



The Amazing RV-3

By Jack Cox

Richard VanGrunsven is a perfectionist.

I had never met the man before Oshkosh '72 but after only a few moments into our initial conversation, this trait was very evident. He was friendly, he was very co-operative in showing me the features of his new airplane . . . but you could tell by the deliberate way he fielded some of the more probing questions that he was trying hard to give you not just an answer, but the EXACT answer.

But most of all, Richard VanGrunsven, the perfectionist, shows in the airplanes he builds.

Every year at Oshkosh EAA awards a trophy for "The Best Aerodynamic Detailing Features". All too often this is one of those nice shiny cups that is awarded one evening to the accompaniment of modest applause, only to be promptly forgotten by all except the owner and judges who were observant

and knowledgeable enough to detect the virtues of the airplane that won it. This year's winner, the RV-3, had so many brilliant examples of design detailing that it may lend new prestige to the award — make it something for designers to really shoot for.

For design detail — the little things done so well — is what the RV-3 is all about.

Here is an aircraft that is conventional in almost every respect. It is a straight forward, low wing monoplane with pleasing lines — nothing to boggle the mind at first sight. But a couple of close-order inspection trips around the little bird begin to reveal why the Amazing RV-3 is . . . amazing!

Take that engine cowl. You are admiring its very spare sleekness when it hits you . . . there's something wrong here, something's . . . missing!!

(Ted Koston Photo)
Richard VanGrunsven of Forest Grove, Oregon and his beautiful RV-3.

Where are the fasteners? latches? multitudinous little sheet metal screws?

"I give up — how th' heck do you get into the darn thing??"

With a little satisfied smile, Dick reaches into the open, aft end of the cheek cowl, twists something, and proceeds to pull out the long wire from the hidden piano hinge that holds one entire side of the cowling in place. Neat, as clean as you can get from an aerodynamic standpoint, simple, light, and when opened, exposes the whole engine for maintenance and/or inspection.

Glancing down the slick flush riveted fuselage, another goodie catches your eye. The fuel filler cap located just in front of the windshield is one of those snap-down-to-lock types — also flush mounted. Dick modestly

admits to making the cap himself — but hurries on to point out something that is not obvious. The tank is integral with the forward fuselage skin and windshield. It is removable (in about 45 minutes) and exposes the instruments, engine controls and rudder pedals. The long narrow tank is of riveted construction and is sloshed with a sealing compound made by the Product Research Corporation. It has been very satisfactory to date, VanGrunsvan reports.

Just inches aft of the tank is still another item that undoubtedly caught

the eye of some judges. If you are as susceptible to sunburn as I am, you are not that enthusiastic about bubble canopies to begin with, and you automatically scan for cool air vents. Here we encounter another guessing game. No little plastic bubbles, no click-out-scoops, no plastic discs with pie slice openings — nothing to protrude into the airstream to create drag.

Then you spot it — up front, at the base of the windshield is a small horizontal slit. Looking from the backside — through the cockpit — it is apparent

that the slit is wedge shaped. On the top of the panel is a wedge-shaped apparatus attached by a screw/slot arrangement that allows the wedge to be pushed forward to seal the air vent or be pulled back opening it to ventilate the bubble. Again, aerodynamic drag is at an absolute minimum.

The first thing that impresses you about the tail section is the slick one piece fiberglass fairing that encloses and streamlines the root areas of the horizontal and vertical surfaces. The second thing is that this fairing is the only opening into the whole tail — it doubles as an aerodynamic fairing and a multi-purpose inspection plate.

One thing you can't help noticing while walking around the tail — in fact you will trip over it if you aren't careful — is the long, sleek fiberglass tail wheel pant. Is this still another VanGrunsvan quest for absolute aerodynamic perfection — an effort to squeeze out the last dram of speed? Sorry 'bout that, detail buffs... but Richard had to have at least one fling at whimsy! The tail wheel pant is merely a conversation piece, hopefully, to get you talking about such things because it just so happens that besides being an engineer, VanGrunsvan makes and sells fiberglass aircraft parts. Sly devil.

So, there you have it — some of the major items that must have contributed to the judge's decision to award the RV-3 the "super slick" award. There were other things, of course, that added a couple of miles per hour each:

- The small fiberglass spinner — VanGrunsvan made, naturally. He believes in keeping spinners small for low frontal area and so that you don't have so much mass constantly fighting a losing battle with centrifugal force, eventually tearing itself apart. No problems with this one.

- Exhaust pipes exit the cowlings at the aft, bottom side and are aimed backwards for whatever propulsive effect that can be realized.

- The Wittman-style gear is faired for a demonstrated 8.5 mph speed increase — a well-proven "must" for all rod-type gears. The gear legs are also smoothly faired into the wheel-pants.

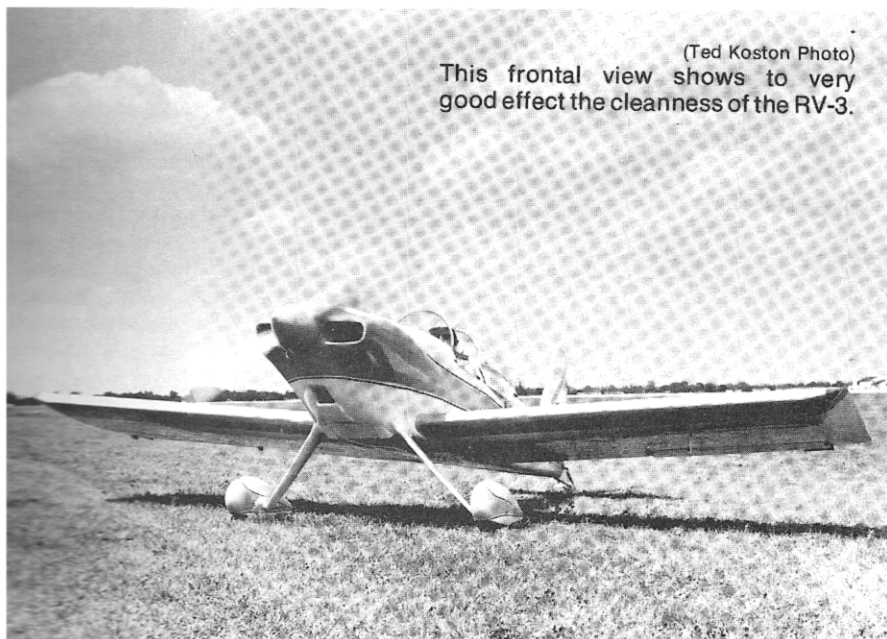
- As previously mentioned, the entire aircraft is flush riveted and the wing is filled to a glass-like finish.

O.K. — so the RV-3 is a real smoothy. It looks good... but does it go? VanGrunsvan gives these figures:

At a gross weight of 1050 lbs., with a Lycoming O-290G swinging a Senenich 68x71 prop the bird tops out at 195 mph, cruises at 171 mph at sea level and 186 at 8,000. Climb rate is 1900 fpm.

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AMAZING RV-3...

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When Richard quotes these numbers (I watched him tell several guys), you can tell he is kinda giving you a quizzical look — and when he finishes, there is a very pregnant pause... as if he's just waiting for you to come back with something like, "Uh... well, Brand X and Y are supposed to do thus-and-so with the same horsepower." About then you get run through with a blue steeled glint from Richard's eyes and are informed in a way that is firm, but still friendly... "the RV-3 WILL do 195 and it WILL cruise at 186 — etc."

After seeing the yellow and white missile whistling around the fly-by pattern almost everyday... and never once seeing it passed by anything else, I believe him!

Some of you may be thinking, "So what? The EAA world is famous for fast little airplanes." And thus it is that we finally get around to that which makes the RV-3 unique.

Consider:

— The RV-3 was flight tested from a 670 foot grass strip — and has been operated regularly from it since.

— According to the builder, the RV-3 can slow fly with a Fly Baby — it has been flown straight and level at 45 mph.

— The RV-3 has a speed ratio of 4.33 to 1.

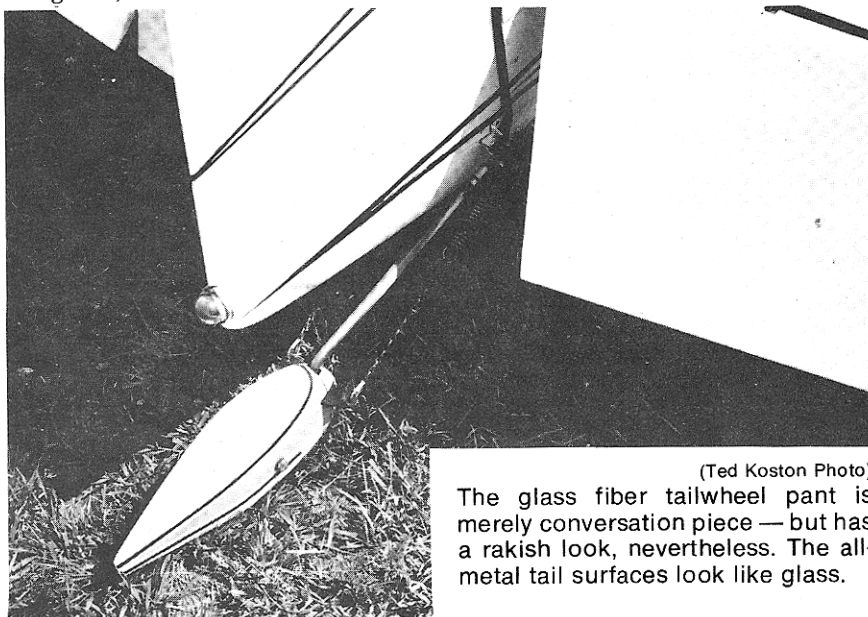
Top end performance, then, is only half the story of the RV-3. It is outstanding as an exception in a world of "hot" homebuilts, most of which are "hot" in the landing regime as well as in top speed.

How does VanGrunsven accomplish this? His devotion to aerodynamic perfection helps — clean airplanes fly faster and slower, everything else being equal. But there are some tricks, chiefly drooping ailerons. Look at the accompanying cockpit photograph and you will see a lever at the base of the control stick. By flipping this over 180° the ailerons droop 18°. The first notch of flaps equals this, creating a high lift wing. More flap can be set in, causing drag and steepening the glide path. While in the drooped condition, the Frieze type ailerons still perform their normal function. A little bit of adverse yaw results when the ailerons are drooped — but cause no handling problems, according to VanGrunsven.

The advantages accrue in low stall speeds. Power off, clean and in level flight attitude, the aircraft pays off at 54 mph indicated; with flaps at 48 mph; and with flaps and ailerons drooped at 45. Remember, with power it will maintain altitude at 45 mph.

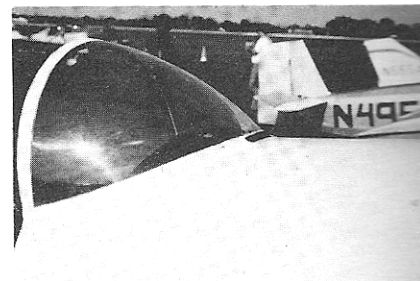
While we don't like to think of such things, the low stalling speed makes the RV-3 a safer airplane in case of a total power failure.

The engine is another VanGrunsven special. It started out as a Lycom-



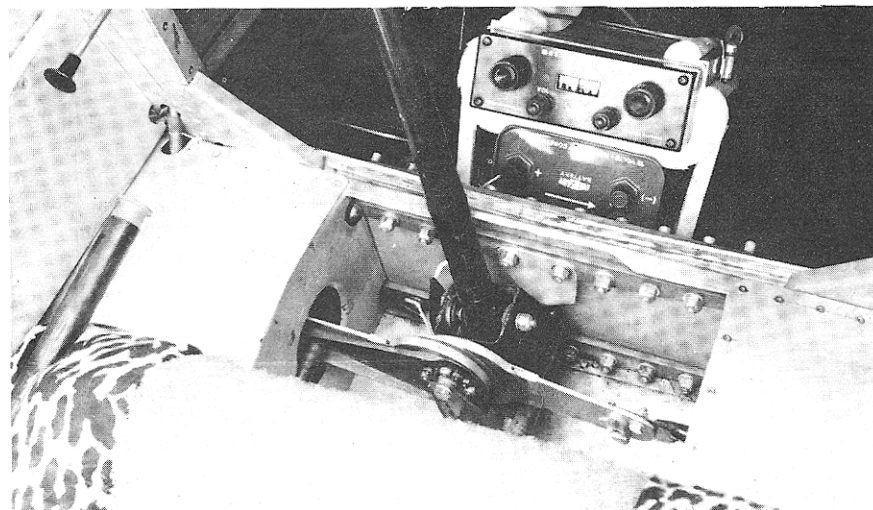
(Ted Koston Photo)

The glass fiber tailwheel pant is merely conversation piece — but has a rakish look, nevertheless. The all-metal tail surfaces look like glass.



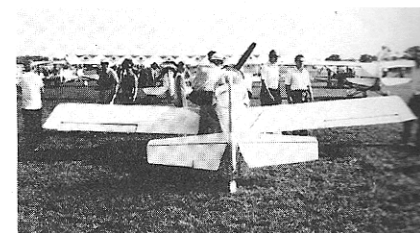
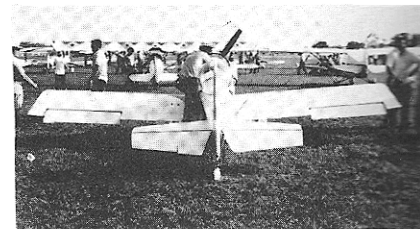
(Photo by Jack Cox)

The RV-3's very clean bubble windshield installation. The cockpit fresh air vent is hardly noticeable.



(Ted Koston Photo)

This close-up shows the aileron drooping device. The lever at the base of the stick can be thrown over to the right to, in effect, shorten the aileron push rods, thus drooping both ailerons. Lower stall speed is the advantage gained by this mechanism.



(Photo by Jack Cox)

These two shots show the designer/builder, Richard VanGrunsven, demonstrating the 18° drooping action of his aircraft's ailerons.

ing 0-290G but has an 0-320 crank. Since a 4" prop extension is used the heavier flange on the 0-320 crank was considered prudent. An 0-320 rear case is also used. To save weight, the aircraft does not have an electrical system. A Dynafocal mount is used to tame the usual four-banger judders, but does not get the workout it ordinarily would because the engine is fully balanced.

The engine is very tightly cowled but has good cooling — a ground adjustable cowl flap is installed on the prototype but is not needed and will likely be left off plans.

HANDLING

So enough with this ground-bound palaver — how does it fly? Here we will turn things over to the builder-pilot himself and let him tell you what his bird will do:

"The performance figures in the data box (below) pretty well tell the story, except that with the many exaggerated performance claims being tossed about, they may not seem overly significant by comparison. The real proof of a superior airplane is better shown by in-flight comparisons. The RV-3 excels in this area, usually causing my performance figures to seem understated rather than inflated. Flight comparisons have shown the RV-3 to slow-fly along with a Fly Baby, cruise nearly as fast as a comparably powered Midget Mustang, and climb and do aerobatics along with a Pitts of the same power."

"Along with its outstanding performance, the RV-3's handling characteristics are also commendable. Most noticeable are the light, very responsive (170°/sec. roll rate) ailerons. Of Frieze design, they retain their effectiveness right down to and even below stall speed. Even though they do not have any differential travel, they induce very little yaw, so that turns and rolls can be performed with little or no rudder. Elevators are powerful and pressures are fairly light. Ground handling is also very good with only light rudder pressure being needed for taxiing. Ground looping tendencies are reduced with the long fuselage and flexible landing gear. Stalls are straight forward with little tendency to drop a wing. Accidental spins are almost an impossibility as it has to be forced into a spin and tries to recover even with the controls at their extreme positions. The only way to remain in a spin is by use of opposite aileron. Overall, I'd say that the RV-3 is very responsive without being overly sensitive or "tricky". I'd say that the skill level required to fly it would be about that of a 50 hour tail-dragger pilot. The following are the first comments of an experienced pilot

(having flown some 32 different homebuilts) after flying the RV-3. "This is the greatest airplane I've ever flown. It breeds confidence. I felt at ease and in complete control the instant the wheels left the ground."

"With its wide speed range and 8 lb./hp power loading, the RV-3 is a fine aerobatic ship. As yet there is no inverted system installed, so maneuvers have been limited to the inside variety. All normal sport aerobatic maneuvers can be done with a minimum of effort by both the airplane and pilot. Vertical rolls and vertical eights (loop immediately following an Immelman turn) can be done without diving for entry airspeed. Overall, I'd classify it as a "sport" rather than "competition" aerobatic airplane because of its relatively low power and its reluctance to do snap maneuvers because the wing planform is too stable. For this reason it is a safe aerobatic airplane as it will recover from any mistake the pilot may make." (But always remember, men... altitude, altitude! - Ed.)

"The cockpit of the RV-3 is large and well proportioned. Over 1000 hours of flying in single seat homebuilts provided me with sufficient experience and incentive to make this one comfortable and functional. Pilots up to 6'4" fit comfortably. The seat bottom is contoured to match the corresponding parts of the human frame, and all controls are within easy reach and operate without undue gymnastics. The seat back, which is recessed to accommodate either a thick cushion or a parachute, hinges forward to provide access to an 8 cubic ft. baggage compartment. Pulling two piano hinge pins removes the seat back for access to the aft fuselage and to provide leg space while servicing rudder pedals, controls, etc. This also makes it possible for the pilot to recline into the baggage area and sleep should other evening accommodations be unavailable."

"Design goals were numerous; high speed, STOL, aerobatic, comfort, servability, asthetically pleasing, easy to construct, light weight, etc. Or perhaps more realistically, I wanted to build a better airplane than the RV-1, a fine performing cantilever wing Playboy which I had just sold. The RV-3 looks like a fast airplane, somewhat like an aerobatic airplane, but not much like an STOL airplane. One might say that I was motivated to incorporate STOL capabilities because my private airport is only 670 ft. long. In addition to this practical consideration, I view low-landing speeds as built in safety factor or insurance policy."

"The RV-3's structure is all aluminum and all flush riveted. The wings are a mono-spar structure with

a light rear spar which absorbs drag loads and is a convenient place to attach ailerons and flaps. The main spar is a fabricated I-Beam consisting of a formed channel of .040 aluminum with 1½x½ aluminum bar flange strips of varying length riveted on. The spar roots extend inward to the fuselage center and are joined together with 4130 steel splice plates. This eliminates the need for a spar center section and attaches the wing to the fuselage at the same time. Each wing panel has 10 ribs and is skinned with .025 aluminum. The fuselage is a monocoque structure using .032 aluminum in the forward portion and .025 aft of the cockpit. Aluminum angle stringers reinforce the forward portion to carry engine and landing gear loads and also come in handy for mounting the fuel tank and as rails for the sliding bubble canopy. The aft fuselage cone uses light aluminum angles to provide rigidity to the skin. Fixed tail surfaces are shell structures, using a heavy .032 skin and no ribs except for the root and tip. All control surfaces including ailerons are skinned with .016 aluminum and use ribs only for the ends; the remainder of the skin being stiffened with light formed aluminum angles. The landing gear is the tapered steel rod or "Wittman" type. It was chosen because of its light weight, 360° flexibility, and the fact that it could be mounted integral with the engine mount, thus eliminating the need to reinforce the structure elsewhere.

SPECIFICATIONS AND PERFORMANCE

(Source: Richard VanGrunsven)

Span	19'9"
Length	19'0"
Wing Area	90 sq. ft.
Empty Weight	695 lbs.
Gross Weight	1050 lbs.
Wing Loading	11.66 lb./ft. ²
Power Loading	8.4 lb./hp
Engine	Lyc. 0-290G
Propeller	Sensenich 68x71
Fuel Capacity	24 Gals.
Baggage (8 cubic ft.)	30 lbs.
Top Speed	195 mph
Cruise (sea level)	171 mph
Cruise (8,000 ft.)	186 mph
Min. speed,	
level flight	45 mph
Take-off Run	250 ft.
Landing Roll	300 ft.
Rate of Climb	1900 fpm
Speed Ratio (Top/Min.)	4.33 : 1
Ceiling	21,000 ft.
Range	600 miles
Roll Rate	170°/sec.

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