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REVISION DESCRIPTION:

Page: 02-02 REV 2: Added text: **DEVIATION FROM THE INSTRUCTIONS OR UNAUTHORIZED MODIFICATIONS MAY PROHIBIT THE ASSEMBLED AIRCRAFT FROM OBTAINING A FLIGHT AUTHORIZATION.**

Added list entitled, "**APPLICABLE AIRCRAFT STANDARDS"** per ASTM 2563-06, §3.1.1, article (5).
[Note: see RV-12 Manual for body of text added.]

SECTION 2: DESIGN PHILOSOPHY

INTRODUCTION

Before getting into the construction details of your RV-12, let's take a look at the design philosophy and goals that are the basis for this airplane. The goal was to achieve the maximum overall performance, flying enjoyment, ease of construction, building and flying economy, ease of maintenance, and pleasing appearance possible for a two-place airplane. Understanding how this was achieved might help you better appreciate many features of the RV-12 as you encounter them during construction.

The formula for achieving maximum overall performance is amazingly simple: Maximize thrust, minimize drag; maximize lift, minimize weight. The implementation of this formula is a bit more complex, however. Thrust, for a given HP engine, has been maximized through use of a good propeller, streamlining of the engine cowl, and directing the engine outlet rearward. Drag was minimized by keeping the aircraft frontal area to a minimum and shaping all airframe components to reduce aerodynamic drag. Lift was maximized through use of a wing with adequate area and good airfoil. Weight is minimized by careful structural design, by using the best airframe materials, and by installation of only essential instrumentation and equipment.

Most of the literally hundreds of features which comprise the overall RV-12 package have been determined in the design stage and involve no choices for the builder unless he chooses to make major modifications. There is little that a builder is likely to do which will have much effect on either thrust or lift of his RV. However, construction techniques and additional installed equipment can have noticeable effects on both drag and weight - the archenemies of performance.

A NEW AVIATION HORIZON

In 2004, the FAA created sport pilot/light-sport aircraft (SP/LSA) regulations. The most significant change in FAA regulations in 50 years, it allows easier and lower-cost access for those wishing to participate in the joy of flight. With adoption of SP/LSA, flying has become less expensive and easier than ever before. You can become a sport pilot with as little as 20 hours of flight instruction. You can fly a one- or two-seat aircraft capable of speeds up to 138 mph. And in most cases, you can pass the medical requirements just by showing your driver's license.

BASIC PARAMETERS OF LSA
The FAA has defined light-sport aircraft as simple-to-operate, easy-to-fly aircraft that, since initial certification, has continued to meet the following performance definition:

Maximum gross weight of 1,320 lb
Maximum stall speed of 45 kt CAS
Maximum speed in level flight with maximum continuous power of 120 kt CAS
One or two person occupancy (pilot and one passenger)
Fixed or ground adjustable propeller
Fixed landing gear
Single reciprocating engine
Unpressurized cabin

The FAA has allowed manufacturers to market an aircraft that complies with S-LSA design, production, maintenance, and continuing airworthiness consensus standards as a kit that requires only minor assembly. The assembly, however, must be done in accordance with a factory-supplied, assembly manual that complies with the appropriate ASTM consensus standard. Only manufacturers that have already received an S-LSA airworthiness certificate are eligible to offer an E-LSA Kit. The E-LSA kit offers some advantages over traditional Experimental - Amateur Built kits, primarily that there is no "major portion" requirement limiting the allowed level of completeness of E-LSA kits.

Van's Aircraft, Inc.'s only option at this time (April 2008) is to license the RV-12 as an S-LSA. This will allow our customers to build an E-LSA from our kit when purchased. This limits aircraft "options" to those tested and approved by Van's Aircraft. We encourage builders to do this as it will minimize construction time and produce consistent airplanes.

Builders may choose to build and certify their RV-12 aircraft under the Experimental - Amateur Built rules which allow greater latitude for deviation from the kit manufacturer's design standard. Van's anticipates that E-AB kit certification will be an option, but at this time (April 2008), E-AB certification will be on an individual basis and the sole responsibility of the builder.

RV-12 DESIGN FEATURES

The RV's "traditional" configuration - tractor engine, monoplane, stabilizer in the rear, is an exercise in logic and not simply a concession to convention. There are many good reasons why light planes have been built this way for decades, other than the often heard arguments of "entrenched design mentality" from those seeking "technological breakthroughs". The bottom line is that this configuration has proven to offer the best compromise resulting in the best all around airplane.

The constant chord wing planform chosen for the RV-12 offers the ultimate in construction ease, stability, and lifting ability. The possible drag and aesthetic penalties for the rectangular wing are negligible in light of its advantages. The airfoil used is a modified NACA 23014.1, an old wing section often maligned in "airfoil selection" articles and texts. However, this basic airfoil section has been used on some of the world's most successful airplanes ranging from the Taylorcraft and Helio Courier on one end of the scale, to the Turbo Commander and even the Cessna Citation on the other end. Others using it include the DC-3, all tapered wing Beechcrafts, and many of the Cessna twins.

Given that low cost of ownership is a selling point for any Light Sport Aircraft and is a prime design goal of all RV designs, the RV-12 incorporates wings that are easily removable. Because the cost of hangar space is typically the single biggest aircraft ownership expense, removable wings mean that storage costs can be reduced (by sharing of 'on-airport' hangar space) or eliminated (by storage 'off-airport' at home). This design feature drove other features such as placement of fuel tank in the fuselage, selection of full-span drooping ailerons (flaperons) which automatically hook-up upon wing installation, and location of the pitot tube in the spinner. Because the RV-12 would possibly be trailered to and from the airport, the wings-removed width had to be sufficiently narrow to allow it to be legally trailered. This limited the span of the horizontal tail surface to 8 ft. The limited tail span requires that the RV-12 use a long fuselage placing the tail surfaces well aft for good control authority.

Seating arrangements vary between the RV designs, depending on the primary mission envisioned. Side-by-side seating was chosen for the RV-12 because this arrangement is generally preferred for its primary mission: Sport Flying. Specific advantages of the side-by-side configuration include equal visibility for both occupants, more easily achieved dual control capability, lots of instrument panel space, minimized CG travel for various loading conditions, and a full cowling with room for engine accessories and plumbing. The RV-12 design places the occupants further forward than the other side-by-side RV designs. This seating position allows for excellent visibility even in the downward direction because the wing leading edge is far aft relative to the occupants' eyes. The potential down-side of this 'cab-forward' arrangement is a CG that is further forward than desired. The selection of the very light Rotax 912ULS engine enables the RV-12 to balance well even with two heavy occupants sitting forward of the wing spar.

Designers often use the term "Mission Profile" which simply refers to the function an airplane is designed to perform. The RV-12's mission profile is rather broad -- it is intended to fill nearly all sport flying needs - excellent flying qualities, maximum speed allowed under LSA rules, low stall speed, good visibility, simple assembly for the home-bulider, economical to own and operate. Meeting all these needs required a design "balancing act". Favoring one need often adversely affects others. An example would be emphasizing cross country cruise performance by installing extra radios, instruments, and upholstery. The weight added would adversely affect all other performance parameters. This is not a "maybe", it is a certainty. Whether the trade-off is worthwhile is a decision that can only be made by the builder. (continued on next page...)

We feel that an RV-12 in its basic form with fixed-pitch prop, modest instrumentation & avionics, and Rotax 912ULS engine represents the best compromise.

Obviously, we could go on and on, covering every design decision, compromise, or concession. However, it should be obvious by now that every feature of the RV-12, whether major or minor, was the end product of much deliberation. In almost all instances, these features are so inter-related that altering one will affect several others; meaning that a builder should not consider making changes unless he is willing and capable of analyzing the *overall* impact of the change.

NOTE: Van's Aircraft Inc. kits are carefully designed and tested. They will demonstrate performance very close to quoted figures with the engines and propellers recommended. Van's Aircraft recommends that the kits only be assembled according to the supplied plans. If the builder chooses to deviate from the plans and install a non-standard engine or to modify the aircraft to a configuration other than what is called out in the plans, he or she is assuming responsibility for the airworthiness of that modification and any effect it may have on the airworthiness of the airframe and/or powerplant. Technical support may not be available for modifications that deviate from the plans nor for installations that are not specifically recommended by Van's Aircraft.

Keep in mind that insurance companies may not be willing to write a policy on an aircraft that has been modified to a configuration other than that recommended by the manufacturer. Prior to modification, the builder should check with their insurance provider regarding this matter.

If a kit is modified in any significant manner, it should not be considered an RV (type) for registration purposes. Deviation from the instructions or unauthorized modifications may prohibit the assembled aircraft from obtaining a flight authorization as an ELSA.

APPLICABLE AIRCRAFT STANDARDS

Design and Performance of a Light Sport Airplane (LSA) (ASTM F2245) This specification covers airworthiness requirements for the design of powered fixed wing LSA.

Required Equipment (ASTM F2245) Minimum instrumentation and equipment LSA aircraft shall be designed with.

Light Sport Aircraft Manufacturer's Quality Assurance System (ASTM F2972) This specification establishes the minimum requirements for a quality assurance system for manufacturers of LSA or LSA kits, or both.

Production Acceptance in the Manufacture of a Fixed Wing LSA (ASTM F3035) This specification provides the minimum requirements for the establishment of a ground and flight test program for verifying the initial production aircraft meets certain operational performance requirements that have been set forth by the manufacturer in its Pilot's Operating Handbook (POH).

Aircraft Operating Instructions (ASTM F2245) see POH

Maintenance and the Development of Maintenance Manuals for LSA (ASTM F2483) This practice provides guidelines for the qualifications to accomplish the various levels of maintenance on U.S.-certificated experimental and special light sport aircraft. In addition, it provides the content and structure of maintenance manuals for aircraft and their components that are operated as LSA.

LSA Major Repair and Alteration (MRA) Requirements (ASTM F2483) Any repair or alteration not contained in the related Aircraft Maintenance Manual must be authorized by the Aircraft Original Equipment Manufacturer (OEM). The Aircraft OEM must provide complete information on how to perform the repair or alteration.

Continued Operational Safety Monitoring of a LSA (ASTM F2295) Establishes a method by which safety of flight issues are discovered, evaluated, and corrected for the purpose of maintaining operational safety of a LSA.

Kit Assembly Instructions of Aircraft Intended Primarily for Recreation (ASTM F2563) This practice covers the instructions a kit producer must provide to a consumer in order to assemble and safely flight-test a recreational aircraft to ensure compliance with applicable ASTM standards.

Required Product Information to be Provided with an Airplane (ASTM F2745) This specification covers the minimum requirements for information that shall be provided by the airplane OEM or seller of a new LSA or LSA kit.

Pilot's Operating Handbook (POH) for Light Sport Airplane (ASTM F2746) This specification provides the minimum requirements for a POH for an aircraft designed, manufactured, and operated as a LSA.