

# Scenario



Damage occurs, an adaptive controller stabilizes and helps control the aircraft, and the pilots use the Emergency Landing Planner (ELP) to find the best emergency landing sites and routes



Friday, April 1, 2011



Aircraft is in cruise flight at 25,000 ft following the route displayed on the Navigation Display (right)



Primary Flight Display



Navigation Display



### The ACFS Simulator

The Advanced Concepts Flight Simulator (ACFS) is a full motion simulator capable of modeling glass cockpit twin engine transport aircraft similar to the Boeing 757/767 and Airbus A320 series. While the ACFS cannot be transported easily we can demonstrated the integration of the Emergency Landing Planner into the Flight Management System and avionics on a laptop simulator.



Friday, April 1, 2011



Failure or damage occurs: in the example below, there is a hole in the left wing, and the left aileron and flaps have failed.



The adaptive controller is compensating for the loss of lift on the left side with right aileron, right spoilers and additional nose-up elevator (in blue).



## Revised Primary Flight Display



Color bands on the Primary Flight display are updated to indicate control limitations for the damage. In this case, the aircraft must maintain a higher airspeed and has difficulty turning right.





Primary Flight Display

Navigation Display

Friday, April 1, 2011



The ELP constructs a probabilistic roadmap that includes all runways within 150 miles, and includes weather "obstacles". The ELP searches this roadmap for plans using a sophisticated model of risk that takes weather, runway and airport conditions, and the flight envelope into account





### Invoking the Emergency Page

Pilots invoke the emergency page from the Departure/Arrival page on the flight management computer. A splash page appears while the ELP is "thinking".



Friday, April 1, 2011



Results are displayed to the pilots in a series of emergency pages with options listed from lowest to highest risk. Display space is very limited.





## Airport Information



Selecting the right button for an option displays additional runway and weather information about the airport



Friday, April 1, 2011



Many options can be considered by the pilots before reaching a decision





### Selecting an Option

Selecting the left button for an option causes it to be highlighted and the route to appear on the navigation display. Note the very gentle right turn (40 mile radius) due to the difficulty of turning right.





Friday, April 1, 2011



Pilots can request an update at any time as the aircraft moves and as the control capabilities or weather change.

