

Example Airplane Pylon from the Federal Aviation Administration Handbook



## Mission Statement

The Product Development Division at Boeing hired the Olin SCOPE team to develop new concepts for the engine-wing interface, hereby referred to as the pylon, the structure which connects the engine to the wing of an aircraft. The current strut design is well optimized for current materials and processes, but the Olin Scope team's role is to propose new topologies for the strut which will take advantage of new materials and processes.

## Ideation

The team used several different methods, including independent ideation, team ideation, research, reflection on the plant visit, and focusing on stakeholders. When the team reflected on these methods, they discovered that the methods could be succinctly represented on three different axes: Blue Sky Ideation, Ownership Ideation, and Motivation Ideation.



### BLUE SKY

The Blue Sky Ideation Axis is the ideation space in which the team initially generated ideas that provided significant improvements or different directions without considering how their feasibility. The next step includes "grounding" these ideas, which means identifying methods and technologies that could be used to bring it down into reality. The team's goal was to leave the idea somewhere between those two spaces, where the idea retains its initial significance but also an implementable manufacturing process.



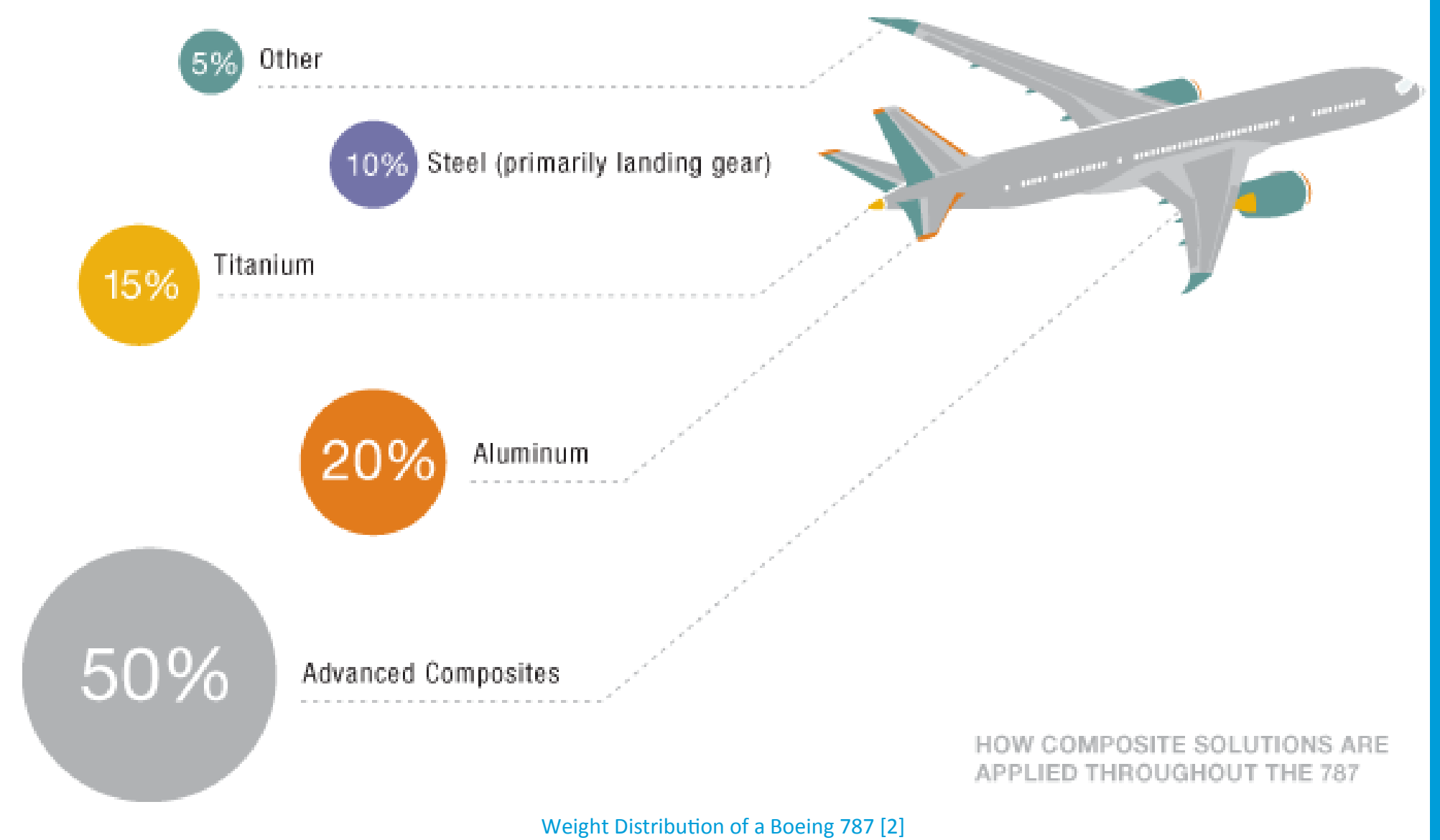
### OWNERSHIP

Ownership is the ideation space in which an idea is given to either an individual or the team to be further developed. The individual, generally more attached to the idea, is motivated to further develop a new idea, versus working as a team allows discussion over a set of ideas and allows the team to build off of each other. Naturally, sub-teams offer the advantages from both ownership types.



### MOTIVATION

The Motivation Ideation Axis is the ideation space in which concepts are initially inspired by existing technology and then developed based on the needs of the stakeholders. The team initially identified technology that currently exists and how these technologies could be applied to the pylon to add unconventional benefits to the system. The team then identified relevant stakeholders that could be affected by this change and considered their needs and values.



## Design and Simulation

Composite materials, such as carbon fiber, proved advantageous in satisfying these geometric constraints since they can be molded to fit the complex curvature prescribed by the proposed design. The team iterated through several rounds of design and optimization to develop a sensitivity analysis and determine the exact geometry of each structural element. To constrain the scope of the design space, the team decided to retain several features of the legacy design.

Structural changes were made to the pylon to take advantage of new load paths to decrease overall weight. Once the team had developed a pylon assembly that provided satisfactory performance with regards to Boeing's metrics, they investigated the quantitative and qualitative advantages of composites. This data was generated through the team's "black plastic" studies, in which they applied CFRP material properties to selective pylon components and simulated them as isotropic, ductile materials for first-pass analyses. While these assumptions oversimplify the problem by ignoring the highly directional qualities of CFRP, the team believes that the degree to which the results are superior provides a compelling outline for future investigation by Boeing and hopefully a future SCOPE team.



Current use of carbon fiber in the Boeing 787 Dreamliner fuselage [3]

**The Team** Zach del Rosario Elizabeth Fitzpatrick Jefferson Lee Mark Muraoka Gracie Sanford  
**The Liaisons** Daniel Greeley Anthony Gilbert James Lee Brett Whitmer Mohammad Heidar  
**The Advisor** Erin Byrne

**The Angel Advisors** Christopher Lee Wego Wang  
**Special Thanks** Alisha Sarang-Sieminski Tracy Tully



## SOURCES

- [1] <<http://www.boeing.com/boeing/companyoffices/aboutus/brief.page>>
- [2] <[http://www.boeing.com/commercial/aeromagazine/articles/qtr\\_4\\_06/article\\_04\\_2.html](http://www.boeing.com/commercial/aeromagazine/articles/qtr_4_06/article_04_2.html)>
- [3] Journal of Young Investigators, *The Boeing 787 Dreamliner – Designing an Aircraft for the Future*. <<http://legacy.jyi.org/features/ft.php?id=3610>>
- [4] Boeing.com and [www.newairplane.com](http://www.newairplane.com)