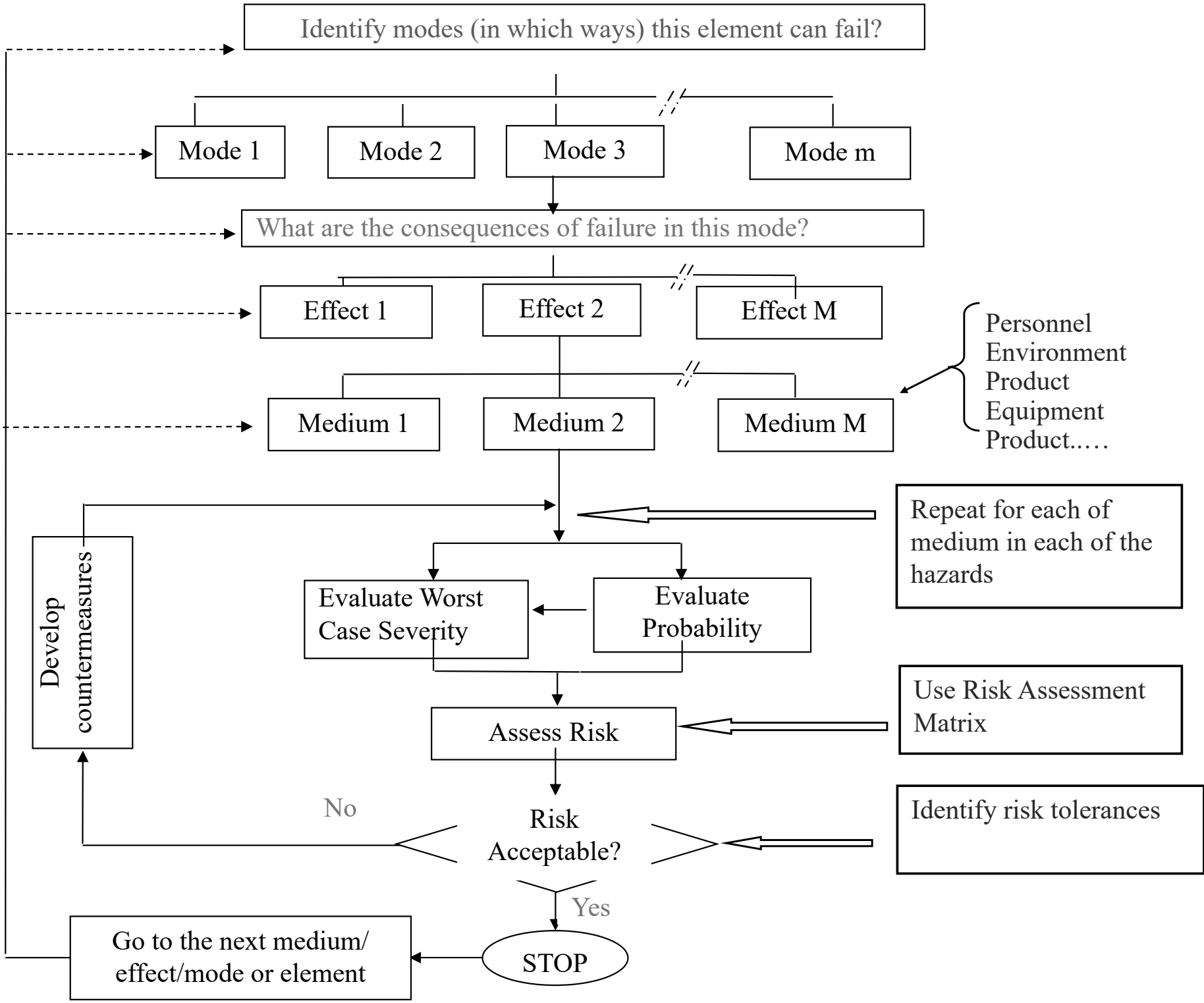
FMEA Process Flow



FMEA Process, 1

- Define the subsystem, scope, and boundaries.
  - ⇨ Drawings, charts, descriptions, diagrams, components lists
- Break the system down into convenient and logical elements.
- System Breakdown
  - ⇨ Functional
    - ✹ according to what the System Elements “do”
    - ✹ Cooling System; Braking System; Steering System……
    - ✹ Engine Compartment; Passenger Compartment, Dashboard/Control Panel, Rear End, ……
  - ⇨ Geographic
    - ✹ i.e., according to where the System Elements “are”)
  - ⇨ OR Both

Failure Mode & Effect

Failure Mode: The **way** in which the failure of an item occurs.

Element	Failure Mode Examples
Switch	open, partially open, closed, partially closed, chatter
Valve	open, partially open, closed, partially closed, wobble
Spring	stretch, compress/collapse, fracture
Cable	stretch, break, kink, fray
Operator	wrong operation to proper item, wrong operation to wrong item

Failure Effect: The **consequence** of a failure mode on an operation, function, status of a system.

Basic Failure Modes

- Open Circuit
- Short Circuit
- Out of Tolerance
- Leak
- Hot Surface
- Bent
- Warped
- Dirty
- Melted
- Omitted
- Oversize/undersize
- Cracked
- Brittle
- Misaligned
- Binding/Bound
- Corroded
- Rough

Typical General Failure Modes

- Premature operation
- Failure to operate at a prescribed time
- Intermittent operation
- Failure to cease operation at a prescribed time
- Loss of output or failure during operation
- Degraded output or operational capability
- Other unique failure conditions based on system features, operation requirements, and constraints, e.g., a switch

Causes of Failure

- System Causes
  - ⇨Item does not work
  - ⇨Short Led to ground
- Design Causes
  - ⇨Vibration
  - ⇨Shock Loads
- Process Causes
  - ⇨Voltage Surge
  - ⇨Worn Bearings
- Service Causes
  - ⇨Human Error
  - ⇨Poor Skills

Failure Effects

- Operations impaired
- Erratic Operation
- Intermittent Operation
- Quality Defects
- Customer expectation not met
- Unstable Process
- Inefficient Process
- Waste
- Excessive Wear/Tear
- Equipment damage
- Chemical Release
- Environmental Damage
- Personal Injury
- Loss of Life
- Catastrophic loss of system