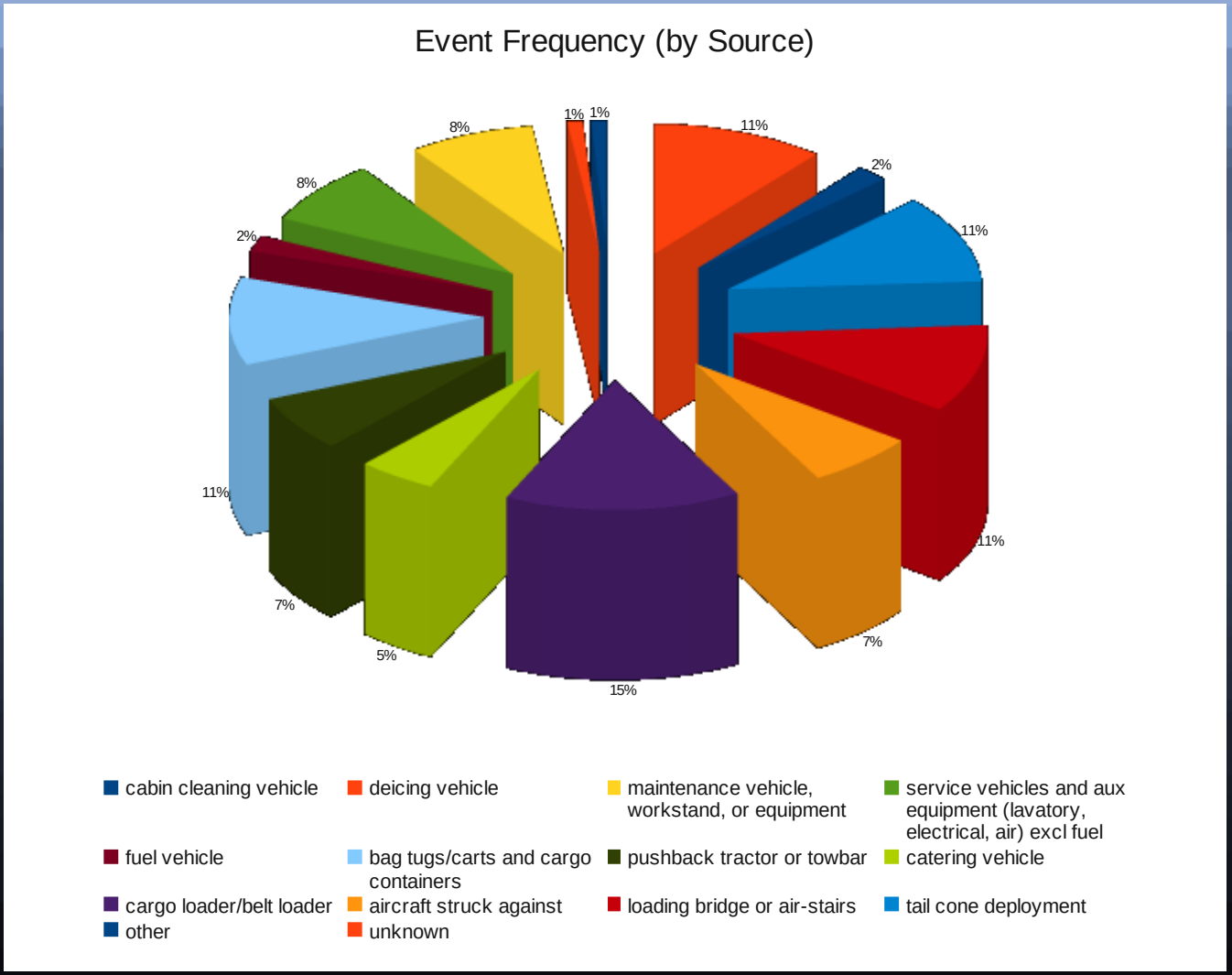
Field Experience with High Energy Wide Area Blunt Impact Damage

Threat Sources

- Jetbridge/ Airstairs
- Tow/Pushback
- Belt loaders
- Maintenance vehicles/Equipment
- Slide/Tailcone Deployments
- Water/ Lav Vehicles/ Equip
- Other aircraft

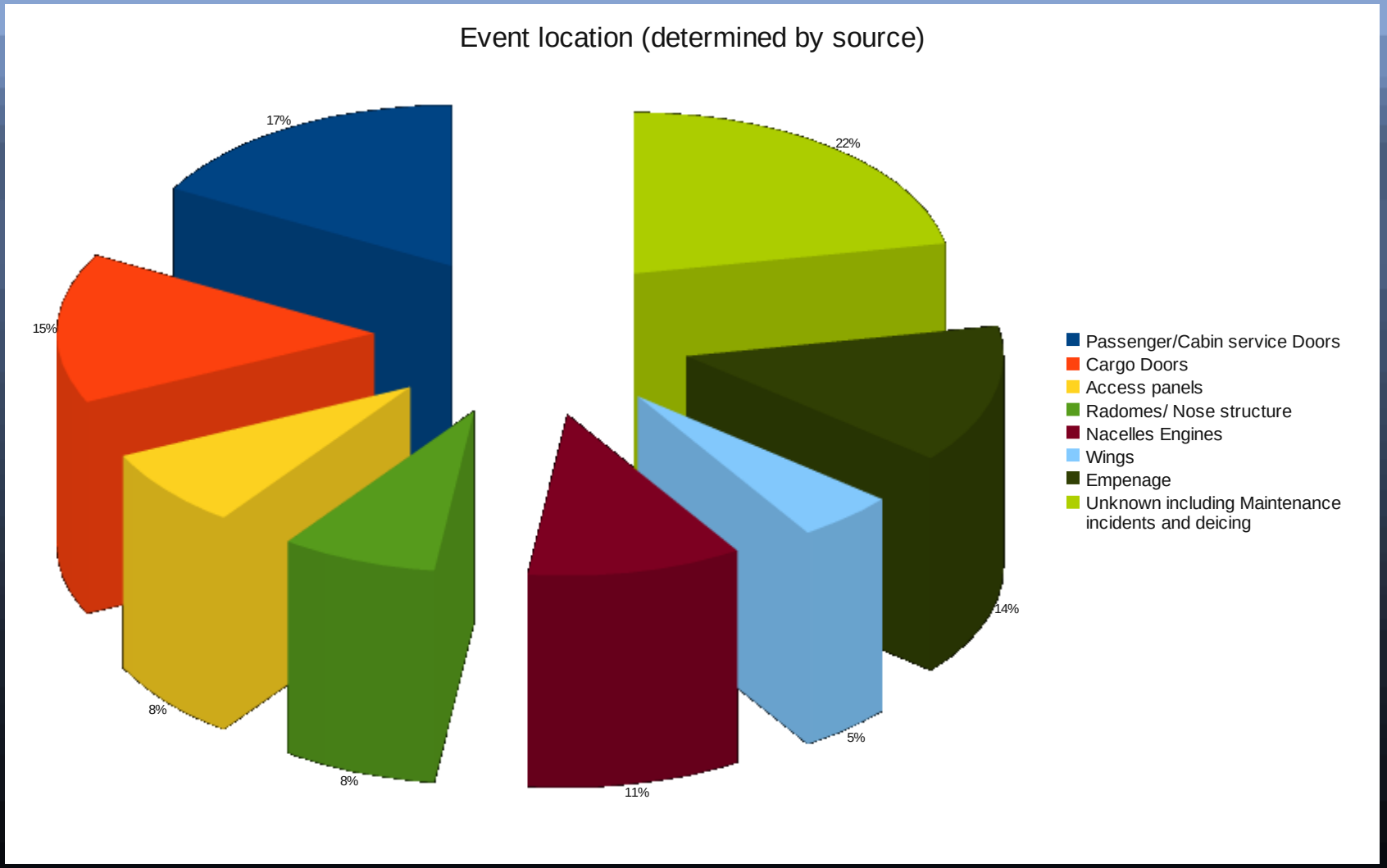
Event Frequency (% by source)



Threats vs. A/C Locations

- Doors
  - Cargo
    - Belt loaders, containers, tugs
  - Boarding
    - Jetways/Airstairs
- Access Panels
  - Service vehicles
    - Air, water, waste, electrical, fuel
- Radomes
  - Tugs/towbars
- Nacelles
  - Service vehicles
  - Containers

Event Location (determined by source)



Event energy

- Estimated 15% of events are high energy
- What is a high energy event?
  - Greater than 1200 inch pounds (135 joules)?
  - Vehicle impact

Data Recording

- Where does the data come from? (ADIT)
  - 50% of impact damage is found vs. witnessed damage
  - How do we improve damage reporting
    - Surveillance
    - Aircraft sensors (accelerometers)
    - Ground Vehicle sensors (proximity)
- How can we determine event energy
  - Impactor mass
  - Impactor velocity
  - Area of impact
  - Angle of incidence

Financial Impact

- Aircraft out of service costs
  - 1 operator average $80,800/event
- Safety Impact
- Repair Costs
  - Difficult to gather, since often spread over several organizations and considerable time
  - Undiscovered damage may grow, increasing repair cost and schedule impact

Current Damage Assessment

- Ramp personnel – “report every vehicle contact”
- Maintenance personnel determine serviceability
  - Visual Indications
    - Additional visual inspections used to quantify
    - NDT depending on structure / availability
  - Access for internal inspections after visual indication
    - Removal of panels interior/exterior
  - Potential for damage far away from impact site
    - Hinges, landing gear, pylons, etc
  - Assessment Instructions
    - SRM – assume visual indications will drive further inspections
    - AMM Chapter 5 – inspection after non-routine events

Human factors

- WHO is around airplane
  - Receipt and Dispatch of aircraft:
    - (When do most incidents occur need data)
    - (Trends between unlicensed ramp services personnel and licensed mechanics?)
    - Training is specific for task and re-current. Lots of existing warnings about damage.
    - Each airline/station manages their own operations. Lots of variation between stations

Human factors

- WHAT is around airplane? Humans not directly involved in all blunt impacts
  - “Found on arrival” is #1 cause
  - Unattended vehicles
  - Rolling aircraft
  - Blown carts, ladders, etc.
  - FOD (birds, deer, thrown tires, etc)
- Therfore, focusing on WHO is not a complete solution

Preventative/Corrective Actions

- Prevention
  - Aircraft Design
    - Location and design of service panels and doors
  - Ground Equipment
    - Standard vs. optional safety features
    - Technology, proximity sensors, etc
    - Target heavy vehicles with higher threat energy
  - Personnel
    - Culture
      - Differences between stations, countries, etc
      - Employee investment, outsourced vs. operator employed
    - Training
      - Specific qualifications exist but not utilized
      - See the CACRC training video
  - Ramp design
    - Currently one zone around the aircraft

Preventative / Corrective Actions

- Corrective Actions
  - OEM assessment instructions
    - NDT and Visual Inspection
    - Create requirements after high energy impact to inspect the far side, hidden structure, distant structure.
  - Improve chances for damage detection.
    - Damage indicating paint
    - Make blunt surfaces have sharp edges so scratches are visible.
  - Maintenance program adjustments