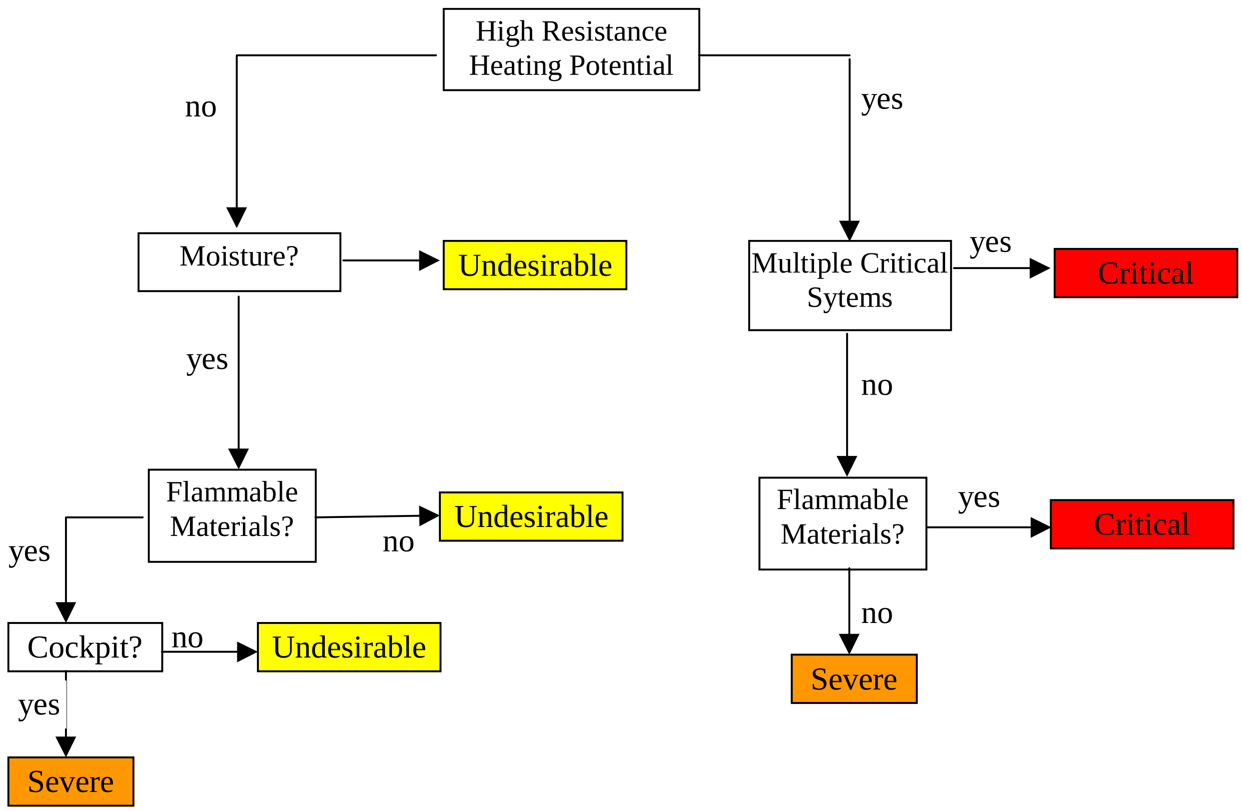
Appendix 7.1: Fault Trees

Degraded Repair



The right branch of this fault tree is based on the observation that resistance heating associated with degraded splices is associated with numerous failures and fires. The heat generated is sufficient to destroy surrounding insulation and increase the potential for short circuit and fire.

The left branch of this fault tree is based on the assumption that a degraded repair will not generally place the conductor in sufficiently close physical proximity to a ground to cause a problem – the more likely threat is the shorting of the wire due to moisture or contamination forming a path to ground (other wire or structure). Furthermore, unless splices are co-located (not recommended practice) the potential of multiple or compounding common mode failure due to a similar flaw is remote (e.g. a short circuit between two degraded wire splices). Multiple or compounding common mode failure is more likely in the case of uniformly aged (and cracked) wires in a bundle.

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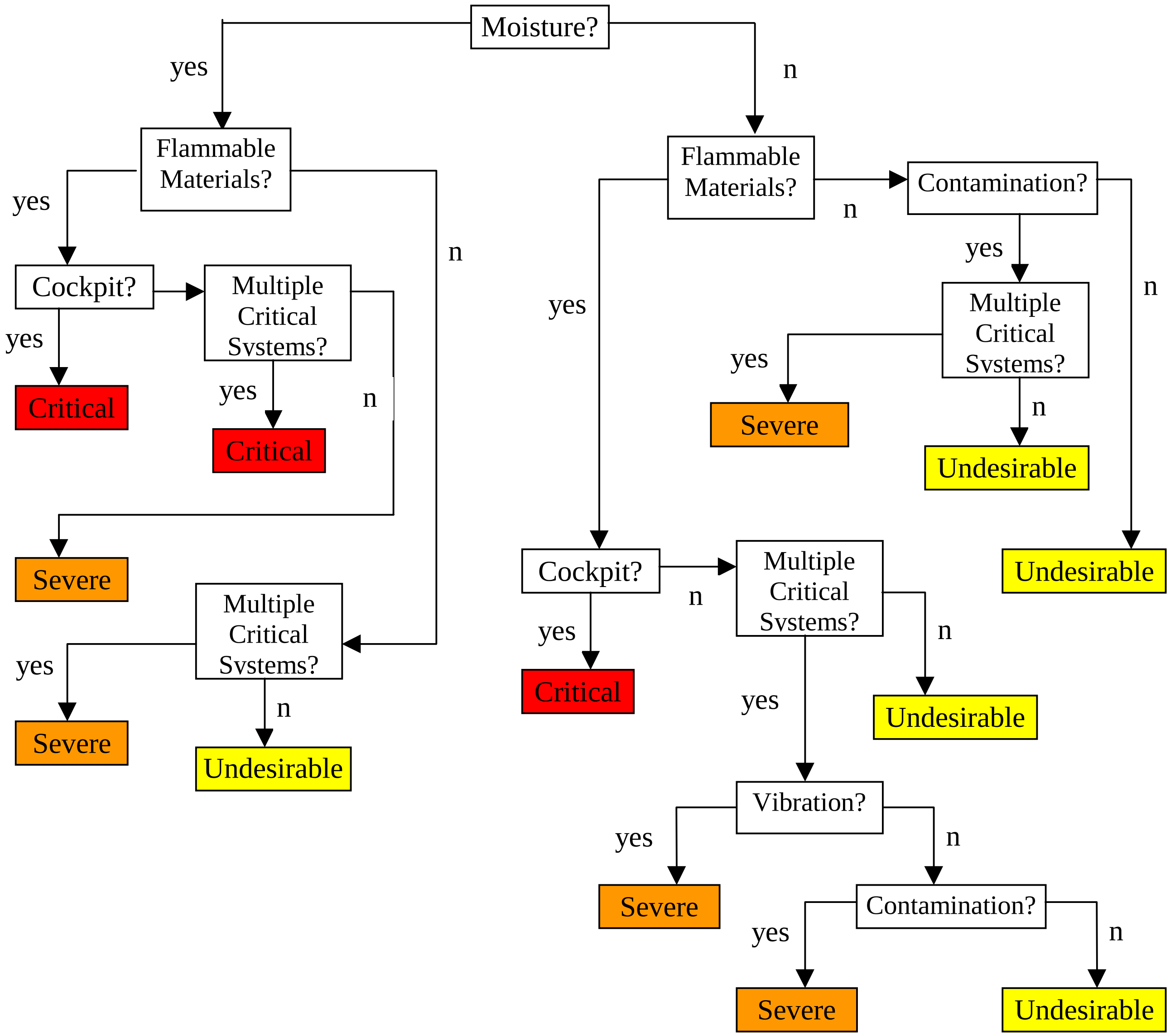
- The fault tree does not take into account the aircraft system design, architecture, materials, which are implemented and used by aircraft manufacturers in compliance with the FAR 25.1309.
- The terms *undesirable, severe, critical* are as defined in this document. Although their definition are related to terms definitions used in SAE ARP4761, they are not identical and must not be

Heat Damaged or Burnt Wire



Heat damage is assumed to embrittle wire and make it more susceptible to cracking. This cracking is likely to exist on many wires in a local area increasing the potential for short circuit.

Vibration and contamination are only present on the right primary branch. These conditions enable failure modes which moisture or flammability would otherwise enable. In other words, if there is moisture we can assume that the potential for a short circuit exists regardless of the presence of contamination or vibration. If moisture is not present we need something like moisture or contamination to enable that failure mode.

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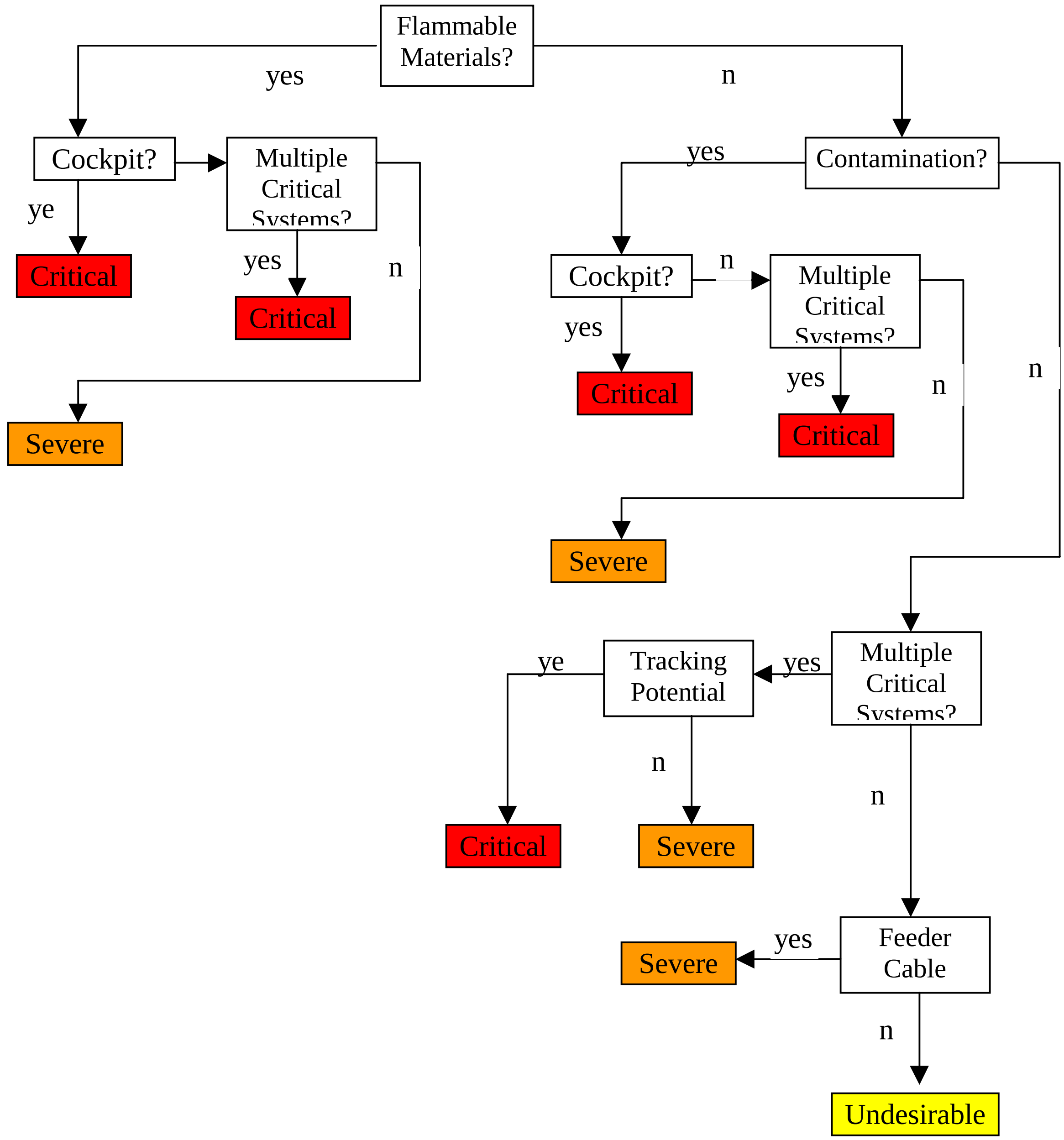
Vibration Damage or Chafing



Moisture is not considered the most important aggravating factor, because the chafing agent itself is – at the time of chafe through – likely to supply the short circuit path. The right branch contains reference to arc tracking potential and power feeder cables, whereas cracked wire and burnt wire (in similar conditions) do not. The resulting added severity of the possible outcomes is appropriate due to the more likely short circuit associated with chafing versus cracked, delaminated, or burnt wire.

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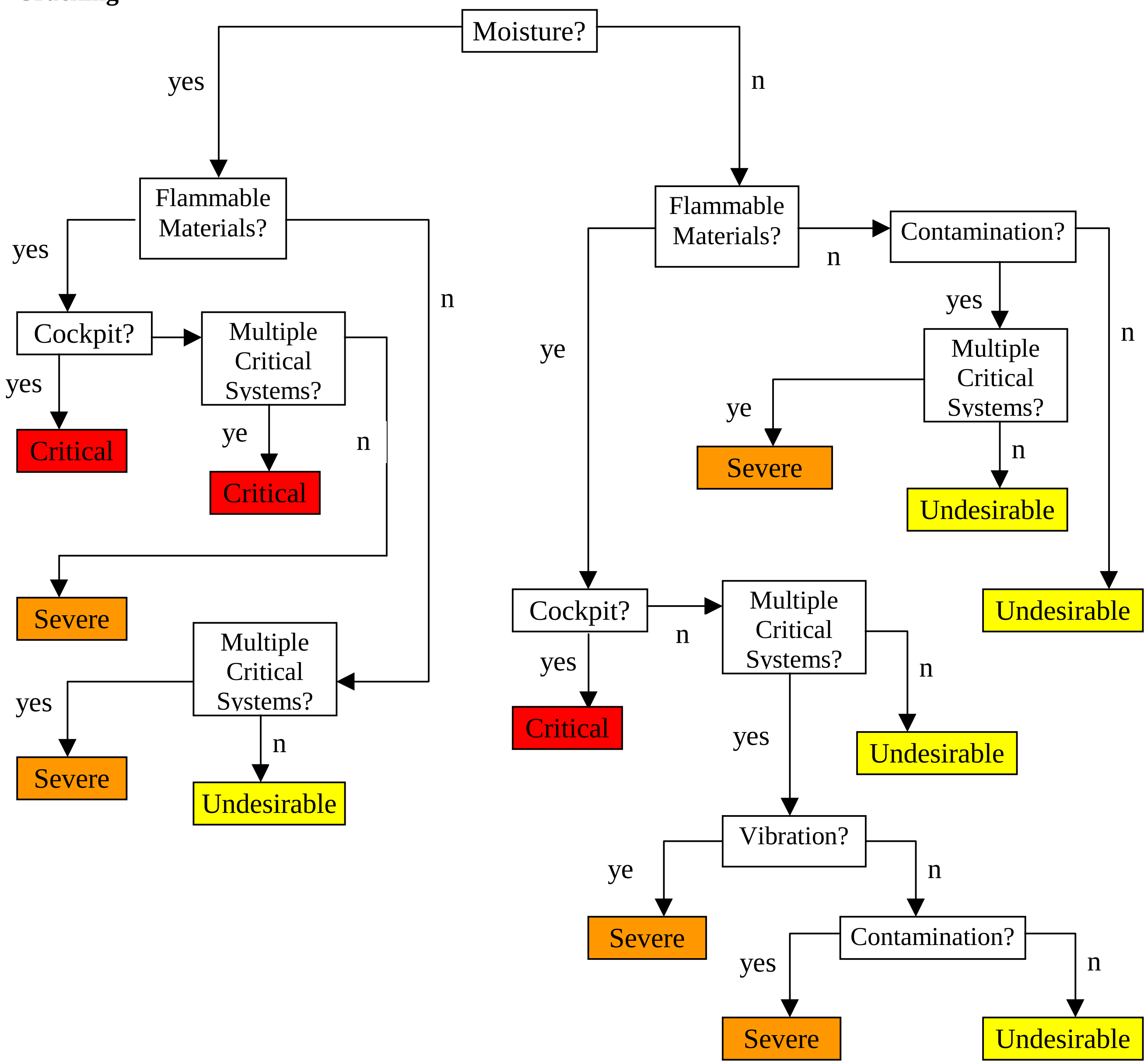
Cracking



The primary threat is considered fire. A secondary threat is the destruction of multiple critical systems due to a common mode failure.

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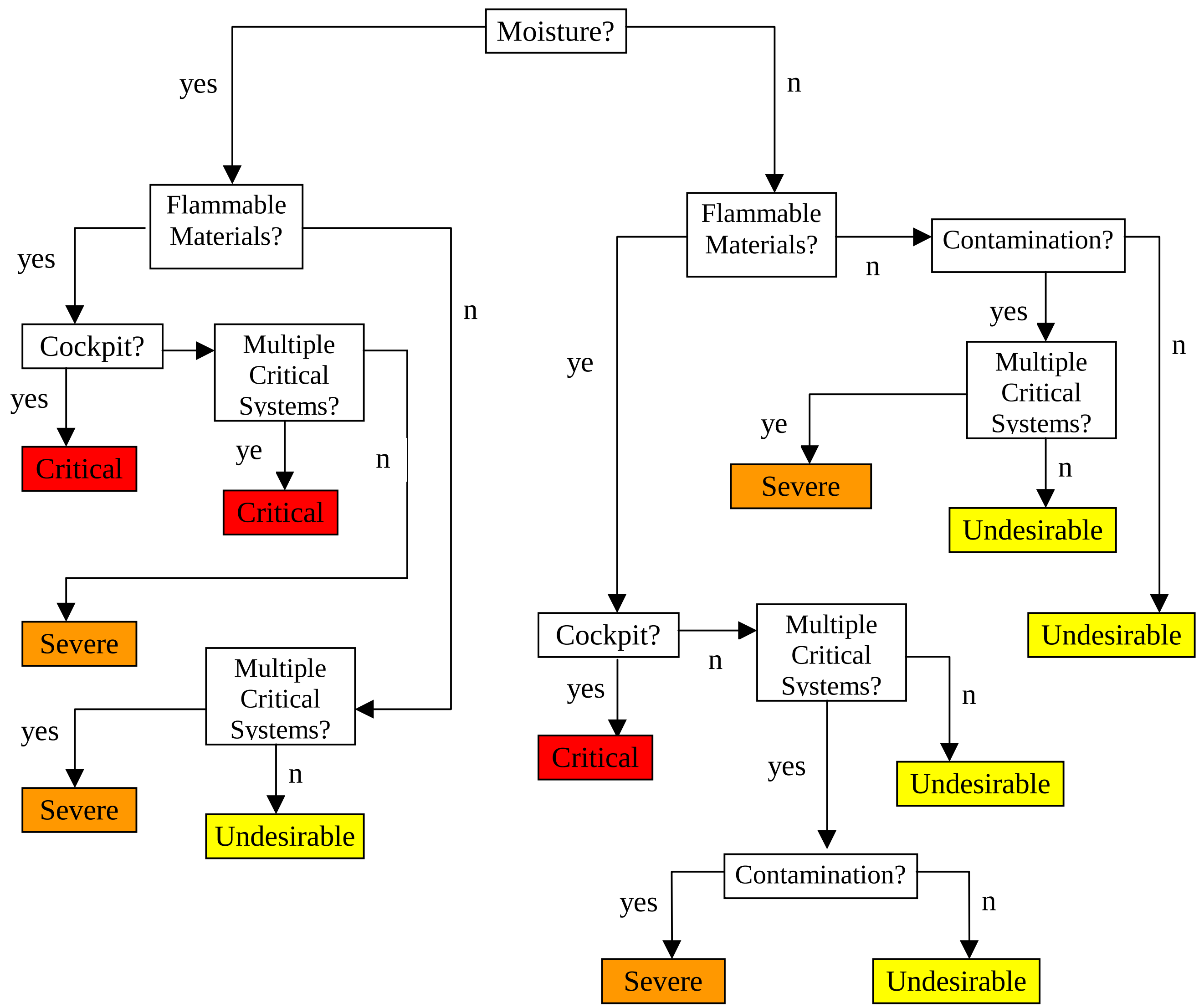
Delamination



The primary threat is considered fire. A secondary threat is the destruction of multiple critical systems due to a common mode failure.

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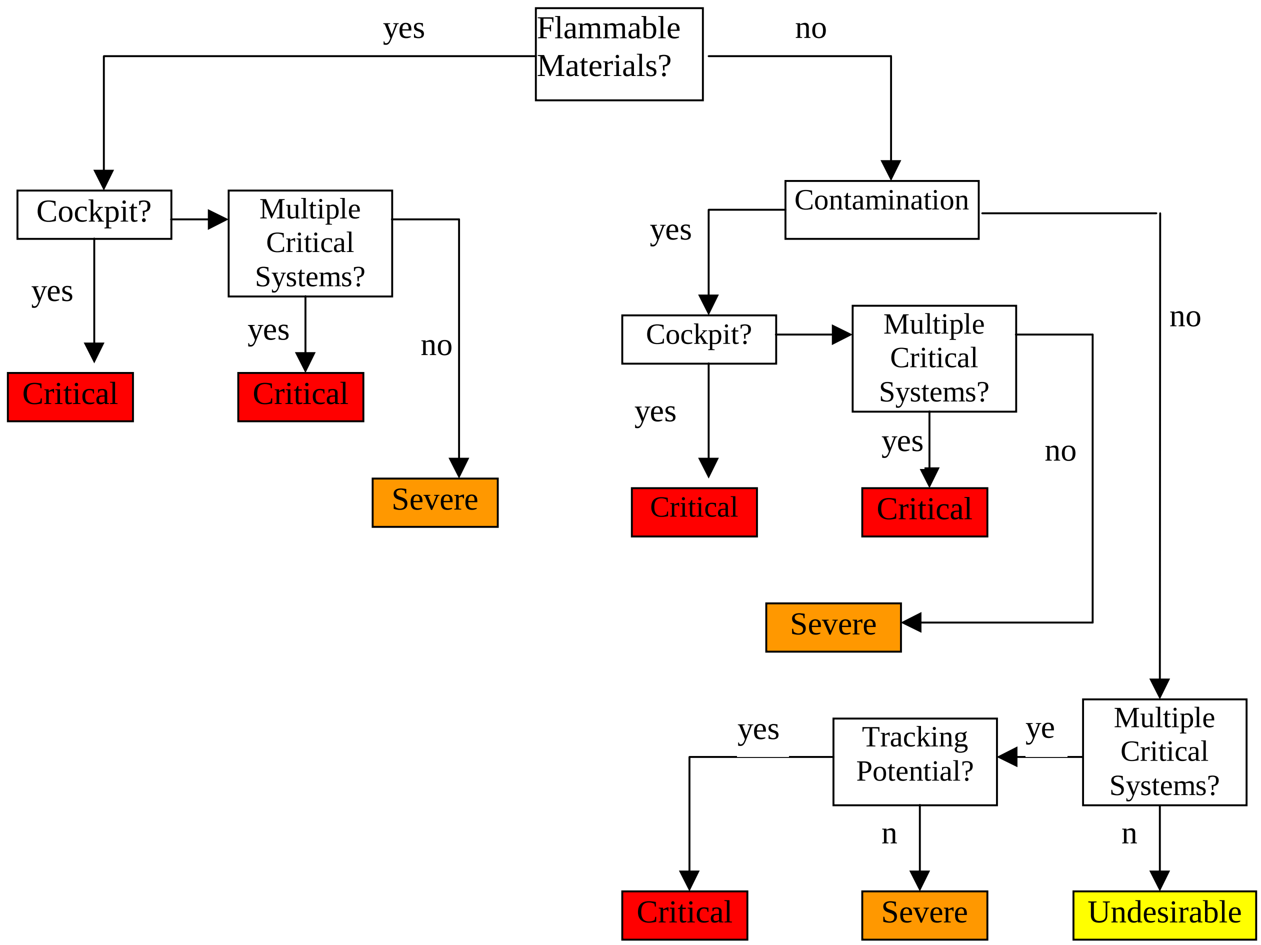
Arcing



Flammable Materials?
yes
no
Cockpit?
Multiple Critical Systems?
yes
Critical
yes
Critical
no
Severe
Contamination
yes
Cockpit?
Multiple Critical Systems?
no
yes
Critical
yes
Critical
no
Severe
Multiple Critical Systems?
ye
Tracking Potential?
yes
n
n
Critical
Severe
Undesirable