Invention Convention - Launch Cage Airplane Launchers
21-Tech Bridging Document

Exhibit Content Focus:
This exhibit focuses on inventing flying machines and the investigation of variables that affect flight. As visitors create, launch, and experiment with paper airplanes, they explore basics in aerodynamics and motion. There are four forces that affect an airplane or rocket in flight: **gravity** is the force pulling the object down toward the center of the earth, which is countered by **lift**, an upward force provided by the wings. **Thrust** is the force propelling the vehicle forward through the air, while **drag** is the air resistance opposing that forward force. Newton's First Law of Motion states that an object in motion will continue in motion unless acted upon by a force and, at this exhibit, experimentation with those friction forces that act upon the object is an important consideration. Trying different designs and materials for airplanes, modifying shape/size of wings, or putting ailerons in the wings of paper airplanes are all ways to explore the physics of flight.

Related Apps:

- **Name: Paper Plane Project**
  - Icon: 
  - Description: Different paper airplane models are the focus of this app, and the techniques needed to make them are presented in very easy-to-follow instructional videos.
  - Relation to Exhibit Content: Experimenting with different designs of paper airplanes is an integral part of tinkering and inventing, and visitors are awarded a better understanding of the physics involved in flight when they are given these easy-to-follow instructions for making other examples.
  - Helpful Hints: The airplane models "Interceptor," "Hawker," "Conforb," and "Stinger" involve many folds in the fuselage, or base of the airplane. They are unfortunately too thick to fit within the groove of the Launch Cage paper airplane launcher. Encourage visitors to hand launch these planes within the Cage by sticking their arms in near the wheeled launchers. Always encourage visitors to come up with their own designs, as well!

- **Name: Wind Tunnel**
  - Icon: 
  - Description: This app presents a virtual wind tunnel in which objects of one's own design may be tested and explored. Visitors may draw out shapes in the moving fluid stream and see how the moving particles are affected, or they may load preset shapes such as an airfoil or different car shapes, and visualize the aerodynamics of those objects. A variety of simulation and visualization modes adds further interest and opportunities to explore.

- Relation to Exhibit Content: This app is a vivid model of the aerodynamic forces of flight, and visualizing the effects of differently shaped objects on an airstream brings a scientific view to visitors' explorations of paper airplane and rocket designs.
- Helpful Hints: The blue triangle at the bottom left provides access to the control panel. By touching "wind tunnel" and "load" visitors may load up pre-existing examples for an easy start.

- **Name: World Record Paper Airplanes**
  - Icon: 

  - Description: Instructional videos for folding three different types of paper airplanes are included in this app. Another section, "flight school," describes elements of flight and of paper airplane design. An additional video and information promoting the world's longest flight time for a paper airplane serves as further inspiration.
  - Relation to Exhibit Content: A challenge posed by this app is to develop a paper airplane that will stay aloft for the longest time. Visitors can be inspired to modify their paper airplanes to serve that or other goals, such as flying through the hoops or toward the targets of the launch cage.
  - Helpful Hints: The airplane models "Stunt" and "Eagle" are too thick to fit within the groove of the Launch Cage paper airplane launcher. Encourage visitors to hand launch these planes within the Cage by sticking their arms in near the wheeled launchers. Always encourage visitors to come up with their own designs, as well! Three airplane models are provided for free, 12 other models are available with an in-app purchase. All of the iPads should be updated to include these models.

Other resources include several websites on paper airplane design:
http://www.10paperairplanes.com/
http://www.paperairplanes.co.uk/
http://www.funpaperairplanes.com/

There is a National Paper Airplane Contest visitors may be interested in participating:
http://teacher.scholastic.com/paperairplane/

An interesting extension is to look at unusual aircraft design, such as those by Burt Rutan. His groundbreaking designs included spacecraft, and an airplane with an asymmetric layout
http://www.scaled.com/
http://en.wikipedia.org/wiki/Burt_Rutan
http://www.air-and-space.com/Rutan.htm