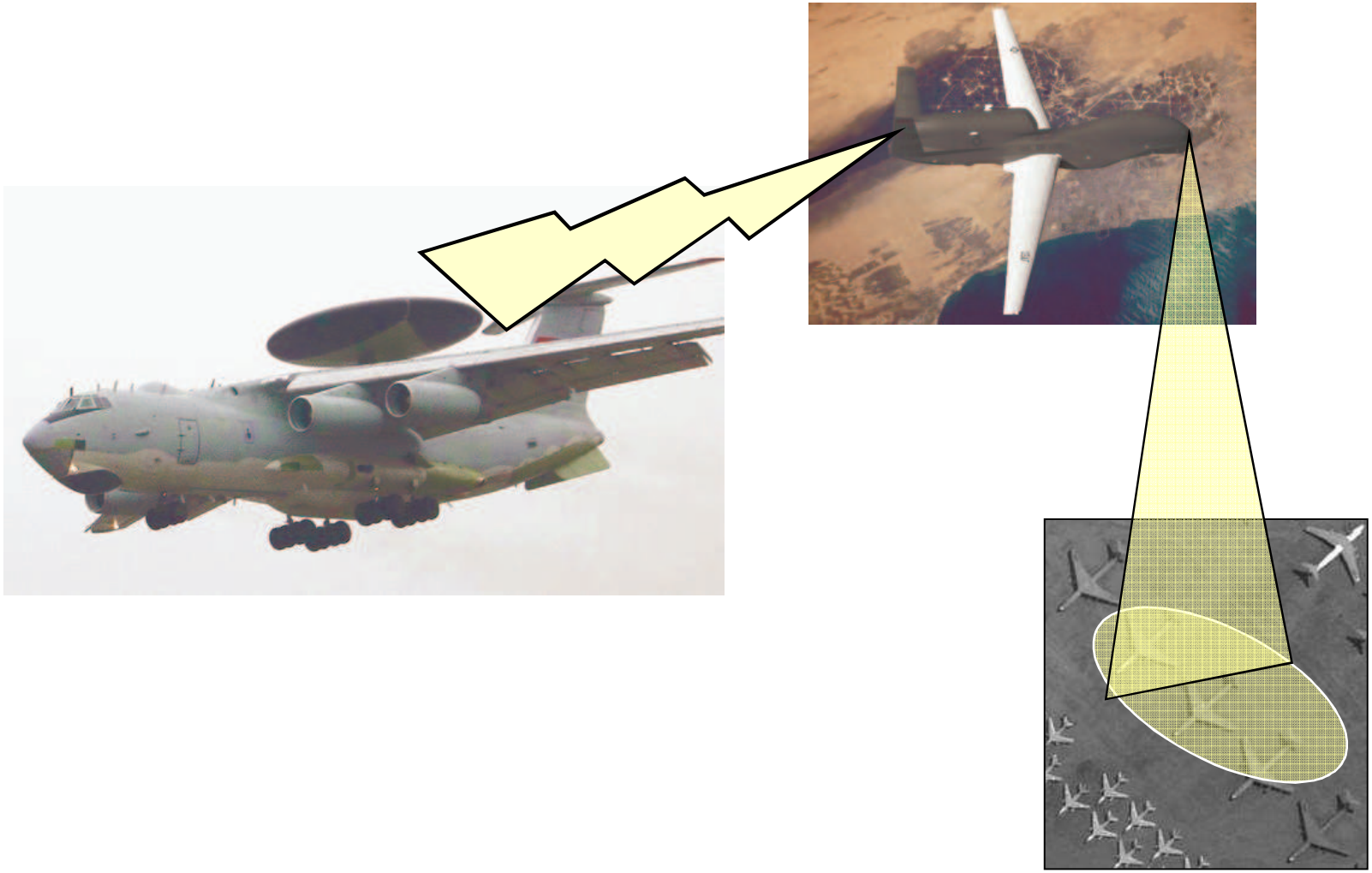
The MathWorks™ MATLAB&SIMULINK®

Developing ISR Communication Systems Using The MathWorks' Tools

Tim Reeves **Applications Engineer**

UAV-based Communications and ISR



Design Objectives

- Increase useable range of UAV from 100 km to 200 km and maintain video performance

Design Approach

- Explore different design alternatives including use of different radio implementations and / or different antenna selections.

System Design Challenges

- Multiple design disciplines
  - Mechanical modeling
  - Communication System modeling
  - Video and Image Processing modeling
- Design Groups working at different locations
  - Work in different facilities / different time zones
- What will happen during the final integration stage?

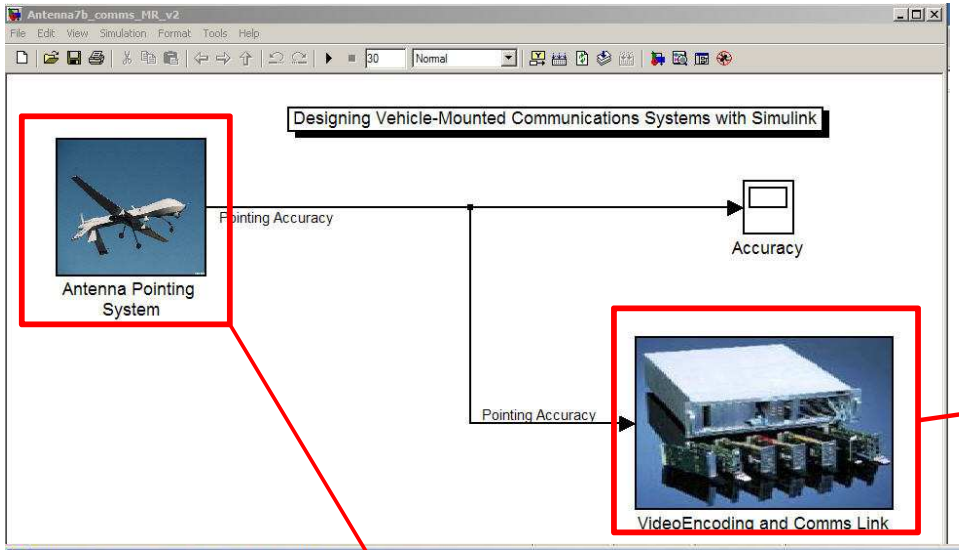
Required System Design Capabilities

- Single Design Environment supporting multiple design disciplines
  - Libraries of pre-built blocks that cover mechanical, communications and video processing design domains
- Continuous Design Verification
  - Single design environment that can be used so as to validate the design at each stage of the design process
- Model Sharing
  - Be able to share models between different teams and locations

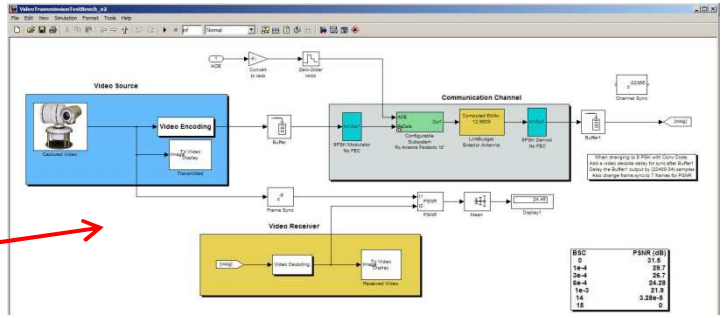
External Factors

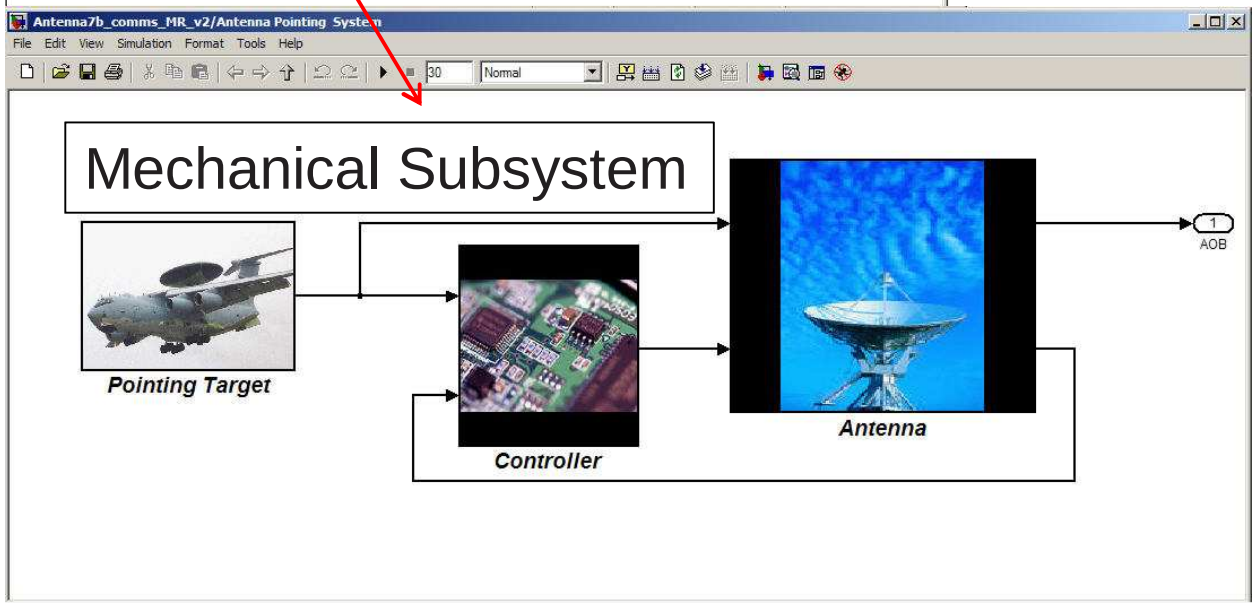
- Shrinking development cycles
  - Pressure from customers to develop systems in a shorter time frame with superior performance.
- Growing Design Complexity
  - Vehicles and other related equipment need to have more functionality than ever before.

UAV Demonstration



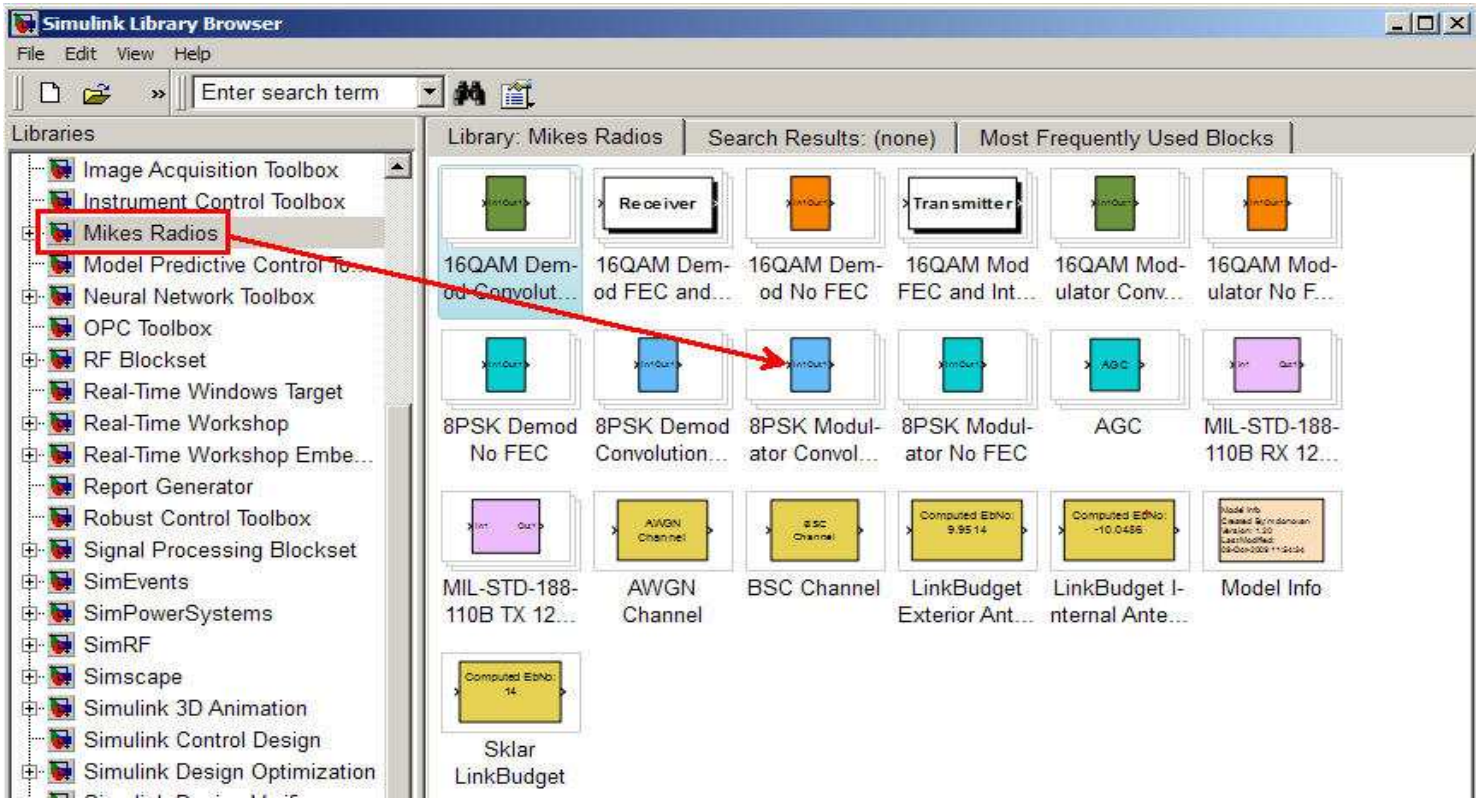
Communications + Video Imaging Subsystem





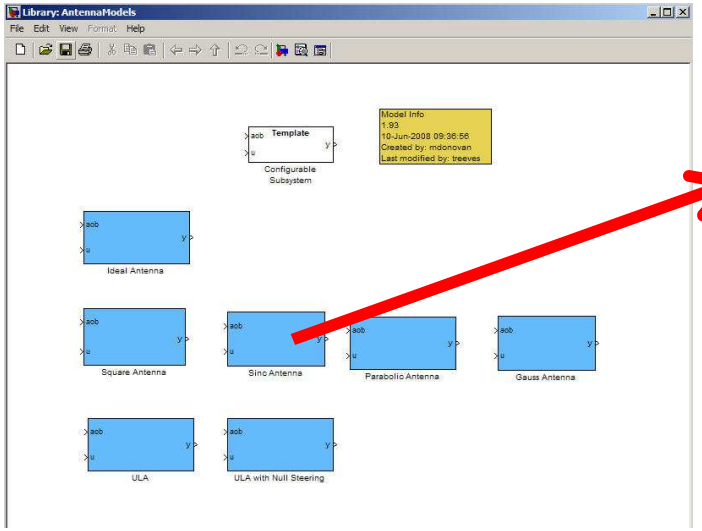
Custom Libraries

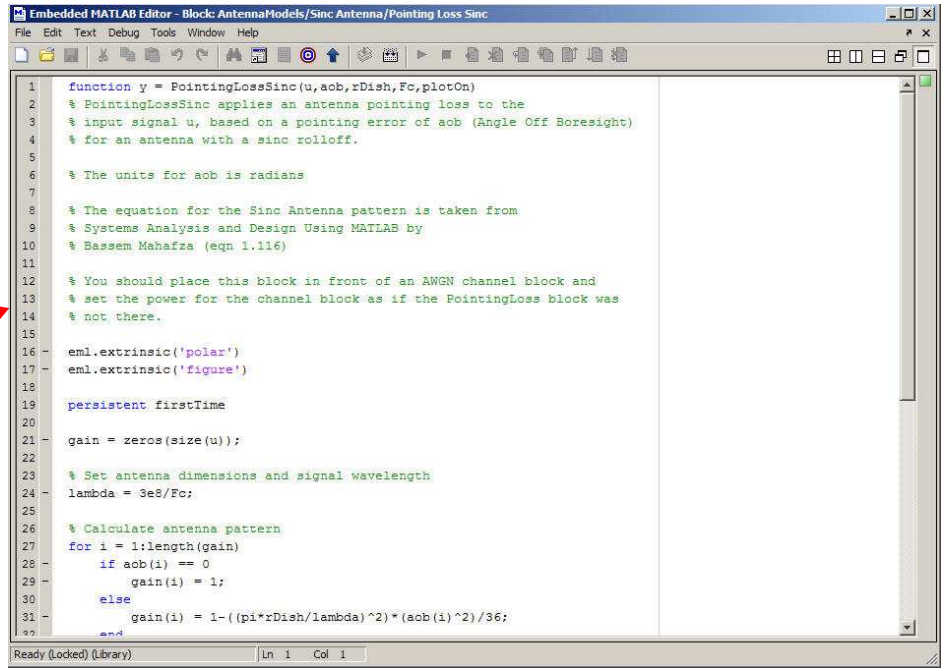
- Allows others access to custom Simulink subsystems that you have developed
- Repository of models that you or your colleagues can use in future designs



Embedded MATLAB Function Block

- Fast execution
- Generates C code (with Real-Time Workshop®)
- Multiple input and output ports
- Modular code: multiple blocks
- Integrated editor





End Results

Design Challenge	Solution
Design and verify communications subsystem	- model different communications schemes using a library of Radio Models
Design and verify Video compressions	Use Video and Image Processing Blocksets to model video algorithms
Access impact of antenna selection	Incorporate MATLAB antenna models in Simulink model using Embedded MATLAB
Access impact of stabilization system	Model antenna gimbal and controller with SimMechanics
Integrate systems in simulation	Use Simulink to integrate multiple domains into single system level model
Optimize design at a system level	Model a number of different design alternatives as well as key parameters such as maximum operating distance

Next Steps

- Incorporate this model into a broader system simulation
  - flight dynamics
  - target tracking

Products Used

- Simulink
  - Embedded MATLAB blocks
- Video and Imaging Processing Blockset
  - Segmentation, motion estimation, morphology and more
- Communications Blockset
  - Source coding, error correction, modulation and more
- Signal Processing Blockset
  - Estimation, filtering, linear algebra, statistics, FFT, and more
- SimMechanics
  - Physical Modeling