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Building an RV12

Getting close to the end!

by Ryan Stark

Since my [last newsletter](#) about building the Van's RV-12 (summer of 2016), my wife and I have made quite a bit of progress. In fact, we're nearly done. I believe the phrase commonly used in the homebuilt industry is "90% complete, 90% left to go." But really, even though it's been a long process and we are mainly only able to work on it over the weekends, we are getting close.

Rapid progress...at first

When we started working, the plane was in a garage in Ossian, Indiana, about 15 miles south of Fort Wayne. The tail and wings were mostly done and the fuselage kit (the third of six kits total) was about one-sixth finished. After buying some videos on how to build the RV-12, we got started. I was actually blessed with a whole garage to work in (many thanks to my step-mother Kathy), and plenty of table space. We were also able to bring some parts home to work on in my basement, which was a nice help.

Progress proceeded rapidly when we started in June 2016. The side and bottom skins of the fuselage were installed that summer, and the basic fuselage structure was pretty well completed by November 2016, just in time to crack into the fourth kit, known as the finishing kit. This name is a bit misleading because we were nowhere near finishing at this point, but that name has a better ring to it than



January 2017: The fuselage is mostly assembled.

“halfway kit,” or “other stuff you'll need kit.” Actually, once that kit was done we were getting close to being finished, and by close, I still mean at least a year away at our pace. This kit included parts like the landing gear, canopy, cowling, and control cables.

The finishing kit

The first section of the finishing kit was wing installation, which was exciting. It's starting to look a little more like an airplane. At that point, we didn't have the tail on yet and that was by design. It's a lot easier to walk around the thing without a tail in the way and it didn't need the tail on until later, when we started stringing the controls for the rudder and horizontal stabilator. I picked up the suggestion

while attending a forum at Oshkosh and also learned there that it wasn't really necessary to complete the sections in order. Things like the rear window installation could be completed after we installed the wiring in the tail section and fuel tank.



March 2017: The tail is on!

The tail was attached shortly after the wings in April 2017, and the vertical stabilizer and rudder followed shortly afterwards. Next we attached the bubble canopy, which on an RV-12 hinges forward — similar to what you might find on a Diamond. This task required our first attempt at fiberglass work. You might not think that would be necessary on an aluminum airplane, but it was and it wasn't the last of the fiberglass work either. The EAA offers training courses for homebuilders on things like sheet metal, fiberglass lay-ups, and electrical wiring to name a few, and I'd highly recommend taking those if you've got your sights set on building your own plane.

Installing the landing gear

By the end of 2017, the canopy was on and we were ready to install the landing gear, and this is when we started to outgrow the garage. The problem was that I couldn't have the vertical stabilizer on and the canopy open with the landing gear on or the canopy would have hit the ceiling. Those items were temporarily removed so we could continue building, though it became obvious that we would need to move to a larger location soon.

But by mid-2018 we were on to the avionics, so we still had a lot of work we could do in the garage without a canopy. For the RV-12, Van's offered two choices of avionics suppliers: Garmin and Avidyne. We talked with both at Oshkosh, and not seeing a major difference between the two, we chose Garmin



April 2018: Landing gear installed. We removed the canopy and vertical stabilizer so the plane would still fit in the garage.

due to the fact that I have been flying behind the G1000 for a while now and was pretty comfortable with it. Other than having to do some minor body contortions to get all the wiring installed, that part went fairly smoothly and by the fall of 2018, it was time to move. At this point, most people would head to the airport and work at a hangar, but fortunately, Blackstone has a large heated garage with a high ceiling, so I gave up my parking space in that garage and moved the plane there, as well as my work tables in preparation for the final kit — the engine.



December 2018: We installed the 100-120 lb. engine using a chain hoist. It would've been a difficult job without the hoist.

having to buy airport fuel. The engine is also equipped with altitude-compensating carburetors, so no mixture adjustments are necessary; one less thing for the pilot to worry about.

The engine was hung on December 21, 2018, a banner day in any airplane's life. Everyone was excited, things are coming together, we'll be in the air in no time now. Well here it is the end of summer and we still aren't ready to fly, but as I said at the start of this article we are getting close. We flipped the master switch last weekend and powered up the avionics for the first time. Nothing caught on fire and the Garmin GX3 started just like it should, so that was another step in the right direction. We rented a hangar at Fort Wayne International and moved it there at the end of July. Next we'll install the prop and start the test-flying process.

Time invested

I get asked occasionally how many hours we have in it and I really don't know. Seems like keeping track of that would just make you depressed. With a project like this you have to just keep plugging away and sooner or later, the end will happen. In our case it's been later, but the project has been fun and I'm glad my wife and I took it on. Still, I don't think I'll tackle another one any time soon. I'll report back next newsletter, once we're in the air!

Engine installation

Unlike a lot of other kits available, there was only one choice for engines from Van's and that was the Rotax 912 ULS. The good news is that this is an excellent choice. We see a lot of samples from that engine and they virtually always look great. The big difference between this and other 100 HP selections is that it has liquid-cooled cylinder heads. With that present, it can run either unleaded fuel or leaded fuel, so now I have the option of buying my own fuel instead of always



April 2019: ready to move to the airport. We had installed the prop and it was time for wings, so we needed more room. Time for the hangar!

Report of the Month

The TSIO-550 engine in this Cirrus was struggling with chrome and nickel. They eventually figured out...what?

To learn more about where the elements are coming from, [click here](#).

	MI/HR on Oil	45	UNIT / LOCATION AVERAGES	55	50	51	30	25	UNIVERSAL AVERAGES
	MI/HR on Unit	340		295	251	240	56	25	
	Sample Date	2/13/2019		10/18/2018	7/13/2018	6/19/2018	6/5/2017	5/18/2017	
	Make Up Oil Added								
ELEMENTS IN PARTS PER MILLION	ALUMINUM	11	11	10	7	13	7	7	7
	CHROMIUM	48	32	36	35	43	47	34	25
	IRON	151	87	124	95	118	87	90	79
	COPPER	22	23	17	17	27	46	65	12
	LEAD	11588	9861	9853	5217	9664	7698	3414	7973
	TIN	2	2	4	1	4	2	4	2
	MOLYBDENUM	21	13	18	15	23	19	13	8
	NICKEL	59	28	35	28	35	11	12	29
	MANGANESE	2	2	2	1	2	2	4	1
	SILVER	0	0	0	0	0	0	0	0
	TITANIUM	2	1	1	1	1	0	0	1
	POTASSIUM	1	1	2	0	0	0	0	1
	BORON	1	1	1	1	2	1	1	1
	SILICON	7	9	7	7	8	17	20	8
	SODIUM	2	2	3	1	2	2	2	1
	CALCIUM	2	7	3	1	3	9	11	26
	MAGNESIUM	0	1	0	0	0	0	1	1
	PHOSPHORUS	1053	156	629	1051	770	9	61	251
ZINC	7	16	6	4	7	30	96	6	
BARIUM	0	0	0	0	0	0	0	0	

Values Should Be*

	SUS Viscosity @ 210°F	87.2	82-105	92.2	95.4	95.0	102.0	89.1
	cSt Viscosity @ 100°C	17.31	16.0-21.8	18.50	19.26	19.17	20.83	17.77
PROPERTIES	Flashpoint in °F	435	>440	445	500	470	445	485
	Fuel %	TR	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5
	Antifreeze %	-		-	-	-	-	-
	Water %	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Insolubles %	0.3	<0.6	0.3	0.4	0.4	0.3	0.6
	TBN							
	TAN							
	ISO Code							

After receiving this report, the owners took the aircraft in to check compressions and borescope the cylinders. Borescope and compressions were all okay. After removal of the starter adapter, they found it impossible to hand-turn. They believe the starter may have caused damage to the starter adapter, contributing to at least some of the elevated metal.

Report of the Month

Metals shot up in the November '18 sample from the IO-360 in this Piper. What happened?

To learn more about where the elements are coming from, [click here](#).

ELEMENTS IN PARTS PER MILLION	MI/HR on Oil	10	UNIT / LOCATION AVERAGES	24	39	38	UNIVERSAL AVERAGES
	MI/HR on Unit	1,199		11/12/2018	5/10/2018	3/20/2018	
	Sample Date	5/6/2019		7.5 qts			
	Make Up Oil Added	4 qts					
	ALUMINUM	16	30	67	11	18	7
	CHROMIUM	4	8	19	3	4	4
	IRON	24	51	90	39	45	24
	COPPER	7	13	15	12	12	6
	LEAD	1647	3954	6055	2896	3247	3878
	TIN	1	2	4	1	2	1
	MOLYBDENUM	0	0	1	0	0	0
	NICKEL	2	5	8	6	6	2
	MANGANESE	1	0	1	0	1	0
	SILVER	0	0	0	0	0	0
	TITANIUM	0	0	0	0	0	0
	POTASSIUM	1	1	1	0	0	1
	BORON	1	0	0	1	0	1
	SILICON	16	9	12	5	473	5
	SODIUM	5	2	0	2	2	2
	CALCIUM	3	5	8	7	3	19
	MAGNESIUM	3	12	14	21	22	4
	PHOSPHORUS	363	1477	401	1281	1181	646
	ZINC	2	8	7	13	11	6
	BARIIUM	0	0	0	0	0	0

Values Should Be*

PROPERTIES	SUS Viscosity @ 210°F	92.1	85-104	103.0	91.1	96.2
		cSt Viscosity @ 100°C	18.48	16.8-21.5	21.06	18.24
	Flashpoint in °F	485	>460	470	470	455
	Fuel %	<0.5	<1.0	<0.5	<0.5	<0.5
	Antifreeze %	-		-	-	-
	Water %	0.0	<0.1	0.0	0.0	0.0
	Insolubles %	0.3	<0.6	0.7	0.3	0.5
	TBN					
	TAN					
	ISO Code					

The engine was running relatively well when the owner received the November sample showing a lot of metal. They checked compression and all was good until the first cylinder got to top dead center, when compression disappeared quickly. A borescope revealed flaking at the upper end of the cylinder, and the same problem was found in all the cylinders. The top compression rings on all the jugs were broken. They did a top overhaul and replaced the cylinders with nitrided steel bores. The engine has since recovered nicely.