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*Safe
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The ATSB Approach to Improving the Quality of Investigation Analysis

Mike Walker

Background

- Analysis has been a neglected area in terms of training, guidance, standards
- ATSB wanted to:
 - improve rigour and consistency of analysis
 - improve ability to detect safety issues in system
 - incorporate new process in Safety Investigation Information Management System (SIIMS)
- Borrowed ideas from available material, developed new material

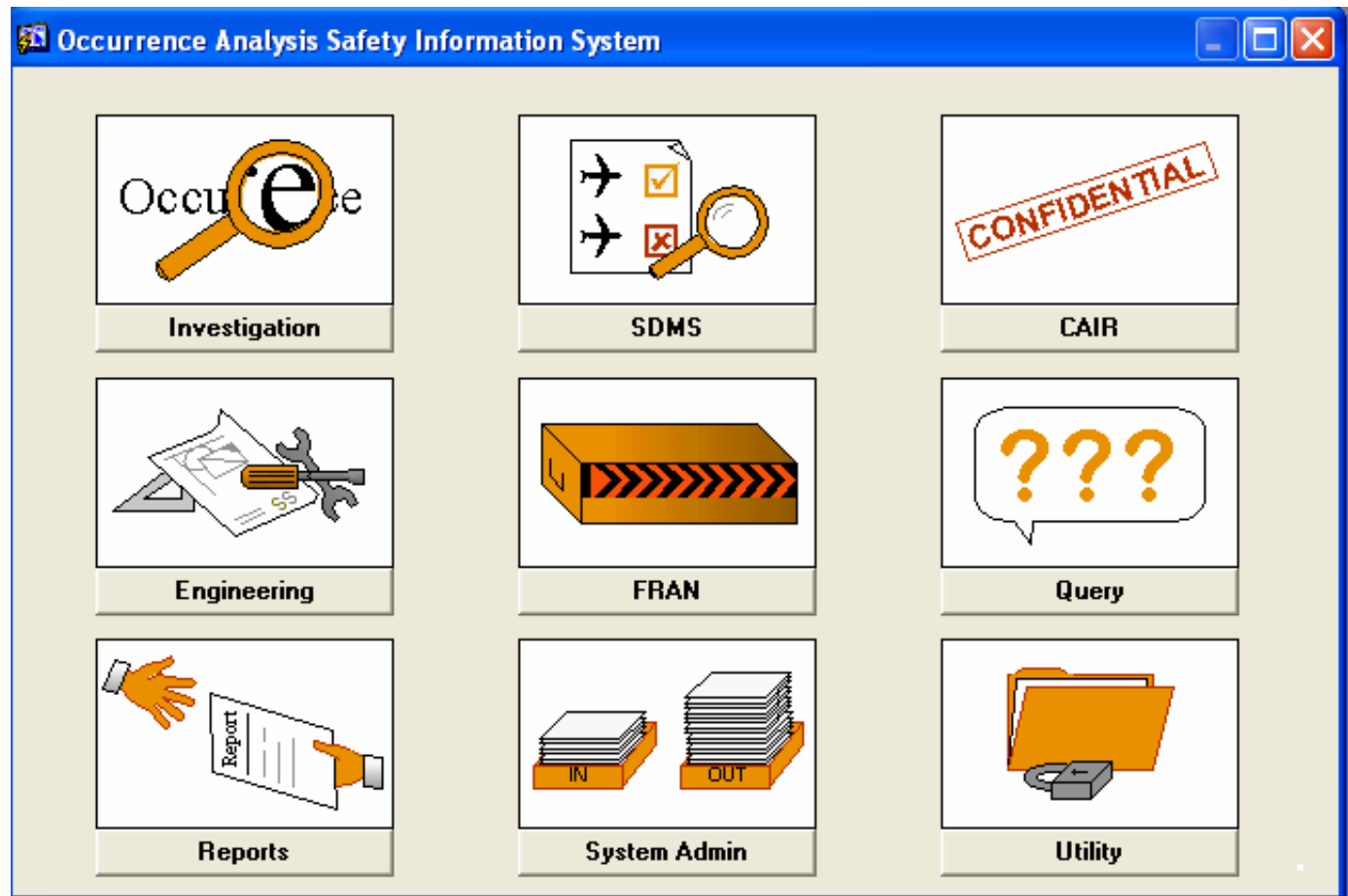


Investigation analysis needs

- Standard terminology
- Standard accident development model
- Principles of critical reasoning
- Defined process / workflow
- Supporting tools in SIIMS
- Policies, guidelines and training
- Clear links between evidence, findings, recommendations, database



Old world - OASIS



New world - SIIMS

- Safety Investigation Information Management System
- Drivers for change:
 - Simplify occurrence data model
 - Manage investigations as formal projects
 - Move from paper to electronic documents
 - Improve information flow with internal and external partners
 - Improve analysis of evidence

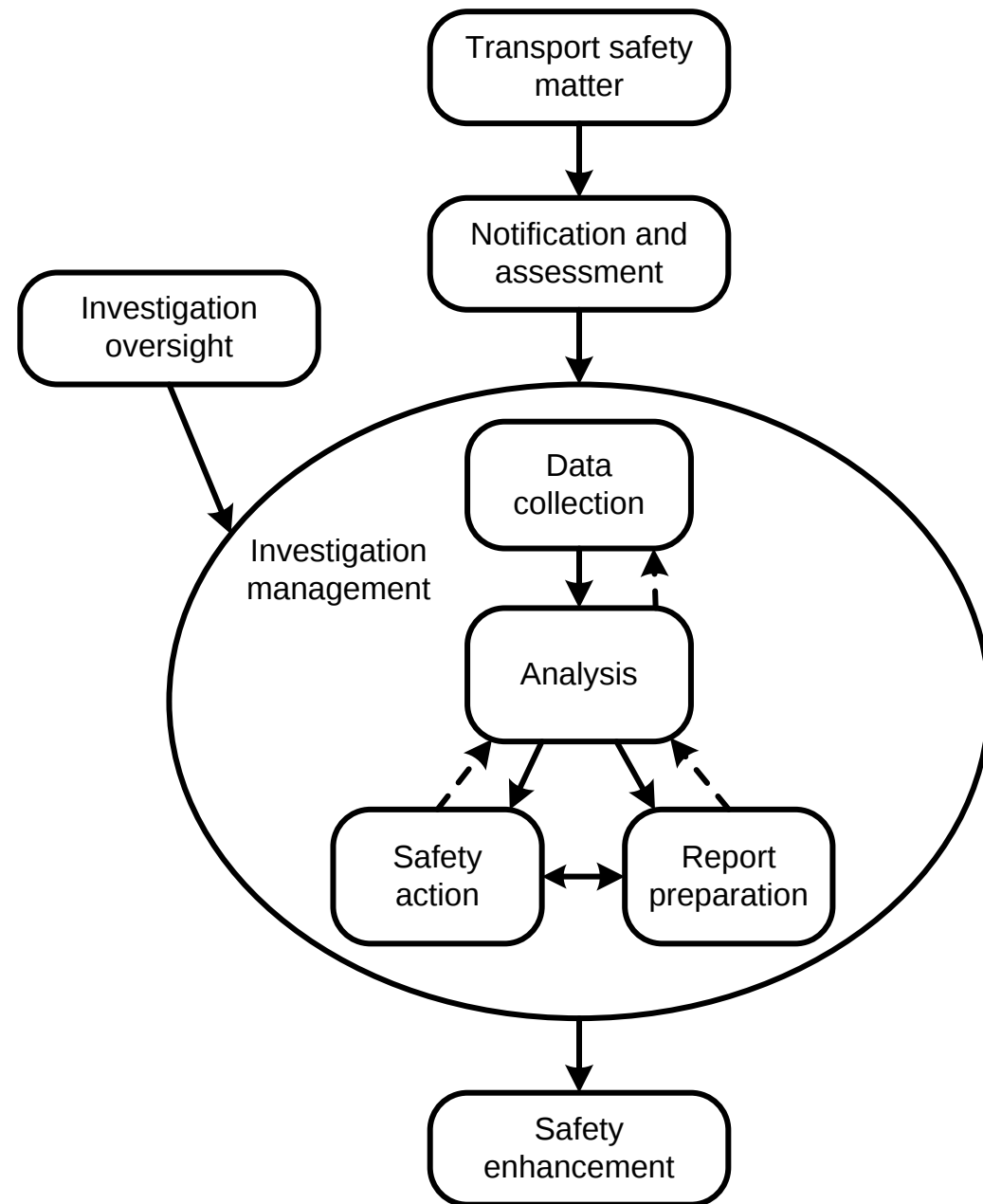


SIIMS investigation workspace

- Investigation log (activities, issues, decisions)
- Document management system
- Evidence management / tracking
- Project management
 - TASKey, risk management
- Analysis tools (including safety action)
- Report workflow
- Contacts
- Access to occurrence database



Safety investigation process



Investigation analysis (1)

- Process of converting data to findings
- Heart of safety investigation
- Iterative process
- Occurs throughout the investigation
- Involves asking questions
(more than just asking 'why')



Investigation analysis (2)

- Relies on judgement
- Can develop useful, realistic and widely accepted findings by using:
 - well-defined concepts
 - structured set of steps
 - team-based approach
 - domain knowledge
- Analysis needs time



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Some key terms

- Risk, hazard, safety
- Accident, incident, occurrence
- Event, condition
- Safety factor
- Contributing safety factor
- Safety issue



Safety factor

- Event or condition that increases risk
- Something that increases the likelihood of an occurrence, and/or severity of the adverse consequences associated with an occurrence
- Not just contributing factors
- Need to be pragmatic



Contributing safety factor

- Safety factor that, if it had not occurred or existed at the relevant time, then:
 - the occurrence would probably not have occurred
 - adverse consequences associated with the occurrence would probably not have occurred or have been as serious
 - another contributing safety factor would probably not have occurred or existed

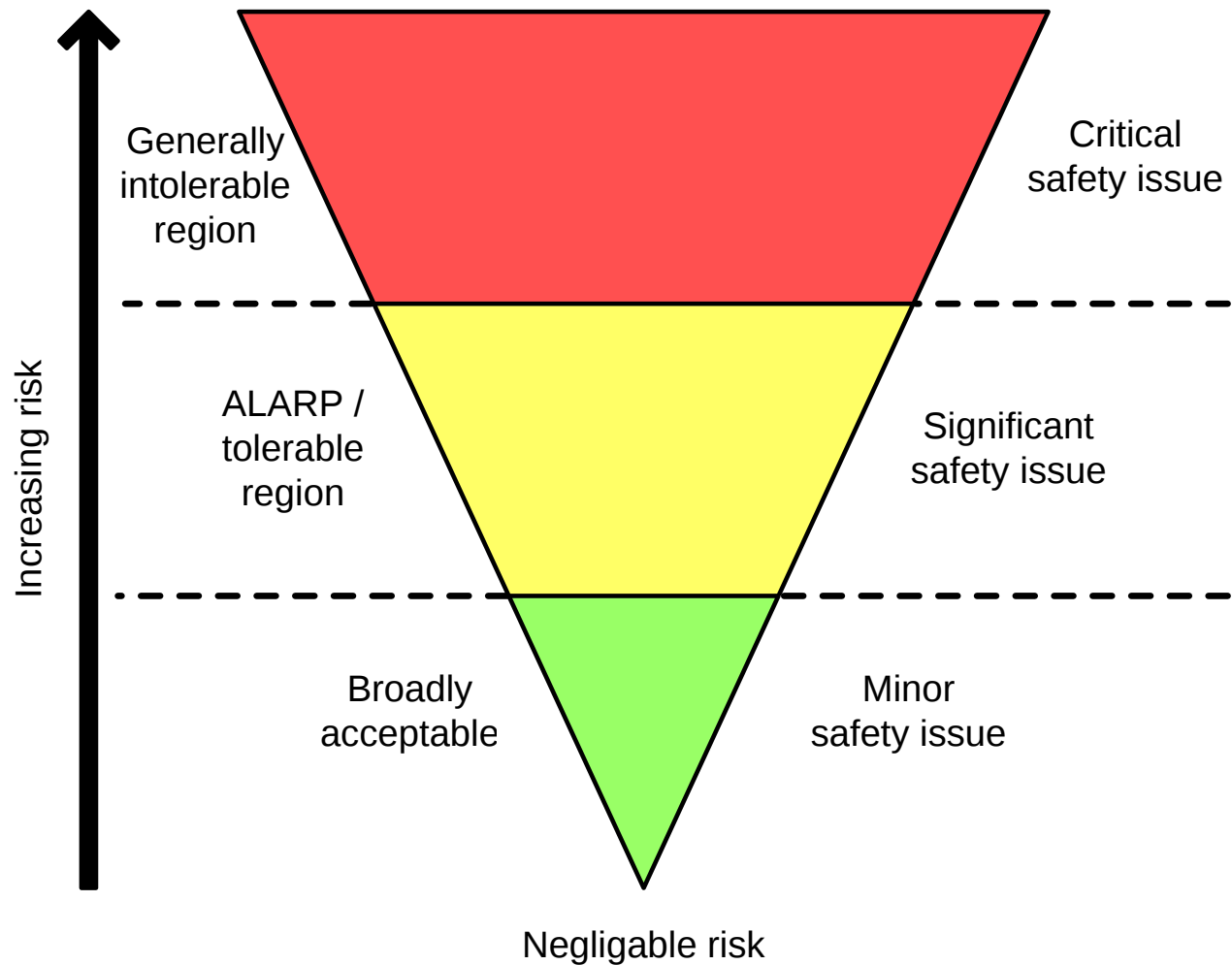


Safety issue

- Safety factor that:
 - can reasonably be regarded as having the potential to adversely affect the safety of future operations; and
 - is a characteristic of an organisation or a system (rather than a characteristic of a specific individual, or characteristic of an operational environment at a specific point in time)



Risk acceptability

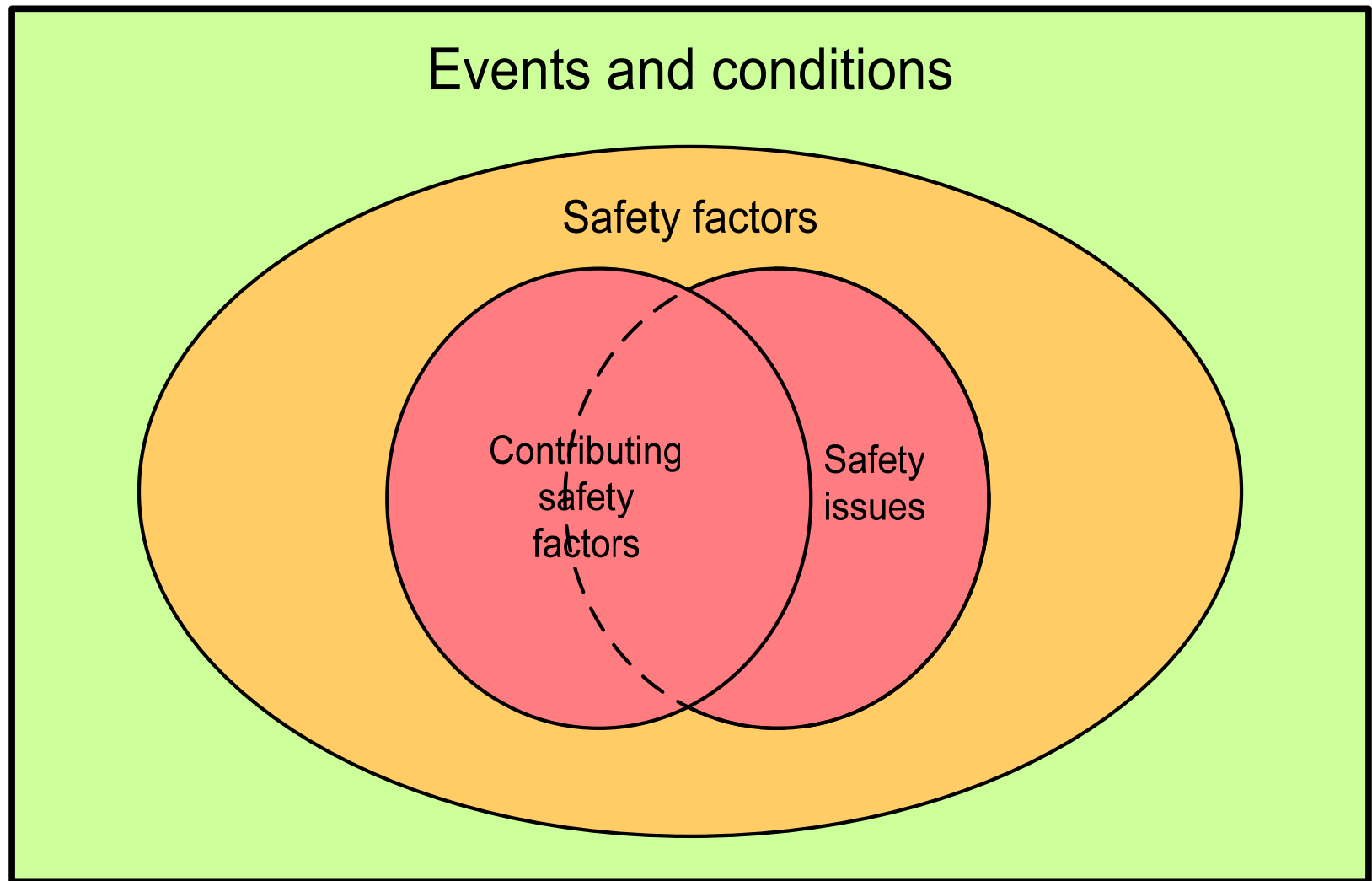


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Types of safety factors

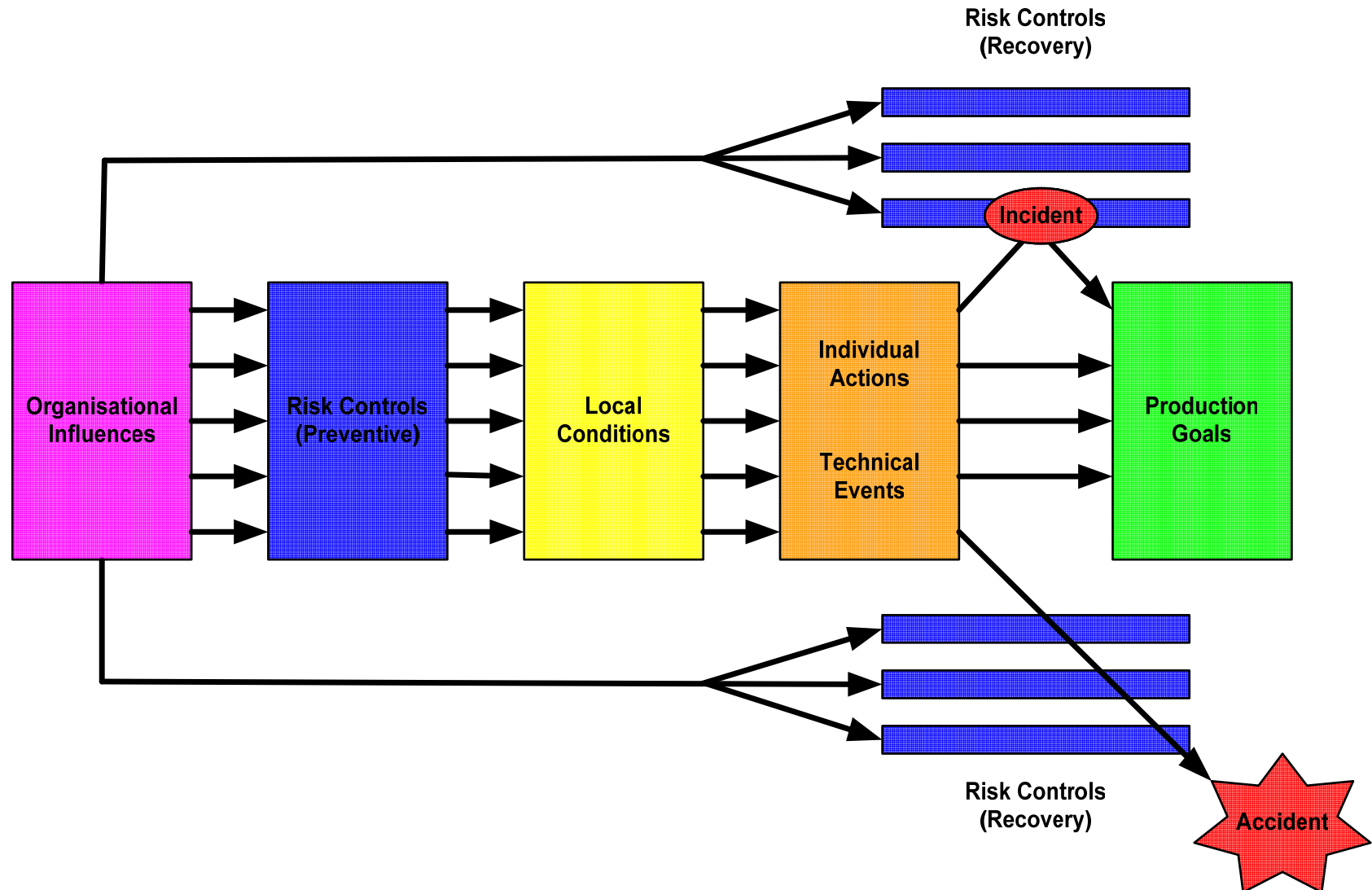


Investigation analysis needs

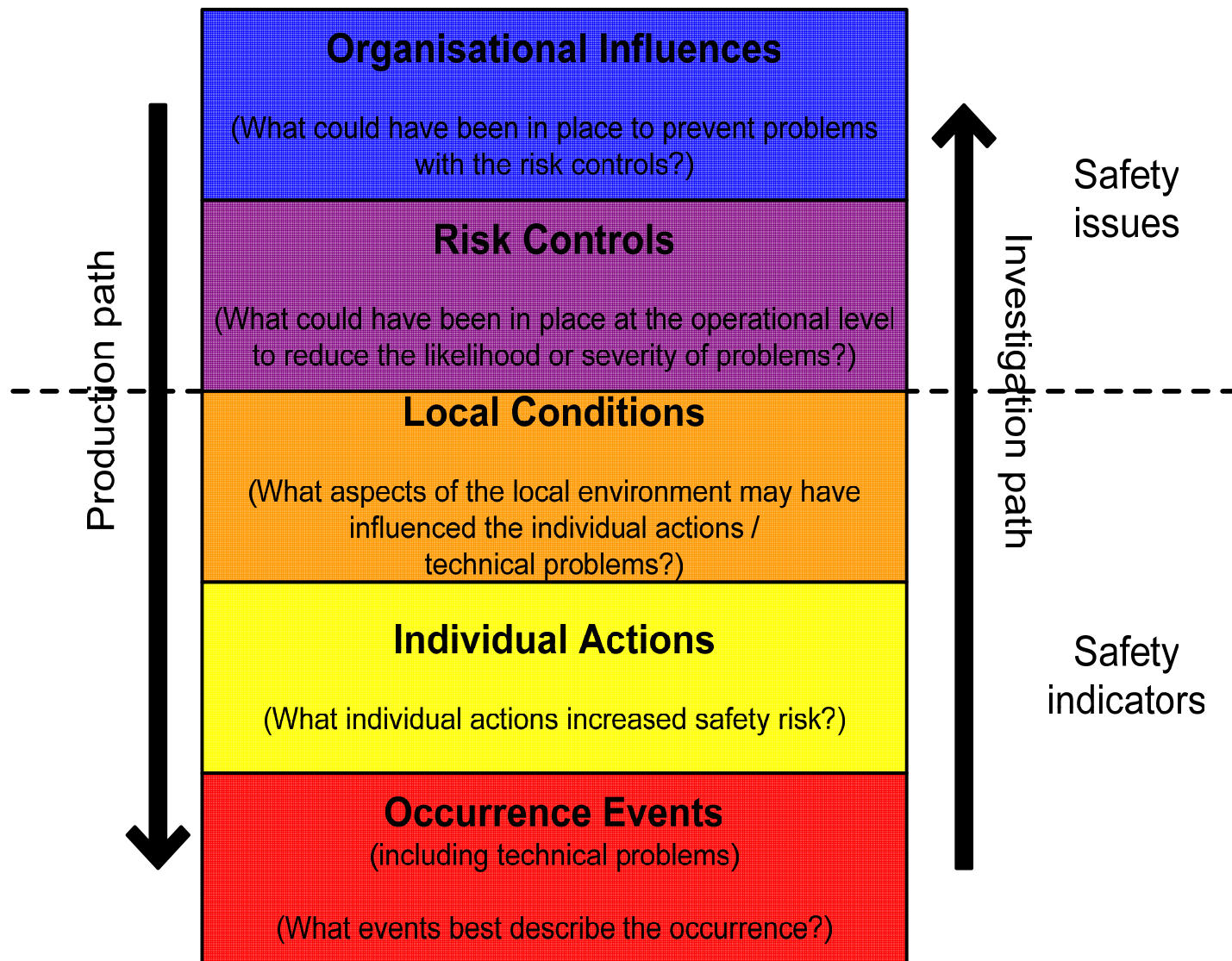
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ATSB investigation analysis model



ATSB investigation analysis model



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Principles of critical reasoning

- Arguments, premises, findings
- Deductive versus inductive reasoning
- Terms to describe likelihood
- Fallacies and biases during reasoning
- General reasoning principles
- Evidence tables



Evidence table

- Structured means of providing supporting argument for proposed finding
- Basic evidence table
 - Intermediate findings
 - Key findings in report (not safety factors)
- Safety factor evidence table
 - Contributing safety factor findings
 - Other safety factor findings



Intermediate findings: Examples

- *What was aircraft configuration at impact?*
- *Who was the handling pilot?*
- *Was the driver appropriately licensed?*
- *When was the last maintenance performed?*
- *What was the wind speed at the time?*
- *Did the witness actually see the impact?*
- *How accurate is the radar data?*



Investigation report findings

- Contributing safety factors
- Other safety factors
 - Other safety factors identified during investigation which are considered important
- Other key findings
 - Resolve significant ambiguity or controversy
 - Discuss potential scenarios
 - Positive factors which 'saved the day'



SIIMS: Basic Evidence Table

Title

Flight crew qualifications / fitness

Description

There were no indications of any medical or physiological conditions that were likely to have impaired the crew's performance.

Item	Comments	Supports?
CASA medical records indicated no ongoing or potential medical fitness concerns.	Such records are not always reliable indicators of existing problems	supports
Interviews with pilots revealed no indications of ongoing or recent medical problems likely to influence performance.	Crews typically unlikely to volunteer such information. However interviews specifically addressed medical issues, and no indications of behaviour suggesting medical problem during interviews.	supports
Operator arranged for crew to undertake eyesight tests – no problems identified.		supports

Summary

Sufficient evidence to support conclusion / no conflicting information

Supported?

Yes

Add to key findings?

No

Completing an evidence table

- Develop the proposed finding
- Identify relevant items of information
 - support the finding
 - are contrary to the finding
 - no direct bearing this time but usually relevant
- Evaluate strength of each item
 - consider reliability, precision, relevance
 - add comments and qualifiers where appropriate
- Evaluate overall merits of proposed finding

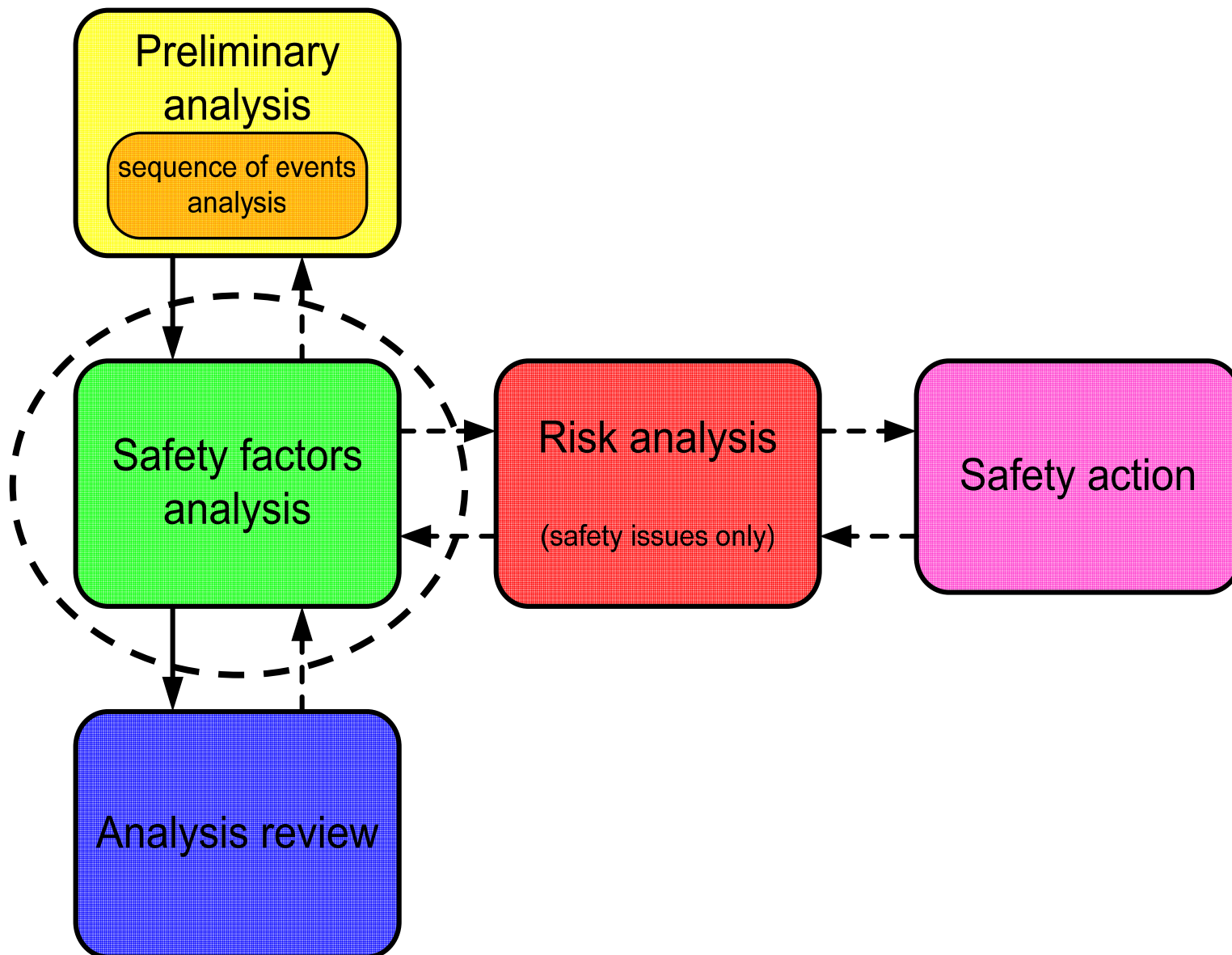


Investigation analysis needs

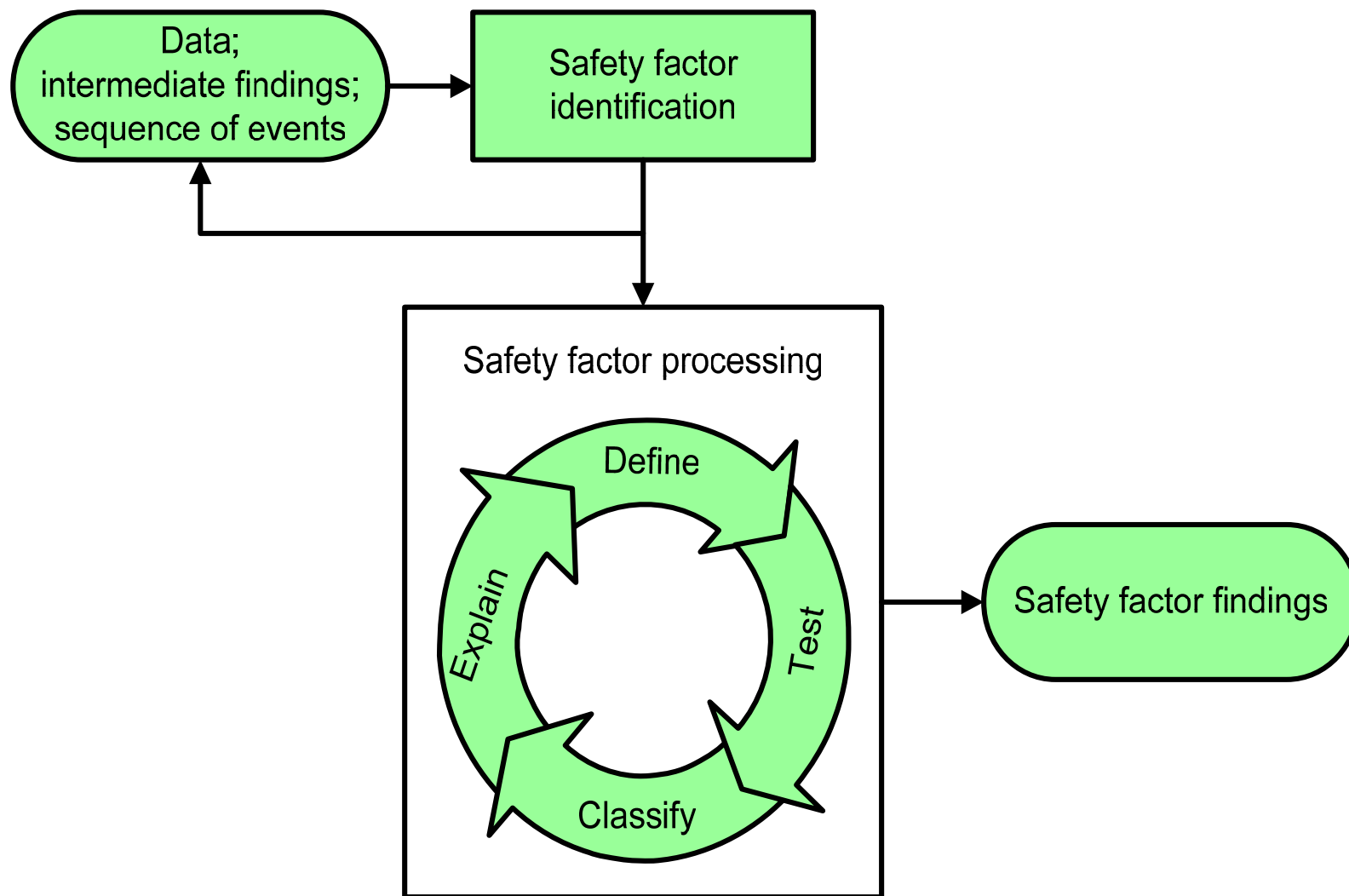
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Investigation analysis process



Safety factors analysis

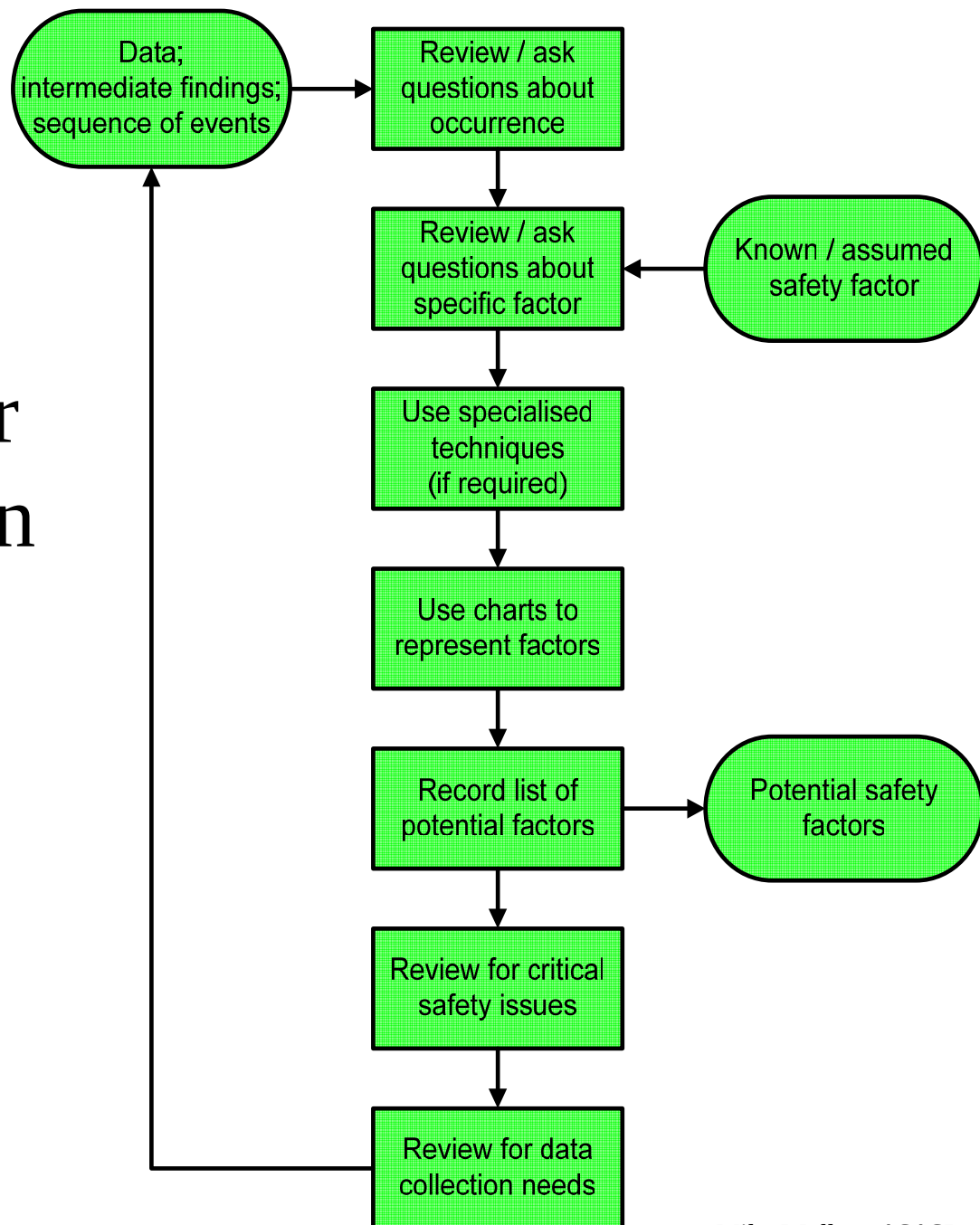


Safety factor identification

- Starts soon after investigation starts, conducted at regular intervals
- Focuses on identifying potential factors
- Aims to:
 - identify potential critical safety issues early
 - guide data collection needs

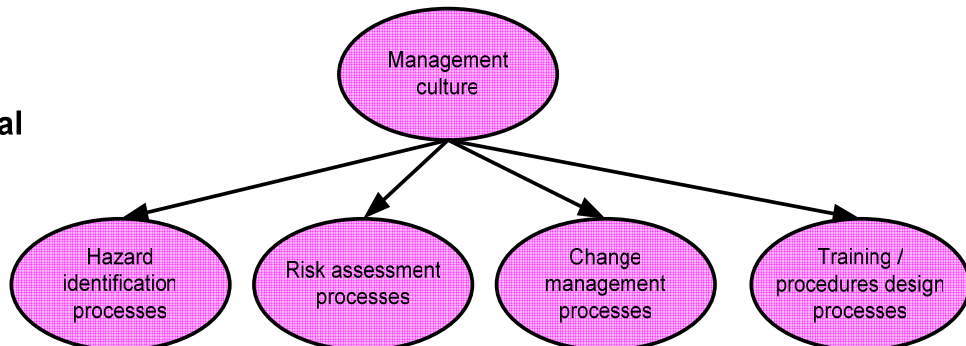


Safety factor identification

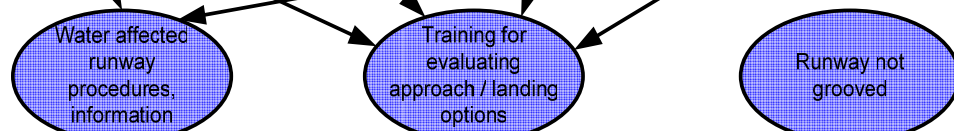




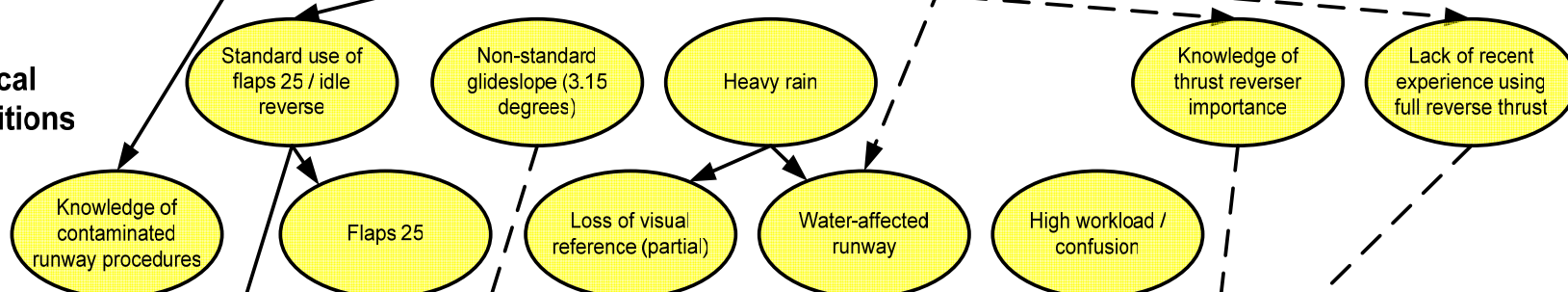
Organisational Influences



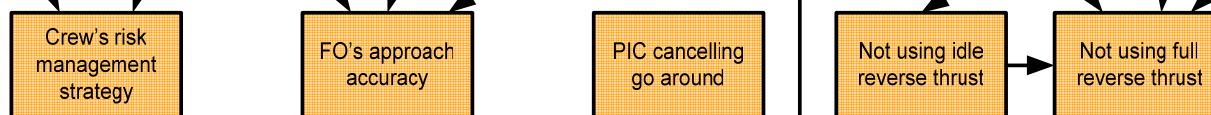
Risk Controls



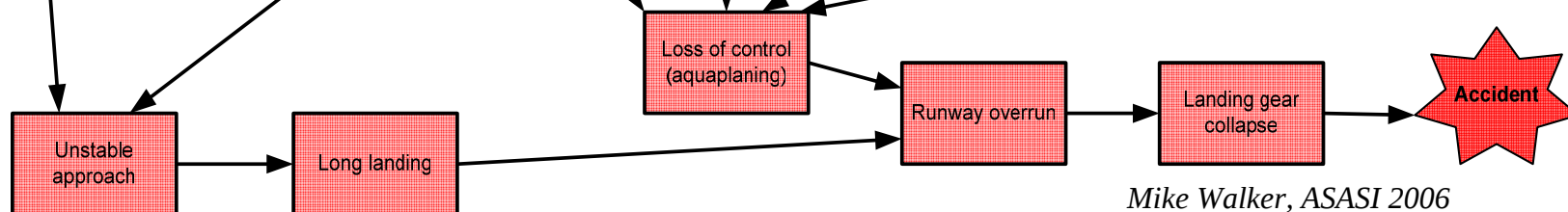
Local Conditions



Individual Actions



Occurrence Events



SIIMS Safety factors list

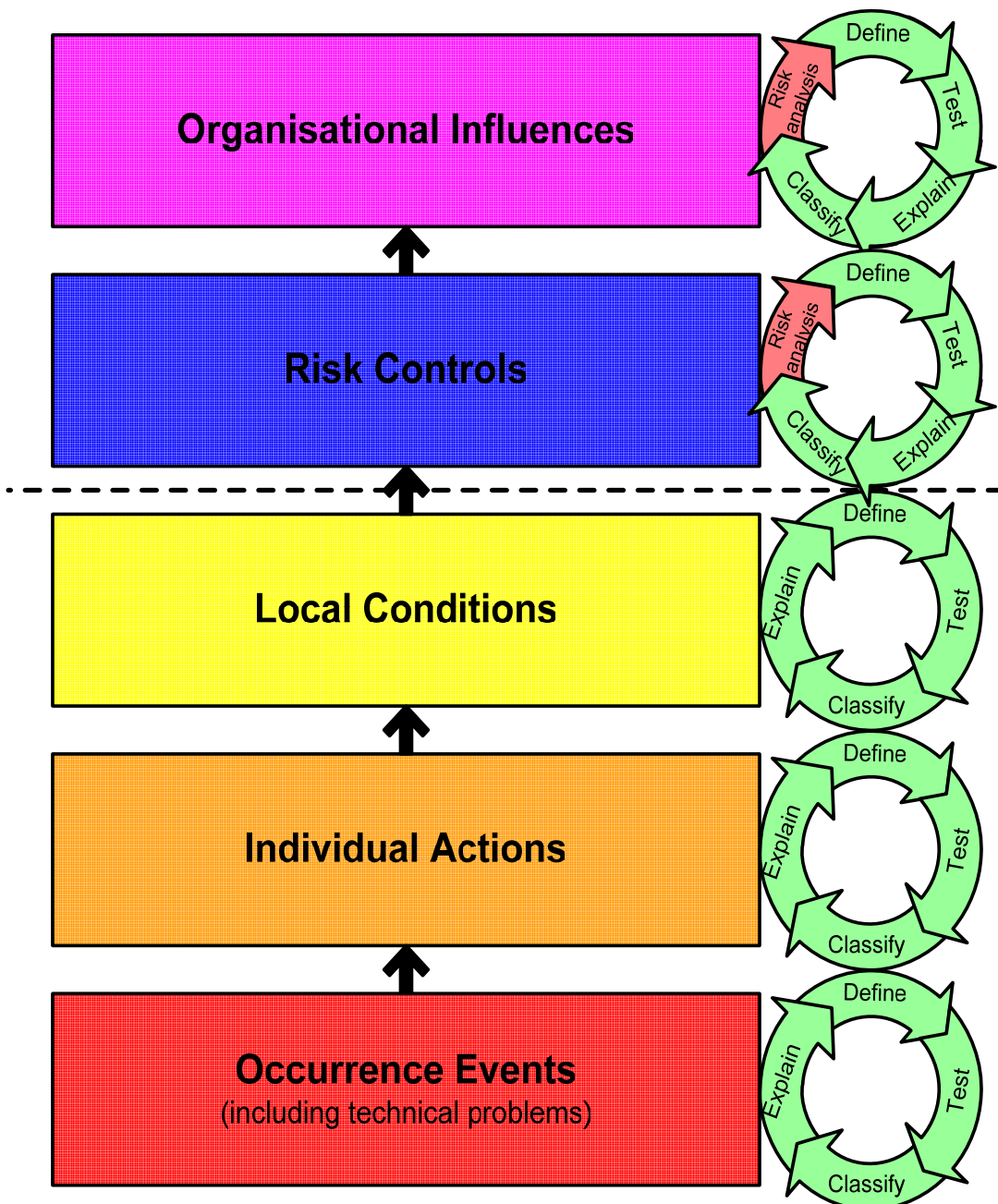
Title	Factor Type	Further Analysis	Existence	Finding Type	Safety Risk Level	Analysis Complete
Long landing	Occurrence event	yes	yes	Contributing factor		Yes
Runway overrun	Occurrence event	yes	yes	Contributing factor		Yes
Flight crew risk management of weather	Individual action	yes	yes	Contributing factor		Yes
Go around too late	Individual action	yes	no	None		Yes
PIC cancelling go-around	Individual action	yes	yes	Contributing factor		Yes
Not using TOGA	Individual action	yes	yes	Other safety factor		Yes
Crew not selected full reverse thrust	Individual action	yes	yes	Contributing factor		Yes
Crew knowledge of contaminated runway operations	Local condition	yes	yes	Contributing factor		Yes
Visibility due rain	Local condition	yes	yes	Contributing factor		Yes
Non-standard glideslope (3.15 degrees)	Local condition	yes	yes	None		Yes
Runway not grooved	Risk control	yes	yes	Other safety factor	Significant	Yes
Contaminated runway procedures and training	Risk control	yes	yes	Contributing factor	Critical	Yes
Training in approach configurations	Risk control	yes	yes	Contributing factor	Significant	Yes
Hazard identification processes	Org influence	yes	yes	Contributing factor	Significant	Yes
Risk assessment processes	Org influence	yes	yes	Contributing factor	Significant	Yes

Safety factor processing

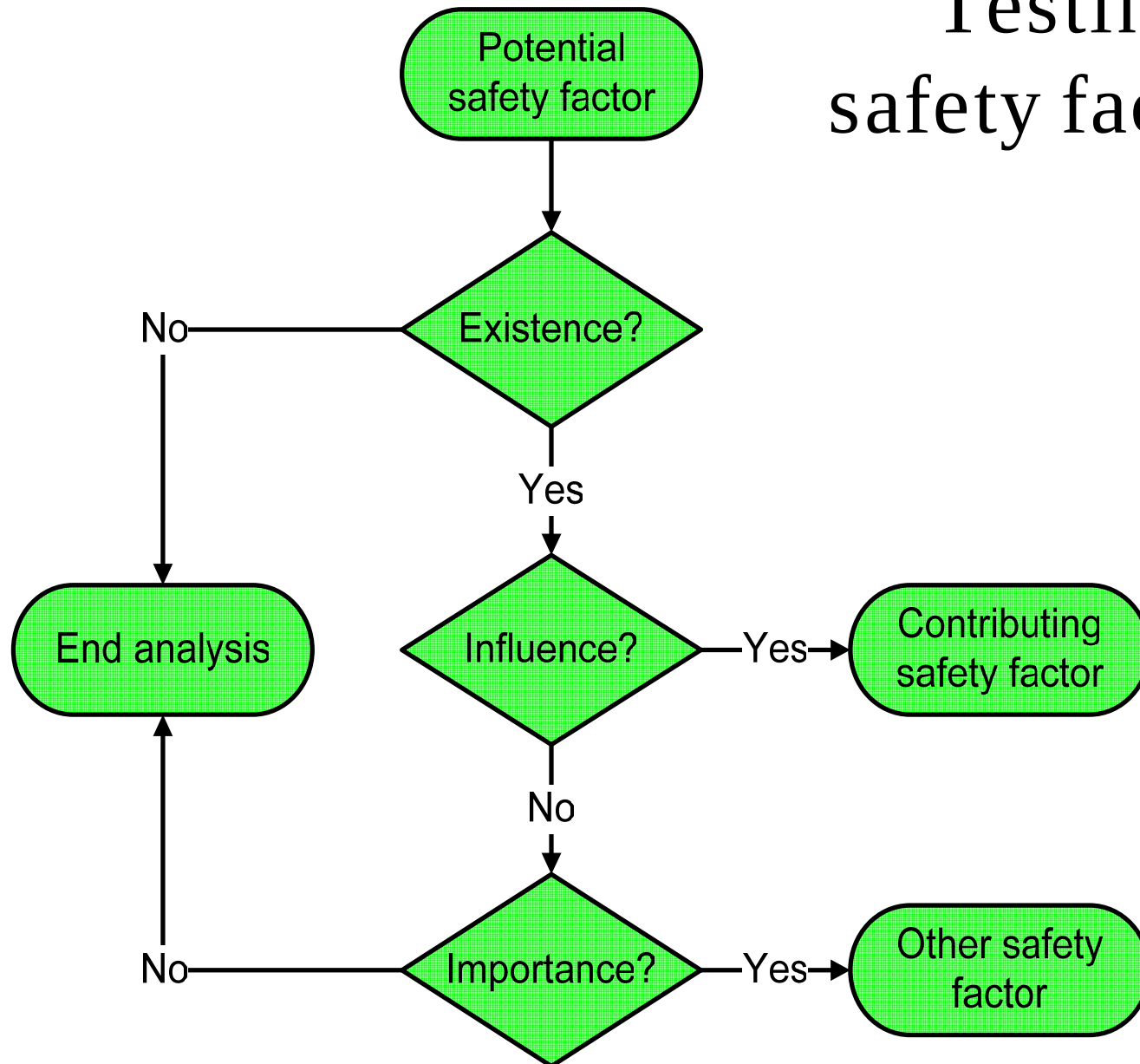
- Starts when most of the data has been collected
- For each potential safety factor:
 - Define
 - Test
 - Classify
 - Explain
- Aims to provide list of established safety factor findings



Safety factor processing



Testing safety factors



SIIMS: Safety Factor Evidence Table

Title		Safety factor type		Safety issue	
Description					

EXISTENCE

Item	Comments	Supports?

Existence?

Summary

INFLUENCE

Factor(s) influenced

Item	Comments	Supports?

Influence?

Summary

IMPORTANCE

Importance?

Justification

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SIIMS analysis tools

Preliminary analysis

- Basic evidence table
- Sequence of events list

Safety factors analysis

- Safety factor form (includes safety factor evidence table)

Risk analysis

- Risk analysis form

Safety action

- Safety action form

Analysis review

- Summarise findings form



Overview

Define

Test

Classify

Explain

Risk analysis

Safety action

Overview

Title:Contaminated runway procedures / training

Description:Company-published information, procedures and flight crew training provided incomplete guidance for landing on water-affected runways.

Safety factor type:Risk controlSafety issue:Yes

Test

Existence: YesInfluence: YesImportance:Finding type: Contributing safety factorComplete: ✓

Classify

Safety factor type	Functional area	Position/role	Error type
Risk control - Procedures	Flight operations	N/A	N/A
Risk control - Training	Flight operations	N/A	N/A

Explain

Title	Safety factor type	Further analysis	Existence	Finding type
Hazard identification processes	Organisational influence	Yes	Yes	Contributing safety factor
Training design process	Organisational influence	Yes	Yes	Contributing safety factor

Risk analysis

Consequence: MajorLikelihood: RareSafety risk level: SignificantComplete: ✓

Safety action

Organisation	ATSB/Non-ATSB	Action type	Date
Superoo airlines	ATSB	Recommendation	21 Oct 05

Complete

☐ Safety factor processing complete

Print summary

Print details

Next >>

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ATSB analysis policies

- Every occurrence investigation requires sequence of events analysis
- All findings supported by an evidence table
- All safety issues to be subject to risk analysis
- ATSB encourages safety action before issuing recommendations
- ATSB recommendations to be based on safety issue description



ATSB analysis guidelines, training

- Comprehensive guidelines on:
 - Basic concepts (key terms, analysis model, critical reasoning)
 - Analysis process (with examples)
- Investigation analysis course
 - 4 days, practical exercises
 - May open to external parties soon
- Materials provide platform for organisational learning



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Classifying safety factors

- Enables trend analysis, research
- Safety factor types plus other variables
- Safety factor types based on investigation analysis model, review of past data, review of other databases
- Classifications aided by factor descriptions



ATSB occurrence database

- Needed simpler data model to help standardise collection and coding of data
- Reviewed ICAO ADREP 2000 and many other databases
- Guiding principles: frequency, importance
- Sending out detailed specifications to organisations interested in electronic notifications to ATSB
- Will eventually be (limited) public access

