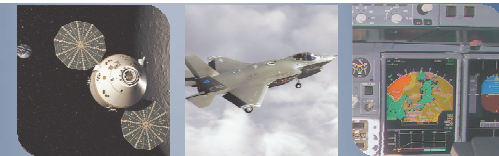


# Stateflow®

## Modeling Safety-Critical Logic with Stateflow

Prepared by: Elisabeth O'Brien

MathWorks  
Aerospace and Defence Conference '08



# Agenda

- Stateflow and Simulink®
- Why use Stateflow?
- An example
  - The requirements
  - Demo: Aircraft thrust reverser modeled with Stateflow
- Conclusion

## How does Stateflow work with Simulink?

Simulink is used to respond to **continuous** changes in dynamic systems.

Stateflow is used to respond to **instantaneous** changes in dynamic systems.



Aerodynamics  
fault detection



Propulsion system  
liftoff stages



Robot kinematics  
operation modes

## Why Stateflow

- Simulink with Stateflow is the only tool in the world that combines
  - Dynamic system simulation
  - State charts and control logic
- Intuitive graphical programming environment
- Stateflow semantics are deterministic (predictable & consistent)
- Powerful integration with verification, validation & test tools

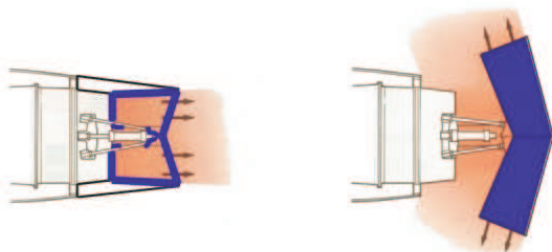
# Thrust Reversers Should not be Deployed During Flight

## Officials Say Thrust Reverser Shut Off Before Brazil Crash

- SAO PAULO, Brazil — One of the two thrust reversers on an airliner carrying 186 people that crashed in a fireball was turned off when the plane landed, the jet's owner said, as officials tried to determine why it raced down a runway instead of slowing down.

## Lauda Air B767 Accident Report SYNOPSIS

- The physical evidence at the crash site showed that the left engine thrust reverser was in the deployed position.



# Thrust Reverser Deployment Requirements

- The following requirements shall be met prior to deploying the thrust reversers:
  - Four weight on wheels sensors
    - All wheels need to be on the ground
  - Two wheel speed sensors
    - Wheels must be spinning fast enough
  - Two airspeed limit sensor
    - Plane must be traveling slow enough
  - Four throttle position sensors
    - Throttle must be in correct position

## Summary

Use Stateflow to:

- Design and simulate state machines and control logic
- Respond to instantaneous changes in dynamic systems
- Describe logic in a natural and understandable form
- Automatically generate portable C code, with the addition of Stateflow Coder™