Software Security in Aviation

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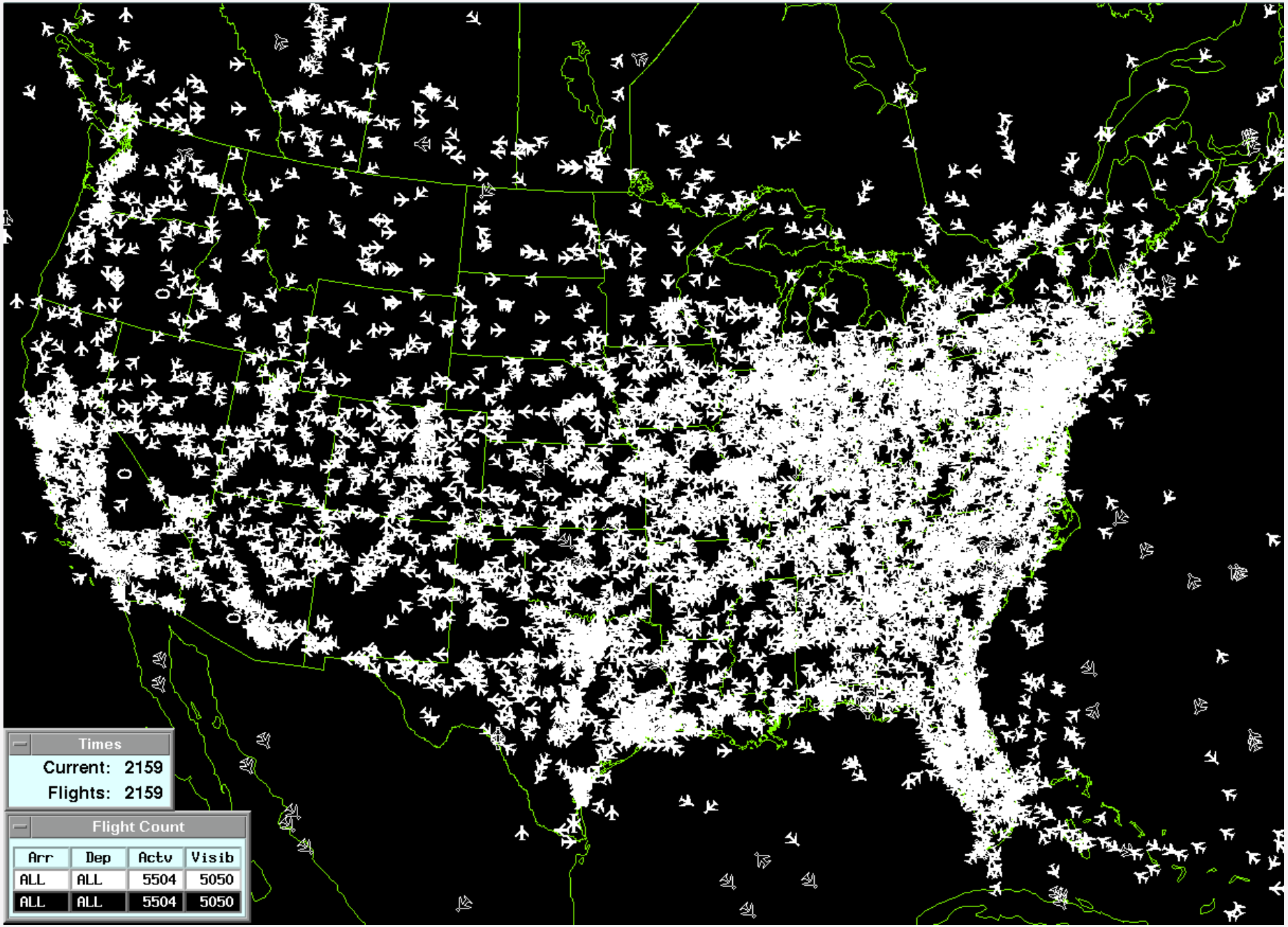
Air Traffic Control



source: FAA

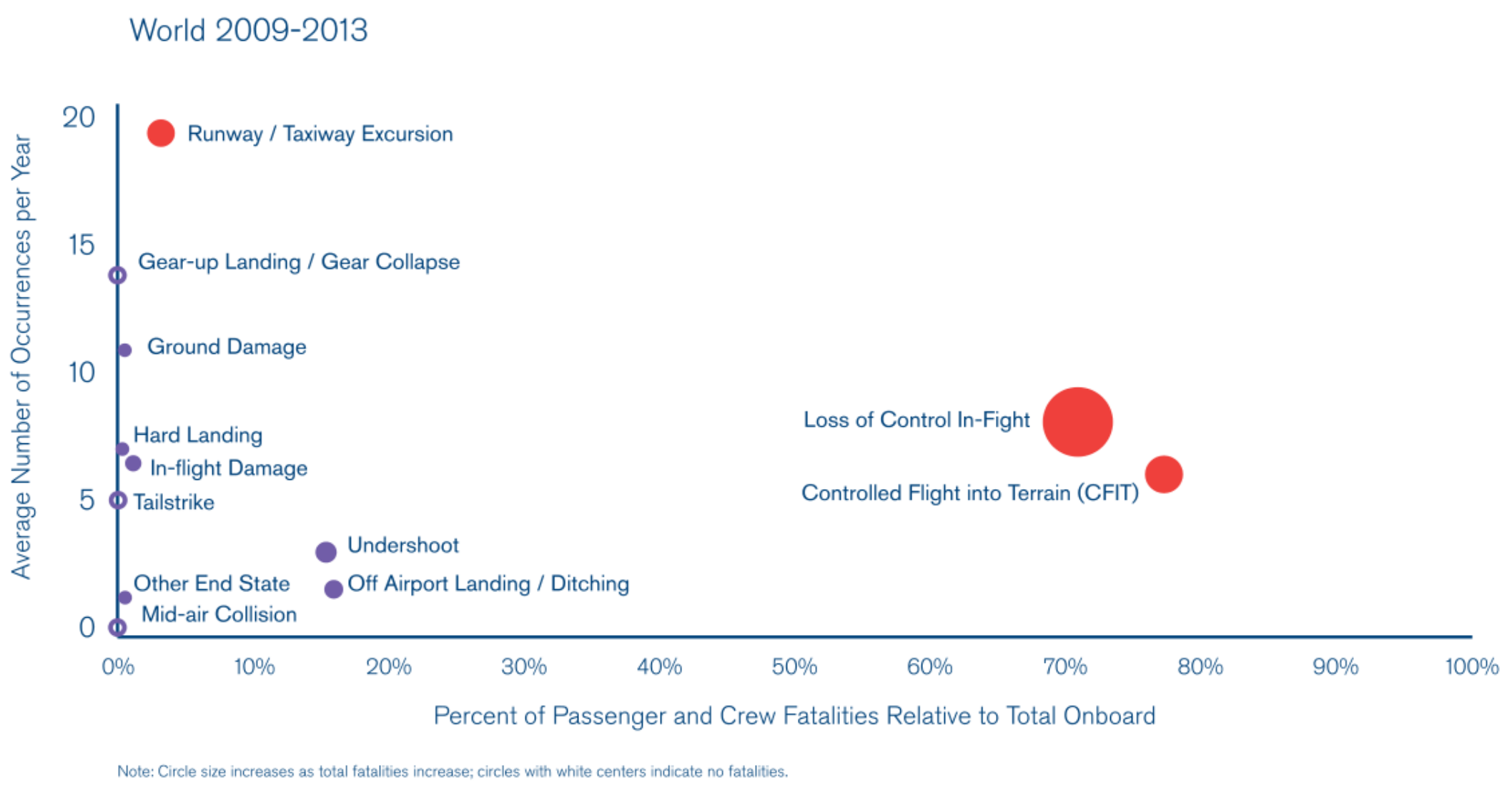
Electronic Flight Bags

source: AeroPlan Systems

Field Loadable Software

source: fordforums.com.au

Commercial aviation Safety Record

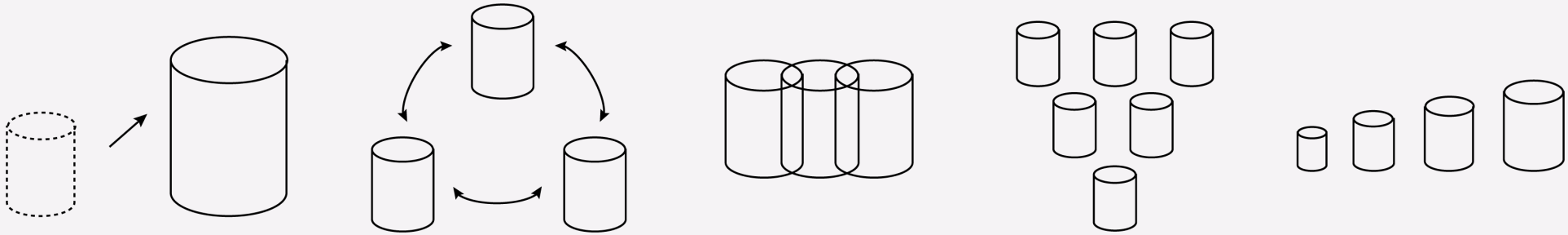


source: IATA

So why look at security now?

Things are changing

- Need to increase NAS capacity → NextGen and ADS-B
- Systems are increasingly being connected (Gatelink, internet)
- Systems are running on shared hardware
- Systems are becoming more standardized
- New adversaries and adversary capabilities



Field Loadable Software

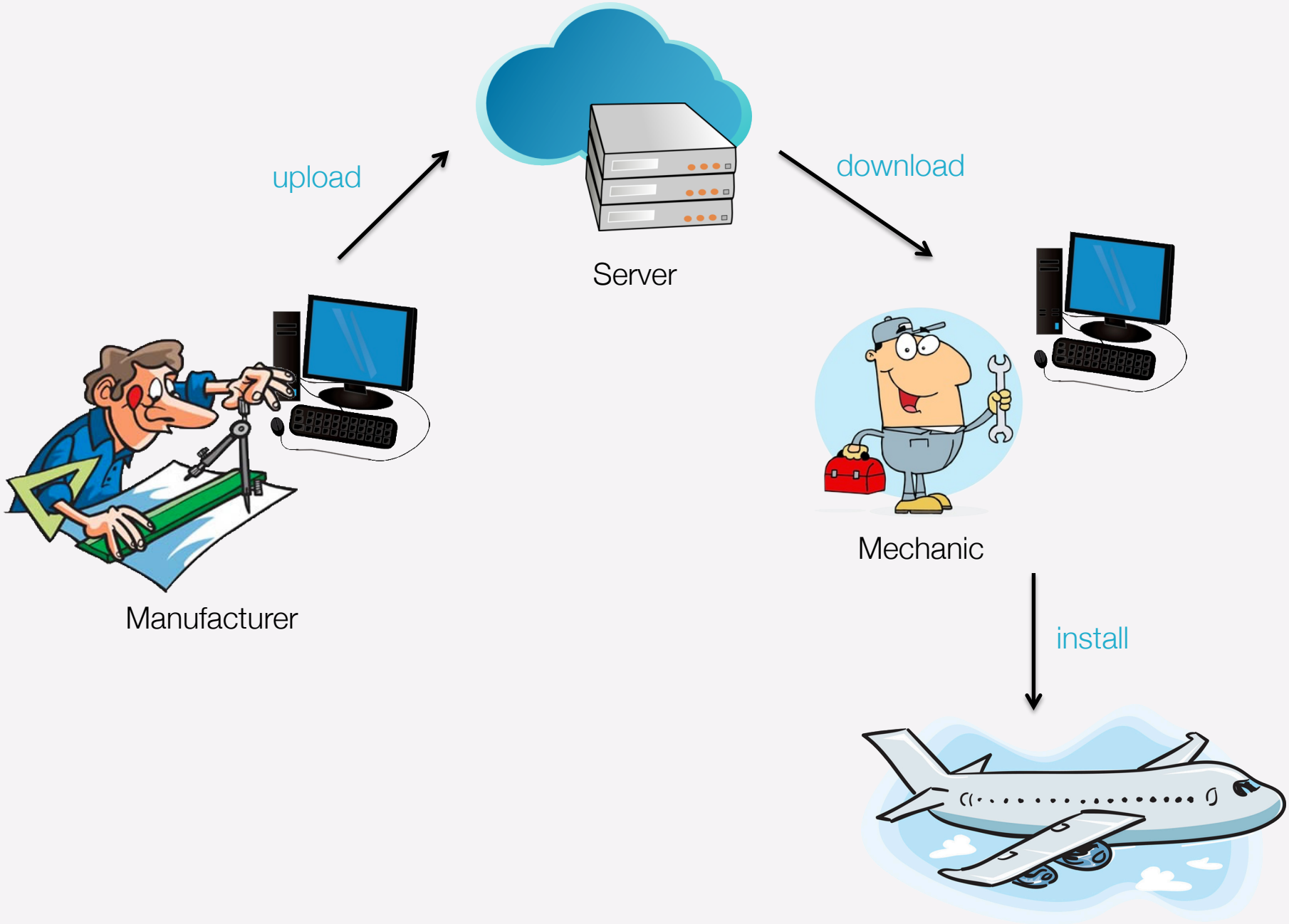
From the Boeing website:

> *"Modifying system functionality with new software instead of with modified or new hardware can help operators reduce the total number of hardware line replaceable units (LRU) in inventory, increase hardware commonality, and reduce airplane modification time."*

Examples:

- Airplane information management system (AIMS)
- Cargo smoke detector system (CSDS)
- Electronic engine control (EEC)
- Flap/slat electronics unit (FSEU)
- Traffic collision avoidance system (TCAS)
- Etc.

Conventional security approach



Applying STPA-Sec to Field Loadable Software

FLS is a system that delivers safe software to aircraft components

by means of a manufacturer's network of approved repair stations

in order to support safe and efficient operations of general aviation.

STPA Losses and Hazards

Losses:

L1: injury or loss of life

L2: damage to equipment

Hazards:

H1: Aircraft is operated when hazardous FLS is installed → L1, L2

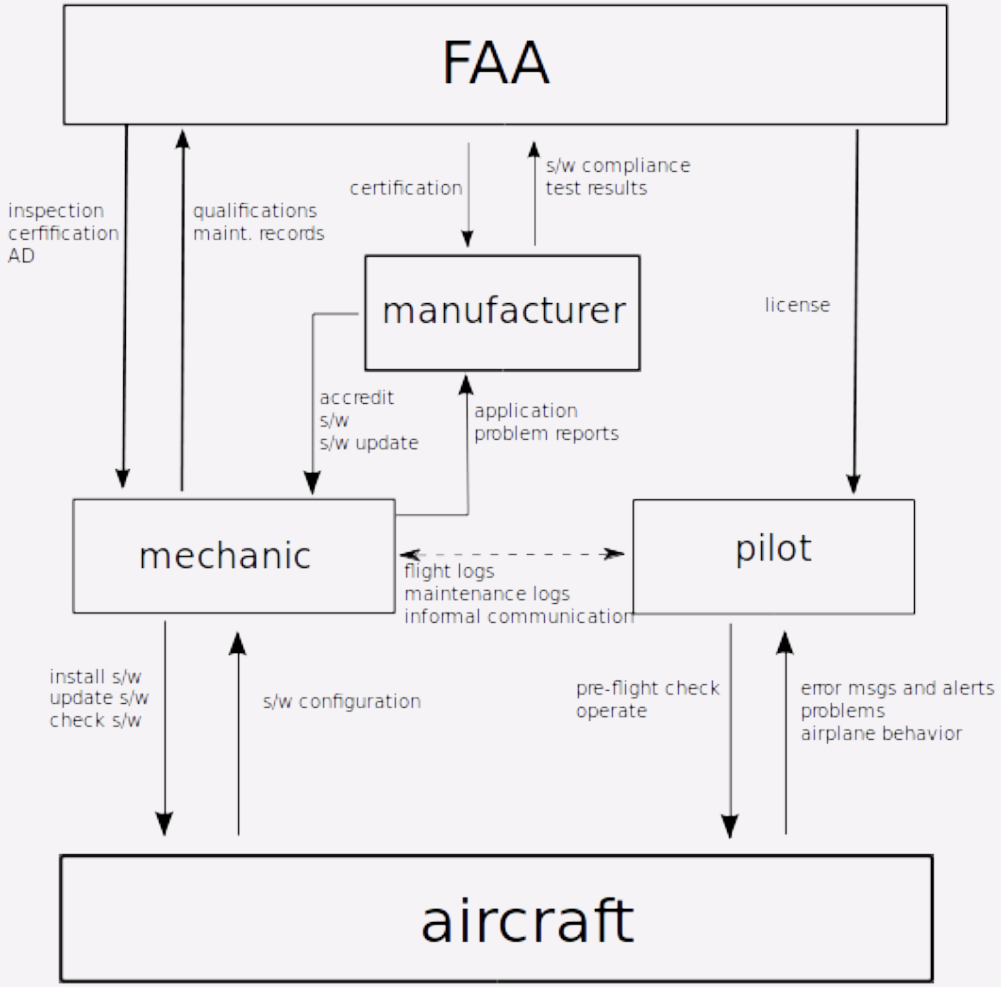
H2: Aircraft component is powered up when hazardous FLS is installed → L2

Safety constraints:

C1: Aircraft must not be operated when hazardous FLS is installed

C2: Aircraft component must not be powered up when hazardous FLS is installed

Functional Control Structure



Control actions (Mechanic)

		P	NP	S	D
Control Action	Context				
install software	Software is hazardous	T			
	Software is not hazardous		T	T	
install update	Software is hazardous	T			
	Software is not hazardous		T	T	
check system	Installed FLS is hazardous		T	T	
	Installed FLS is not hazardous				

Control actions (Manufacturer)

Control Action	Context	P	NP	S	D
Make software available	Software is hazardous	T			
Make update available	Update is hazardous	T			
	Update is not hazardous		T	T	
Issue service bulletin	Current FLS is hazardous		T	T	

Some questions to consider

- How does the mechanic verify if he installed the right software?
- Does it matter if the pilot cannot check the software version himself?
- Does the manufacturer need a formal channel to the pilots?
- Are there reasons for a mechanic not to notify the manufacturer of issues?
- Do we even need a mechanic to update field loadable software?
- What happens if we leave out the mechanic?

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