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Safety Management System (SMS) for UAS Operators

- Hans Petter Heimro

Safety Management System – What is it?

«**Safety mangement system (SMS).** A systematic approach to managing safety, including the necessary organizational structures, accountability, responsibilitites, policies and procedures.»

(ICAO Doc 9859)

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Safety Management System – What is it?

- A system to manage safety
- Finding safety issues that are present
- Develop corrective action to reduce the risk
- Monitor the process to make sure controls are working
- “Organized common sense””

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Why spend time and money on an SMS?

Photo: mostphotos.com

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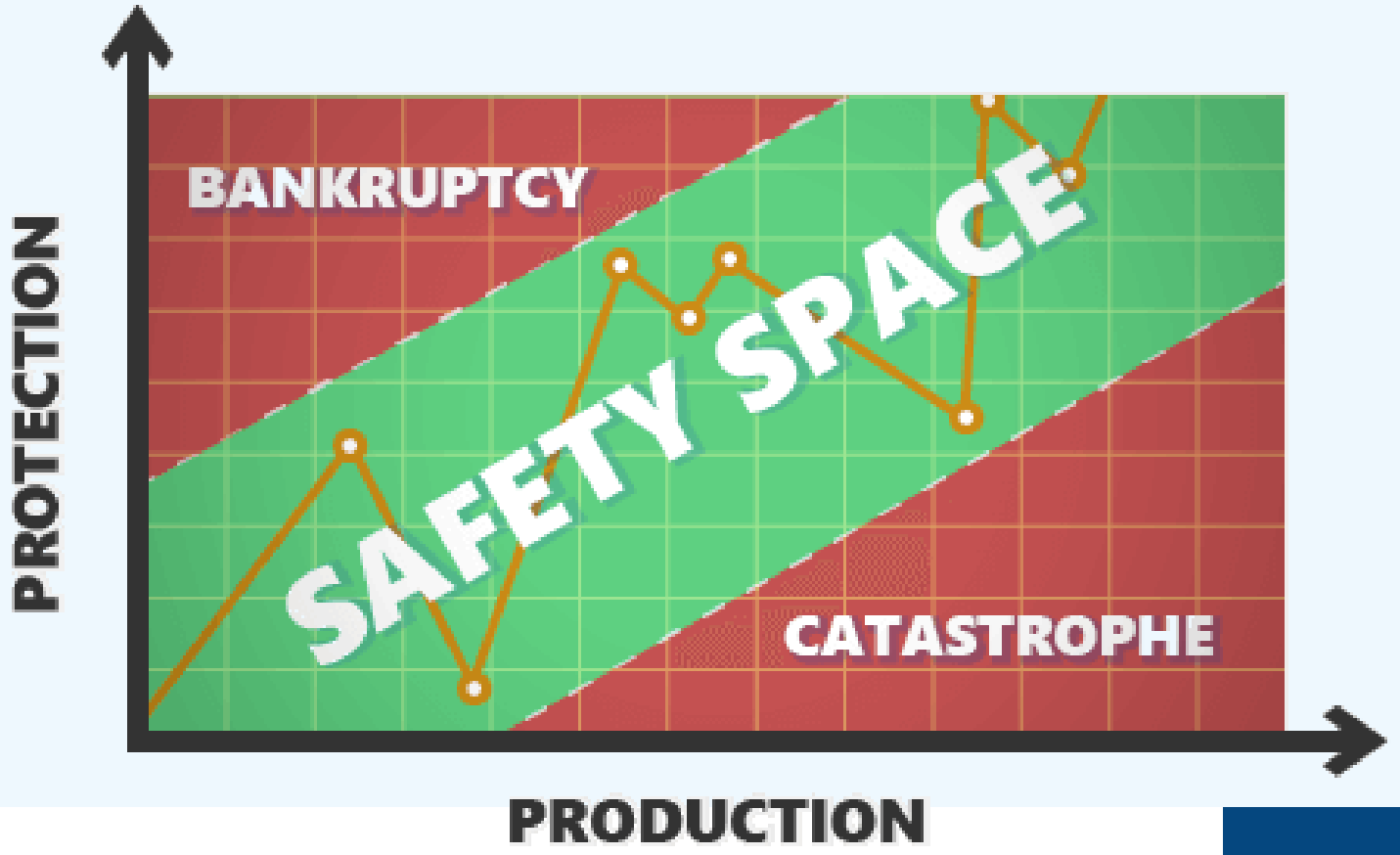
Accidents are expensive

- Repairing or replacing equipment
- Postponing operations
- Raised insurance costs
- Reputation
- Complaints
- Motivation
- Investigation

Balancing safety and production is challenging



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Who are required to have an SMS?

OPEN – low risk

- Operations at maximum height <120m and max. 25kg and only in Visual Line of sight (VLOS) and inside UAS zones;
- No pre-approval but minimum training;
- 3 Sub-categories: fly over, close, far from people

Example:

- General public / recreational purpose
- Model Flying, Photographers

SPECIFIC - higher risk

- Operations in very low airspace.
- Authorization by Nat. Comp. Auth.
- Based on specific operation risk assessment (SORA);
- Declaration in case of standard scenario;
- Light UAS operator certificate.

Example:

- Below VLOS operations (linear inspections, aerial work, ...)
- Transport of goods.

CERTIFIED - risk equal to manned aviation

- Operations in controlled airspace;
- Certification of UAS by EASA;
- Approval of the operator and licensed pilot by the NAAs, unless autonomous flight).

Example:

- Package delivery over people;
- Air Taxi;
- International IFR flights (cargo, passengers).

Figure: EASA

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A Light UAS Operator Certificate (LUC) always require an SMS

UAS.LUC.030 Safety management system

Regulation (EU) 2020/639

(1) An UAS operator who applies for an LUC shall establish, implement and maintain a safety management system corresponding to the size of the organisation, to the nature and complexity of its activities, taking into account the hazards and associated risks inherent in these activities.

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A high SAIL-level can also require risk management

SAIL < III

TECHNICAL ISSUE WITH THE UAS		Level of integrity		
		Low	Medium	High
OSO #01 Ensure that the UAS operator is competent and/or proven	Criteria	The applicant is knowledgeable of the UAS being used and as a minimum has the following relevant operational procedures: checklists, maintenance, training, responsibilities, and associated duties.	Same as low. In addition, the applicant has an organisation appropriate[1] for the intended operation. Also, the applicant has a method to identify, assess, and mitigate the risks associated with flight operations. These should be consistent with the nature and extent of the operations specified.	Same as medium.
	Comments	*N/A*	*[1] For the purpose of this assessment, 'appropriate' should be interpreted as commensurate with/proportionate to the size of the organisation and the complexity of the operation.*	*N/A*

SAIL < IV

TECHNICAL ISSUE WITH THE UAS		Level of assurance		
		Low	Medium	High
OSO #01 Ensure that the UAS operator is competent and/or proven	Criteria	The elements delineated in the level of integrity are addressed in the ConOps.	Prior to the first operation, a competent third party performs an audit of the organisation	The applicant holds an organisational operating certificate or has a recognised flight test organisation. In addition, a competent third party recurrently verifies the UAS operator's competences.
	Comments	*N/A*	*N/A*	*N/A*

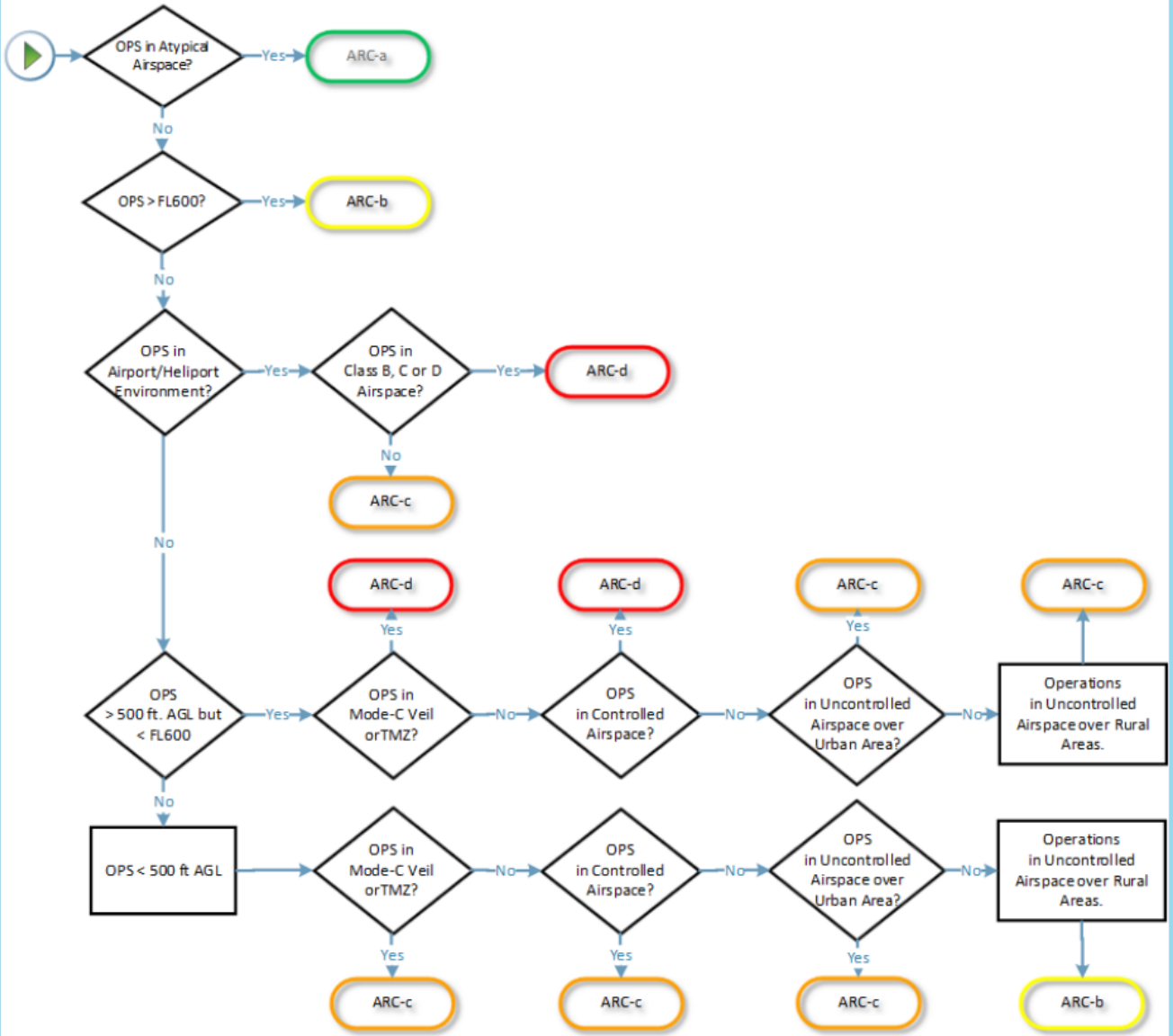
Ground Risk Class (GRC)

Intrinsic UAS ground risk class				
Max UAS characteristics dimension	1 m / approx. 3 ft	3 m / approx. 10 ft	8 m / approx. 25 ft	>8 m / approx. 25 ft
Typical kinetic energy expected	< 700 J (approx. 529 ft lb)	< 34 kJ (approx. 25 000 ft lb)	< 1 084 kJ (approx. 800 000 ft lb)	> 1 084 kJ (approx. 800 000 ft lb)
Operational scenarios				
VLOS/BVLOS over a controlled ground area[3]	1	2	3	4
VLOS over a sparsely populated area	2	3	4	5
BVLOS over a sparsely populated area	3	4	5	6
VLOS over a populated area	4	5	6	8
BVLOS over a populated area	5	6	8	10
VLOS over an assembly of people	7			
BVLOS over an assembly of people	8			

Specific Assurance And Integrity Level (SAIL)

GRC	ARC a	ARC b	ARC c	ARC d
2	I	II	IV	VI
3	II	II	IV	VI
4	III	III	IV	VI
5	IV	IV	IV	VI
6	V	V	V	VI
7	VI	VI	VI	VI

Air Risk Class (ARC)



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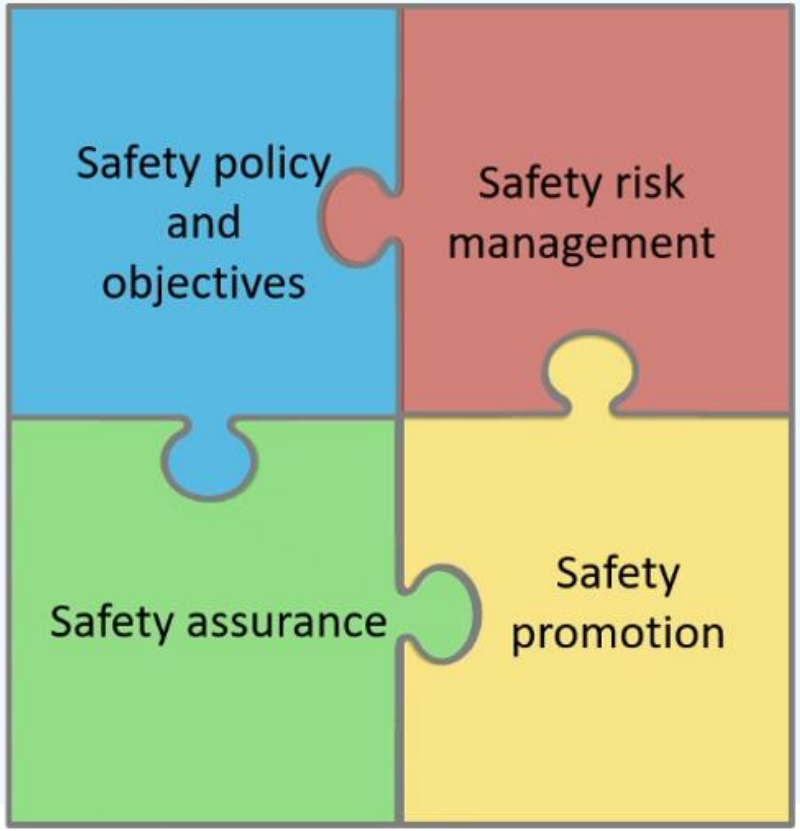
The basics of an SMS are the same for manned aviation



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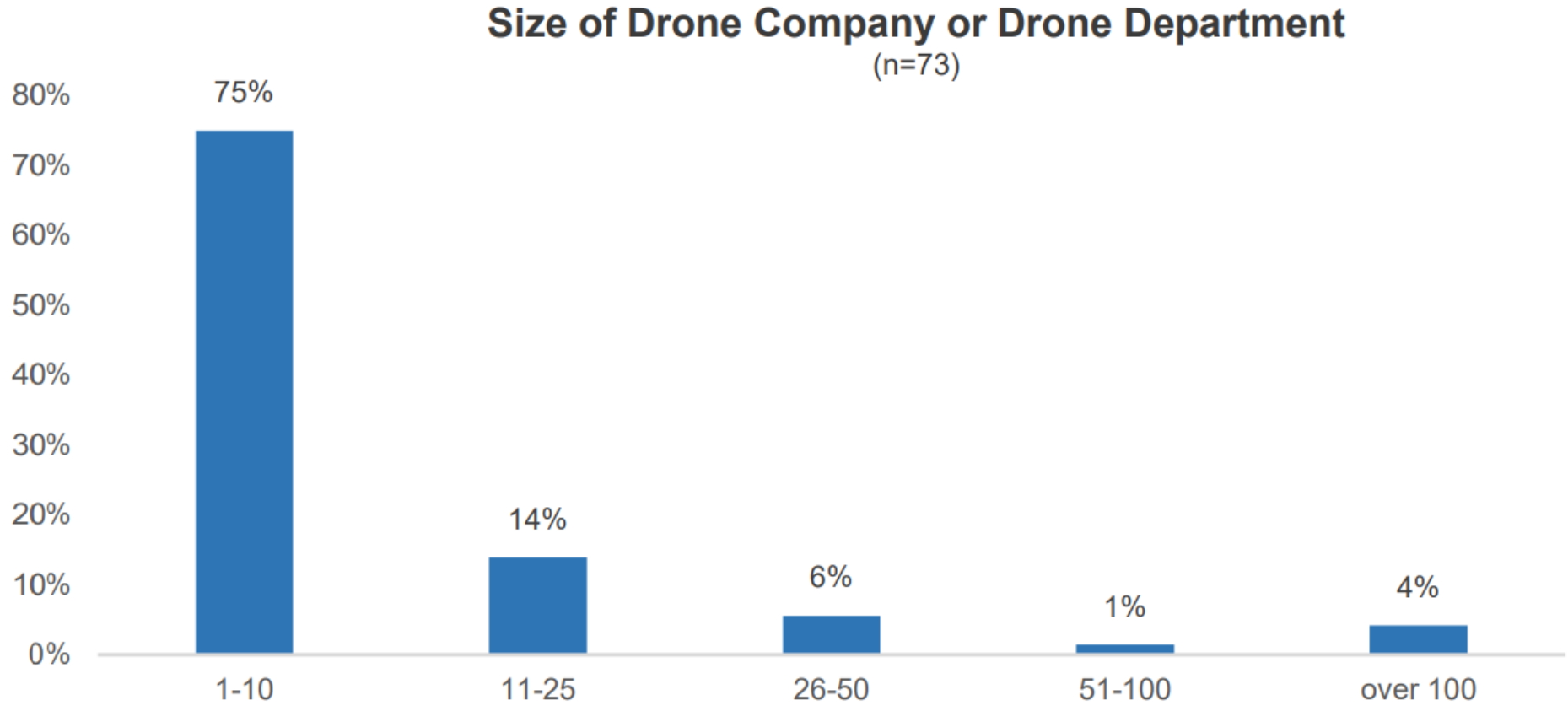
Most UAS operators are small and non-complex



From *market research study - The Norwegian Drone Industry* done by Drone Industry Insights on behalf of the Norwegian Ministry of Transport

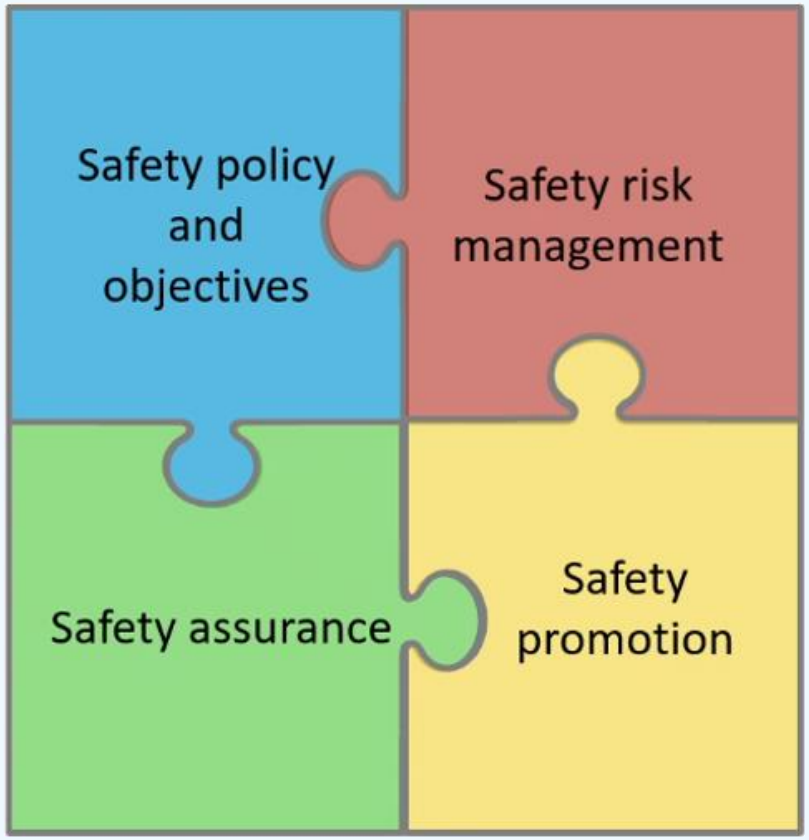
Handy guidance for small, non-complex organisations

- CAA Australia SMS resource kit – book 1 and 7
- CAA UK - CAP 1059

- The LUC-requirements for an SMS:

Easy Access Rules for Unmanned Aircraft Systems, UAS.LUC.030

An SMS consist of four main parts



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The key elements of an SMS:

1. Safety Policy and Objectives
   - Management Commitment
   - Safety Accountabilities and Responsibilities
   - Appointment of Key Safety Personell
   - Coordination of Emergency Response Planning
   - SMS Documentation

ICAO Document 9859

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The key elements of an SMS:

1. Safety Policy and Objectives
2. Safety Risk Management
   - Hazard Identification
   - Safety Risk Assessment and Mitigation

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The key elements of an SMS:

1. Safety Policy and Objectives
2. Safety Risk Management
3. Safety Assurance
   - Safety Performance Monitoring and Measurement
   - The Management of Change
   - Continuous Improvement of the SMS

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The key elements of an SMS:

1. Safety Policy and Objectives
2. Safety Risk Management
3. Safety Assurance
4. Safety Promotion
   - Training and Education
   - Safety Communication

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The key elements of an SMS:

1. Safety Policy and Objectives
2. Safety Risk Management
3. Safety Assurance
4. Safety Promotion

+ Safety-culture

Systematic, proactive, predictive

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Reports provide the SMS with vital data

1 serious accident

10 incidents

30 near misses

60+ unsafe acts

Illustration after Brian Brophy, JAA TO

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The key elements of an SMS:

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   - Safety Performance Monitoring and Measurement
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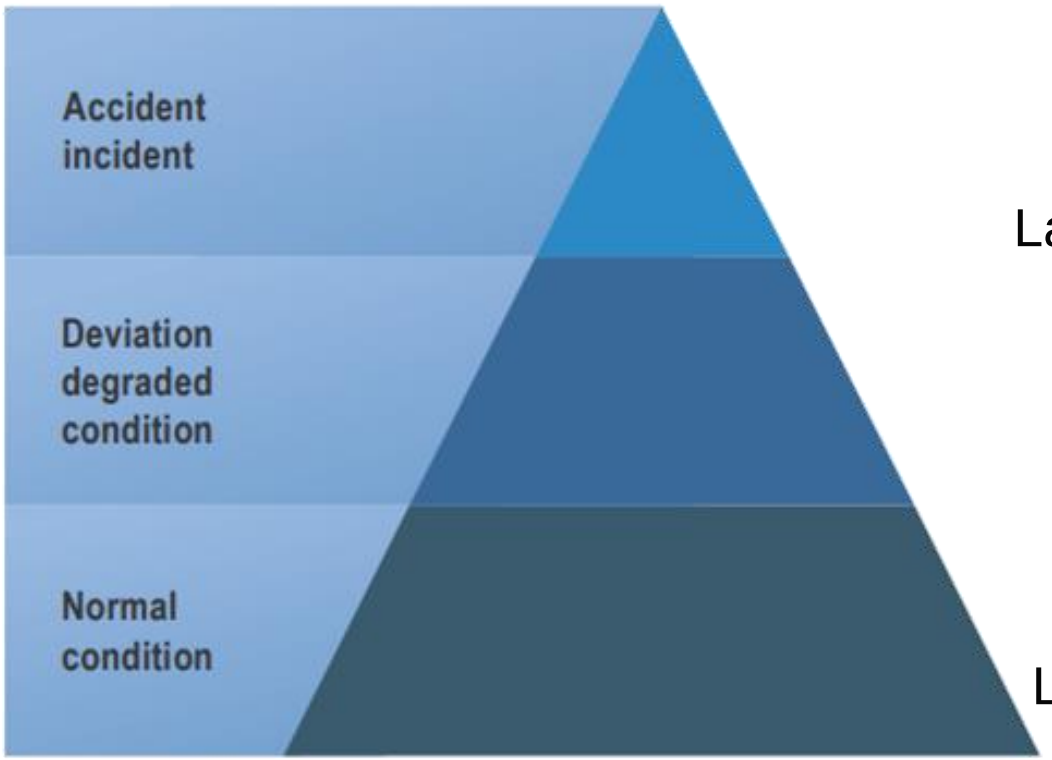
Safety Performance Monitoring and Measurement – What is it?

- Assuring you are handling risk to inspire confidence in operations
- Having a good indication of the safety level
- Indication that the organization is working to improve safety
- Measure safety performance

Illustrasjon: mostphotos.com

Safety Performance Indicators (SPI) must be defined and tracked

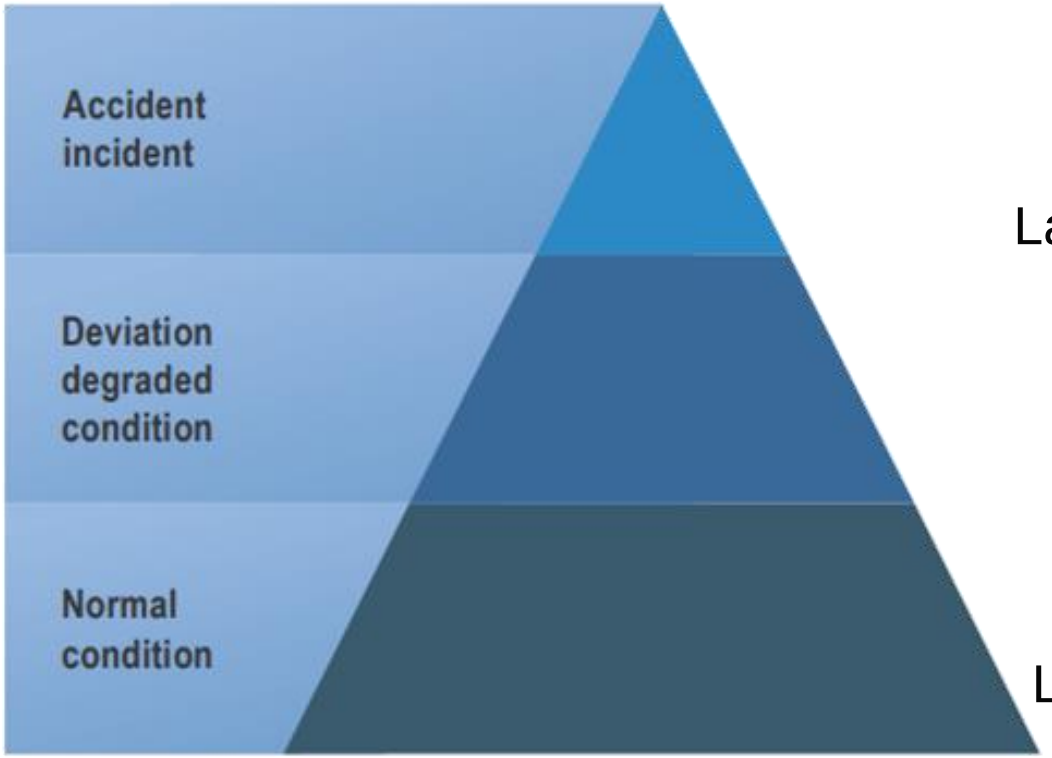


ICAO Document 9859, Fig. 4-3

Example:

- Lagging indicators
  - Number of crashes due to wind / 100 flights
  - Precursor events
    - Number of “high wind warnings” / 100 flights
- Leading indicators
  - Percentage of pilots trained in micrometeorology

SPI must be adapted to your operations and relevant for the safety objectives

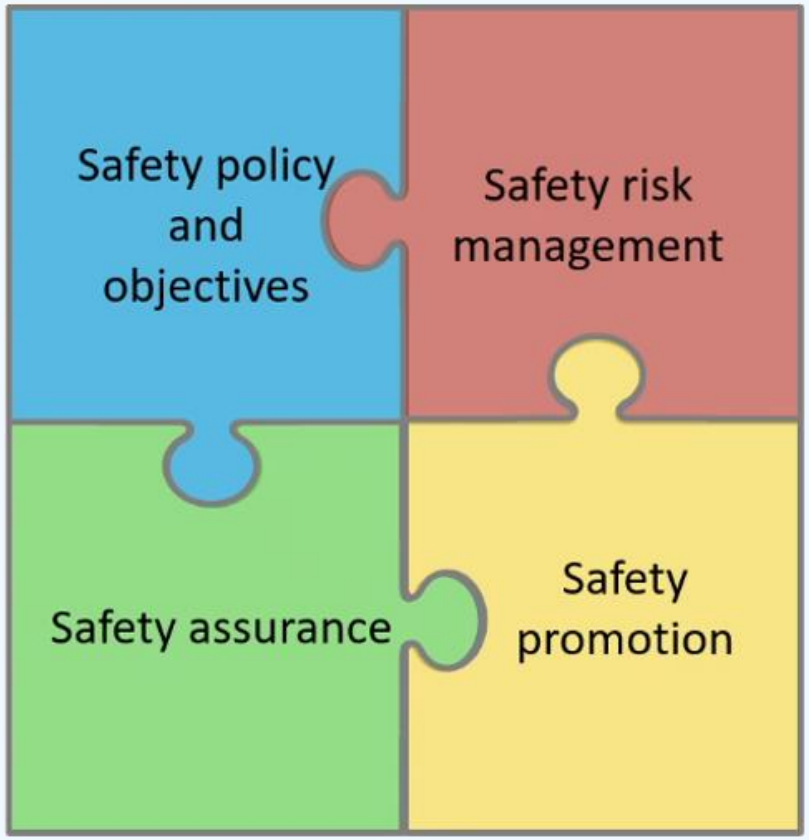


ICAO Document 9859, Fig. 4-3

Example:

- Lagging indicators
  - Number of CFIT / 100 flights
  - Precursor events
    - Number of times VLOS was lost / 100 flights
- Leading indicators
  - Percentage of pilots trained in VLOS procedures

How to get started?



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Step by step guidance

Photo: mostphotos.com

- Step 1 – GAP analysis
  - Review requirements
  - What do you have?
  - What do you need?
- Step 2 – Design and development
  - Prioritize
  - Adapt
  - Document

Step by step guidance

Photo: mostphotos.com

Step 3 – Introduction and rollout

- Get everyone involved
- Communicate the changes
- Set a realistic timeline

Step 4 – Improvement and measurement

- Continuous improvement is fundamental
- Have actions worked?
- Gather feedback

Useful resources

- ICAO Document 9859
- CAA Australia SMS resource kit
- EASA - Management System Assessment Tool
- CAA UK - CAP 795 and CAP 1059

- The LUC-requirements for an SMS:

Easy Access Rules for Unmanned Aircraft Systems, UAS.LUC.030

To summarize

Photo: mostphotos.com

- An SMS doesn’t have to be costly or complex
  ‘Organized common sense’
- Begins with what you have in place
- Unique to your operation
- Leads to continually improved safety

Thank you

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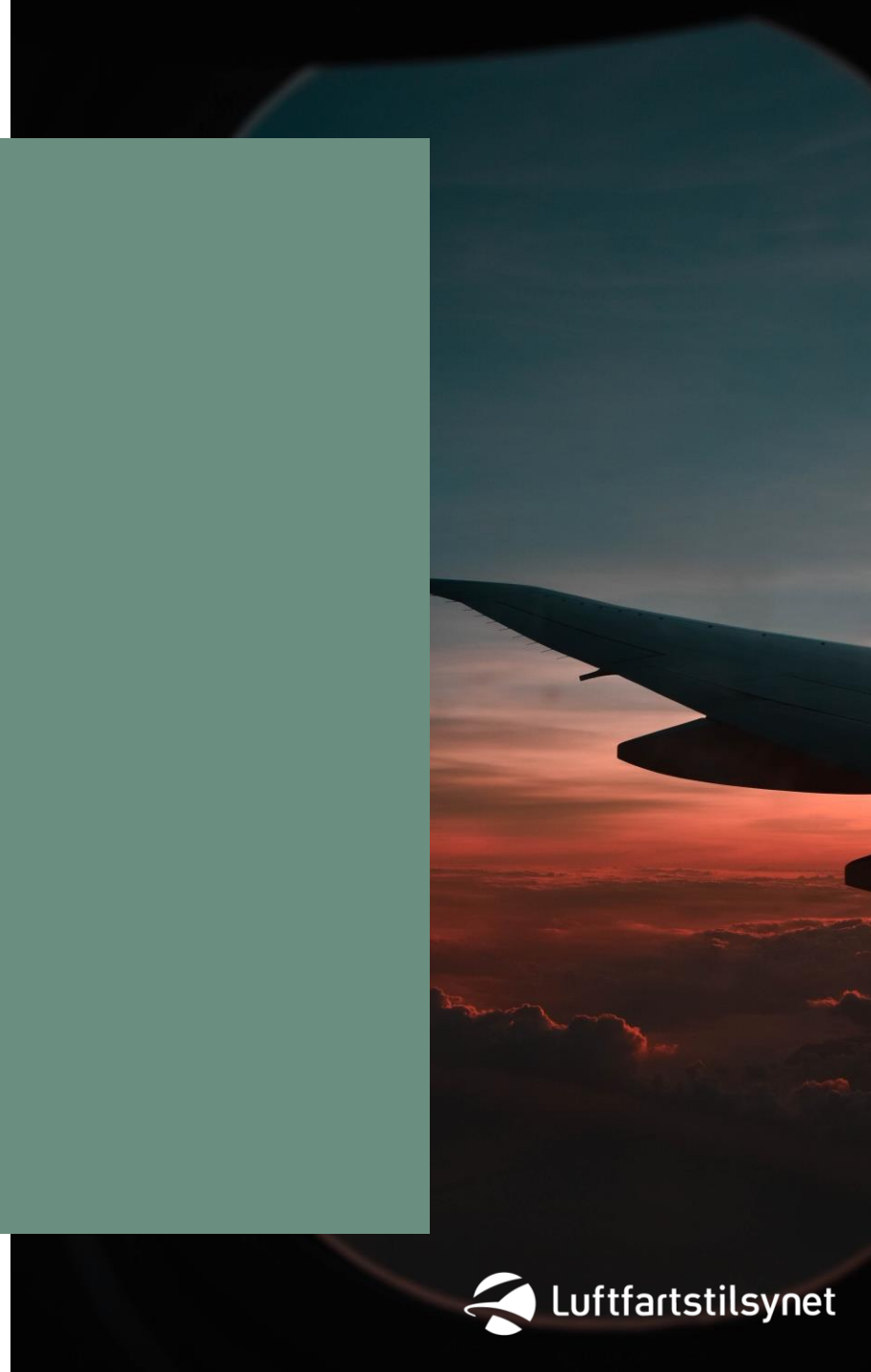

Foto: Leonardo Yip, unsplash.com

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