduces the "parallax error" when looking at the gauges. When reading an analog gauge at an angle, the markings behind the gauge are slightly "off" if not viewed straight on. This panel angle change reduces that reading error. It also provides more fiberglass overhang and can shield the gauges from direct sunlight from above. This is helpful not only to minimize glare on the glass of the instruments, but also to minimize "light washout" on the LED warning or indicator lights I'll install in the panel. These benefits are a fortuitous example of ending up with a better outcome, after first having to work through unanticipated problems. "In every problem lies the seed of an equivalent or greater benefit. - Napoleon Hill

Here is where the seat restraint belts go through the fiberglass from behind. I plan to use retractable belts over the shoulders. The Helicycle is designed to make remarkable use of every square inch of space. This makes for a compact ship, but no extra room is included for sloppy construction technique or extra components. The AMSAFE engineer I worked with helped me identify a suitable restraint retractor that was small enough to fit in this space, but also strong enough that only one mounting hole is required. I end up with around 1/8"to spare but it works. The FAA does not permit retractable lap belts on aircraft. One of many regulations I've learned during the building process.

Measuring for instrument fit from the back. Most of the gauges are placed into round holes from behind, but the gauges themselves are larger than the holes. Achieving a suitable fit involves aesthetics from the front, and sufficient clearance between gauges from the back. As another builder has said (in a difference set of circumstances), “Don’t ask me how I know this.”

Here’s my final instrument layout. Not as pretty looking as if it had been drawn using a computer CAD program, and cut out by a laser by a professional shop. Every hole has been hand cut. It’s not perfect, but after powder coating, and with the instruments installed, I’ll probably be the only one who will notice the “imperfections.”

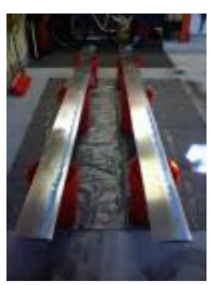
A fuel gauge is important, but one is not supplied with the Helicycle. I chose a full-sweep gauge and had the low-fuel marking put directly on the face of the gauge. This instrument will read a custom matching capacitance gauge installed in the lower left tank. The lower two tanks (and in my case, also an auxiliary tank) are all tied together so the fuel level in this one tank really reflects the total fuel level in the bottom three tanks. I calculated the fuel level at which I expect to reach the required minimum reserve fuel of 20 minutes. The capacitance sender will turn on a low fuel light with approximately 25 minutes of fuel remaining. As I’ll show later, I have three sources to alert me of low fuel.

October

Final reaming of the middle hole in a drag link bracket. Because my holes weren’t perfect (When you know your life is at stake every time you lift off, “good enough.” isn’t really quite “good enough” You’re aiming for a higher quality standard…) I got permission from the factory also to epoxy these brackets to the blades. For proper tracking, it’s ESSENTIAL that these brackets don’t wiggle at all. The three screws should hold the brackets in place, but I wanted the additional security of epoxy along with the bolts. These obviously can’t be removed easily later...

All gaps in the blade surfaces as well as open holes in the rivets need to be filled in and smoothed. BJ specifies “Dynaglaze” polyester blending and finishing putty. Superfil is suitable for this job and it what I used...

Blades ready for sanding. Requires VERY fine grand paper, and sanding only WITH (not across) the length of the blades.



Last year, I had spent quite a bit of time with seat layout but was not satisfied with the result. I did further sanding on the foam seat insert (that positions me slightly farther forward for better CG balance). I'll eventually have these pieces covered with leather.

Marked a hole for an LED combined taxi and landing light.

The Helicycle plans call for an optional grease zerk facing 45 degrees to the rear on the collective slider. This facilitates lubrication during periodic maintenance without the need to remove some protective rubber bellows that keep dirt particles outside of the slider area. Some builders have machined a channel inside their slider to allow grease to flow around the tube more easily. I don't have the tools to do this, so I'll count on manual movement of the controls to distribute grease around the tube.

After sanding, this feels VERY smooth to the touch. After priming and painting, any elevation change will not be noticeable.

The blades back in their resting space and the quality control inspector getting up from his...

I spent a lot of time thinking about how I wanted the lower panel switches and circuit breakers. This is another area with considerable builder discretion. The factory supplies electrical schematics, but there are a number of different ways things can be done...

I ordered and received a custom made Infinity Aerospace military style cyclic stick grip. Several builders have used this specific type of grip. Using push buttons or toggle switches, I’ll be able to control lighting, fuel computer displays, and radio frequencies as well as the radio microphone.

First generation lower instrument panel. I ended up scrapping this one and making another...

The electrical wiring needs to be either soldered or crimped. This is a surplus AMP 59250 crimper for making foolproof PIDG (Pre-Insulated Diamond Grip) crimps. I was able to get one for less than 10% of the price of new. This tool sells for around $1600 new. Juan Rivera, a Group 1 builder who sold his first Helicycle and is also a Group 6 builder has produced text and YouTube videos regarding proper crimping techniques, and the differences between solder joints and crimping. Wiring to aircraft quality standards is important to the long-term safety and reliability of the Helicycle. Some of the NTSB "incidents" (unplanned landings that were reported to the NTSB, but did not involve any injuries to the pilot) were ultimately traced to electrical system failures.

Note the bottom of the upper panel aluminum sticking down behind the upper two holes on the lower panel. I marked this overlap, and used it to trim additional metal away from the bottom of the upper panel. Another builder had shown a similar solution, but he positioned the Red Lion digital engine tachometer at the top of his lower panel, whereas I have two round gauges at the top.

Instrument panel taking shape. The switches are military grade Honeywell TL switches. The circuit breakers (only 5 of 15 installed) are the original circuit breakers. I returned these to the factory and purchased military grade Klixon breakers. I have re-purposed the supplied 300 amp switch (red key at bottom right of lower panel) as a “key” switch for auxiliary battery - which will be mounted inside the instrument pod for weight, and also to minimize resistive losses.

The two gauges below the black rectangular “Red Lion” gauge are paper cutouts I taped into place from behind. I have not yet purchased these instruments. Both are made in the UK by TRIG and are very small and light and consume little power. The left is a communication radio and the right is a Mode S transponder that is comparable with the FAA’s future requirements that take effect in 2020. I wanted avionics in my Helicycle that would permit me legally to fly in any US airspace. The TRIG units have received FAA certification status (not required for experimental aircraft, but indicative of their quality).

Since my start fuel and igniter for the Turbine will be supplied by the auxiliary battery, with the red key removed, it will not be possible for someone to start the turbine...

I cut out the hole for the LED taxi / landing light. A this point, I’m committed to following through with the purchase... It’s the brightest I can find and has low enough current draw that I can safely switch the lights on or off using the military grade push button switches installed in my Infinity Aerospace grip. Most of what I control with the cyclic grip is very low current “signal level” circuits. The lights draw more current. For safety, all higher-current loads that can be switched using the cyclic grip first pass through a switch on the panel. That way, if I ever had a short or switch failure (unlikely, since the switches are all military spec components), I can turn off power to the grip switches at the panel...

Upgraded cyclic mixer from the factory marked with areas to be protected from powder coating. There are several small metal pieces, most of which require some type of corrosion protection. The flight criticality of the component might rule out some types of metal treatments. I confirmed all protective coating decisions with the factory prior to implementing.

November

Several small parts returned from the Powder Coating shop

Removing and powder coating the skids gave me an opportunity to vacuum out all of the small metal shavings inside the skids from the initial installation. The construction DVDs mention the need to clean out metal shavings in several instances, but the specific construction sequence advised for the skids leaves some metal shavings inside the tubes. After several rounds of vacuuming, both skid tubes are completely free of any internal metal shavings...

The Helicycle main transmission was designed to accept a specific “chip detector” made by Aviation Development Corporation (ADC). The company went out of business years ago, but was viable in the early production runs of the Helicycle. Some builders have adapted their transmissions to use Robinson chip detectors. I was able to find an ADC chip detector (installed in an ADC engine oil filter). Chip detectors are present on all certified helicopters and light up an indicator on the instrument panel if a sufficient number of metal particles are present in the transmission oil. The main rotor transmission is one of the most heavily loaded components in any helicopter and having advance warning of any degradation / abnormal wear is helpful. Eagle R&D designed a special fitting with double O-rings (not shown in this photo) that positions the electric contacts of the chip detector at the proper location to sense any metal particles in the oil. The ADC chip detector shown can be removed from the transmission without draining the oil; a small valve closes at the time the center of the detector is removed...

Gluing the “milk jug” pull handles on the metal shaft of the six door latches. The plans call for a bend in the metal, but I wanted to cover the end of the 1/4” metal rods for greater safety in a crash. This is also a small way I can “customize” my Helicycle. In the background (top left of the photo) are lower fuel tank cover plates.

Drilling 1/16” holes in cap screws for installing safety wire in the bolts that will hold the tail rotor transmission to the airframe.

A couple of rolls of .032 safety wire along with the panel light dimming rheostat and a Klixon (military specification) circuit breaker.

Shortening a specific bolt as required in the plans.

A few gauges preliminarily installed after powder coating. The Electronics International FP-5L fuel computer was custom wired by the manufacturer (at my request, and for an additional cost) to allow me to use the bottom two push buttons and center toggle switch functions remotely from the cyclic stick grip. These buttons and the toggle allow me to cycle through every available information screen the fuel computer can display. Examples include gallons per hour of fuel being burned (a good proxy for horsepower), fuel remaining in the tanks, fuel used since last fill-up, time to empty and using GPS and speed information, remaining range in miles, etc. The low-fuel light can be programmed to come on when specific conditions have been met and the gauge also includes another warning light that can be used to monitor another condition, such as a temperature.

Upper instrument panel from the back.

The 2 1/4” instruments all contain internal lighting for night or low light conditions. The larger 3 1/4” gauges do not have internal lights, and are lighted from the front using LED post lights.

The aluminum retaining rings that hold these instruments to the panel are threaded with size 6-32 screws - the size of standard instrument mounting screws. The threads on the post lights are 8-32, so I needed to drill out the holes and re-tap the threads using an 8-32 tap.

Final layout of my lower instrument panel. The volt meter will display voltage of the backup battery buss. Hours will reflect flight hours (a normally closed micro switch mounted under the collective switch will open when the collective is fully lowered, preventing the hour meter from incrementing. At least two other builders have implemented this refinement.

Color-coding on my switches does not conform to industry standards, but is meaningful to me:

Green = Power or fuel (fuel is normally red).
Yellow = Backup / auxiliary battery circuit.
Red = Do Not Touch during flight. Some builders use switch guards. I chose not to do this. In an emergency landing situation, I can shut off main fuel without lifting a switch guard.
Blue = Lighting
White = Avionics

All switches are military spec. Honeywell TL, but some are single pole, some are double pole, and one is a 4-pole switch.

Most are click-on-click off, but some are momentary hold-on, or return-to-center-off DPDT momentary, depending on use.

The kit includes lower quality switches and a few push buttons, but also the recommendation that builders purchase a higher quality switch. The obvious question is why higher quality switches are not included in the first place. If military grade (or even top tier commercial grade) components were used in the Helicycle, the price would be much higher. So one way the kit can be "complete" and still affordable for the market it serves is to use less expensive components. Several ships are flying without problems, using all of the components supplied with the kit. Other builders have replaced several components at a premium cost. This decision is a personal one; in my case, I wanted military spec components for switches and circuit breakers, and I cleared my choices with the factory before purchasing the components.

The upper instrument panel contains 12 colored LED indicator lights, each with a metal light shade.

Red lights indicate a condition that must be cleared before flying or indicate it's time to land immediately.

Blue indicates a light (all will be aircraft quality LEDs).
Orange or Yellow is a temporary condition, but normally not an emergency.

I experimented (on paper) with several different instrument configurations before settling on what is shown below.

Two of the other builders with electronic circuit design expertise are contributing components to my low and high RPM rotor alarms. Under normal powered flight, the governor is capable of holding the turbine RPM to within 100 RPM of the roughly 61,400 flight RPM. During an autorotation, it is essential that the pilot keep the rotor RPM within safe limits. Too fast, and the rotor system can experience mechanical stresses that reduce longevity, or in an extreme situation could cause a mechanical failure. Too slow a rotor RPM can cause the aircraft to drop unacceptably fast.

The combined amp / volt meter will show main battery buss voltage and amps returning to the battery to charge it. If the amp meter reads zero, the load is equal to the stator output.

Positive amps indicate a charging condition (desirable) and negative amps indicate a condition in which the electric load exceeds the stator output and the batteries are being discharged; with the components I have selected, this situation should not ever occur. All components are low-current devices.

This panel conforms to the latest electrical schematic drawings released by the factory at this time.

The electrical system is critical for the Helicycle since the engine requires power to the governor.

I have designed redundant circuits for most components in which loss of electric supply would force an autorotation landing.

The original design of the Helicycle used a normally closed fuel solenoid. To operate the turbine, power was required to open the solenoid and allow fuel to flow. When power was turned off, the solenoid closed, cutting off the fuel flow and shutting down the turbine.

A later modification (which I have chosen) uses a normally open main fuel solenoid. Fuel flows without power, and power is supplied to shut down the engine.

The normally open vs. normally closed main fuel solenoid is one example of several trade-off choices involved in any aircraft. The intent is to solve the most important (or highest risk or highest danger) problems without causing other problems worse than the one solved.

Fortunately the builder's online / email discussion board contains a large amount of builder commentary about the trade-offs involved.

December

Another non-stock "project." The Helicycle uses a stator from a Briggs & Stratton riding lawnmower. It is supposed to be capable of generating 20 charging amps under some conditions but seems to do about half of this in the Helicycle. Builders with VERY simple electric systems (no lights, no transponder, etc. are fine with the stock charging system. Other builders have adapted car-type alternators for their Helicycle.

I contacted the factory to discuss possibilities. The preferred (at least for now) option is to create a wider stator so that the width of the iron core is approximately the same width of the magnets. Combining the iron from three stock stator units is a suitable option. This "modification" requires unwinding the wire from three individual stator units, creating a contiguous core from the 3 separate cores, and then re-winding the poles. As with every design, there are numerous design-trade-offs to consider. As an example, larger wire results in lower resistance, but fewer potential winding turns for the same space. The stock stators use 16 AWG wire. The first builder to complete this modification used 17 AWG wire. I will use 15 AWG wire.

Some turns using the original 16 AWG wire but a combined "triple" core.

Some builders do their construction at an airport hanger, others in a private residential garage. Regardless of where the ship is constructed, at some point, a "hang test" is required to appropriately adjust the Center of Gravity (CG) based on the pilot's weight, the thickness of the seat back insert (thicker for lighter pilots) and the weight of the specific build components used (primarily instruments and avionics). I used a 2 ton adjustable length hook secured to cables and reinforced the garage beams to handle the weight of a fully loaded Helicycle. Although I won't do the hang test until near the end of my build, providing a safe location to perform the hang test was one task I completed in 2014.

The light bulbs that are inserted into the 2 1/4" instruments from behind must first be "assembled." This involves gluing the actual bulb into a plastic sleeve, and then using a silicon material to hold these into the gauge from behind.

Working with wire this small also led me to purchase a precision wire stripper capable of near-perfect stripping of all sizes between 30 and 20. In wiring any aircraft, there are many, many individual pieces of wire that must be cut, stripped, and spliced or soldered. Good tools enable a superior job and at far less effort than attempting to use lesser quality tools.

The tail rotor transmission has an opening that needs to be vented to allow excess pressure to be relieved when the transmission gets warm. Plans call for a plastic tube to be routed from the transmission and up through a hole drilled in the vertical trim fin. A few builders have found pressure vents that protect the tail rotor transmission seals from over-pressure, but do not require a small PVC tube the routed into a hole in the tail fin. I am using the

LENZ KVM14 filter with an adapter to make it fit the threads in the tail rotor transmission.

Here is the high temperature wire I’ll use for re-winding the stator.

Much of what I “accomplished” with the Helicycle in 2014 was educational, and not capable of being shown with photos. As with my 2013 summary, I’ve selected a small but somewhat representative sample of photos to cover my main build activities.

There are several “dead-end rabbit trails” I pursued that are not mentioned in this summary. Builders who can completely avoid these time-wasting efforts can build faster. As with any skill-based task, the better your skills, the faster you can do quality work.

Parting thoughts for 2014:

Two people died flying a Helicycle in 2014. Both had very few flight hours in a Helicycle, and neither fully built the machine they fatally crashed; they purchased it from someone else who did most or all of the construction.

When one fatal accident occurs in an aircraft almost exactly like the one you're building, it rocks your world. It certainly did mine. Two fatalities in one calendar year was tough -- tough on me, tough on the factory engineers and crews, and tough on the other builder / pilots. Both accidents were later determined by the NTSB to be caused by pilot error.

After the first fatality, I read every accident report in the NTSB database and involving a Helicycle. I learned much more about safe helicopter flying in general, and flight characteristics of the Helicycle in particular. The second fatality involved a pilot flying outside of the approved CG window for the Helicycle.

When I was acquiring my private pilot's license many years ago, I heard the saying:

There are old pilots.

There are bold pilots.

There are no old bold pilots.

Casualness brings Casualty.

If you decide to build or buy a Helicycle, please do so with the intent and the commitment to do it safely.

Commit to safety for your personal wellbeing, of course, but also to help protect and preserve the freedom of fellow general aviation enthusiasts who are pursuing their own personal dream of rotary flight. The FAA takes aviation safety very seriously. If enough fatalities occur in general aviation -- and especially in Light Sport or Experimental aviation, some of our current freedoms may be further restricted through additional (and possibly burdensome) regulations.

If you have already flown a helicopter, you know what I mean. If you’re not yet a helicopter pilot and you become one, you’ll see first hand that there are very few freedoms like the freedom to observe the earth from above and to maneuver your aircraft like a helicopter allows.

Like all builders, I'm required to document the construction process to receive my FAA Airworthiness Certificate. This web page contains a small sample of the hundreds of photos I have taken so far in two years of building. Obviously, I have a lot of work left to do, but don't recall any project I've enjoyed as much as the Helicycle. I can’t wait to see what I get done in 2015!

I hope you enjoyed the pictures and I wish you happy building and happy (and safe!) flying. Building a Helicycle is not for everyone, but if it's right for you, you'll know, and along the way, you'll learn and grow and meet some great people ... Good luck and Godspeed!

Peter H. Larkam

Helicycle 6-06B

Austin, Texas