EUROPEAN AVIATION SAFETY AGENCY
AGENCE EUROPÉENNE DE LA SÉCURITÉ AÉRIENNE
EUROPÄISCHE AGENTUR FÜR FLUGSICHERHEIT

Impact Assessment in EASA

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SM.2.1. Safety Programmes

Your safety is our mission.
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Why do we do Impact Assessment?

Better Regulation: the need of transparency to sustain efficiency for the European Union

EC

- **Better regulation** principles:
  - Design EU policies and laws so to achieve their objectives at minimum cost.
  - Evidence-based and well designed measures that deliver tangible and sustainable benefits for citizens, business and society as a whole
  - Policies prepared, implemented and reviewed in an open, transparent manner, involving stakeholders
  - *Link*

Tools

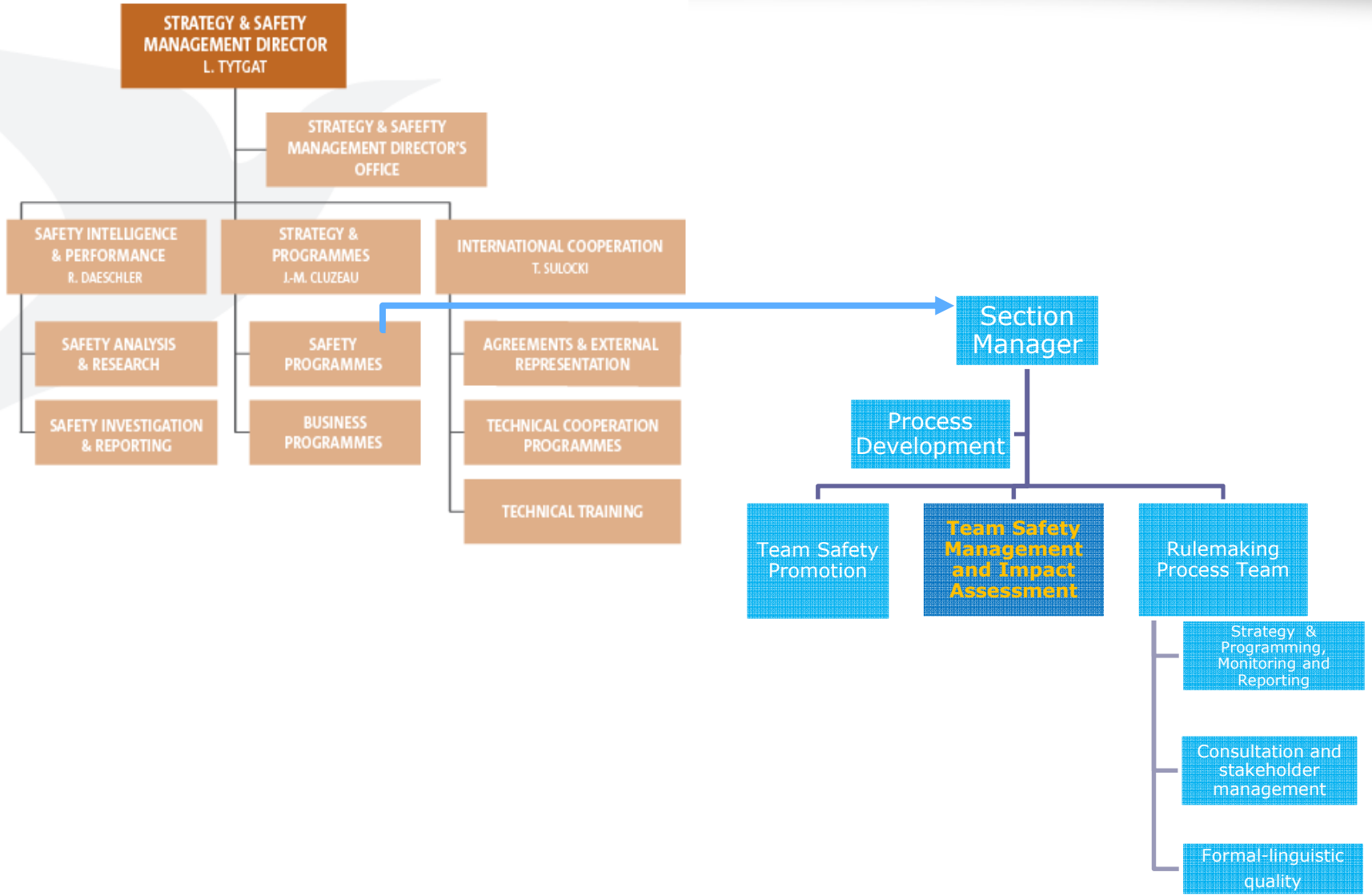
- Key **tools**:
  - **Impact Assessment** before legislative adoption
  - **Evaluation** to check the implementation
  - Stakeholder **consultation**
  - **Plain** English

EASA

- "Better Regulation" elements in the **EASA rulemaking** procedure**:**
- Management Board Decision 2015-18: *Link*
- EASA impact assessment page

How is IA integrated in EASA?

SM2.1. Safety Programmes



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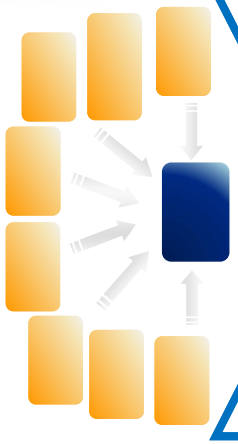
Triggers for voluntary and regulatory actions

A large number of proposals from a wide variety of sources

What to do when?

Integrated programming



Phase 1: Programming

EASA Multi-Annual Programme

EASp: SPP, RMP, StP

RMP Phase 2: Rule development

Decision

Opinion

What to do? when?
Which tool to use?

How to do it?

TOOLS

Rulemaking
Safety promotion
Oversight
Member State action
Research

SPP: Safety Promotion Programme

RMP: Rulemaking Programme

StP: Standardisation Programme

The feedback loop for smart rules

Feedback on the rule

Evaluation

- Comment Response Tool
- consultative bodies
- conferences
- focussed consultation

We **communicate** with stakeholders

It is our duty to **explain** why these rules are safe and cost-efficient

RMP

We prioritise and plan rulemaking

Phase 1: Programming

PIA

- stakeholder concerns
- objectives
- priorities
- risk assessment

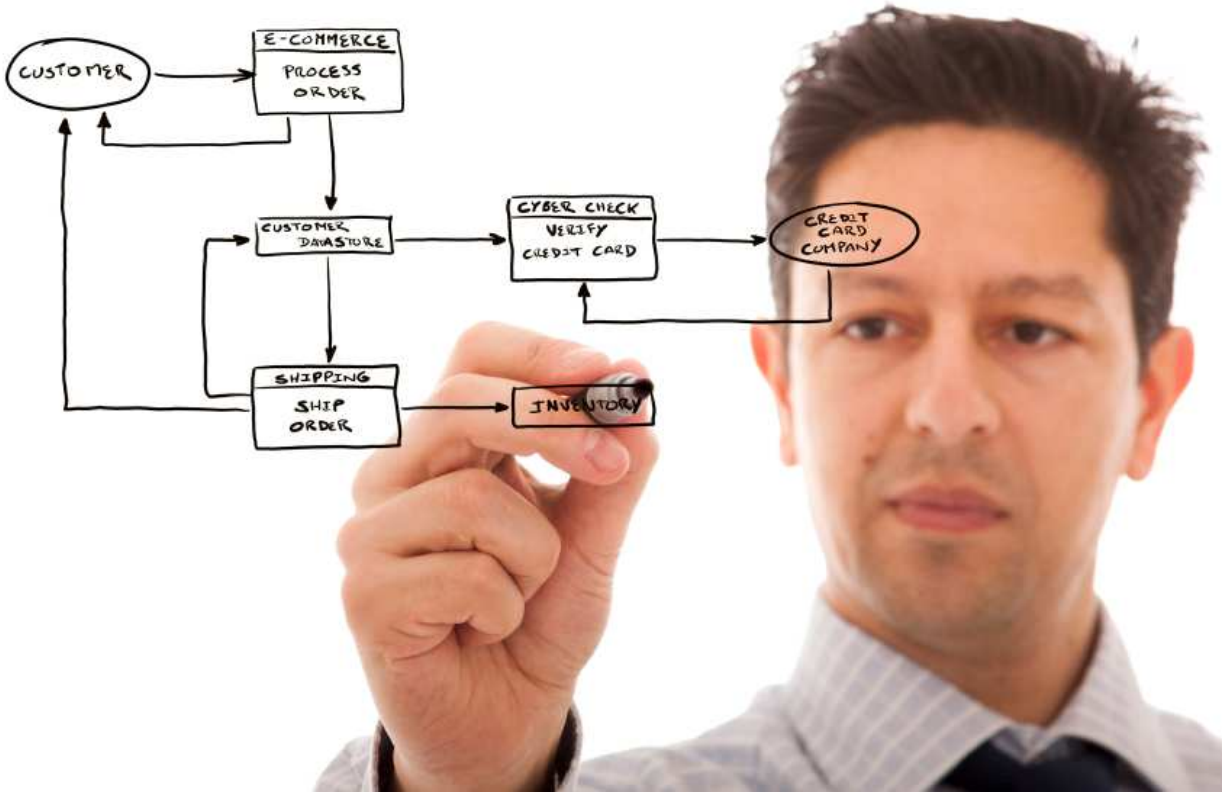
We **draft** safe and cost-effective rules

- analysis to select the best option

Phase 2: Rule development

NPA

RIA



What are the main IA principles?

What are the steps for transparent decision-making?

How to take a decision ?		
Before the decision	Issue analysis	What is the problem?
	Objective	What do I want to achieve?
	Definition of options	What are the different solutions?
	Analysis of options	Which consequences of these solutions?
Decision	Conclusion	What do I decide?

Impact Assessment

How to correct a decision ?			
After the decision	Monitoring	During the first years	Is the decision implemented according to the expectation?
	Ex-post evaluation	E.g. after 5 years	Does the decision answer to the problem?

Feedback loops

Review of rules

Define objectives

- **Aim**: Provide a clear understanding of **what** the new rule is supposed to achieve **once** implemented

Proposing a new rule is **not** an objective

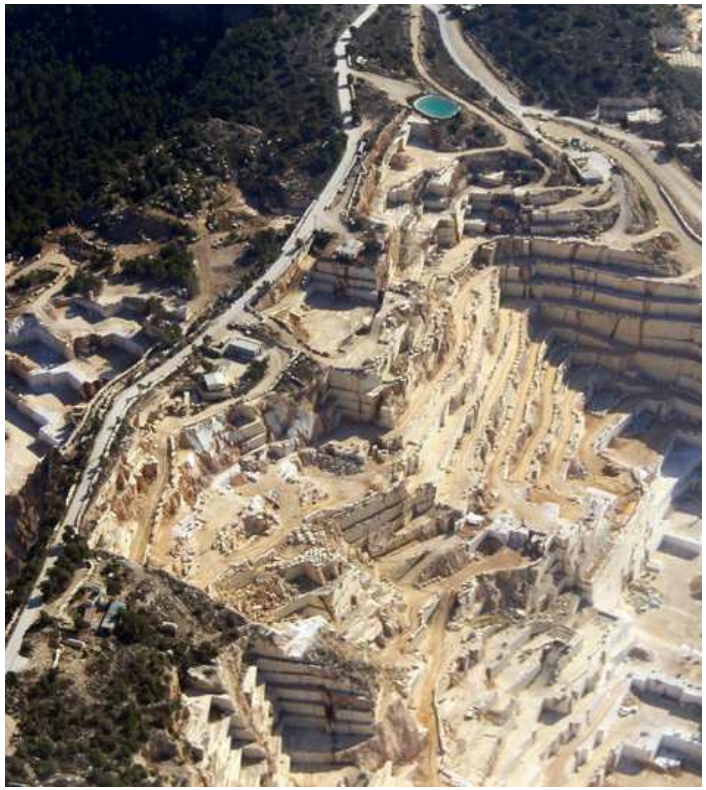
Describe the activities to develop the rules is **not** an objective

Objectives are **derived** from the criteria in BR 216/2008 Article 2:

- Safety
- Environment
- Cost-efficiency & Level playing field
- Free movement of persons and goods
- Fulfill ICAO obligations & International cooperation

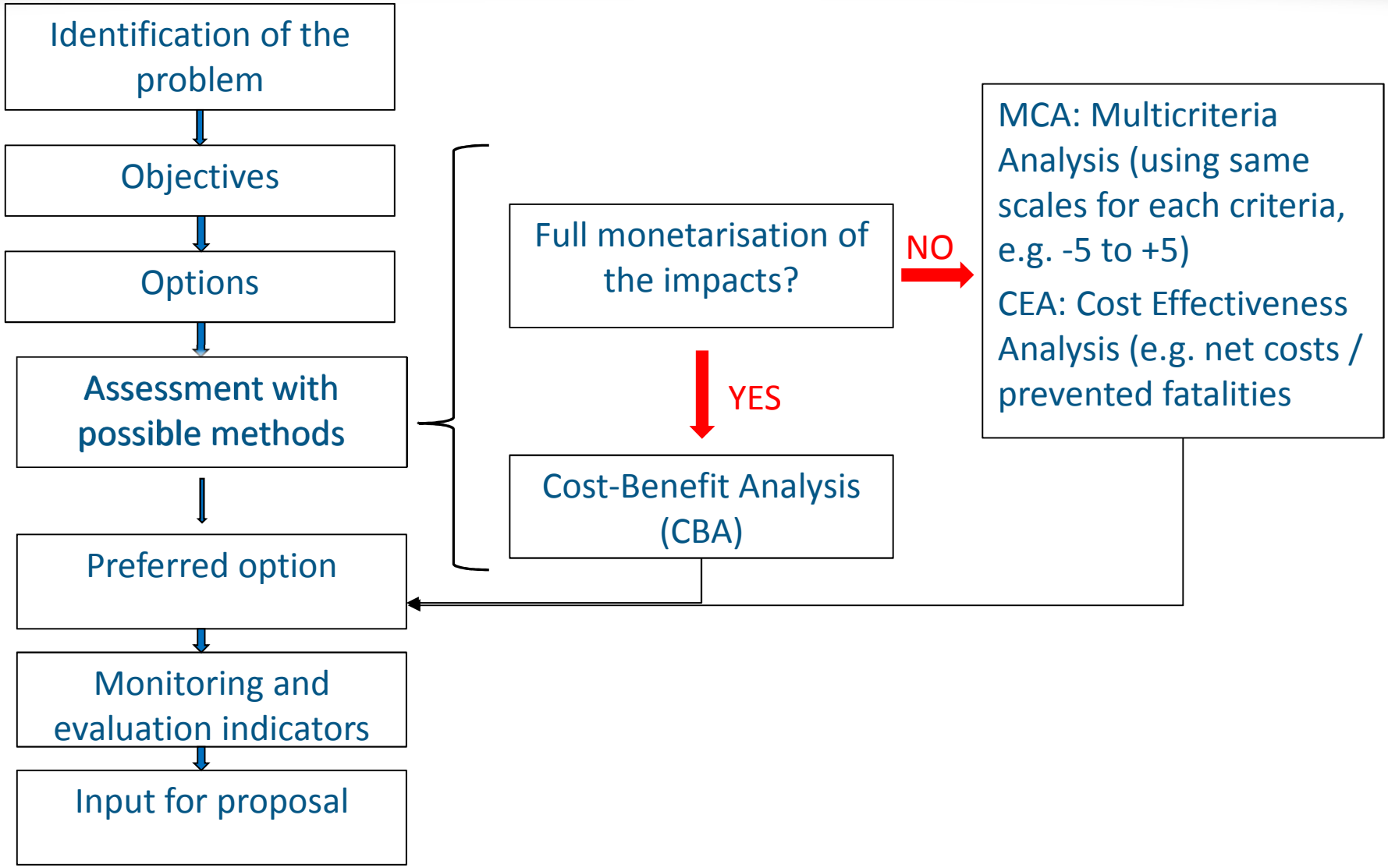
Analysing the impacts

- **Aim**
  - Identify the intended effects of the options and **un**intended ones



Note: The options are all assessed against the “do nothing” option

How to decide which method to use?



Key characteristics of IA

- IA provides **an** input for decision-making
- Support **transparency** in decision-making and the **intervention logic**
- **Proportionality** principle
  - Develop the depth of the analysis with the scale of the issue
  - Spend time on significant impacts and controversial items
- **Public** document with **open** commenting

An example of Preliminary Impact Assessment with Erroneous Take-Off Parameters

Starting point of the analysis

- Safety Risk Portfolio CAT FW
- Safety Analysis performed by SM1
  - Number of accidents and serious incidents for the period 1989-2014
  - Root cause analysis
  - List of existing prevention/mitigation actions
  - List of potential prevention/mitigation actions
- Role of the PIA: to select the most useful actions according their
  - Safety improvement
  - Cost-effectiveness
  - Time implementation

Grouping of actions with PIA on safety issue « erroneous take-off parameters »

Type of solution	Type of action
Operational guidelines on: • **Training** • **Flight Data Monitoring** • **SMS**	1. **SIB** to recommend to operators • Review procedures and training • Assess their risk mitigation • Use appropriate equipment/tools for computing T-O data
Technical solutions • **A/C weight checks before T/O: WG-88** • **Continous monitoring of a/c weight and requested thrust for T/O: WG-94**	2. Eurocae WG-88 technical requirements implemented with **either**: • Industry standard • Safety Promotion • Rulemaking Note: WG94 on hold
Use of Electronic Flight Bag RMT.0601/602	**RMT.**0601/0602 • EFB Provisions for the evaluation of W&B and T-O performance applications (NLR report) • transposition of provisions on EFB from ICAO in 965/2012

Scale for safety improvement level

Score	*Estimated safety risk reduction*
10	100%
9	90%
8	80%
7	70%
6	60%
5	50%
4	40%
3	30%
2	20%
1	10%
0	0%

Action 1 (event)

Action 2 (accidents and serious incidents)

Issue with comparison of these safety improvements

Potential effectiveness of SIB implementation

- 250 operators **using FDM without take-off monitoring events** could be impacted
- Possible implementation options:
  - **Operators develop alone the change**
    - Maximum 1200 hours per operator to implement the change
    - Estimated unit cost: 100 €/hours
    - Total cost per operator: 120 000 €
    - **At EU level: 30 M€ one-off cost [120 000 € x 250 operators], 0.08% of turnover**
  - **FDM software providers** decide to develop take-off monitoring module ➔ lower cost impacts per operator
  - **NAAs support:** e.g. UK CAA provide their ressources to develop the FDM tool to decrease impact on operator

Scale for implementation cost level

Qualitative description	Score	Turnover impact	EASA	NAA	ATM / ANSP	Airlines
		Turnover (M€)	170	1 000	8 000	150 000
			M€			
Very high impact	10	> +1.5%				
	9	]1 to 1.5%[	2.50	15.0	150	2 500
High impact	8	]0.8 to 1%[	1.70	10.0	90	1 500
	7	]0.6 to 0.8%[	1.40	8.0	70	1 200
Medium impact	6	]0.4 to 0.6%[	1.00	6.0	50	900
	5	]0.2 to 0.4%[	0.70	4.0	30	600
Low impact	4	]0.1 to 0.2%[	0.35	2.0	20	300
	3	]0.05 to 0.1%[	0.20	1.0	10	150
Very low impact	2	]0.02 to 0.05%[	0.10	0.5	5	75
	1	]0 to 0.02%[	0.03	0.2	2	30
None	0		0.00	0.0	0	0

Action 1: 0.08% of airlines turnover impact

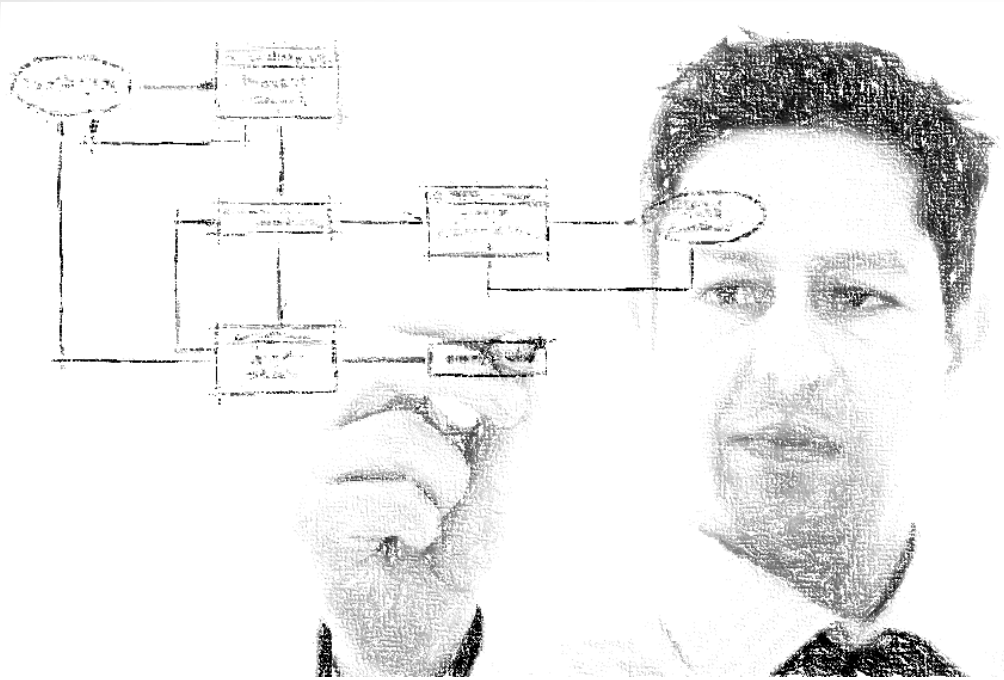
Action 2: no cost estimate

PIA indicators

Actions	Owner	Objective – Intended impacts	Safety benefit	Cost-Effect.	Timing (years)
Action 1	EASA FS /SM	SIB to alert operators and flight crew of operational mitigation measures. Safety Promotion materials to be developed by SM.	7	2.5	2
Action 2	EASA CT	EUROCAE WG-88 to develop minimum operational specifications for the On Board Weight and Balance System (inputs for RMT.0196)	5	n.a	n.a
Action 3	EASA FS	RMT.0601 Improve the use of EFBs (RMT starting in 2016)	n.a	n.a	n.a

Action 1:

- safety improvement = 7
- Cost implementation level = 3
- Cost-effectivness ratio = 7/3 = 2.5



RMP **Phase 2: Rule development**

Decision

Opinion

An example of Cost Effectiveness Analysis with Runway Excursion (NPA 2013-09)

Cost effectiveness analysis

- Cost effectiveness analysis
  - Ranks regulatory options based on '*cost per unit of effectiveness*'
  - Here: *Cost per prevented fatality*
- In order to account for other benefits, we used the *net cost per fatality avoided*
- Net cost = Gross costs
  - Equipment damage avoided
  - Diversion and delay costs avoided

Step 6 – Overview of the impacts with NPA 2013-09 Runway Excursion Prevention (discount rate 4%, 2012-2032)

Benefits

Prevented fatalities

Prevented costs

Costs

Net costs

CEA

	Option 1 New TCs	Option 2 New Deliveries	Option 3 Full retrofit
BENEFITS			
Number of accidents prevented	7.7	15.6	27.2
Casualties prevented			
Fatalities prevented	5.3	10.9	18.9
Injuries prevented	47.4	96.5	168.2
Avoided costs			
Aircraft damage avoided	€ 42 693 598	€ 89 366 550	€ 159 121 285
Diversions, delays and cancellations	€ 9 191 304	€ 19 239 305	€ 34 256 474
Total avoided costs	€ 51 884 902	€ 108 605 855	€ 193 377 759
COSTS			
Equipment (implementation costs)			
Low estimate	€ 62 457 290	€ 111 034 943	€ 216 809 506
High estimate	€ 84 501 040	€ 150 223 747	€ 292 134 623
COST EFFECTIVENESS			
Net costs (Gross costs - Avoided costs)			
Low estimate	€ 10 572 388	€ 2 429 088	€ 23 431 747
High estimate	€ 32 616 138	€ 41 617 892	€ 98 756 865
Net cost per fatality prevented			
Low estimate	€ 1 980 441	€ 223 321	€ 1 236 584
High estimate	€ 6 109 722	€ 3 826 196	€ 5 211 782

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Thank you for your attention

Comments and questions welcome!

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Analysing the impacts

- **Actions**
  - Look for quantitative impacts where easily available, otherwise qualitative
  - Compare and rank the options according assessment criteria (safety, environment, social, …)
  - Identify uncertainty in your impacts (weak assumption for cost estimates, benefits, …)
- **Tools**
  - Multi-Criteria Analysis
  - Cost Effectiveness Analysis
  - Cost Benefit Analysis

An example of Preliminary Impact Assessment with Erroneous Take-Off Parameters

Assessment of safety occurrences

- Fatal and non-fatal accidents 1989 – 2014 (worldwide scope)

Occurrence category	EASA MS related*	Non EASA MS related*	Grand Total
Non fatal accidents	19	10	29
Fatal accident	0	3	3
Total accidents	**19**	**13**	**32**
Total fatalities	**0**	**158**	**158**

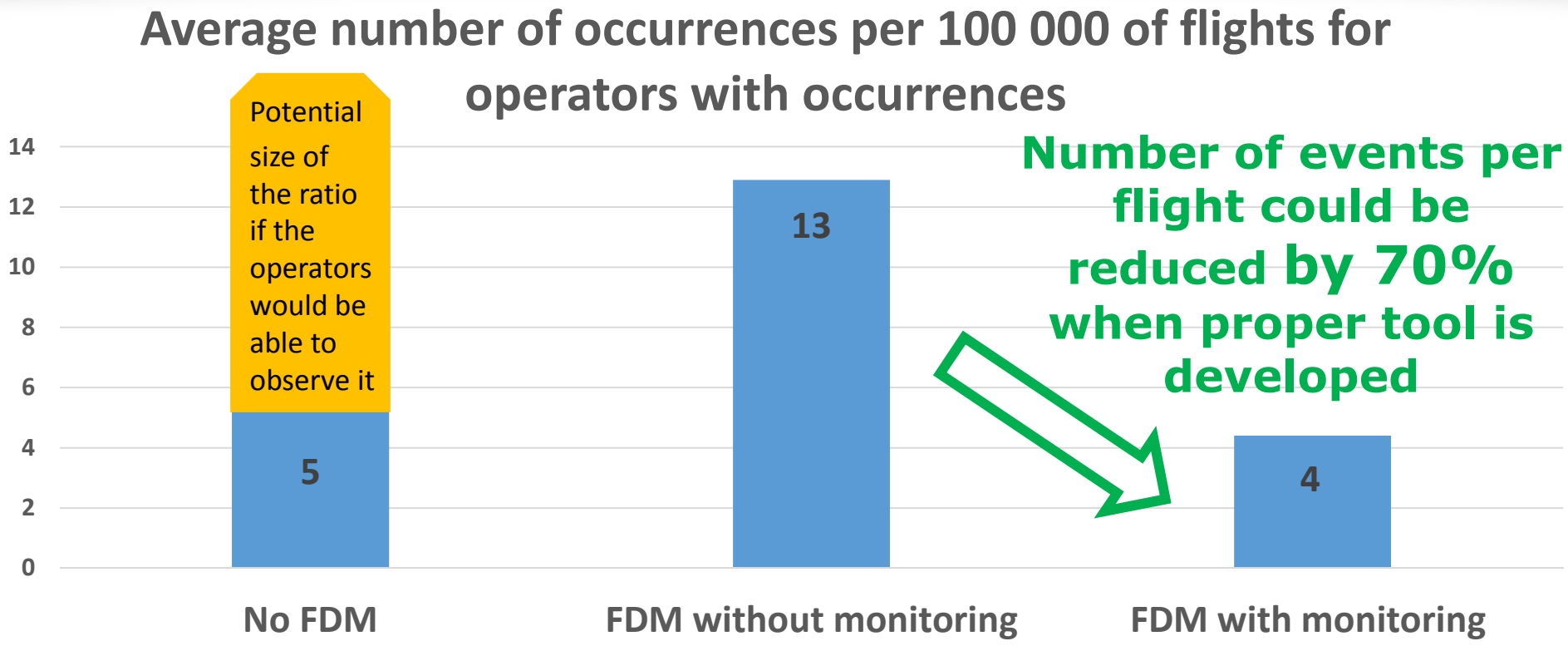
States

- Summary for EASA MS related events over the last 25 years:
  - 19 non fatal accidents related to EU scope
  - 0 fatal accidents related to EU scope

However … what is the scale of the problem today?

And what are the potential prevention/mitigation actions?

Correlation of ratio "erroneous take off events/flight" and FDM capabilities



- There are a large number of undetected events for operators with NO FDM
- There a number of undetected events for operators with FDM only
- **It is key important to be aware of the problem, in order to apply the correct mitigation measures, and therefore lower the risks (3rd category on the right)**

SIB draft: 3 axis of actions

FDM erroneous take-off event

The SIB recommends technical documentation from European Operators Flight Data Monitoring group and the European Authorities coordination group on Flight Data Monitoring where EASA participates.

One-off impact: 1000 hours per operator

Crew Training

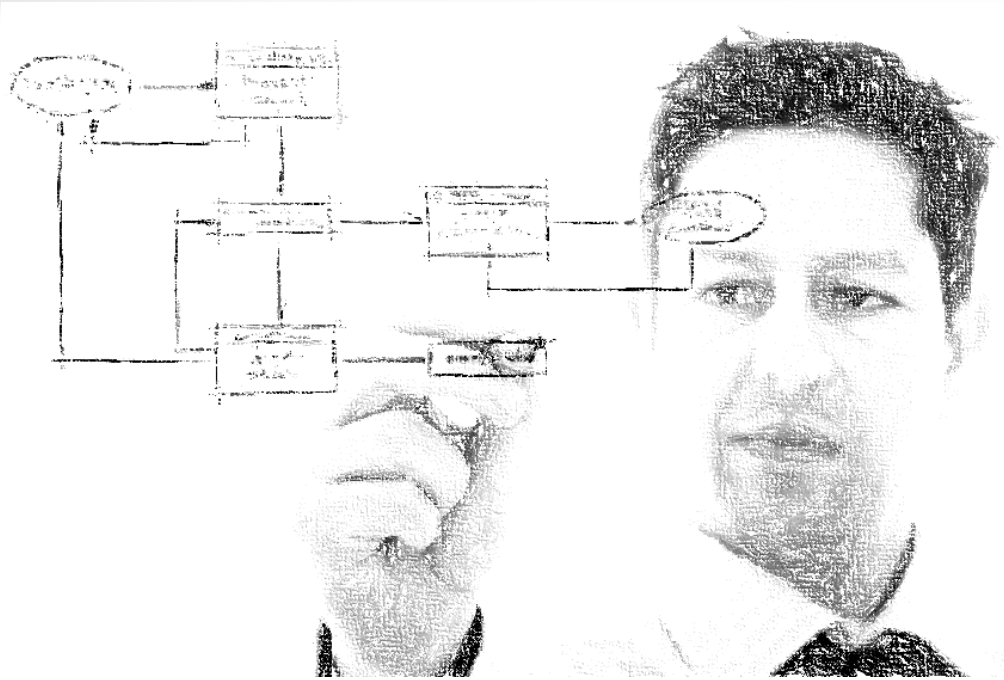
- Prevention: crews need to conduct appropriate consistency checks (e.g. mental gross error check, the pilots should know a few rules of thumb to detect large inconsistencies)
- Awareness: give the pilots tools to detect erroneous take off parameters during take off
- Mitigation: crew awareness on possible mitigation measures (e.g.: apply TOGA)
- Note: Negative training is consider

One-off impact: very minor, 100 hours/operator for NAA approval of training content

Management System (SMS)

Recommend to conduct a safety risk assessment. Clear guidance is given in the SIB how it should be done.

Impact: very minor, 100 hours / operator



RMP **Phase 2: Rule development**

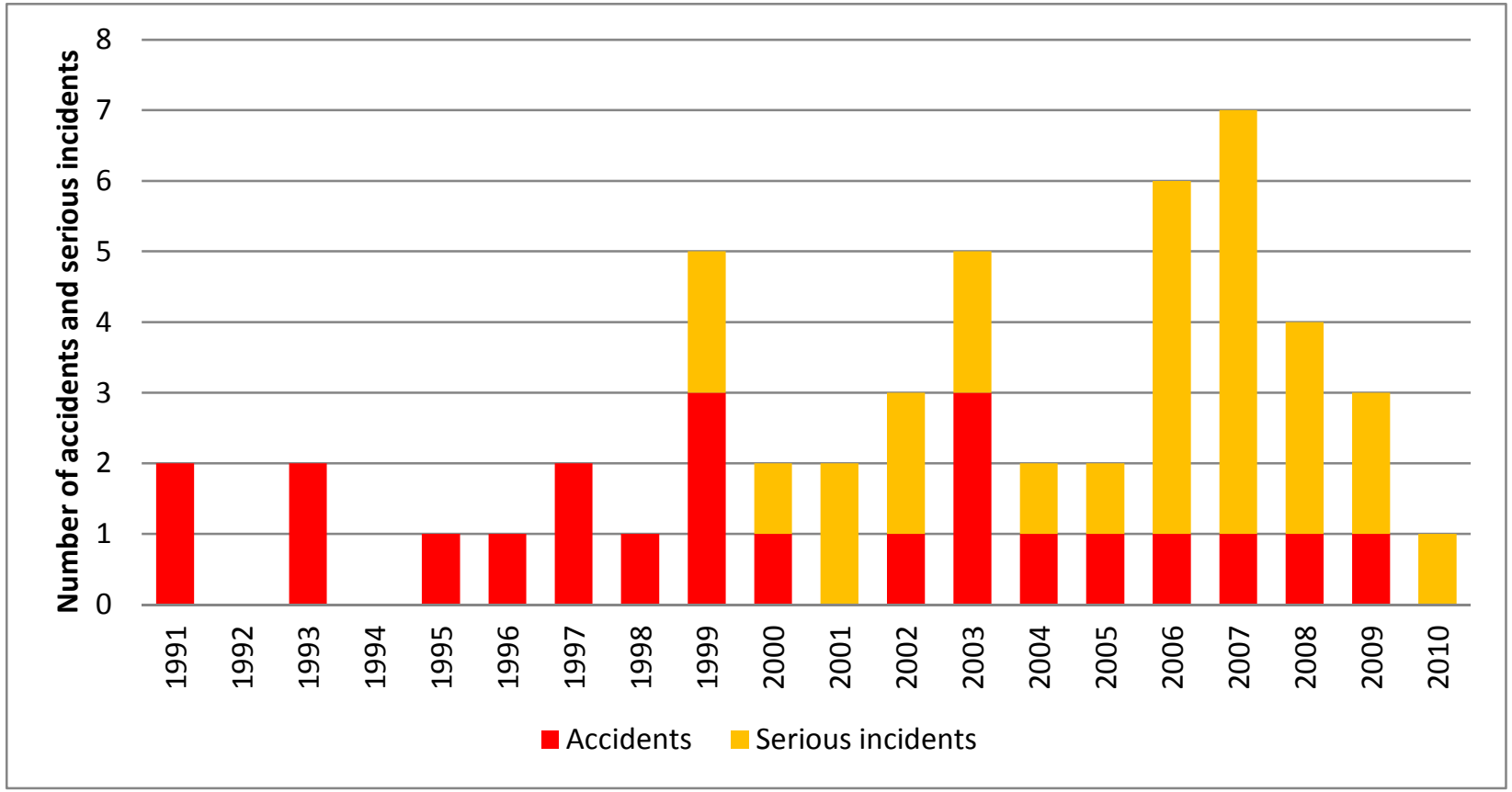
Decision

Opinion

An example of Cost Effectiveness Analysis with Runway Excursion (NPA 2013-09)

Step 1 - Issue analysis and risk assessment

Runway excursions at landing (EASA MS)



Step 1 - How could the problem evolve?

Year	Accidents	Fatalities	Injuries
2012	1.2	0.9	7.7
2013	1.3	0.9	8.0
2014	1.3	0.9	8.3
2015	1.4	1.0	8.6
2016	1.4	1.0	8.9
2017	1.5	1.0	9.3
2018	1.6	1.1	9.6
2019	1.6	1.1	10.0
2020	1.7	1.2	10.4
2021	1.8	1.2	10.8
2022	1.8	1.3	11.2
2023	1.9	1.3	11.7
2024	2.0	1.4	12.1
2025	2.0	1.4	12.6
2026	2.1	1.5	13.1
2027	2.2	1.5	13.6
2028	2.3	1.6	14.1
2029	2.4	1.7	14.7
2030	2.5	1.7	15.3
2031	2.6	1.8	15.9
2032	2.7	1.9	16.5
Total	39.3	27.3	242.4

Step 2 - Policy options

- **Option 0:**

  Baseline option – Do nothing

- **Option 1:**

  New types only

- **Option 2:**

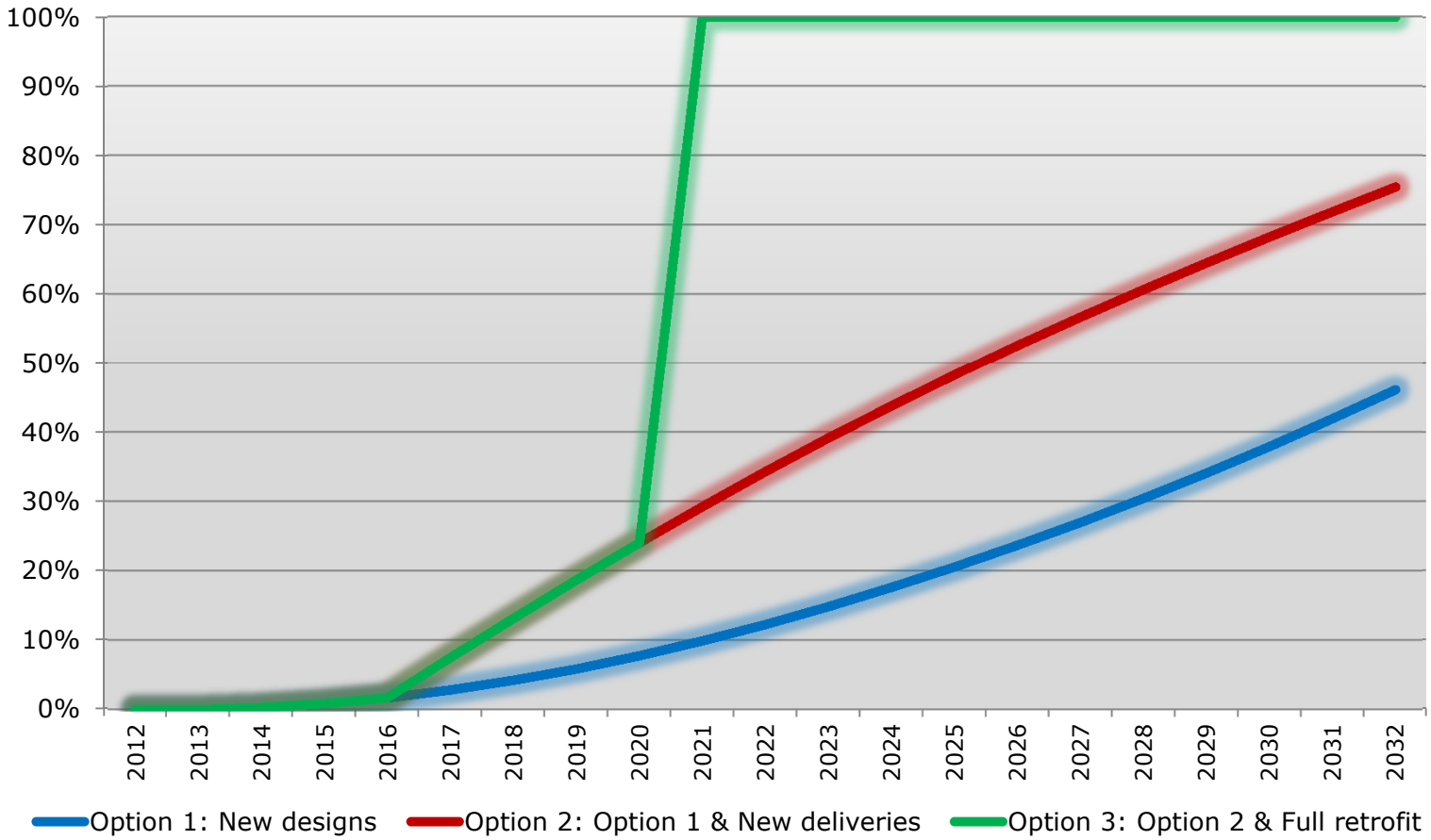
  New types AND new deliveries

- **Option 3:**

  New types AND new deliveries AND full retrofit

Step 3 - Analysis of safety impacts

- The three options result in different speeds at which ROAAS is introduced into the fleet.



Step 3 - Analysis of safety impact

Analysis of **83** serious incidents and accidents of European operators at landing — **100%**

28 cases where the system **could** be effective — **34%**

- In **11** cases there is considerable **uncertainty** if ROAAS could have prevented the event ➔ **40% of the 28 cases !** — **13%**
- In **17** cases there is reasonable **certainty** that ROAAS could have prevented the event with the new system ➔ 60% of the 28 cases! — **21%**

55 cases where the system **cannot** be effective — **66%**

- In 32 cases the landing excursion was sideways (veer-off)
- In 23 cases the system could not have prevented the event (e.g. mechanical failure or extreme weather conditions)

Step 4 - Projected safety benefits (2012–2032)

Option	Avoided/Prevented:		
	Accidents	Fatalities	Injuries
Do nothing	0	0	0
New TCs	8	5	47
New deliveries	16	11	97
Full retrofit	27	19	168

Note:

- Table not discounted
- This indicator, even if not monetarised, is also discounted: the time preference for the present applies also in this case!
- The CEA indicator (see later) includes this discount

Step 4 – Monetizing impacts – Economic impacts avoided

- Aircraft damage avoided
  - Average value of aircraft damage per runway excursion accidents: EUR 11.7 million
- Diversion, delay and cancellation costs avoided
  - Assumptions for an average accident:
    - Affected runway is closed for 10 hours
    - 10 movements per hour
    - Monetised values based on Eurocontrol estimates:
      - Ground delay: EUR 7,900 per hour
      - Diversion: EUR 13,900
      - Cancellation: EUR 33,100

Step 4 – Monetizing and discouting total economic impacts (4%, 2012-2032)

Option	Avoided/Prevented:		
	Accidents	Aircraft damage	Delay &diversion
Do nothing	0	€ 0	€ 0
New TCs	8	€ 42 693 598	€ 9 191 304
New deliveries	16	€ 89 366 550	€ 19 239 305
Full retrofit	27	€ 159 121 285	€ 34 256 474

Step 5 – Monetizing and discounting economic costs

- Unit cost of aircraft equipment to reduce Runway Excursions
  - New aircraft: EUR 17 000 to 23 000
  - Retrofit: EUR 29 000 to 39 000

- Other direct and indirect costs were not included:
  - Adaptation of SOPs/checklists
  - Adaptation of training crew
  - Additional functional checks