

Lightning and Other Stuff That Bother Wind Turbines

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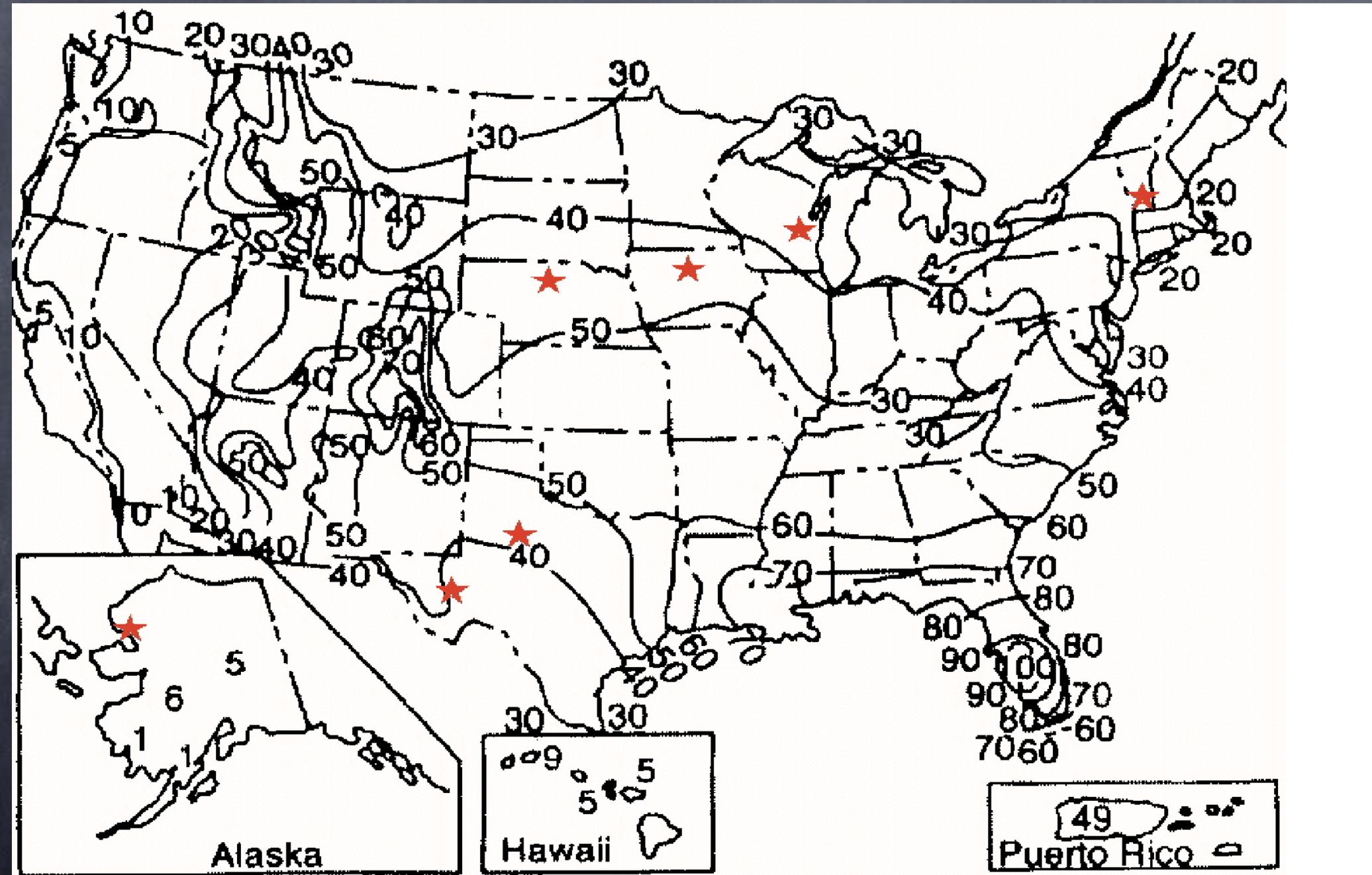
Environmental Issues

- other atmospheric effects than wind
- lightning, hail, airborne debris
- event damage
- temperature, sun, moisture,
debris - wear and material
degradation
- And , of course, then there is
time...

Lightning

- location specific - rare in California, 75+ days/ yr in Texas, Midwest
- In these locations, 1-2 strikes to 10 units per year
- most damage is to electrical and electronics - can be indirect from nearby events
- some to blades

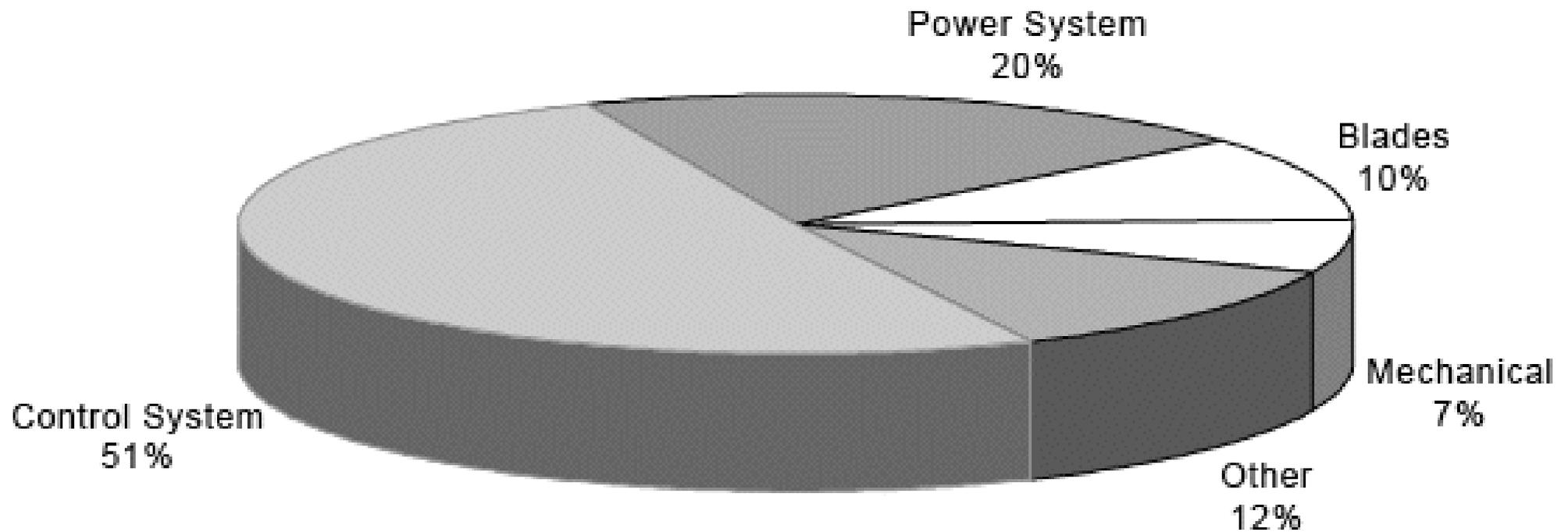
Nasty Locations



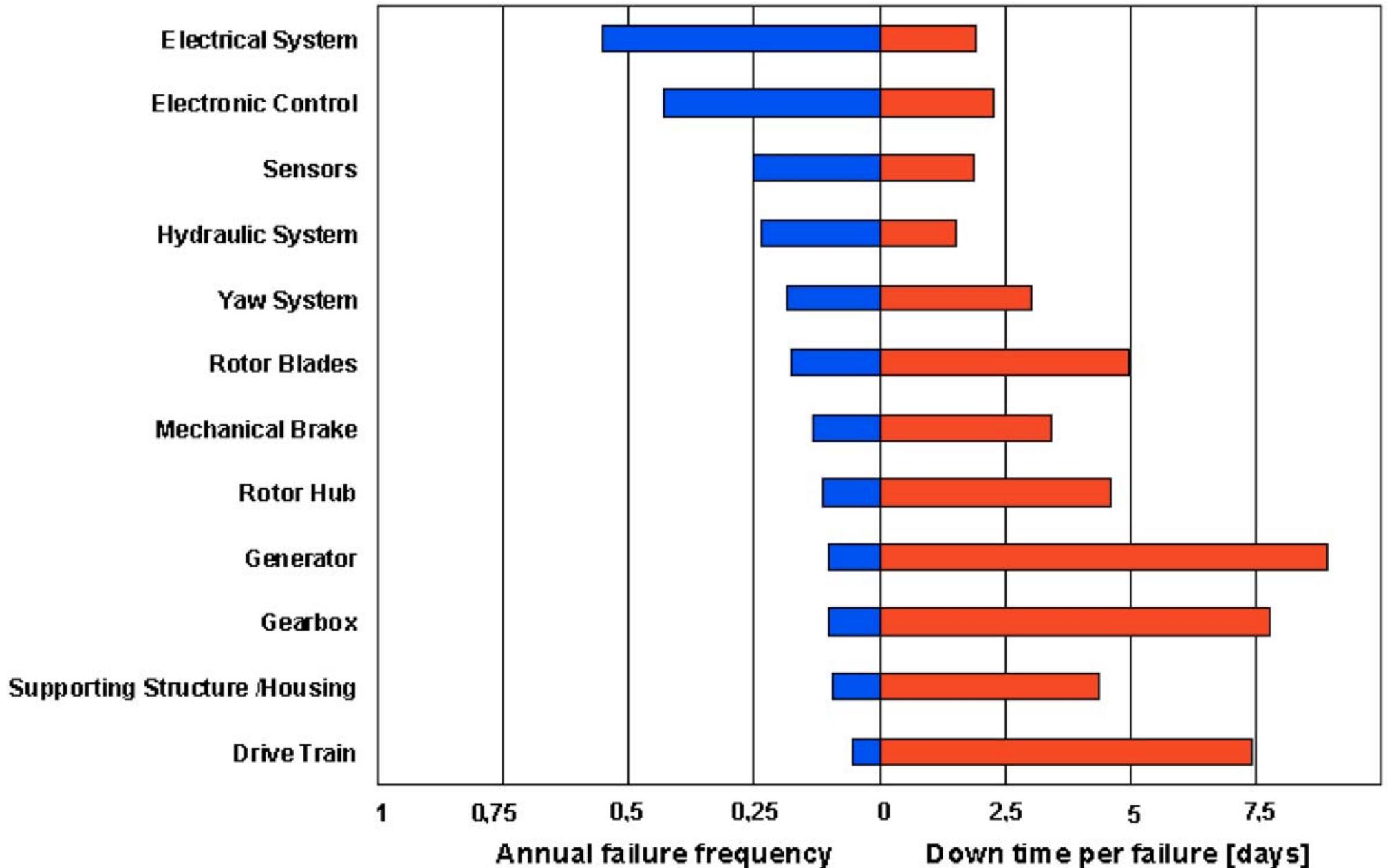
Lightning Impacts

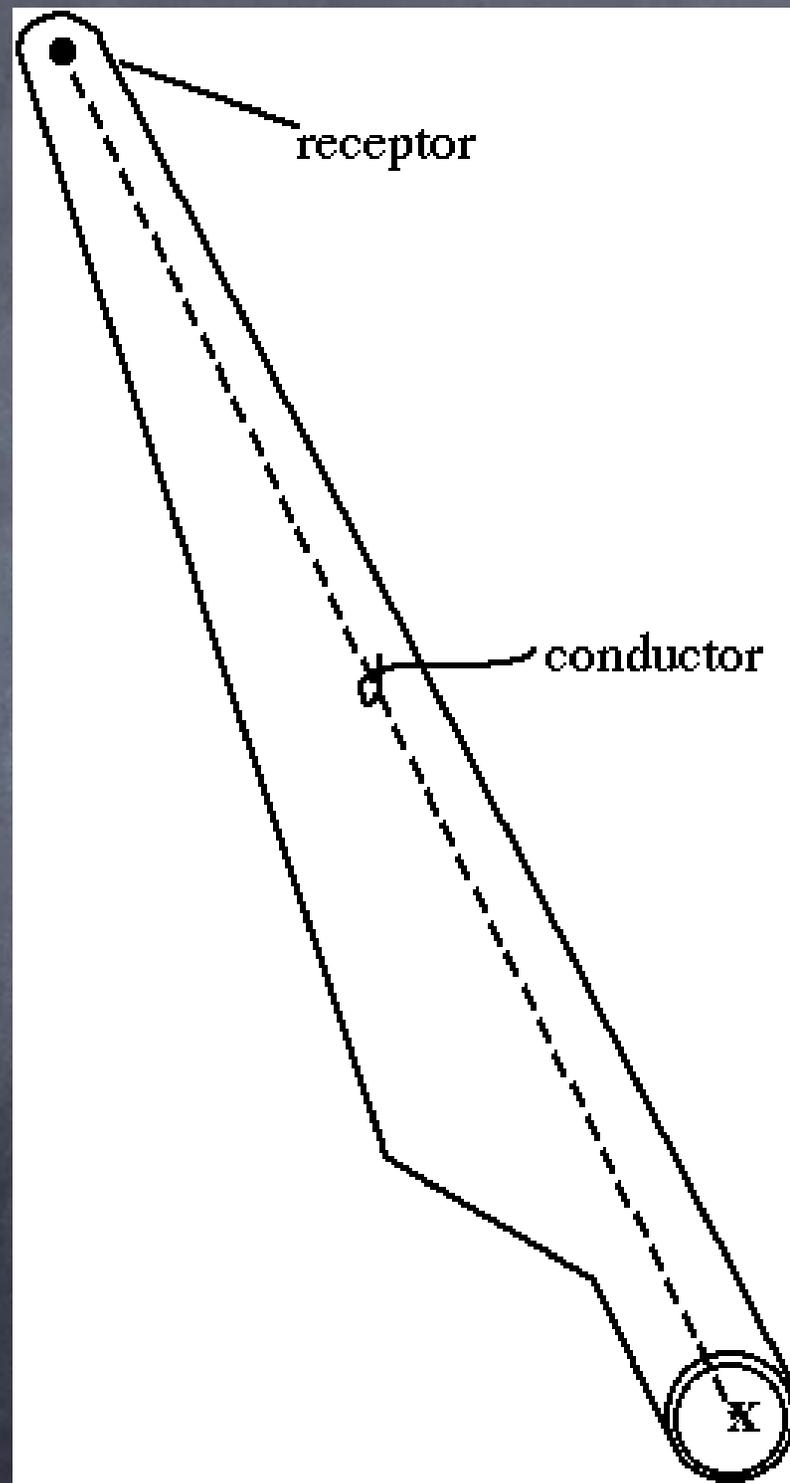
- Blade damage - minor and major
- Electrical and electronics - nuisance failures, scrams
- Hub based controls and actuators
- Bearings
- Latent failures due to undetected damage - a kind of fatigue
- Personnel safety

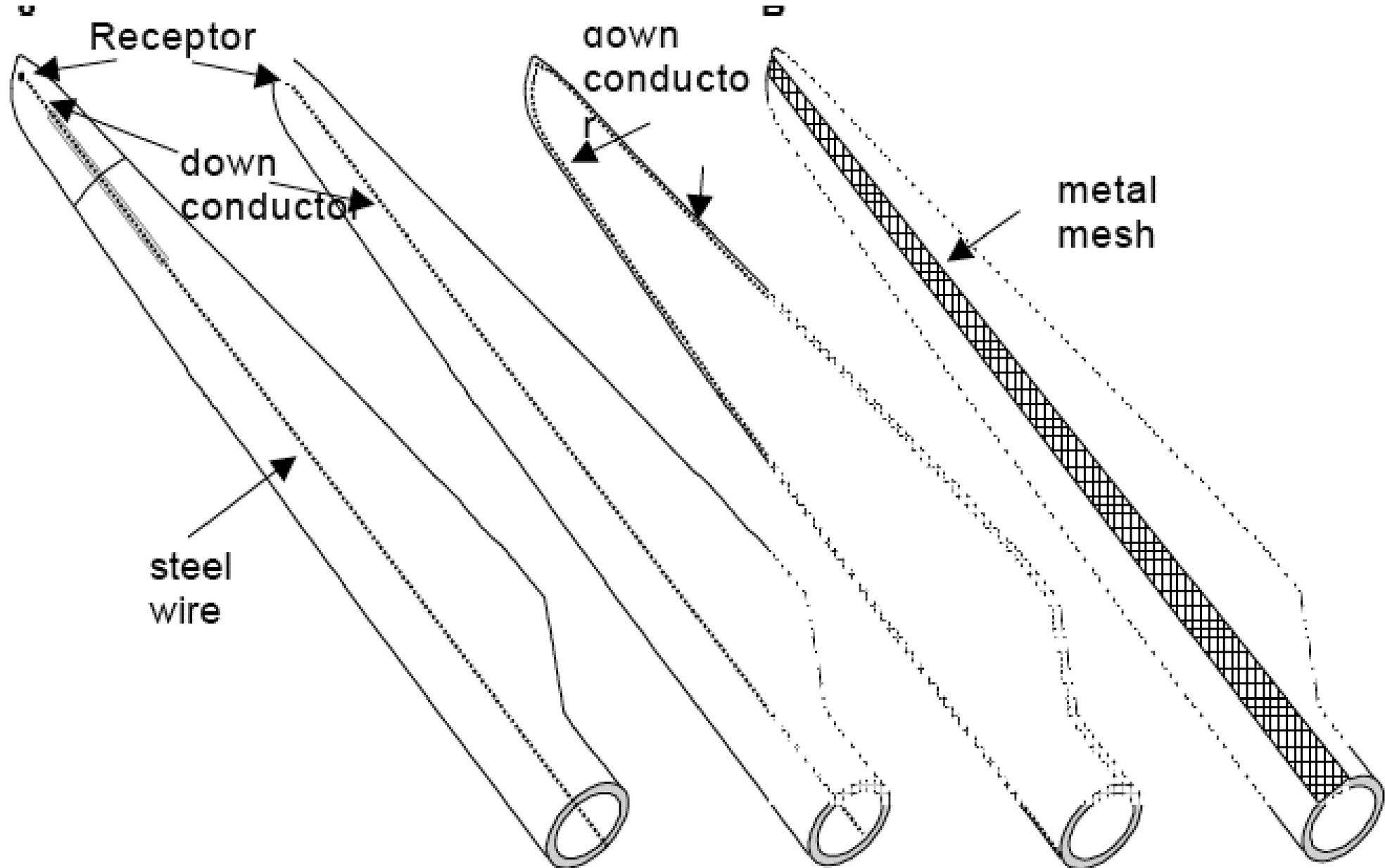
Damage Distribution



Failure Rate – Downtime



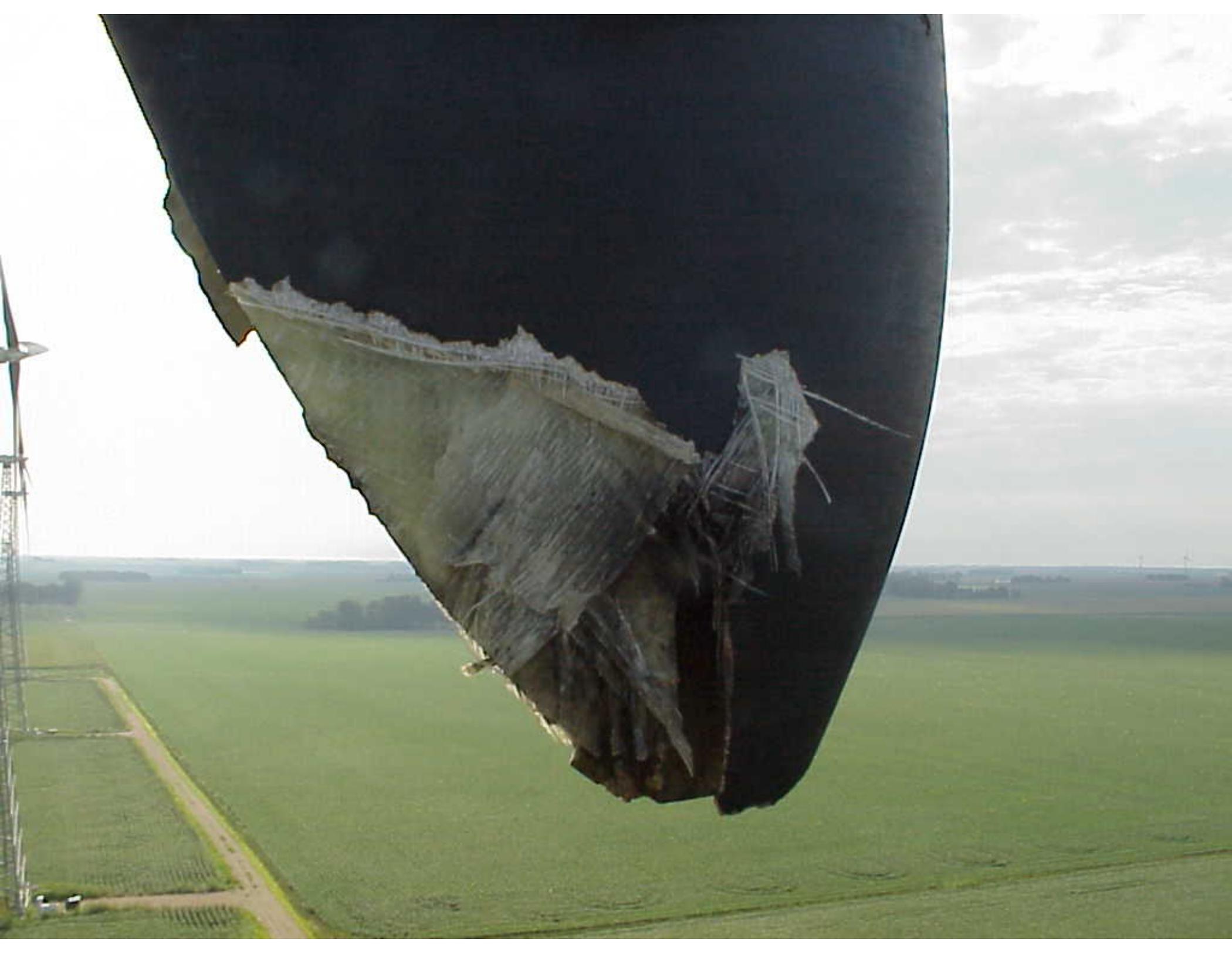




Receptor Example



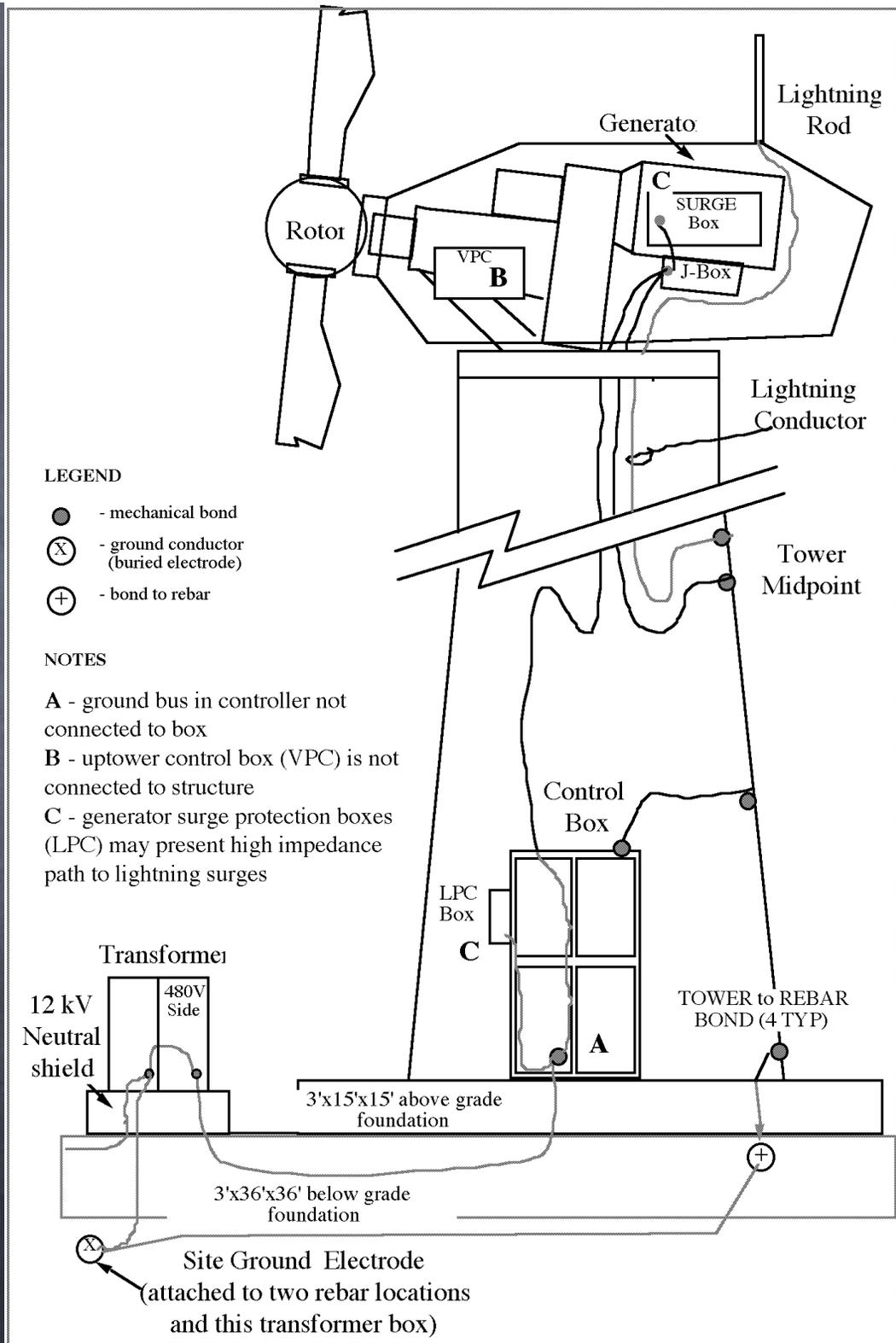






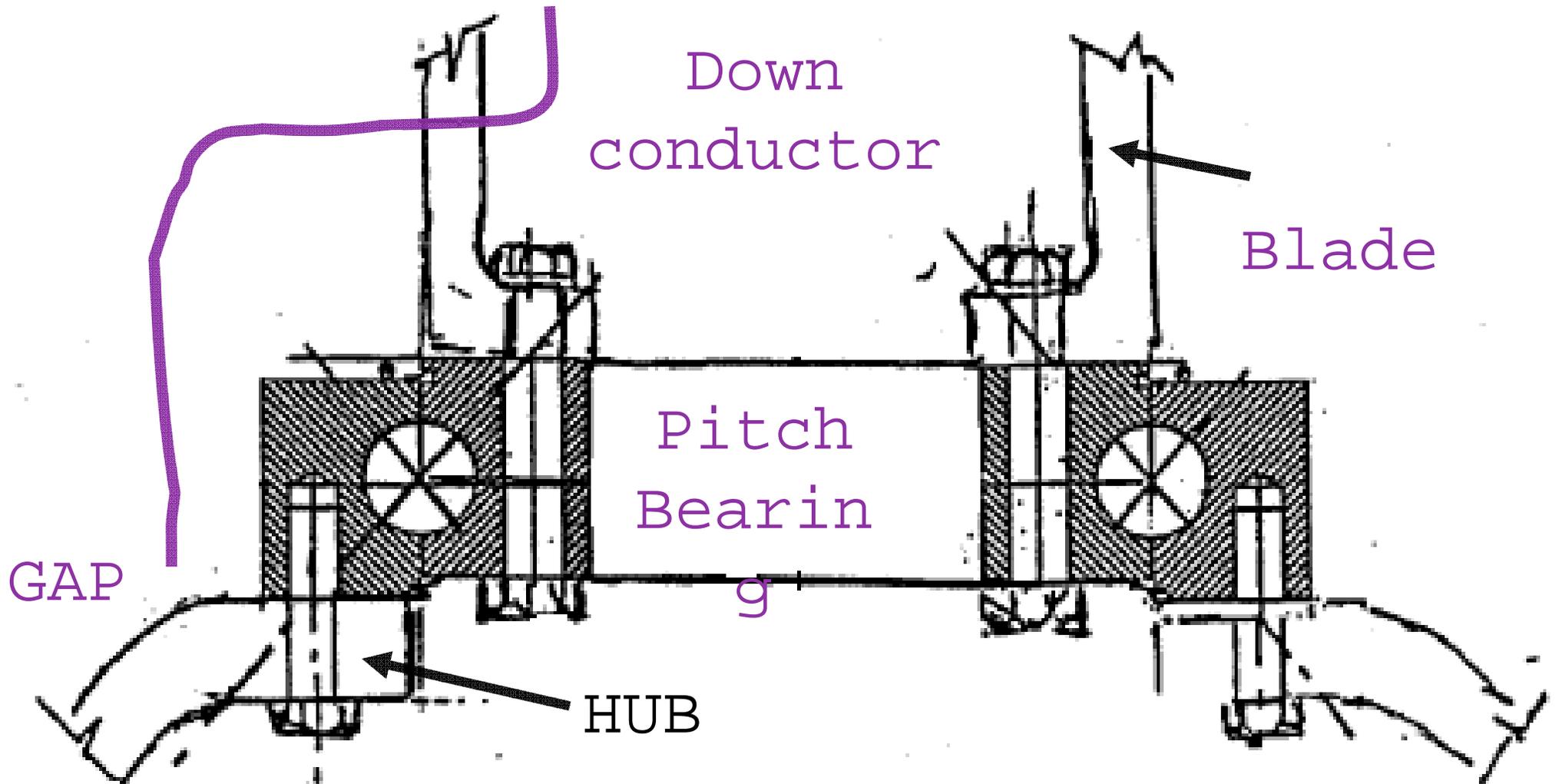


other stuff

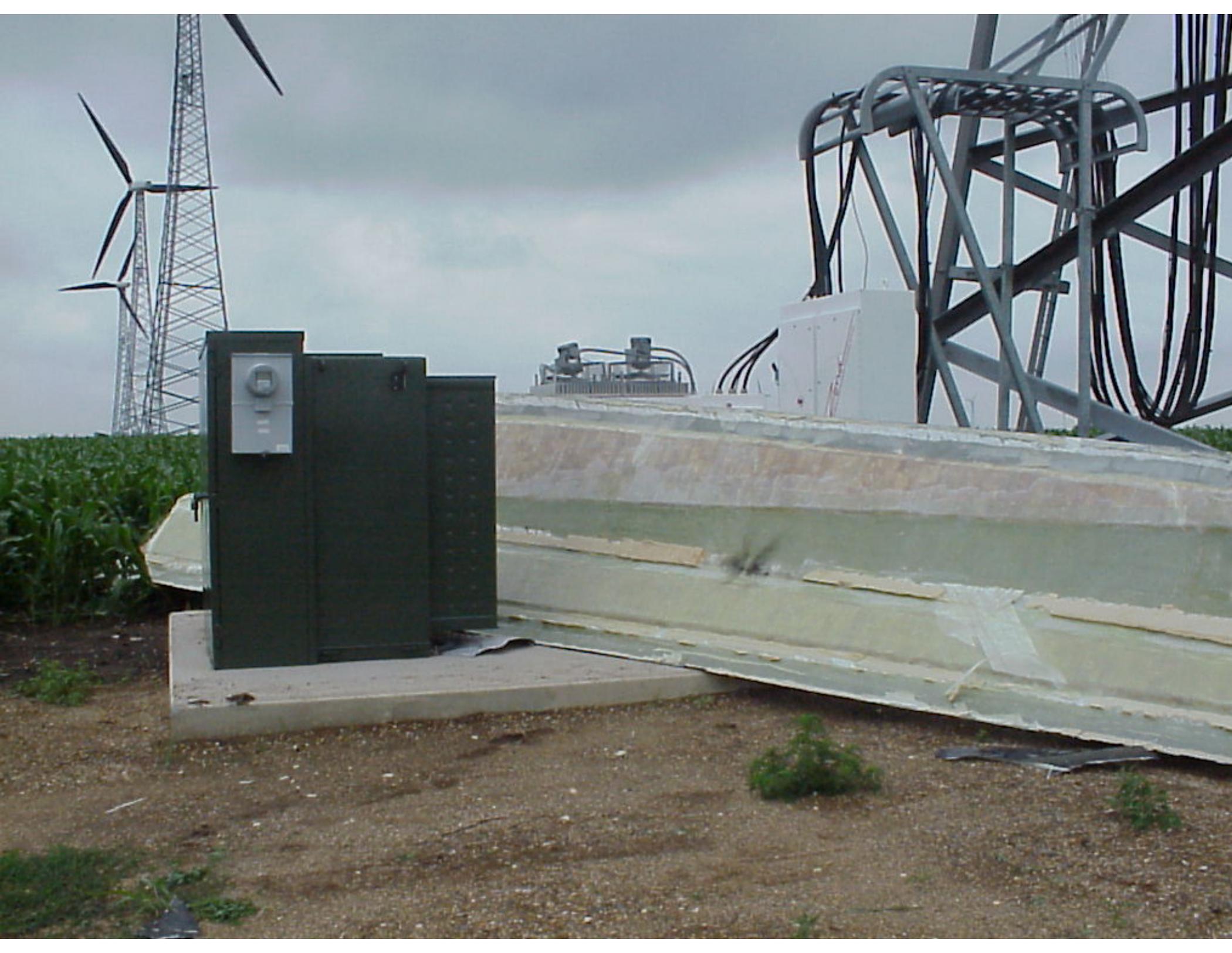




Bearing Bypass







What to Do?

• Learn from failures:

- LP nuisance faults - shielding/ bonding/ surge

- use NLDN, Strikenet, archive causal data

- when problems get fixed, retrofit all units

• Maintain the LP system (PM+seasonal)

- inspect blade receptor and root transfer

- adjust spark gaps/ bypass at PM

- inspect surge protection

What to Do?

- IEC 61400-24 TR has good **operator safety** recommendations (ANSI.org)
- 2 day course-facility lightning protection (with wind turbine focus)
- Lightning Technologies, inc
- February 5-6, 2007
- lightningtech.com



**DANGER
WIND ELECTRIC
SYSTEMS**