

Exemption No. 16648

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, DC 20591

In the matter of the petition of

TERRAFUGIA, INCORPORATED

for an exemption from §§ 21.181(a)(3)(i),
21.190(a), 43.3(c), 43.7(g), 61.89(c)(1),
61.303(a), 61.315(a), 61.411(a), 61.415(a),
61.429(b), 65.107(b) and (c) of Title 14,
Code of Federal Regulations

Regulatory Docket No. FAA-2014-0935

GRANT OF EXEMPTION

By letter dated November 4, 2014, Mr. Carl Dietrich, Ph.D., CEO/CTO, Terrafugia, Incorporated (Terrafugia), 23 Rainin Rd., Woburn, MA, 01801, petitioned the Federal Aviation Administration (FAA) on behalf of Terrafugia for an exemption from §§ 21.175, 21.181, 21.182, 21.190, 21.191, 21.193, 43.1, 43.3, 43.7, 61.1, 61.23, 61.31, 61.45, 61.89, 61.113, 61.303, 61.305, 61.315, 61.317, 61.321, 61.325, 61.327, 61.403, 61.405, 61.411, 61.415, 61.417, 61.419, 61.423, and 61.429 of Title 14, Code of Federal Regulations (14 CFR). The proposed exemption, if granted, would allow the Terrafugia Model Transition® to be certificated, operated, and maintained under the regulations applicable to aircraft issued a special airworthiness certificate in the light-sport category with a maximum takeoff weight (MTOW) of 1,800 pounds and a maximum stalling speed (V_{S1}) of 54 knots calibrated airspeed (CAS) at the aircraft's maximum certificated takeoff weight and most critical center of gravity.

To obtain the desired relief, the petitioner requires exemption from the following regulations:

Section 21.181 prescribes, in pertinent part, that:

(a) Unless sooner surrendered, suspended, revoked, or a termination date is otherwise established by the FAA, airworthiness certificates are effective as follows:"

(3) A special airworthiness certificate in the light-sport category is effective as long as—

(i) The aircraft meets the definition of a light-sport aircraft.

Section 21.190 prescribes, in pertinent part, that:

(a) *Purpose.* The FAA issues a special airworthiness certificate in the light-sport category to operate a light-sport aircraft, other than a gyroplane.

Section 43.3 prescribes in pertinent part, that:

(c) The holder of a repairman certificate may perform maintenance, preventive maintenance, and alterations as provided in part 65 of this chapter.

Section 43.7 prescribes in pertinent part, that:

(g) The holder of a repairman certificate (light-sport aircraft) with a maintenance rating may approve an aircraft issued a special airworthiness certificate in light-sport category for return to service, as provided in part 65 of this chapter.

Section 61.89 prescribes in pertinent part, that:

(c) A student pilot seeking a sport pilot certificate must comply with the provisions of paragraphs (a) and (b) of this section and may not act as pilot in command—

(1) Of an aircraft other than a light-sport aircraft.

Section 61.303 prescribes in pertinent part, that:

(a) Use the following table to determine what operating limits and endorsement requirements in this subpart, if any, apply to you when you operate a light-sport aircraft. The medical certificate specified in this table must be in compliance with § 61.2 in regards to currency and validity. If you hold a recreational pilot certificate, but not a medical certificate, you must comply with cross country requirements in § 61.101 (c), even if your flight does not exceed 50 nautical miles from your departure airport. You must also comply with requirements in other subparts of this part that apply to your certificate and the operation you conduct.

If you hold	And you hold	Then you may operate	And
(1) A medical certificate	(i) A sport pilot certificate,	(A) Any light-sport aircraft for which you hold the endorsements required for its category and class	(I) You must hold any other endorsements required by this subpart, and comply with the limitations in § 61.315.
	(ii) At least a recreational pilot certificate with a category and class rating,	(A) Any light-sport aircraft in that category and class,	(I) You do not have to hold any of the endorsements required by this subpart, nor do you have to comply with the limitations in § 61.315.
	(iii) At least a recreational pilot	(A) That light-sport aircraft, only if you hold	(I) You must comply with the limitations in § 61.315, except

	certificate but not a rating for the category and class of light-sport aircraft you operate,	the endorsements required in § 61.321 for its category and class,	§ 61.315(c)(14) and, if a private pilot or higher, § 61.315(c)(7).
(2) Only a U.S. driver's license	(i) A sport pilot certificate,	(A) Any light-sport aircraft for which you hold the endorsements required for its category and class.	(I) You must hold any other endorsements required by this subpart, and comply with the limitations in § 61.315.
	(ii) At least a recreational pilot certificate with a category and class rating,	(A) Any light-sport aircraft in that category and class,	(I) You do not have to hold any of the endorsements required by this subpart, but you must comply with the limitations in § 61.315.
	(iii) At least a recreational pilot certificate but not a rating for the category and class of light-sport aircraft you operate,	(A) That light-sport aircraft, only if you hold the endorsements required in § 61.321 for its category and class,	(I) You must comply with the limitations in § 61.315, except § 61.315(c)(14) and, if a private pilot or higher, § 61.315(c)(7).

Section 61.315 prescribes, in pertinent part, that:

(a) If you hold a sport pilot certificate you may act as pilot in command of a light-sport aircraft, except as specified in paragraph (c) of this section.

Section 61.411 prescribes in pertinent part, that:

“Use the following table to determine the experience you must have for each aircraft category and class:”

If you are applying for a flight instructor certificate with a sport pilot rating for . . .	Then you must log at least . . .	Which must include at least . . .
(a) Airplane category and single-engine class privileges,	(1) 150 hours of flight time as a pilot,	(i) 100 hours of flight time as pilot in command in powered aircraft, (ii) 50 hours of flight time in a single-engine airplane, (iii) 25 hours of cross-country flight time, (iv) 10 hours of cross-country flight time in a single-engine airplane, and (v) 15 hours of flight time as pilot in command in a single-engine airplane that is

		a light-sport aircraft.
--	--	-------------------------

Section 61.415 states in pertinent part, that:

If you hold a flight instructor certificate with a sport pilot rating, you may only provide flight training in a light-sport aircraft and are subject to the following limits:

- (a) You may not provide ground or flight training in any aircraft for which you do not hold:
 - (1) A sport pilot certificate with applicable category and class privileges or a pilot certificate with the applicable category and class rating; and
 - (2) Applicable category and class privileges for your flight instructor certificate with a sport pilot rating.

Section 61.429 states in pertinent part, that:

If you hold a flight instructor certificate, a commercial pilot certificate with an airship rating, or a commercial pilot certificate with a balloon rating issued under this part, and you seek to exercise the privileges of a flight instructor certificate with a sport pilot rating, you may do so without any further showing of proficiency, subject to the following limits:

- (b) You must comply with the limits specified in § 61.415 and the recordkeeping requirements of § 61.423.

Section 65.107 states in pertinent part, that:

(b) The holder of a repairman certificate (light-sport aircraft) with an inspection rating may perform the annual condition inspection on a light-sport aircraft:

- (1) That is owned by the holder;
 - (2) That has been issued an experimental certificate for operating a light-sport aircraft under § 21.191(i) of this chapter; and
 - (3) That is in the same class of light-sport-aircraft for which the holder has completed the training specified in paragraph (a)(2)(ii) of this section.
- (c) The holder of a repairman certificate (light-sport aircraft) with a maintenance rating may—
- (1) Approve and return to service an aircraft that has been issued a special airworthiness certificate in the light-sport category under § 21.190 of this chapter, or any part thereof, after performing or inspecting maintenance (to include the annual condition inspection and the 100-hour inspection required by § 91.327 of this chapter), preventive maintenance, or an alteration (excluding a major repair or a major alteration on a product produced under an FAA approval);
 - (2) Perform the annual condition inspection on a light-sport aircraft that has been issued an experimental certificate for operating a light-sport aircraft under § 21.191(i) of this chapter; and

(3) Only perform maintenance, preventive maintenance, and an alteration on a light-sport aircraft that is in the same class of light-sport aircraft for which the holder has completed the training specified in paragraph (a)(3)(ii) of this section. Before performing a major repair, the holder must complete additional training acceptable to the FAA and appropriate to the repair performed.

The petitioner supports its request with the following information:

The petitioner states for the past eight years Terrafugia has been developing the Transition® street-legal airplane for the Light-Sport Aircraft (LSA) market. The petitioner states the Transition® incorporates a large number of features not required for a typical LSA, but which are designed to provide substantial safety benefits and satisfy applicable Federal Motor Vehicle Safety Standards (FMVSS). The petitioner states these safety features add a significant amount of weight to the aircraft, causing the Transition® to be heavier than the regulatory weight limits for an LSA.

In 2010, in consideration of some of these safety features, the FAA granted a weight allowance of 110 pounds for the Transition® to use the 1,430-pound weight limit for LSA intended for operation on water, instead of the 1,320-pound weight limit for LSA not intended for operation on water (Exemption No. 10072). In its latest petition, Terrafugia states its engineering team has made its best effort to refine the design of the aircraft's safety systems to fit within the extra weight permitted by the exemption, but it was not sufficient to achieve the desired level of safety. Therefore, Terrafugia is requesting an exemption for the Transition® to permit the aircraft to be certificated, operated, and maintained under the regulations applicable to LSA at a higher MTOW and with an increased stall speed.

The petitioner states the primary need for the additional weight in excess of that specified in the regulations for an LSA is the incorporation of systems and structures necessary for safe road use in general and crashworthiness in particular. In order to be roadworthy, the Transition® has been designed to comply with a number of the FMVSS, most notably those standards applicable to frontal impact crash scenarios. The petitioner notes that the occupant protection features incorporated into the Transition® to meet these FMVSS-based crash scenarios, incur substantial weight penalties over the structure typically found in an LSA. However, the petitioner notes that these features may provide an additional level of safety when evaluating the aircraft's crashworthiness.

The petitioner submitted the following information indicating those design changes necessary to meet the applicable FMVSS and the corresponding weight penalties incurred to meet those standards:

Basic LSA Weight Definition	1,320 lbs.
Safety Feature	Weight Penalty
Occupant Protection – Structural	

Survivable Volume	44 lbs.
Energy Absorption	25 lbs.
Total Structural Components	69 lbs.
Occupant Protection – Non-Structural	
Seat Belt System	13 lbs.
Knee Bolsters	10 lbs.
Door Retention and Functionality	13 lbs.
Seats and Headrests	10 lbs.
Head Impact Protection	6 lbs.
Total Occupant Protection Systems	52 lbs.
Roadability Systems	
Fuel Measurement & Containment	8 lbs.
Ground Handling (Steering, Suspension, & Braking)	150 lbs.
Ground Drive System	84 lbs.
Ground Visibility	24 lbs.
Total Roadability Systems	266 lbs.
Enhanced Flight Safety	
Ballistic Recovery System	36 lbs.
Total Enhanced Flight Safety	36 lbs.
Total Weight Penalty	
	423 lbs.
Contingency (weights shown are estimates)	57 lbs.
Requested Maximum Takeoff Weight	1,800 lbs.

The petitioner states that additional weight required to meet FMVSS also compels it to petition for an increase in allowable stall speed. Due to the dimensional constraints of road use (e.g., lane width, parking space size, garage height, etc.), Terrafugia notes that it is not feasible to increase the wing span or wing area of the aircraft to proportionally keep stall speed constant as its weight has increased. Based on a spectrum of pilot experience, Terrafugia indicates that the necessary stall speed increase will not affect the underlying safety intent that an LSA be easy-to-fly.

The petitioner states one of the key safety benefits the Transition® provides is that a pilot will no longer be tempted to fly into marginal conditions for fear of being stranded by poor weather. Instead, pilots of the Transition ® will be able to land at the nearest airport and drive safely to their destinations. However, to realize this additional utility, the petitioner notes that the Transition® must be designed to meet minimum safety standards for road use, including several of the FMVSS pertaining to Multi-Purpose Passenger Vehicles. The petitioner asserts that this need drives a level of crash safety and occupant protection unmatched in other light aircraft through the incorporation of energy absorption features, maintenance of a survivable cabin volume, and the use of proven occupant restraint technology.

The petitioner states that allowing the Transition® to come to market certified in the light-sport category is in the public interest. Terrafugia asserts that both short and long term benefits result from granting its petition and that these diverse benefits would enhance General Aviation (GA) utility and safety, provide economic benefit to the United States; foster Science, Technology, Engineering, and Mathematics (STEM) education and inspiration, and establish a key first step in the advancement of the value of personal aviation to the people of the United States by addressing the largest barriers to the more widespread use of GA for transportation. According to Terrafugia, the Transition® will serve as an example to the GA industry of what can be accomplished with the incorporation of crashworthiness features into light aircraft. Terrafugia further notes that field experience gained with the Transition® will also help drive future improvements in crashworthiness both for later models of the Transition®, other products developed by Terrafugia, and similar vehicles developed by others.

The petitioner states that on average, a U.S. commuter spends 54 minutes in traffic each day, travelling at an average speed of 17 mph. It further notes that 8 percent of commuters travel longer than 60 minutes one way. Combined with the number and earnings of full-time wage and salary workers in the U.S., this represents over \$650 billion in lost productivity annually. Beyond the monetary cost of commuting, Terrafugia notes that a host of health and emotional problems also result from long commutes including obesity, stress, divorce, and insomnia. The petitioner states that development of the Transition® is a key step toward a transportation future that utilizes personal aviation more and automotive commuting less.

The petitioner states the Transition® was designed from the start to be an easy-to-fly aircraft – in the spirit of the sport pilot/light-sport aircraft rule. Terrafugia states that the aircraft has a high stability margin, good stall warning characteristics, and significant stall margin during takeoff and landing maneuvers. The conversion of the Transition® from an airplane to a car does not add complexity to its operations as an airplane (or as a car). The conversion mechanism is automated and operated from inside the cockpit: the pilot does not need to perform any mechanical operations to convert the aircraft from a vehicle capable of flying to driving or vice versa.

The petitioner concludes that granting this exemption is in accord with the original spirit of light-sport rulemaking and serves safety, the GA industry, and the public good.

Summary of Comments Received:

A summary of the petition was published in the Federal Register on December 30, 2014 (79 FR 78554). The FAA received and considered 286 comments submitted during and shortly after the comment period. Of the submissions, 270 commenters were in favor of the petition submitted by Terrafugia and 16 commenters were in opposition to Terrafugia's petition.

The 270 commenters in favor of the petition support granting Terrafugia's request for an increased MTOW and stall speed for its Transition® design. A total of 182 of these commenters support Terrafugia's petition based upon: (1) their confidence in Terrafugia's abilities and an interest in the company's success, (2) their desire for innovation, (3) the need for change in general aviation, (4) advancement in technology, (5) favorable support for dual-purpose vehicles, (6) inclusion of automotive occupant safety in airplanes, (7) breaking the boundaries of arbitrary regulations, (8) wanting the U.S. to lead the way into the future of transportation, and (9) keeping the regulatory system from stifling ingenuity. A total of 66 commenters specifically support the increase in MTOW and stall speed because the aircraft: (1) is a unique design subject to both the FAA and the National Highway Traffic Safety Administration (NHTSA) regulations, (2) incorporates modern crashworthiness technology, (3) will foster growth in the general aviation industry, and (4) will spur innovation in the development of dual-purpose vehicles that will increase safety in transportation. A number of commenters also asserted that the Terrafugia Transition® design meets the original "intent" and "spirit" of the LSA regulations which some consider to be unnecessarily limiting. Sixteen commenters support the petition, but also make a case for consideration of additional rules or rule changes to accommodate a special roadable category and class of aircraft to better define requirements for the Transition® and other similar designs. Three commenters recommended not only that the petitioner's request be granted but also that the requested relief of an increased MTOW be applied to all LSA. One commenter suggests there could be special training requirements established to operate the Transition®. One commenter supports the petition pending FAA testing to verify the aircraft's handling and performance. Another commenter requests consideration of a more affordable Transition®.

The 16 commenters in opposition to Terrafugia's petition are concerned the Transition® design may not meet the clearly stated requirements of the LSA definition. Nine commenters believe that Terrafugia should either meet the certification requirements of the current LSA regulations or meet other appropriate certification regulations. Several commenters point out that the LSA regulations were established for the specific purposes of addressing the certification of "light" aircraft, allowing the use of simplified certification standards, certifying pilots with a minimum level of flying experience, and fostering the introduction of lower cost of aircraft. Three commenters suggest that the Transition® could pose safety issues for sport pilots because of its unique flight characteristics, including its higher stall speed. Two commenters are opposed to the increase in weight and stall speed for the Transition® unless these same increases are allowed for all LSA designs, further indicating support for a change to the definition of LSA. One commenter suggests the petitioner develop a design change to eliminate the need for a higher stall speed while another commenter suggests that the Transition® be certificated as a different class of aircraft.

Additional Information Provided by Terrafugia at the FAA's Request:

At the FAA's request, on July 31, 2015, Terrafugia provided the following additional documents in support of the FAA's analysis of Terrafugia's petition:

1. *Maintenance of the Transition® Light Sport Aircraft*: which includes Terrafugia's answers to many frequently asked questions about the maintenance of the Transition®. Terrafugia notes that this document clarifies that while the Transition® is capable of both being flown and driven, it is primarily an LSA airplane from a maintenance perspective.
2. *LSA Airplane Accidents: Transition® Improvements to Safety*: which the petitioner uses to quantify the safety benefits of the Transition and support its claim that the Transition® could achieve a much higher level of safety than that found in Light Sport Aviation today.

Copies of these documents have been placed in the docket.

The FAA's analysis is as follows:

Background

The *Aircraft Certification Service (AIR) Strategic Plan for Light-Sport Aircraft* sets forth AIR's strategy for the continued support of the special light-sport aircraft (SLSA) segment of the general aviation community and the continued safe integration of SLSA operations. This document reflects the objectives and goals of *Aircraft Certification Service AIR: 2018* and outlines tactical methods for achieving these objectives with safety as a first priority.

One of the objectives identified in the strategic plan for LSA is "innovation." This objective was established to enable and facilitate innovation in recreational aviation and encompasses the development of safety enhancing, energy efficient, and environmentally responsible products. The implementation strategy for achieving this objective is for the FAA to:

- (1) Support development of design standards for emerging SLSA concepts.
- (2) Consider rulemaking to acknowledge the unique needs of emerging SLSA designs.
- (3) Develop policy to support emerging vehicle technologies, addressing the relationship between ASTM standards and other transportation authority requirements that may be applicable to these concepts.
- (4) Explain processes to industry that may allow companies to introduce new and innovative technology or new designs in LSA, and how they may eventually pursue FAA design certification, if desired.

Accordingly, fostering the development of roadable SLSA is in accordance with the FAA's stated strategic goals. Another objective identified in the strategic plan for LSA addresses the "regulatory future" of these aircraft. This objective was established to provide an appropriate, competitive, and fair regulatory structure to allow SLSA to maintain FAA safety goals, accommodate innovation, and continue international leadership and harmonization. The FAA's implementation strategy for this objective is as follows:

- (1) Actively plan for the future of SLSA to determine what boundaries we need to maintain regarding the type of aircraft that could be included as future SLSA.
- (2) Review current LSA rules and identify any needed changes and/or additional rulemaking to allow SLSA to maintain FAA safety goals.
- (3) Continue to identify appropriate changes to regulations, policy, and consensus standards to allow continuous improvement of the light-sport program.

The FAA strives to achieve the safety goals set forth in these implementation strategies and follows a philosophy that reflects the safety continuum. The FAA recognizes the public expects progressively higher levels of safety assurance as aircraft complexity, passenger carrying capability, performance, and operational usage advance from recreational aviation, through small type-certificated aircraft, and up to large aircraft used for air carrier service and other uses. The FAA establishes safety standards consistent with this continuum by evaluating the appropriate level of safety and acceptable level of risk for each segment of GA. The anticipated operation of the aircraft plays a major role in establishing this continuum and in setting appropriate safety standards.

Within the SLSA segment of the safety continuum, the FAA has designed its rules to establish appropriate regulatory standards to permit individuals to safely operate aircraft for the purpose of sport and recreation. The FAA agrees with commenters to this petition that recognize SLSA regulations were meant for the operation of simple “light” aircraft with simplified certification standards by pilots with a minimum level of flying experience at lower cost. The FAA notes that the MTOW limits specified for LSA in 14 CFR 1.1 accounted for the inclusion of certain features in those aircraft that can provide an additional safety benefit, such as ballistic parachute recovery systems and other safety enhancing features. The typical weight of these features was considered in establishing a final MTOW for LSA that was greater than proposed in the original Notice of Proposed Rulemaking (NPRM), *Certification of Aircraft and Airmen for the Operation of Light-Sport Aircraft* (67 FR 5268; February 5, 2002). The FAA believes it has achieved an acceptable balance between enabling innovation and regulating safety in the regulations governing the certification and operation of LSA.

While the LSA regulations do not prevent the introduction of occupant protection features, the FAA notes that it did not consider the additional weight required for FMVSS-based occupant protection technology and systems necessary for road use when establishing the MTOW and minimum stall speed for LSA. The FAA, however, believes that incorporation of FMVSS-based occupant protection standards will provide a safety benefit over other SLSA, since FAA accepted SLSA standards do not specify specific crash scenarios, or applicable occupant survival criteria that must be met other than requiring basic occupant restraints in the aircraft. The FAA notes that the Transition® introduces frontal crash design features to meet the FMVSS standards for a 30 mph frontal crash, which translate into to a forward deceleration of over 30 g's, vs. the typical 9 g forward deceleration requirements for aviation restraint systems set forth in ASTM International Standard F2245.

Analysis

The FAA has reviewed Terrafugia's request for an exemption to allow its Transition® to be certificated under the regulations applicable to SLSA while incorporating FMVSS-based occupant protection features and roadability systems at an MTOW of 1,800 pounds and a maximum stall speed (V_{S1}) of 54 knots CAS at the aircraft's maximum certificated takeoff weight and most critical center of gravity. The FAA considers Terrafugia's petition significantly different from other petitions for relief from certification standards as the Transition aircraft is a unique design that must simultaneously meet both ASTM standards for LSA and FMVSS.

The FAA considered a number of factors while conducting its review to determine whether granting the petitioner's request would be in the public interest and whether the requested relief would provide a level of safety at least equal to that provided by the rules or not adversely affect safety. In considering these factors, the FAA also specifically considered its strategic goal to reduce fatal GA accidents by making them more survivable, its strategic plan to encourage the development of standards for roadable LSA designs, the well-established safety continuum, the agency's changing approach to regulatory oversight of small type-certificated airplanes and SLSA, comments received from the public, and the agency's own research.

The FAA has specifically denied previous petitions for exemption from the certification provisions for SLSA, where the petitioner requested relief from meeting the MTOW parameter specified in the definition of LSA in § 1.1 for operational considerations in those instances where the aircraft design did not incorporate unique and distinguishable design or operational features. However, the FAA has previously granted exemptions to certificate and operate "roadable" SLSA. Exemptions have been granted for SLSA certification of the "prototype" design of the Terrafugia Transition® (see Exemption No. 10072), and SLSA certification of the ITEC Maverick powered parachute (see exemption No. 10299). In both instances the aircraft exceeded the MTOW specified in § 1.1 for LSA not intended for operation on water, due to the incorporation of ground drive systems and equipment required by other regulatory agencies. This petition clearly requests similar relief. Although the FAA originally intended to limit the scope of this relief to permitting a MTOW of 1,430 pounds, a review of the aircraft's more mature design indicates that such a limitation was neither technically feasible nor warranted by any specific safety consideration.

The petitioner states that the Transition® incorporates a large number of features not required for a typical SLSA, but which are designed to provide substantial safety benefits. Additionally, the Transition includes features such as an Angle of Attack (AOA) indicator and a ballistic recovery complete-aircraft parachute system. These safety features add a significant amount of weight to the aircraft, yet provide an enhanced level of safety for its occupants. The petitioner states that the primary reason it requires the additional weight for its aircraft design is the incorporation of systems and structure required for safe road use in general, and crashworthiness in particular. Data submitted by the petitioner indicates that accidents involving airplanes that are equipped with safety features required to meet FMVSS are more survivable than accidents in similar airplanes which are not equipped with these features. The

petitioner states this additional weight also necessitates Terrafugia's petition for an increase in allowable stall speed. The petitioner further states the dimensional constraints required for road use (e.g., lane width, parking space size, garage height, etc.) impose design limitations on the wing span of the aircraft. Accordingly it is not feasible for the petitioner to increase the wing area proportionally with the aircraft's increased weight as a means of reducing the aircraft's stall speed. The added weight and increased stall speed are therefore directly attributable to the specific design constraints of the vehicle for road use. The added weight and increased stall speed are a result of meeting the FMVSS-based requirements for occupant protection features and for public road use.

The FAA agrees with the 182 commenters who expressed a desire for innovation, a need for change in general aviation, advancement in technology, support for dual-purpose vehicles, inclusion of automotive occupant safety features in airplanes, breaking the boundaries found in current regulations, wanting the U.S. to lead the way into the future of transportation, and keeping the regulatory system from stifling ingenuity.

Additionally, the FAA agrees with the 66 commenters who support the increase in MTOW and stall speed based on: the need for the unique aircraft design to meet both FAA and NHTSA regulations; the benefits of including crashworthiness technology that provides a level of safety in excess of that mandated for SLSA; Congressional mandates to foster growth in the general aviation industry, and the need to foster innovation in the development of a dual-purpose vehicle with occupant safety enhancements.

The FAA will continue to evaluate the 16 comments in support of the petition which request that the agency consider additional rules or rule changes that would accommodate a special category or class of roadable aircraft to better accommodate the Transition® and other similar designs. Three commenters suggest that the relief requested by the petitioner be applied to all LSA. However, such recommendations are also more appropriately the subject of petitions for rulemaking action.

The FAA disagrees with the commenters in opposition to Terrafugia's petition because of concerns with the Transition® design not meeting the parameters of the LSA definition. In establishing the LSA definition, the FAA sought to ensure that LSA flight characteristics are consistent with the skills and training of the sport pilot. In issuing the sport pilot/LSA rule, the FAA believed that pilots operating an aircraft with an MTOW that exceeds that established by the rule should hold at least a private or recreational pilot's certificate. However, the FAA has concluded that granting relief for an aircraft with an MTOW of 1,800 pounds and a maximum stall speed (V_{S1}) of 54 knots for the Transition®, by taking into account its crashworthiness, will provide a level of safety equivalent to that of an SLSA aircraft without these features. Accordingly, subject to verification in accordance with the conditions imposed by this exemption, the FAA believes that this determination supports a finding that these aircraft can be operated by persons exercising the privileges of a sport pilot and that flight instruction in these aircraft can be provided by flight instructors with a sport pilot rating.

One commenter suggests that there could be special training requirements established to operate the Transition®. One commenter supports the petition pending FAA testing. One commenter requests consideration of a more affordable Transition®. These comments, however, do not provide any specific substantiation for or against the Transition® to be certificated, operated, and maintained under the regulations applicable to aircraft issued a special airworthiness certificate in the light-sport category, while operating with an MTOW of 1,800 pounds and a maximum stall speed (V_{S1}) of 54 knots. The FAA may consider evaluating the performance and handling of the Transition® to verify that it is compatible with the skills of a person exercising sport pilot privileges.

The FAA has also determined that maintenance and preventive maintenance can be performed on the Transition® by persons who are authorized to perform such actions on aircraft that meet the definition of an LSA. The FAA has determined that the incorporation of FMVSS-based occupant protection and other “roadable” features included as part of the design and performance of the Transition® do not add complexity to the maintenance and inspection aspects of the aircraft for repairmen or sport pilots beyond that of other aircraft issued a special airworthiness certificate in the light-sport category.

The FAA’s Decision:

In consideration of the foregoing, I find that a grant of exemption would be in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. §§ 40113 and 44701, delegated to me by the Administrator, the petition of Terrafugia, Incorporated for an exemption from 14 CFR §§ 21.181(a)(3)(i) and 21.190(a) to the extent necessary to allow the Terrafugia Transition® aircraft with an MTOW of 1,800 pounds and a maximum stall speed (V_{S1}) of 54 knots calibrated airspeed (CAS) at the aircraft’s maximum certificated takeoff weight and most critical center of gravity to be eligible for issuance of a special airworthiness certificate in the light-sport category. Terrafugia is also granted an exemption from 14 CFR §§ 61.89(c)(1), 61.303(a), and 61.315(a) on behalf of persons exercising the privileges of a sport pilot certificate or student pilots seeking a sport pilot certificate to permit those persons to operate the Terrafugia Transition® and to permit flight time obtained in the Terrafugia Transition® to be considered flight time obtained in a light-sport aircraft. Terrafugia is also granted an exemption from 14 CFR §§ 61.411(a), 61.415, and 61.429(b) on behalf of persons exercising the privileges of a flight instructor certificate with a sport pilot rating to permit those persons to provide flight training in the Terrafugia Transition®. Additionally, Terrafugia is granted an exemption from 14 CFR §§ 43.3(c), 43.7(g) and 65.107(b) and (c) on behalf of holders of sport pilot certificates and repairman certificates (light-sport aircraft) with a maintenance rating or an inspection rating to permit those persons to perform maintenance and preventive maintenance on Terrafugia Transition® aircraft as authorized within those sections. All of these grants are subject to the conditions and limitations listed below. The FAA has determined that an exemption from 14 CFR §§ 21.175, 21.182, 21.191, 21.193, 43.1, 61.1, 61.23, 61.31, 61.45, 61.113, 61.305, 61.317, 61.403, 61.405, 61.417, 61.419, and 61.423 is not necessary to provide the relief requested. The FAA has also determined that an exemption from 14 CFR §§ 61.321, 61.325, and 61.327 is not

necessary; however, the FAA has included compliance with the provisions of those sections for certain persons as conditions and limitations of this exemption.

Conditions and Limitations

1. This exemption applies only to the Terrafugia Transition® aircraft while incorporating FMVSS-based occupant protection features and roadability systems as described in the conditions and limitations specified in this exemption.
2. Terrafugia must supply each purchaser of a Transition® certificated under the provisions of this exemption with a copy of the exemption. A copy of this exemption must be carried on board each aircraft during its operation.
3. Terrafugia may issue the manufacturer's statement of compliance required by 14 CFR § 21.190(b)(1)(iii) for its Transition® aircraft indicating a maximum takeoff weight (MTOW) up to and including 1,800 pounds and a maximum stall speed (V_{S1}) up to and including 54 knots calibrated airspeed (CAS) at the aircraft's maximum certificated takeoff weight and most critical center of gravity, provided the aircraft meets all applicable requirements of 14 CFR § 21.190 and the conditions and limitations specified in this exemption.
4. The manufacturer's statement of compliance required by 14 CFR § 21.190(b)(1)(iii) must:
 - (a) State that the aircraft meets the provisions of the applicable consensus standards and the design requirements specified in these conditions and limitations.
 - (b) State that the aircraft is in compliance with either the latest FAA-accepted revision of ASTM International Standard F2245 that incorporates an appendix addressing the certification of "roadable" light-sport aircraft or a previous version of that standard, if permitted under the Notice of Acceptance for the latest standard.
 - (c) State that the following safety design features have been incorporated into the aircraft:
 - (1) Features to meet FMVSS requirements for occupant protection to include:
 - a. Energy absorbing crush structures, which include a "safety cage" chassis design with bumpers and crush rails.
 - b. Occupant protection devices which include self-tensioning/load-limiting seatbelts, knee bolsters, door retention features, seats, headrests, and head impact protection.
 - (2) Roadability systems for:
 - a. Fuel measurement and containment.

- b. Ground handling, to include steering, suspension, and braking.
 - c. Ground driving.
 - d. Ground visibility.
- (3) An AOA indicator that includes an indication of sensed AOA rate, allowing the pilot to identify margin above stall.
- (4) A ballistic recovery complete-aircraft parachute system in compliance with the latest FAA-accepted revision of ASTM International Standard F2316 or a previous version of that standard, if permitted under the Notice of Acceptance for the latest standard.
5. Prior to issuance of a special airworthiness certificate in the light-sport category for the first Terrafugia Transition® certificated under the provisions of this exemption, the FAA must complete an audit of Terrafugia's facilities and find that Terrafugia can produce the Transition® aircraft in accordance with applicable regulations, consensus standards, and the conditions and limitations set forth in this exemption.
6. Prior to issuance of a special airworthiness certificate in the light-sport category for the first Terrafugia Transition® certificated under the provisions of this exemption, the FAA must complete an inspection of the first make/model Transition® aircraft and find that the Transition® aircraft meets the provisions of all applicable regulations, consensus standards, and the conditions and limitations set forth in this exemption.
7. Any person who holds a sport pilot certificate who does not have airplane category and single-engine land class privileges and seeks to obtain privileges to operate the Terrafugia Transition® aircraft must receive the logbook endorsements, successfully complete the proficiency check, and complete the application specified in 14 CFR § 61.321.
8. Any person who holds a sport pilot certificate and seeks privileges to operate the Terrafugia Transition® aircraft at an airport within, or in airspace within, Class B, C, and D airspace, or in other airspace with an airport having an operational control tower must receive and log the ground and flight training and obtain the endorsement specified in 14 CFR § 61.325.
9. Any person who holds a sport pilot certificate and seeks to operate the Terrafugia Transition® aircraft must receive and log the ground and flight training and obtain the endorsement specified in 14 CFR § 61.327(b).
10. Any person who performs maintenance or preventive maintenance on the Terrafugia Transition® aircraft under the provisions of this exemption must include a reference to this exemption in the maintenance record entry required to be made under the provisions of 14 CFR § 43.9 or 43.11, as applicable.

11. Terrafugia must maintain a record of all failures, malfunctions, or defects of the Transition® aircraft and report any failure, malfunction, or defect of the aircraft or any accident or incident involving the Transition® aircraft to the Small Airplane Directorate within 48 hours after learning of the occurrence.

This exemption terminates on April 30, 2021, unless sooner superseded or rescinded.

Issued in Washington, D.C., on May 12, 2016.

/s/

David Hempe

Deputy Director, Aircraft Certification Service

Project No.: AIR-15-133-E

Project Officer: Terry Chasteen
ACE-114: BMatro:9/4/15:Doc#xxxx

Dr. Carl Dietrich, Ph.D.
CEO/CTO
Terrafugia, Inc.
23 Rainin Road
Woburn, MA 01801