

# CHASING ELECTRICAL NOISE


The single most vexing challenge in troubleshooting.....





# The Goal Here


To give you the “tools” you need  
to methodically troubleshoot  
electrical noise.





Why do we care?

YOU CAN CRASH

- Interferes with  
Communication  
Navigation  
Digital Flight controls
- 



# Types of Interference


- Static
  - Arcing caused by friction
- Dynamic
  - Bleed from other systems

# What is Static?

- That stuff you (and your other systems) hear
- Arcing – the first run at the science behind this
  - ESD – Electro Static Discharge
  - Fiction – exchange of electrons
  - Another term – Potential
- Some static cannot be avoided
  - “P” static
  - Moving parts



# Dynamic

- Bleed over from onboard systems
    - Radio transmissions
    - Battery
  - Systems who's job it is to produce an arc
    - Ignition systems
    - Strobes
  - The ultimate arc
- 

# What to DO?


- Designers know this
- The Science
  - Bonding
    - Manufacturers specs
    - Rule of thumb
      - 0.1 ohm anywhere
      - 0.05 ohm adjacent parts
    - Don't forget your non conductive parts
      - Yeah, yeah...you won't meet the above



# Fix Your Bad Bonds


- Clean faying surfaces
  - Corrosion
  - Dirt
  - Oil
  - Paint
- Replace, repair, add, tighten
  - Bonding straps
  - Bolts, rivets



- 
- “Grounding” or Discharging – **On Purpose**
    - Air is a pretty good insulator
    - The cool science thing about ESD
      - Round vs. pointy
    - Wicks
      - Well bonded
      - Tips intact



# The Table

- Start at the top and eliminate by symptom
  - Please save the table as a reference
- 

# Ignition Systems

- Symptom
  - Popping, clicking
  - Varies with engine RPM
- Probably Cause
  - Poor shielding on individual leads
  - Frayed or poorly grounded leads

# Ignition System – cont.

- Test
  - Listen on very expensive high tech test unit
    - AM radio
  - Onboard radios
  - Resistance test between adjacent parts
- Possible Cure
  - Repair or replace damaged leads
  - Properly ground leads

# Ignition System – cont.


- Symptom
  - Continuous Stream of static
  - Varies with engine RPM
- Probable Cause
  - All leads have a problem
  - Poor ground between mag and engine
  - Poor ground between engine and airframe
  - Etc.

# Ignition System – cont.

- Test
  - AM Radio
  - Onboard Radios
  - Resistance test between adjacent parts
- Possible Cure
  - Clean faying surfaces
  - Add or repair ground strap



# Charging system

- Symptom
    - High pitch siren-like whine
    - Varies with engine RPM
  - Probable Cause
    - Generator
      - Bad ground – dirt, corrosion,
    - Alternator
      - Arcing brushes, slip rings
      - Poor ground
- 

# Charging System – cont.

- Test
  - Resistance test between adjacent parts
  - Try the cures
- Possible cures
  - Generator
    - Clean commutator
    - Add RF filter
    - Repair poor bonds



# Charging System – cont.

- Possible cures (cont.)
  - Alternator
    - Repair poor bonds
    - Add RF filter
- Alternator specific oddity
  - Symptom - Clicking caused by failing diodes
  - Test and replace bad diodes



# Other Systems


- Symptom
  - Whining – does **NOT** vary with RPM
- Possible Cause
  - Electric motors
    - Rotating beacon
    - Flap motor
    - Turn and Bank indicator
    - Etc.

# Other Systems – cont.

- Test
  - Isolation game
  - Resistance test between adjacent parts
- Possible Cure
  - Clean faying surfaces
  - Add ground straps
  - Rebuild or replace motors



# Another Oddity

- Symptom
    - Low frequency whining
    - Does not vary with RPM
  - Probably Cause
    - Battery
      - Damaged internally
      - Loose connections
- 

# Another Oddity – cont.

- Test
  - Rock battery and listen
  - Check connections
  - Replace with known good battery
- Possible Cure
  - Replace battery
  - Tighten connections



# Other Possibilities

- Symptom
  - Other baffling noises
- Probable cause
  - Rapidly spinning parts
    - Gyros
    - Engine motor shaft

# Other Possibilities – cont.

- Test
  - Turn off engines after spooling up air driven gyros
  - Listen on AM radio during wind down
  - Touch front face of gyros and feel for extra vibration
  - Isolation game
- Probably cure
  - Rebuild, replace



# Radio stuff

- Symptom
  - Squeals, wails
  - Poor radio performance
  - Crackling
- Probable Cause
  - Poor bonding, corrosion
    - Antenna connections
    - Antenna cabling




# Radio Stuff – cont.

- Test
  - Inspection
  - Wiggle test
- Possible Cure
  - Clean faying surfaces
  - Repair or replace parts and materials



# The Digital Age


- Symptom
    - Steady ticking usually on only some frequencies
  - Probably Cause
    - Clock harmonics of processor based equipment
- 

# The Digital Age – cont.

- Test
  - Check different radios frequencies
  - Bond test suspect equipment
- Possible Cure
  - Repair poor bonds
  - Turn off or eliminate offending non-critical equipment (ex. CD player)



# The Radios Themselves


- Symptom
    - Squeal, wails and crosstalk
  - Probable Cause
    - Poorly routed wiring
- 

# The Radios Themselves – cont.

- Test
  - Inspect
- Possible Cure
  - Reroute cables
    - 2 ft minimum between transmitter and audio or other antenna cable




# More Radio Stuff

- Symptom
    - Crosstalk and interference
  - Probably Cause
    - Audio panels
    - Poor shielding in wiring
- 



# More Radio Stuff

- Test
    - Inspect
  - Probable Cause
    - Use twisted pair or shielded wire
    - Route suspect wiring at 90 degrees to each other
    - Eliminate old style audio panels
- 

# Big Time Arc Producer

- Symptom
  - Annoying ZIT, ZIT, ZIT, especially on the intercom
- Probable Cause
  - Strobe light capacitor- Duh



# Big Time Arc Producer – cont.

- Test
  - Turn off strobe
- Possible Cure
  - Follow installation instructions from manufacturer. They know!
  - Move strobe power supply at least 5 ft. from avionics or intercom
  - Twisted pair

# When it All Comes Together

- Symptom
  - Hissing
  - Snapping
  - Any other sound already mentioned

Especially during precipitation

# When it All Comes Together – cont.

- Probably Cause
  - Poor condition wicks
  - Frayed, broken ground straps
  - Corrosion or paint isolating parts
  - Overall lack of electro-mechanical integrity


# When it All Comes Together – cont.

- Test

- Inspect wicks and bond straps
- Bond test
- Turn on radios (remember the AM radio?) and listen while someone walks around the airplane and pats airframe and exercises the moveable surfaces.

# When it All Comes Together – cont.

- Possible Cures
  - Replace wicks and ground straps
  - Remove corrosion, paint, dirt
  - Resistance checks between parts



**GOOD LUCK  
YOU WILL NEED IT**

**Not really, because you are:**

**SMART**

**And you have:**

**THE TABLE**