

Airspace Management Decision Tool

*Validating the Structure & Behavior
of Software Design*

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Introduction

- ◆ World of Air Traffic Control (ATC) is a constantly changing environment
- ◆ NO COMPROMISES!!
SAFETY CRITICAL!!
- ◆ What happens during a shift change? How do controllers “inherit” situation awareness?



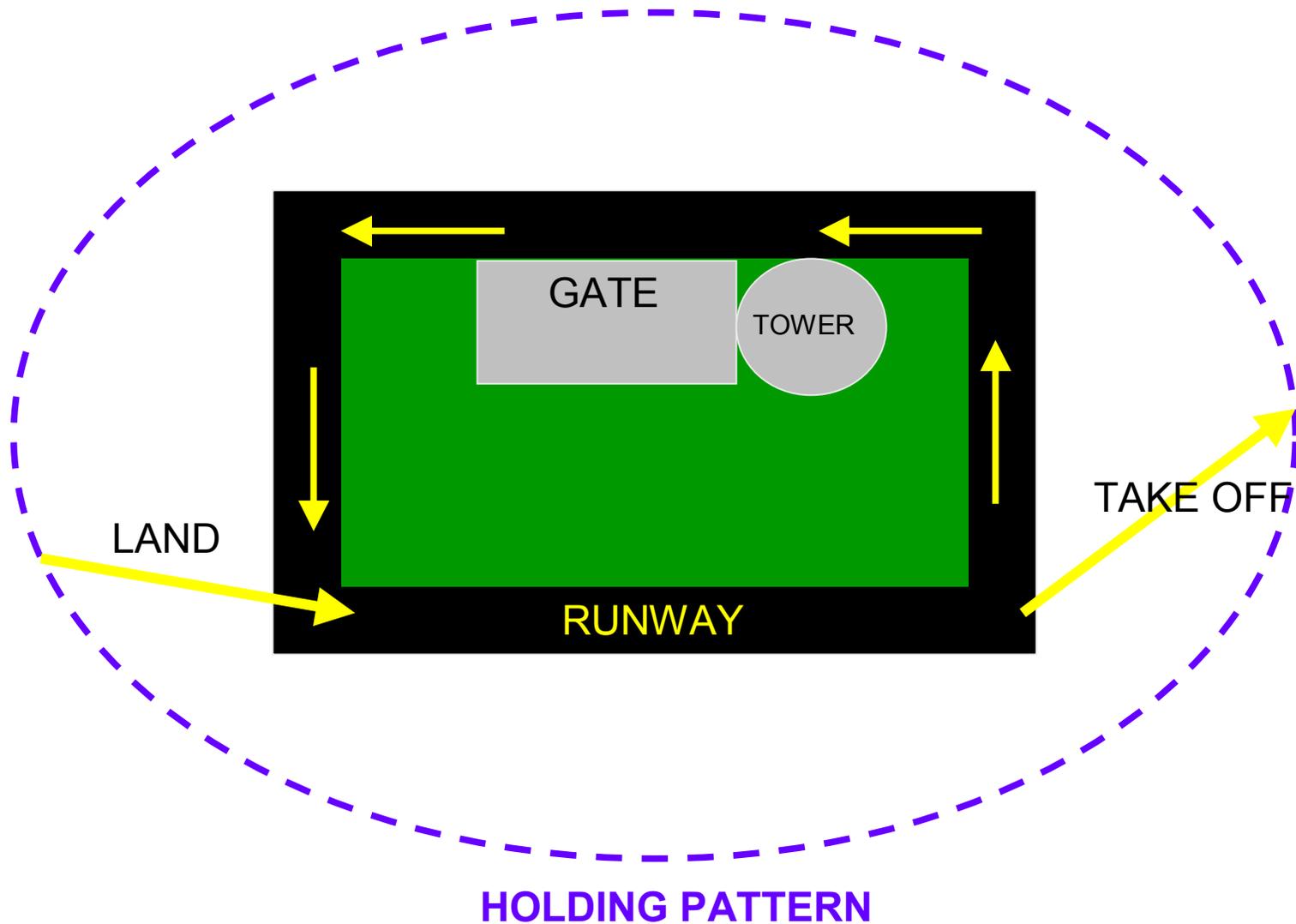
Solution

- ◆ Create a tool that models airport situations

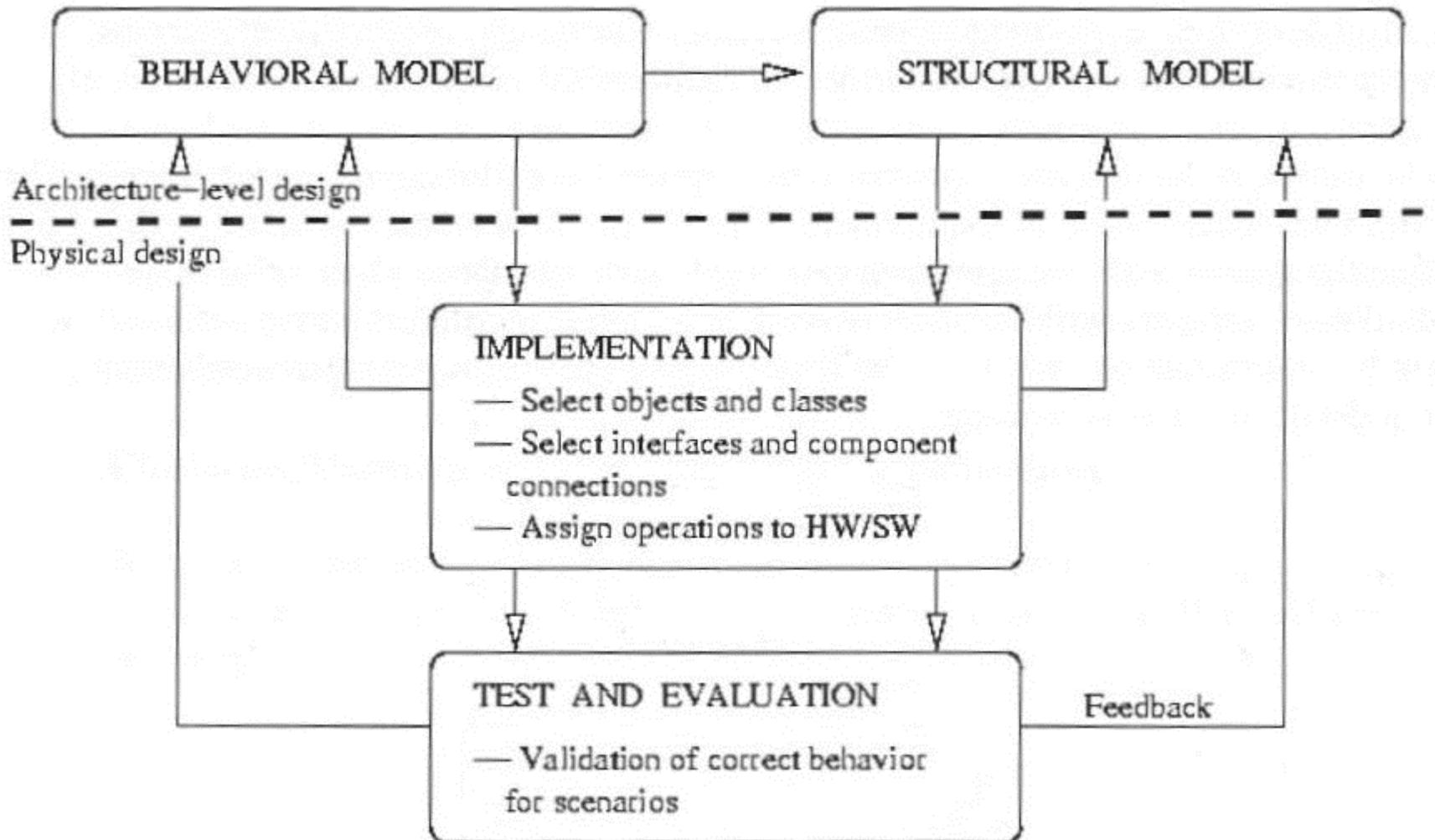
- Enable outgoing controller to enter current state
- Enable incoming controller to enter pilot requests
- Program outputs controller action and updates the current state



Airport Schematic



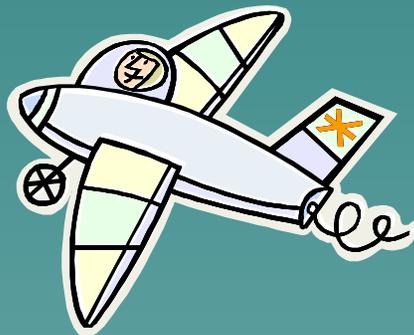
Validation of Behavioral & Structural Model



System Validation & Verification

◆ Verify:

- Program structure enables desired behavior
- System behaves as expected
- Spatial constraints are not violated
- Safety is guaranteed by the system



LTSA

- ◆ Verification tool for concurrent systems
- ◆ Models Finite State Processes as Labeled Transition Systems
- ◆ Animation feature simulates system behavior

LTSA

◆ Constraint checks:

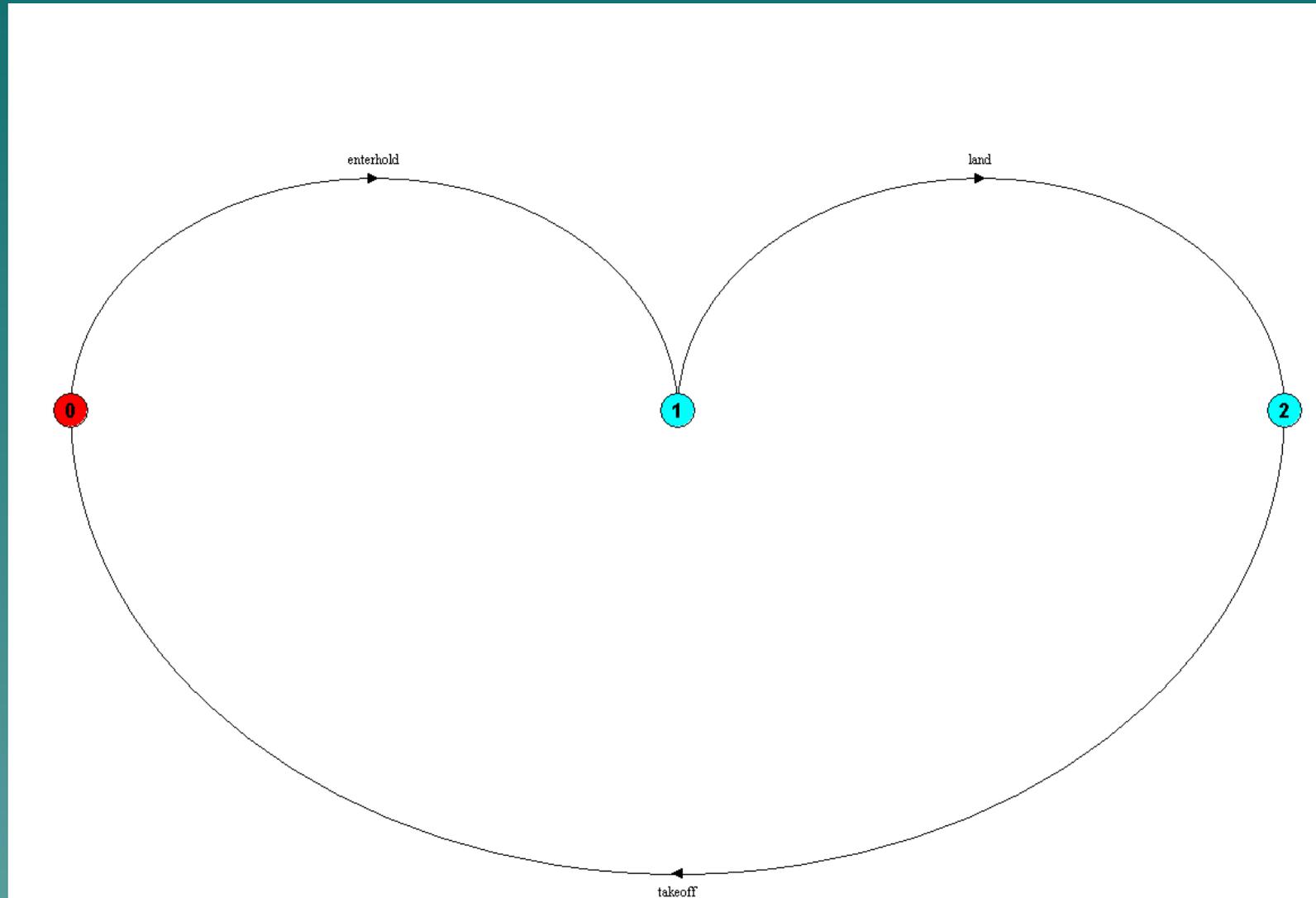
- Verify no more than one plane allowed in any position at a given time
- Verify that all aircraft progress through each airport phase in order
- Verify that controller-issued orders meet pilot-issued requests

System Validation & Verification

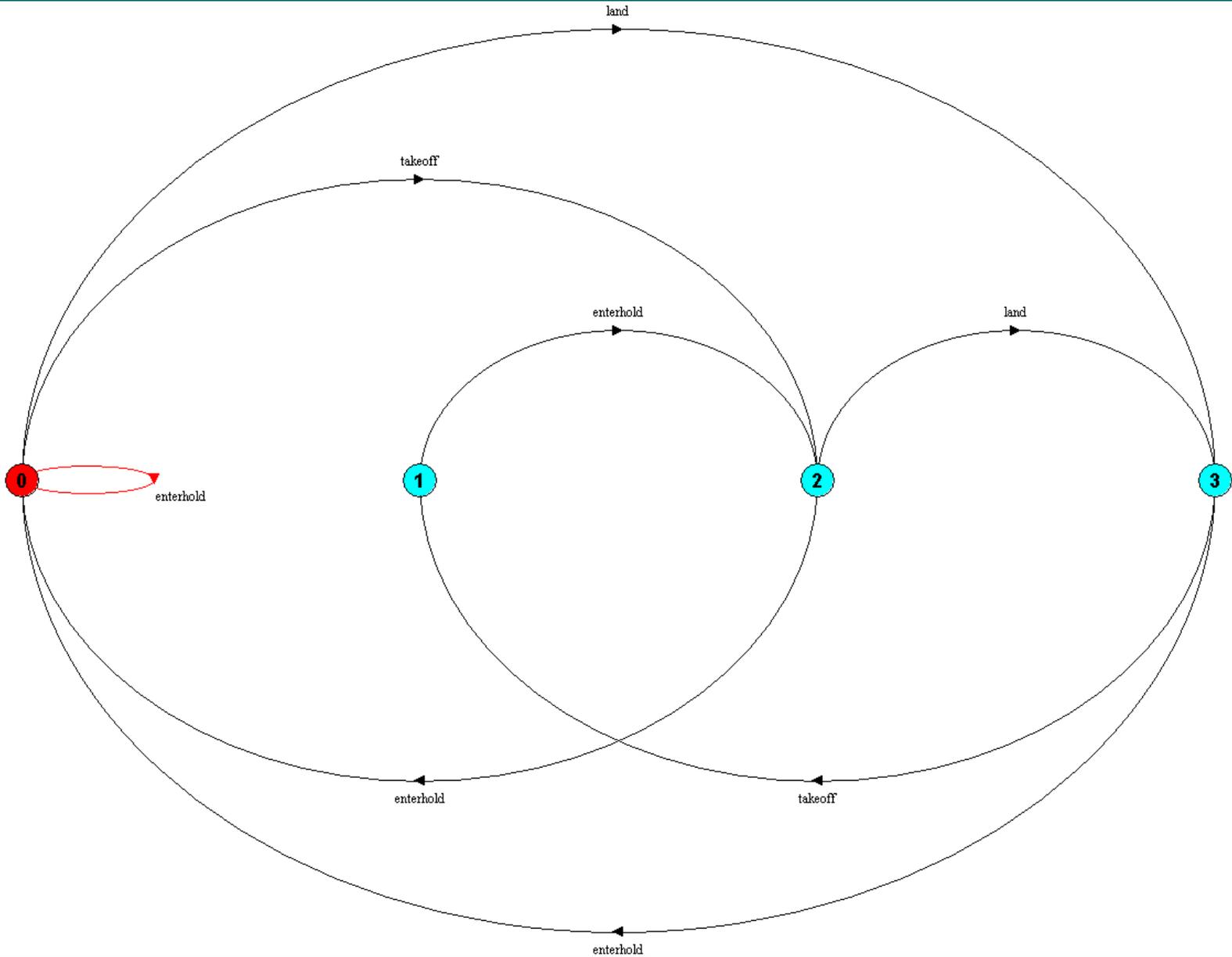
◆ Limitations

- Does not account for *human error*
- Does not cover invalid scenarios
- Does not cover validation of avionics, communications, or surveillance systems

Airport Phases



Software Behavior



Example

- ◆ Generate scenario using MATLAB code
- ◆ Use validation tables (from 642) to calculate expected outcomes
- ◆ Use LTSA animation to verify outcomes

Example - Continued

Current State	Input	New State
[1,1]	Enter Holding Pattern 'E'	[1,1]
[1,1]	Takeoff 'T'	[1,0]
[1,0]	Enter Holding Pattern 'E'	[1,1]
[1,1]	Land 'L'	[0,1]
[0,1]	Takeoff 'T'	[0,0]

Questions?

