# Deriving *Safety* Metrics

## From data to intelligence


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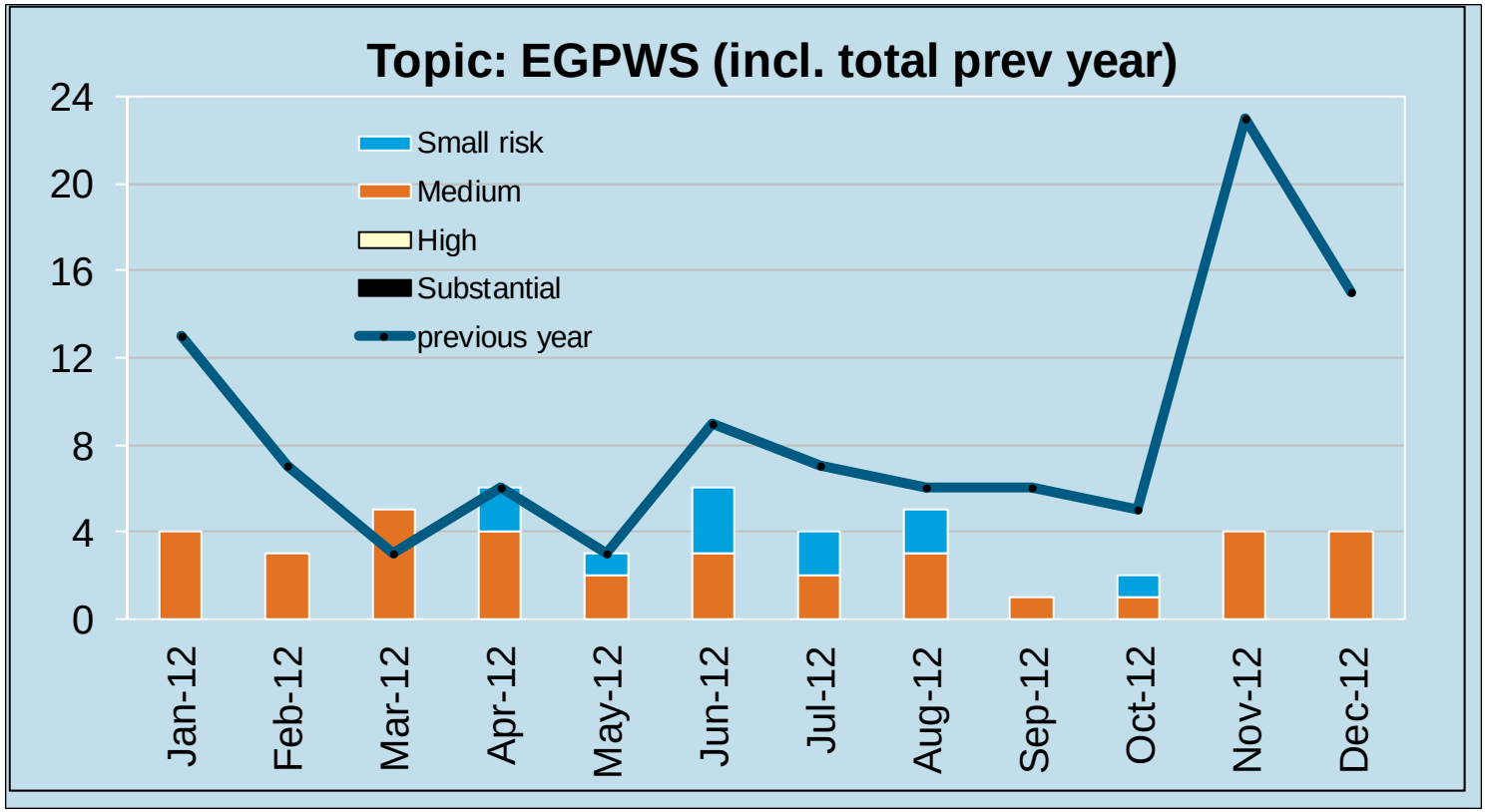
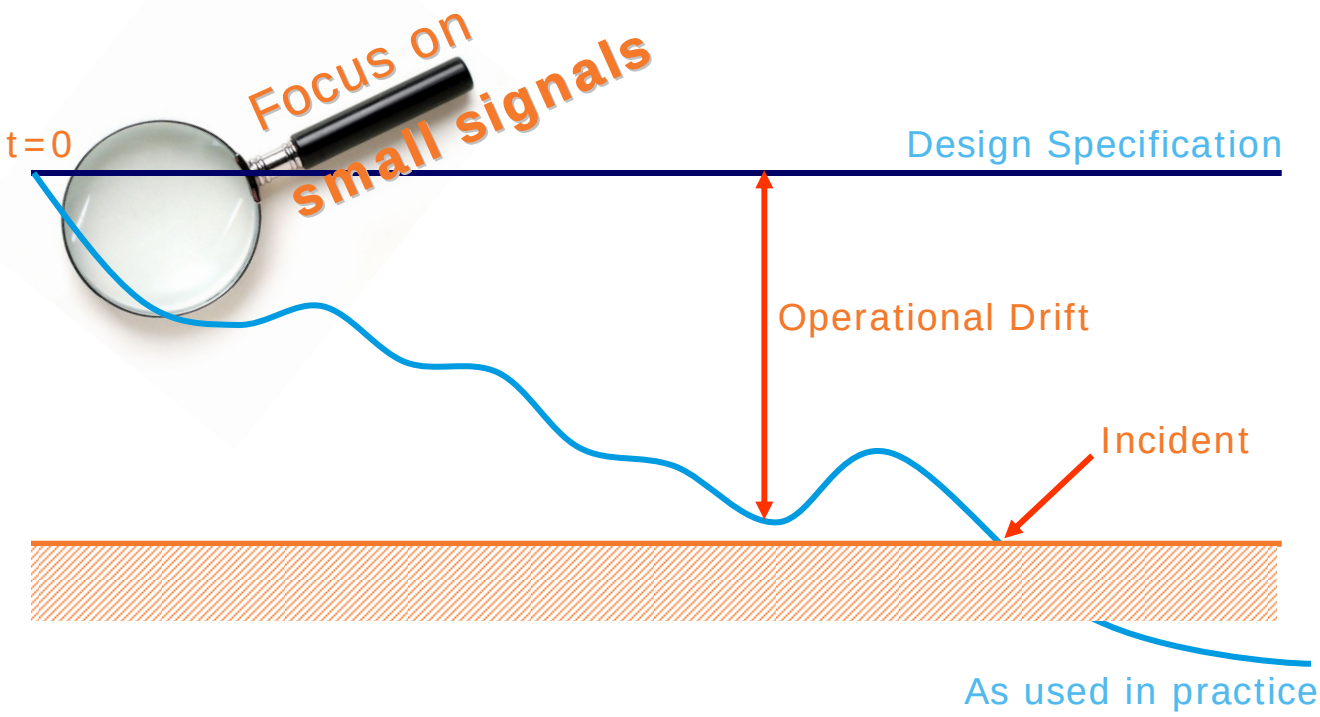
# Current Incident-based Safety Info: *Data*



# Operational Drift



# **Bill Voss** — Flight Safety Foundation

1. What is most likely to be the cause of your next accident or serious incident?
2. How do you know that?
3. What are you doing about it?
4. Is it working?

- Simple to answer if we have an effective SMS
- Impossible to answer if we don't

Source: Aero Safety World dec11-jan12

# Transition to **Risk Based** Safety Assurance & Change Management

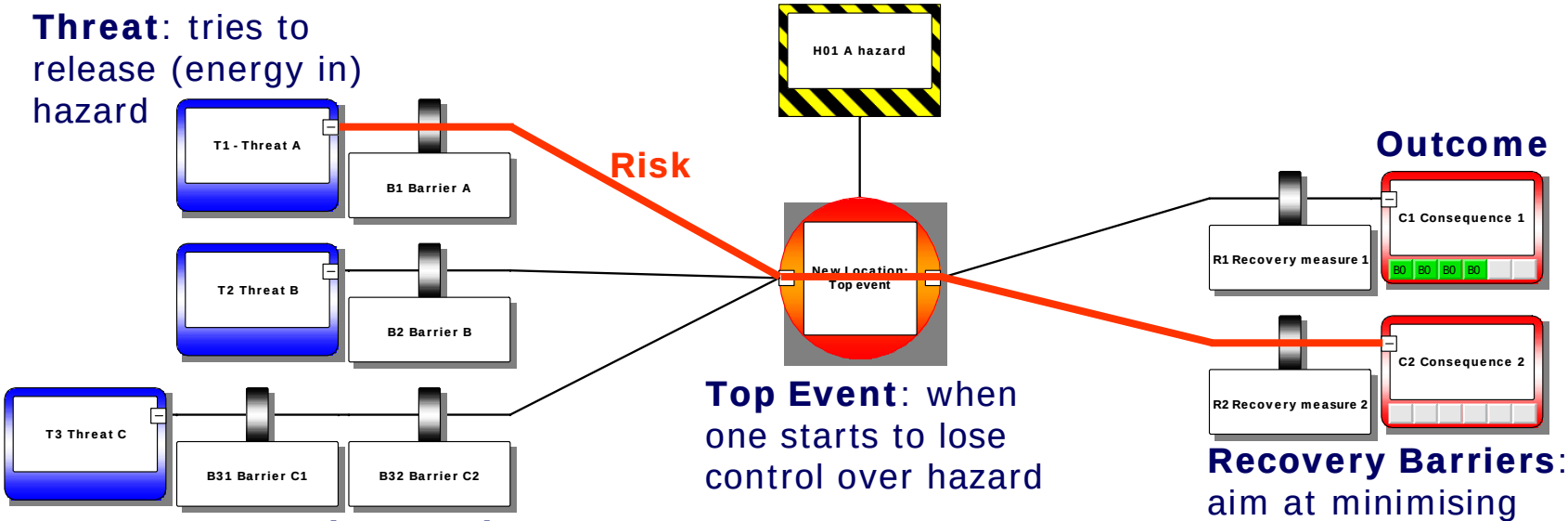
- Need for a sensible representation of
  - risk
  - potential failure of measures taken to control risk
- Need to look for “small signals”
- Wish to use (much) more data from operation

- Need to transform data into intelligence

# Bow Tie as a **Risk Model**

**Hazard**: potential (negative) energy

**Threat**: tries to release (energy in) hazard




**Top Event**: when one starts to lose control over hazard

**Preventive Barriers**: aim at preventing Top Event from happening

**Recovery Barriers**: aim at minimising damage once Top Event has happened

# Example

## Stabilised Approaches vs Overrun Risk

- ALAR TF reasserted need for Stabilised Approaches
- Criteria are seen as precursors for underlying risk: overrun (a.o.)
- Focus on Stabilised Approach Criteria ≠ risk

# Risk-based Safety Performance Metrics

- Approach and landing manoeuvre & crew actions "peeled back" to reveal underlying risk

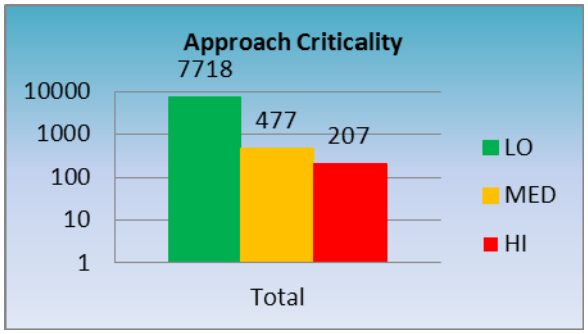
- Stabilised Approach Criteria are part of barrier performance;
  Risk indicates Barrier "non-performance"

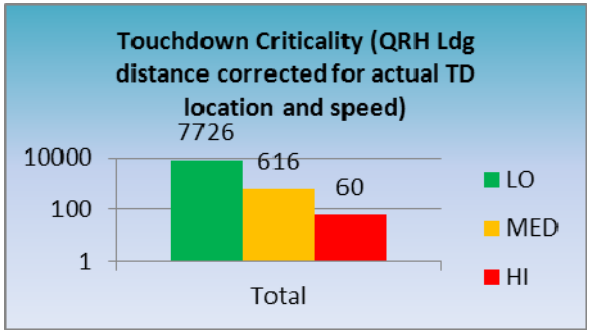
- Both are needed for proper risk-based safety mgmt!

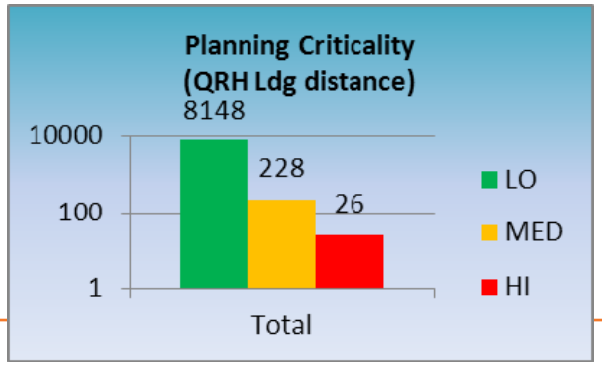
- For overrun risk:
  Focus on kinetic energy; stopping performance vs runway available.

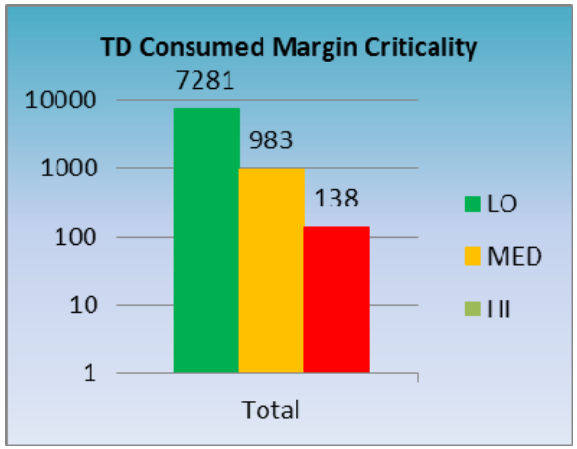
# Data from **All** Landings…

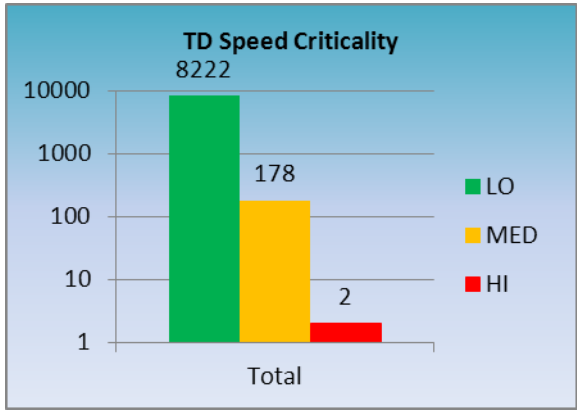
# ...Converted into **Intelligence**

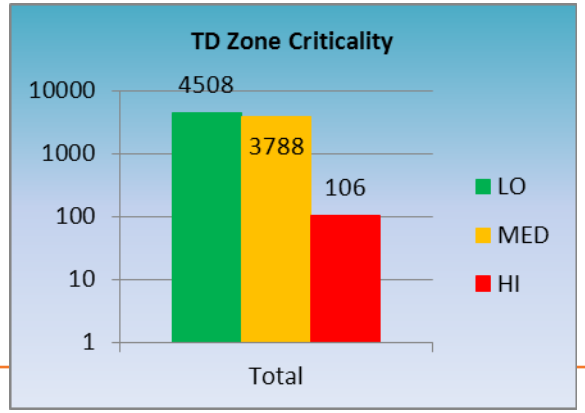


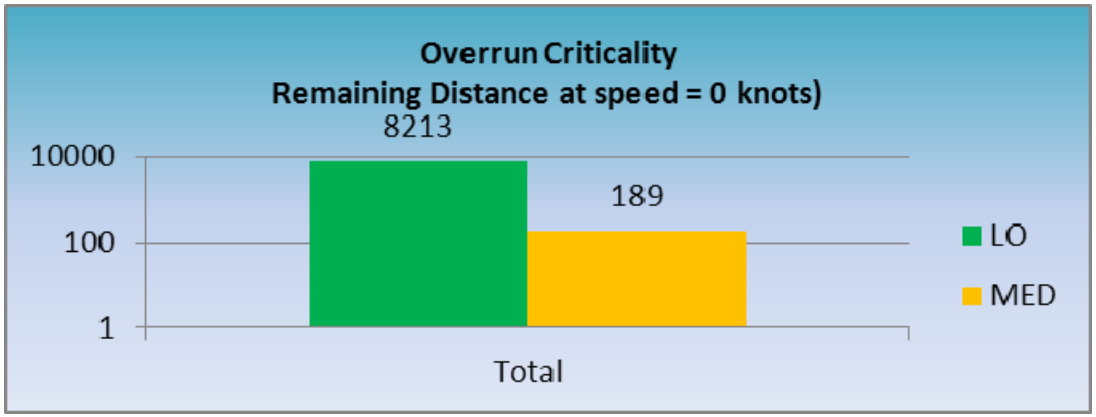



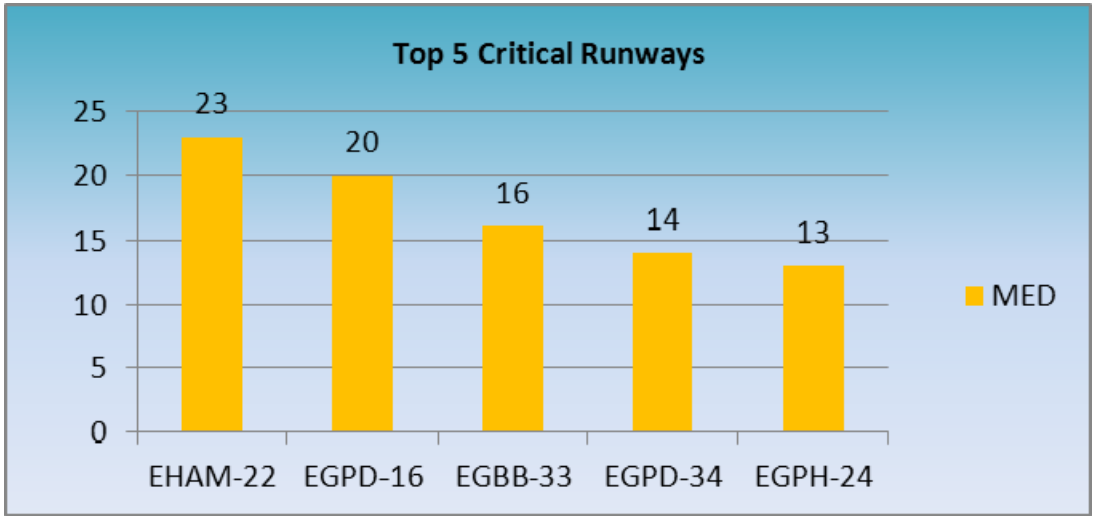



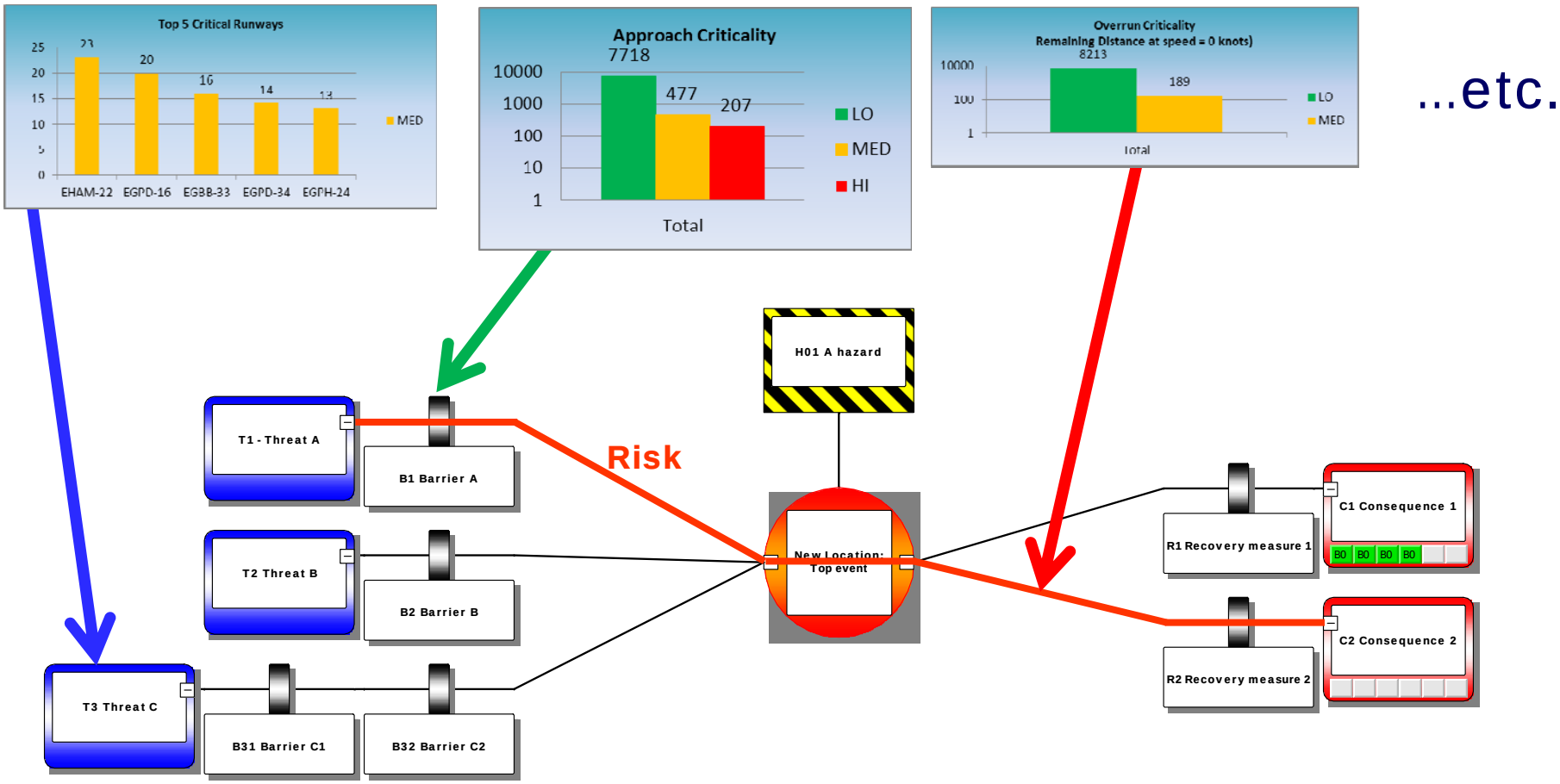



# Safety Risk Metrics

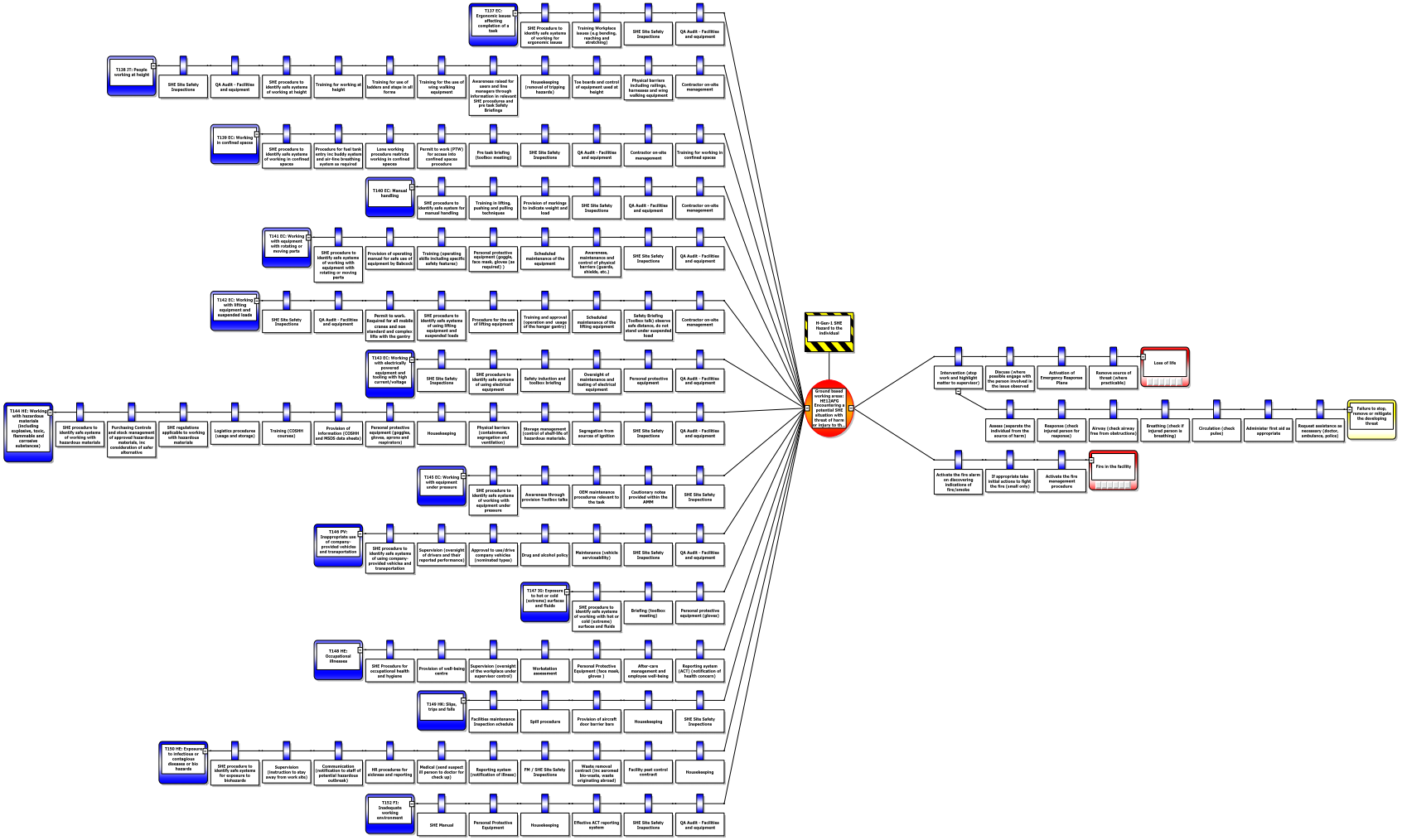


# Mapping Safety Risk Metrics to the risk model



# Operational Bow Tie



# Practical Implications of Risk-based metrics

- Need for a proper risk model (or else: failure)
- Introduction of Criticality = measure of margin to limit; based on KLM Risk Matrix
- Barrier Performance made up of several criticalities
- Enormous amounts of data required – introduction of advanced statistics
- Qualitative intelligence required – quest for data gathering and analysis methods
- New input sources required

Risk model to be used for

- Safety Assurance; and
- Change Management


KLM
PH-BFO
KLM

# **Integrated** SMS Data Warehouse