6th USA/Europe ATM 2005 R&D Seminar

Safety Rapporteur Report

George Donohue

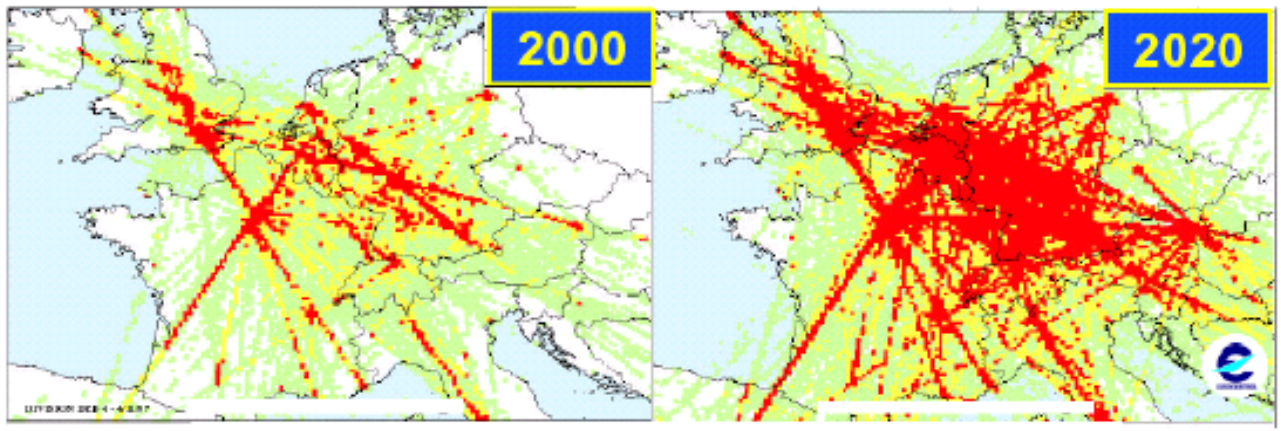
Summary Observations

- 7 papers: 1 European, 1 Joint, 5 US
- Need for EARLY Safety Analysis
- Historical Analysis Required for Hypothesis Confirmation
- Analysis Prioritization Methodology is Required to Proceed from System CONOPS to Qualitative Fault Tree/Hazard Analysis to Quantitative Analysis
- Quantitative Analysis is Required to Provide System Specifications for New Technology and Procedures
- Quantitative Analysis will Develop Validated Models that provide both Normalization and Quantitative Safety Metrics for System Monitoring
- We have a Shortage of Trained Safety Analysts to deal with large number of Issues to be Addressed
- Example Analysis Presented for New En-Route System Concept, UAV's in the NAS, Wake Vortex Encounter and Runway Incursion Severity

Barry Kirwan, EEC

Safety Needs

- **Recent accidents involving ATM**
- **Increasing traffic (capacity)**
- **Advanced systems (2012; 2017; 2025)**
- ***Keep ATM safe***
- ***Anticipate & Resolve Problems***
- ***Learn <u>before</u> accidents occur***

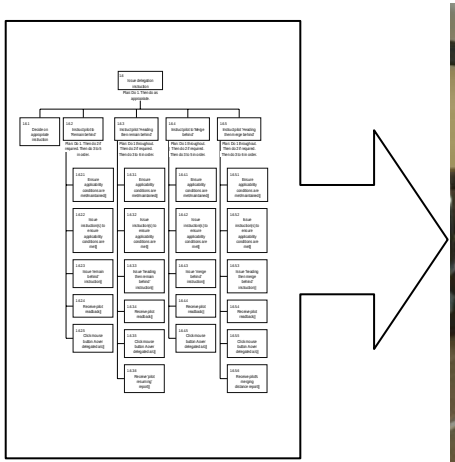


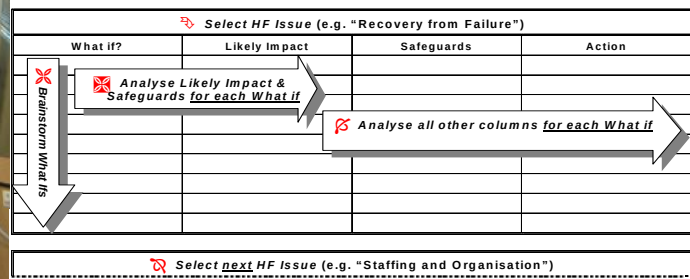
Guiding Principles

- **ATM must become a learning organization**
- **ATM must have suitable methods with which to anticipate and protect itself against risks**
- **Safety must be built in at the early stages of ATM system design, right through to implementation**
- **ATM must improve safety in key risk areas**
- **ATM must be sure that the systems it is developing will deliver the required safety levels**
- **ATM must retain its 'High Reliability' status and its 'safe culture'**
- **The above collaboration should be achieved effectively and cost-efficiently**

Safety Methods

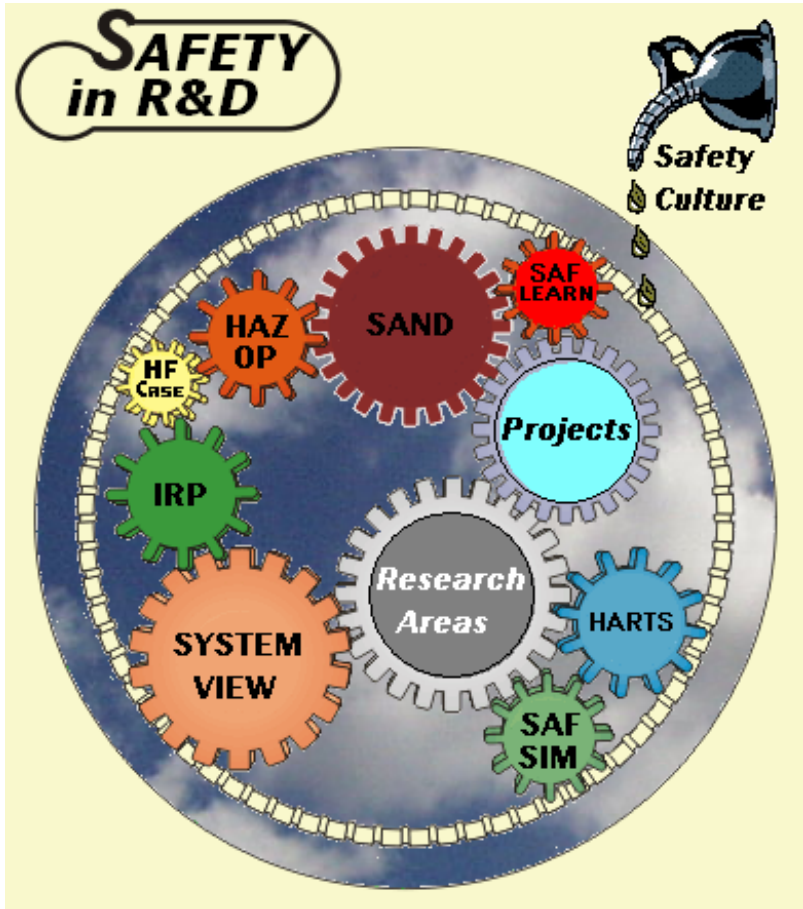
- **Toolbox of 30+ methods (FAA + Eurocontrol + ANSPs):**
  - **Hazard and human error identification**
  - **Representation in fault and event trees**
  - **Quantification of events & human errors; evidence from incidents/simulations**
  - **Analysis of dependence and common mode failures**
  - **Evaluation of uncertainty, sensitivity, and risk impact**
  - **Determination of safety requirements**
  - **Documentation for re-usability**
- **Need more Analysts Trained to use these tools**





Safety in Design

- **EEC therefore carries out concept exploration and preliminary design**
- **EEC research suggests that 50% of accidents have their roots in the design phase**
- **EEC has a safety policy, and safety plans for sector tools, traffic flow, and airport research areas**
- **Safety activities are ongoing for each project in these areas**
- **Integrative project is ongoing to determine safety levels for the integrated vision for 2012**



Mark Hansen, UC/B

Historical Analysis for Hypothesis/Model Validation

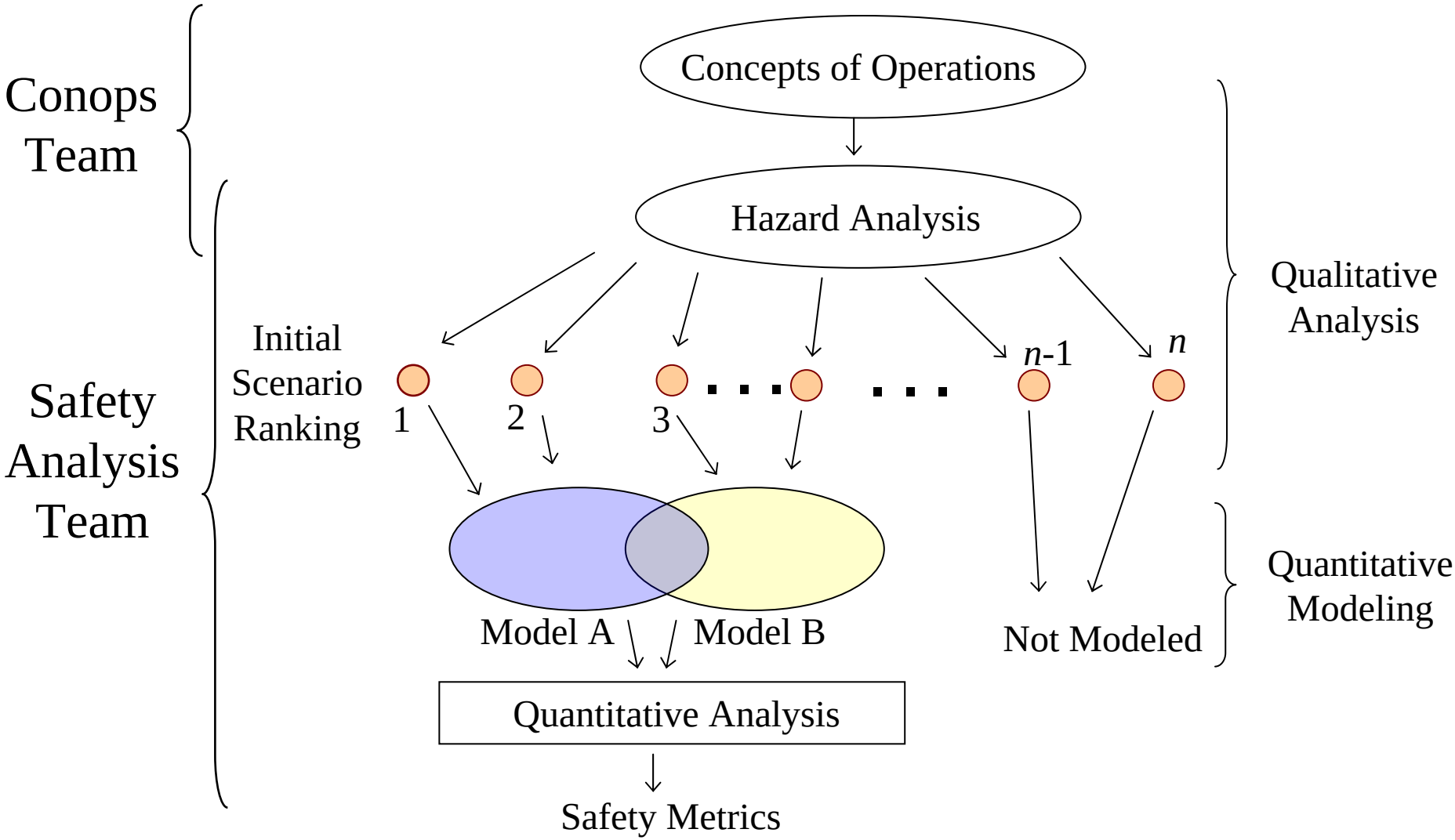
Analysis of Daily OE Count: Tower OE

$$\ln(\lambda_i) = \alpha + \beta_0 \ln(OP_i) + \beta_1 \ln(WI_i) + \sum_j \beta_j \ln(Factor_{ij}) + \sum_k \gamma_k D_k$$

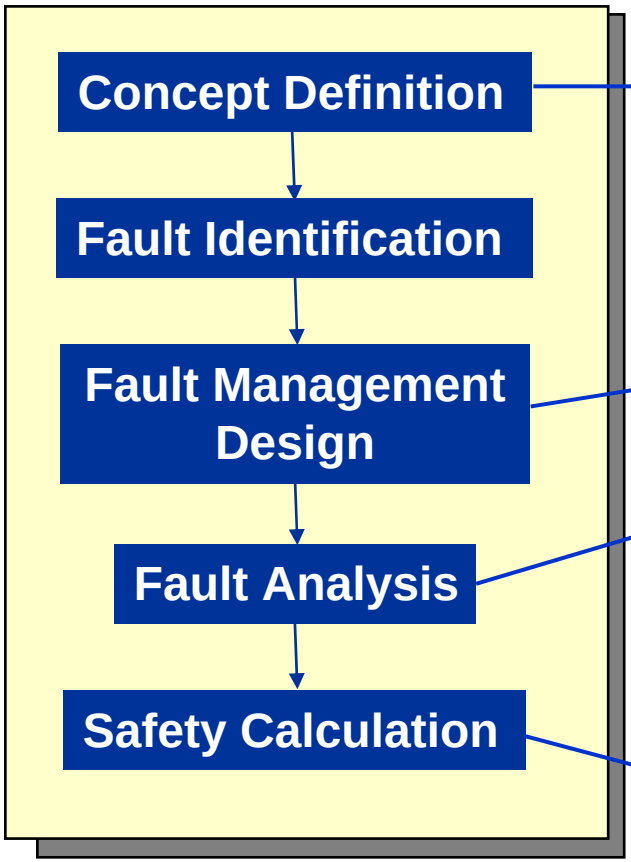
Parameter	Description	Estimate	Standard Error
α	Intercept	**-17.00**	0.57
β_0	Logarithm of operations	**1.97**	0.09
β_1	Logarithm of weather index	**-0.68**	0.08
β_2	Log of Airfield/Airspace Delay	**0.33**	0.03
β_3	Log of Arrival Delay	**0.04**	0.03
β_4	Log of Downstream Congestion	**-0.15**	0.04
γ_{2001}	Yearly dummy variable for 2001	**0.22**	0.03
γ_{2002}	yearly dummy variable for 2002	**-0.08**	0.03
Scale		**0.264**	

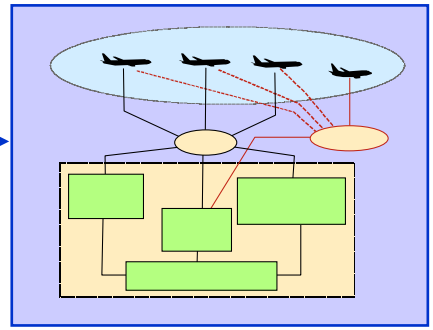
John Shortle, GMU

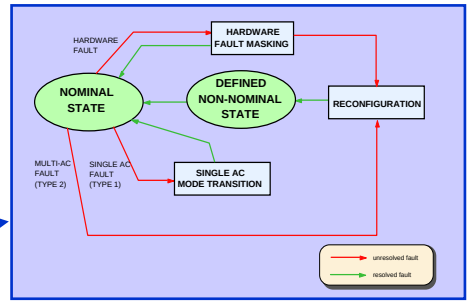
Process for New WV CONOPS Analysis Prioritization

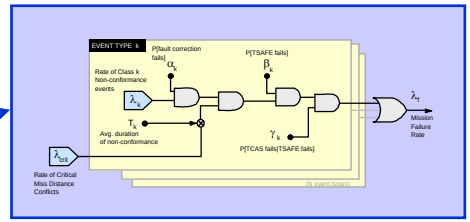


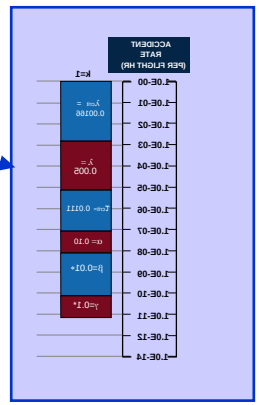
Safety Assessment for New En-Route System Concept (AAC)







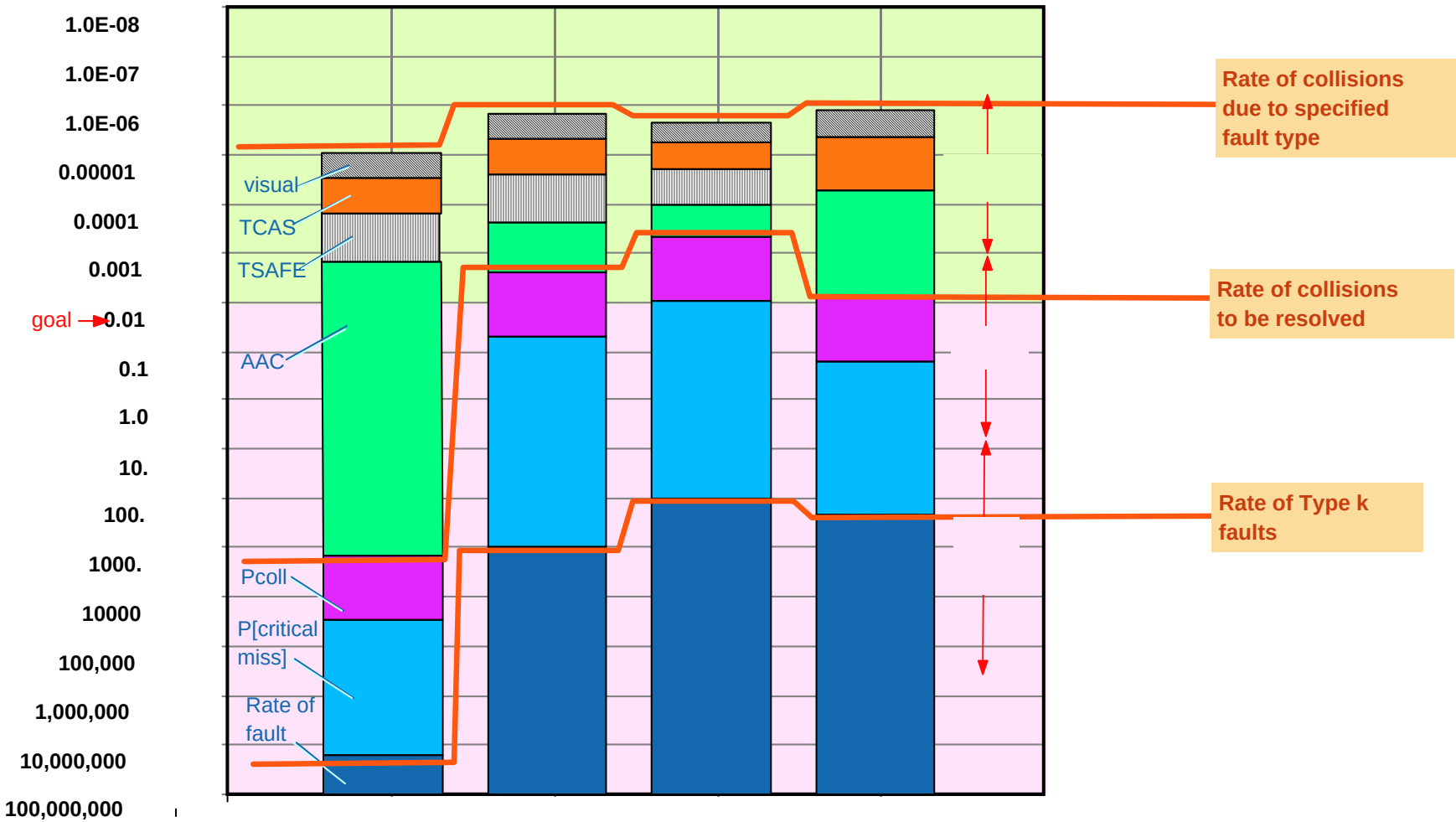




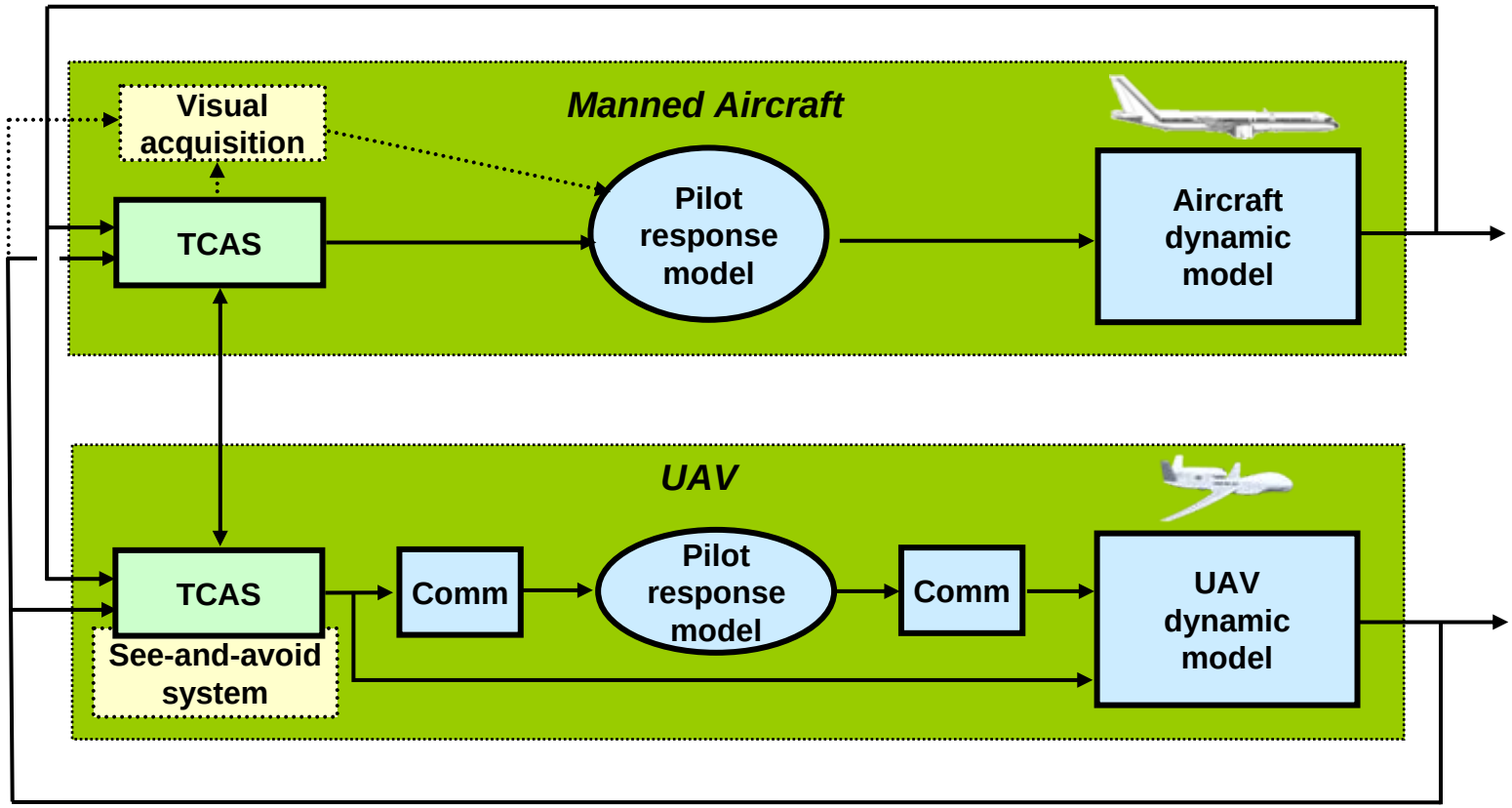
John Andrews, MIT/LL

John Andrews, MIT/LL

Safety Assessment



UAV Safety Analysis Simulation Components



= areas of planned growth

James Kuchar, MIT/LL

WV encounter Probability Can Be Computed Using Aircraft and WV Stochastic Models

- **Two Phase WV Decay and Propagation Model (2P2) combined with Aircraft Arrival Flight Track Deviation Model (3 DOF)**
- **Effects of Cross Wind and Cross Wind Variance can be evaluated**
- **Encounter Probability and Severity can be Computed for any mixture of Aircraft Types**

Severity of Runway Incursions

- **Safety Analysis is moving from just Event Counting to Modeling Events and Assessing Severity of Events**

Kim Cardosi, Volpe

Congratulations “S/V Esprit”
The Best Boat Won

From the “S/V Ana G”