

Advanced Finite Element Analysis for the Skyhook-Boeing HLV Aircraft

Frank A. Smith Jr.

The Boeing Company

Abstract: Boeing and Skyhook International entered into an agreement whereby Boeing will design and build two prototypes of the new Skyhook HLV aircraft. This hybrid airship is intended to carry 40 tons of cargo 100 miles. Due to the flexible, non-linear nature of fabric airship envelopes, as well as the complexity of designing a hybrid airship, the internal loads model for this aircraft is being developed in Abaqus and will be solved non-linearly. Additionally, certain key technologies within Abaqus are being used in the early stages of aircraft development to help speed up the design process and improve accuracy.

Keywords: Aircraft, airship, conceptual design, loads modeling, non-linear loads modeling, internal loads modeling.

1. Introduction

In 2007 Boeing was approached by Skyhook International to assess the concept feasibility of a 40-ton VTOL capable platform. Subsequent to the feasibility study The Boeing Company entered into an agreement to begin development of the first-of-its-kind SkyHook aircraft, which operates on neutral buoyancy principles that will revolutionize VTOL (Vertical Take Off and Landing) by using a combination of aerostatic lift and rotorcraft technologies to transport loads of up to 40 tons for up to 200 miles without refueling.

Target markets for the new aircraft include the oil and gas industry, mining industry, civil construction, and the general transport of heavy loads in remote regions of the world where conventional transportation does not exist or where building such infrastructure is difficult, costly or environmentally unfavorable. Boeing is designing and will fabricate two production SkyHook prototypes at its Rotorcraft Systems facility in Ridley Park, Pa. In November 2008, Boeing completed the “configuration freeze” phase, a major milestone, which fixes the overall performance and layout of the aircraft, including the operational range, structural and systems design, analysis and certification approach. The project team is currently in the “critical systems selection” phase, where existing equipment, components and systems are matched to the aircraft requirements.

The new aircraft will enter commercial service as soon as it is certified by Transport Canada and the U.S. Federal Aviation Administration. The first SkyHook aircraft is scheduled to fly in 2012.