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The Seventh Triennial International Aircraft Fire and Cabin Safety Research Conference

*Crashdynamics Session*

Abstract for Presentation Submission:

Submitted to Ms. April Horner, [april.ctr.horner@faa.gov](mailto:april.ctr.horner@faa.gov)

Submitted by Anna Mracek Dietrich, Chief Operating Officer, Terrafugia Inc, [anna@terrafugia.com](mailto:anna@terrafugia.com)

June 1, 2013

Dear Ms. Horner:

The following abstract is being submitted per the suggestion of Mr. Joseph Pelletiere, Chief Scientific and Technical Advisor, Crash Dynamics, FAA Aviation Safety, who saw me present this material at the May 2012 meeting of the Part 23 Aviation Rulemaking Committee in Pittsburgh, PA. We have since had several conversations about the synergies between aviation and automotive crash safety techniques and regulatory philosophies, something on which Terrafugia has a unique perspective with our Transition® roadable aircraft nearing first delivery.

If you have any questions or require any additional information, please don't hesitate to contact me. I look forward to attending the conference, learning from the expertise that will be present, and sharing Terrafugia's perspective if you deem that to be of value to the event.

Best regards,

Anna Mracek Dietrich

## Abstract: A “flying car” perspective on small aircraft crash safety

Anna Mracek Dietrich, COO Terrafugia Inc.

The Transition® is a two-place light aircraft capable of folding its wings, driving on roads and highways, and parking in a single car garage. By adding roadworthiness to a personal aircraft platform, the Transition® addresses cost of ownership, solves the last mile problem, reduces door-to-door travel time, and mitigates weather sensitivity. Being able to land in the event of bad weather and continue safely on the road provides a convenient alternative to VFR into IMC. This capability also presents a unique regulatory and crash safety challenge. We have found that despite differences in crash scenarios, lessons from automotive crash safety can be effectively applied to light aircraft and potentially increase the survivability of small aircraft accidents.

The Transition® is designed to meet the Light Sport Aircraft ASTM standards, with an FAA weight exemption, and the Federal Motor Vehicle Safety Standards (FMVSS) for Multipurpose Passenger Vehicles (MPVs), with four line-item exemptions from NHTSA. In the process of designing to meet both FAA and National Highway Traffic Safety Administration (NHTSA) regulations, we have noticed that aviation and automotive regulations take different approaches to the concept of crash safety. Aircraft regulations tend to focus on crash avoidance, not crash survivability, and provide design solutions; automotive regulations address crash avoidance items such as lighting and braking, but generally assume a crash will happen, define the crash scenarios, and provide injury criteria that must not be exceeded for the occupants.

Terrafugia is combining these two approaches and has designed the Transition® with a more traditional automotive-style structure: a bumper and energy-absorbing “crumple zone” at the front of the vehicle dissipates kinetic energy while a rigid passenger “safety cage” maintains the integrity of the cockpit. Inside the cockpit, safety belts, an automotive-style airbag system, knee bolsters, smoothed dashboard and control design, and head impact foam provide occupant protection. These considerations must be taken into account from the design’s inception and result in a vehicle noticeably different from most small aircraft.

To verify the effectiveness of the design and minimize the weight impact of these safety features, Terrafugia is working with analytical leaders in the automotive industry utilizing state-of-the-art crash simulation tools such as LS-DYNA® and Madymo®. These advanced analyses are being validated through body-in-white crash testing, component testing, and material property verification.