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The Potential of Technologies to Mitigate Helicopter Accident Factors
- an EHEST study –

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EHEST
Component of ESSI
European Helicopter Safety Team

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- Introduction
- EHSIT Specialist Team Technology
- Methodology
- Results
- Challenges
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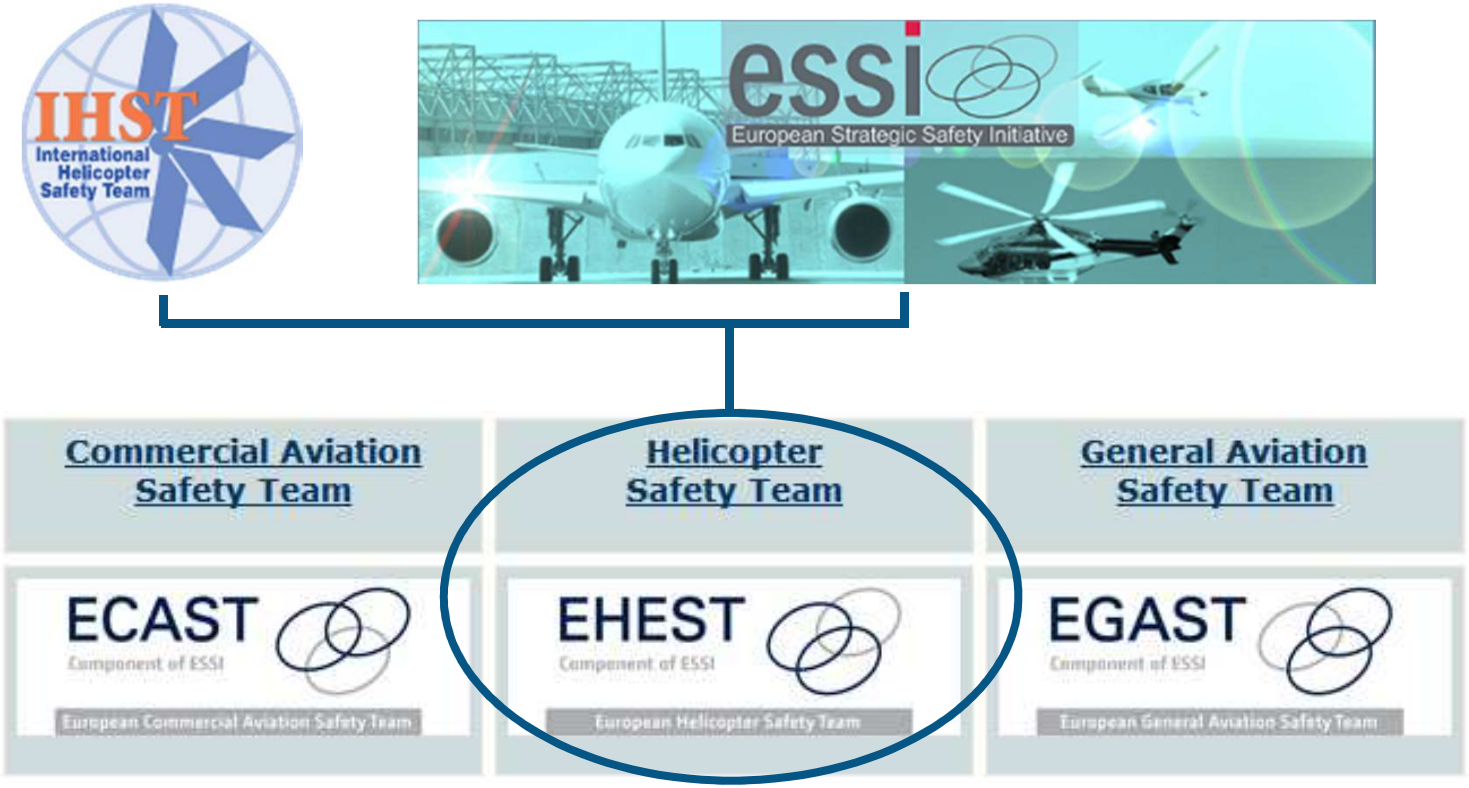
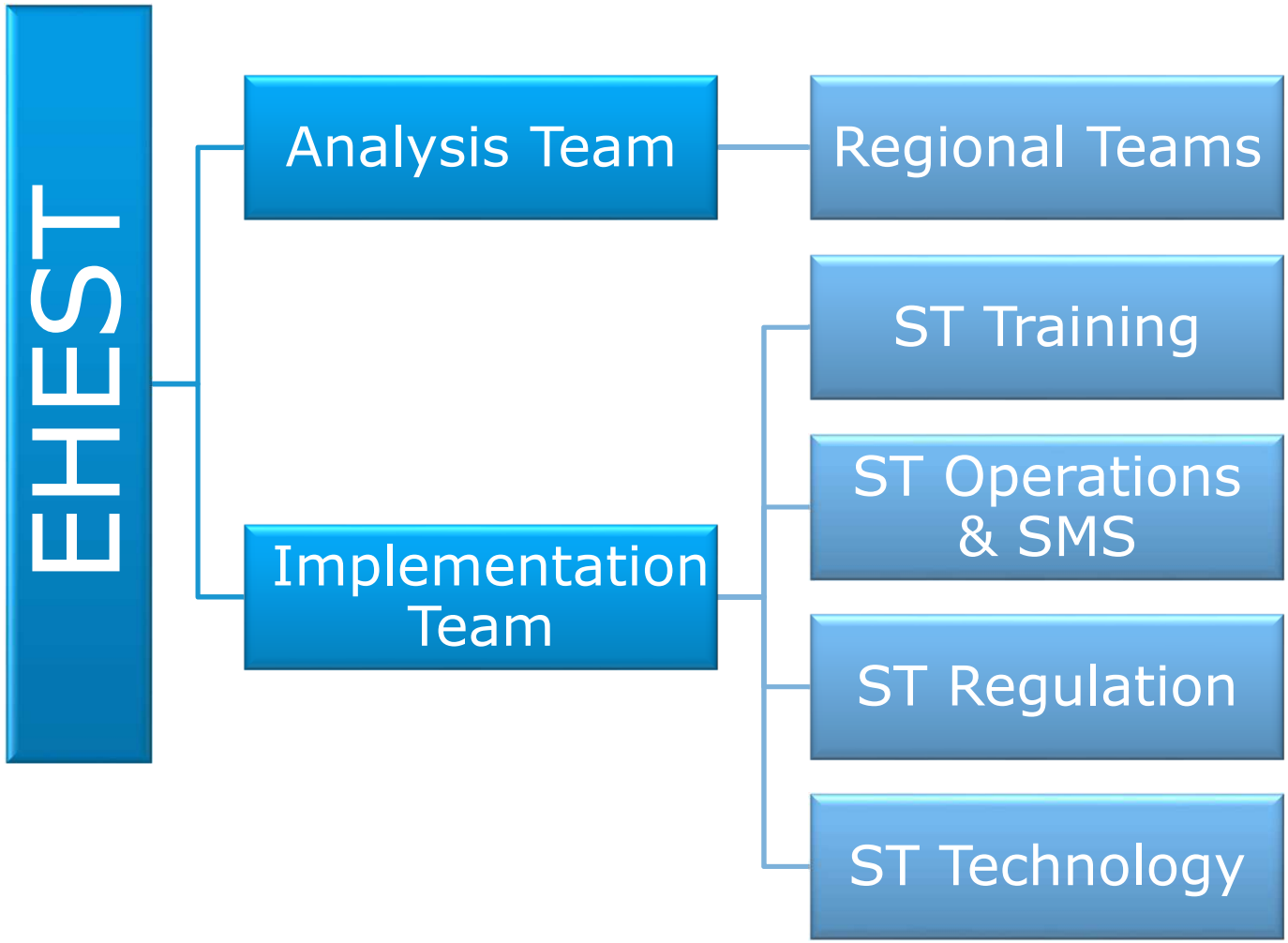
Introduction

- **EHEST is**
  - European part of the IHST
  - Helicopter part of ESSI



Introduction



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EHSIT Specialist Team Technology

- **Team to develop tool to**
  - Link incident/accident analysis results to R&D and technological developments
  - Assess potential of technologies to mitigate safety issues
- **Created in March 2011**
- **Range of team members with various expertise and backgrounds**

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Methodology - Overview

Assess the potential of technologies to mitigate safety issues

- Define a tool
- List technologies
- Rate technologies
- (Provide updates)
- Report results

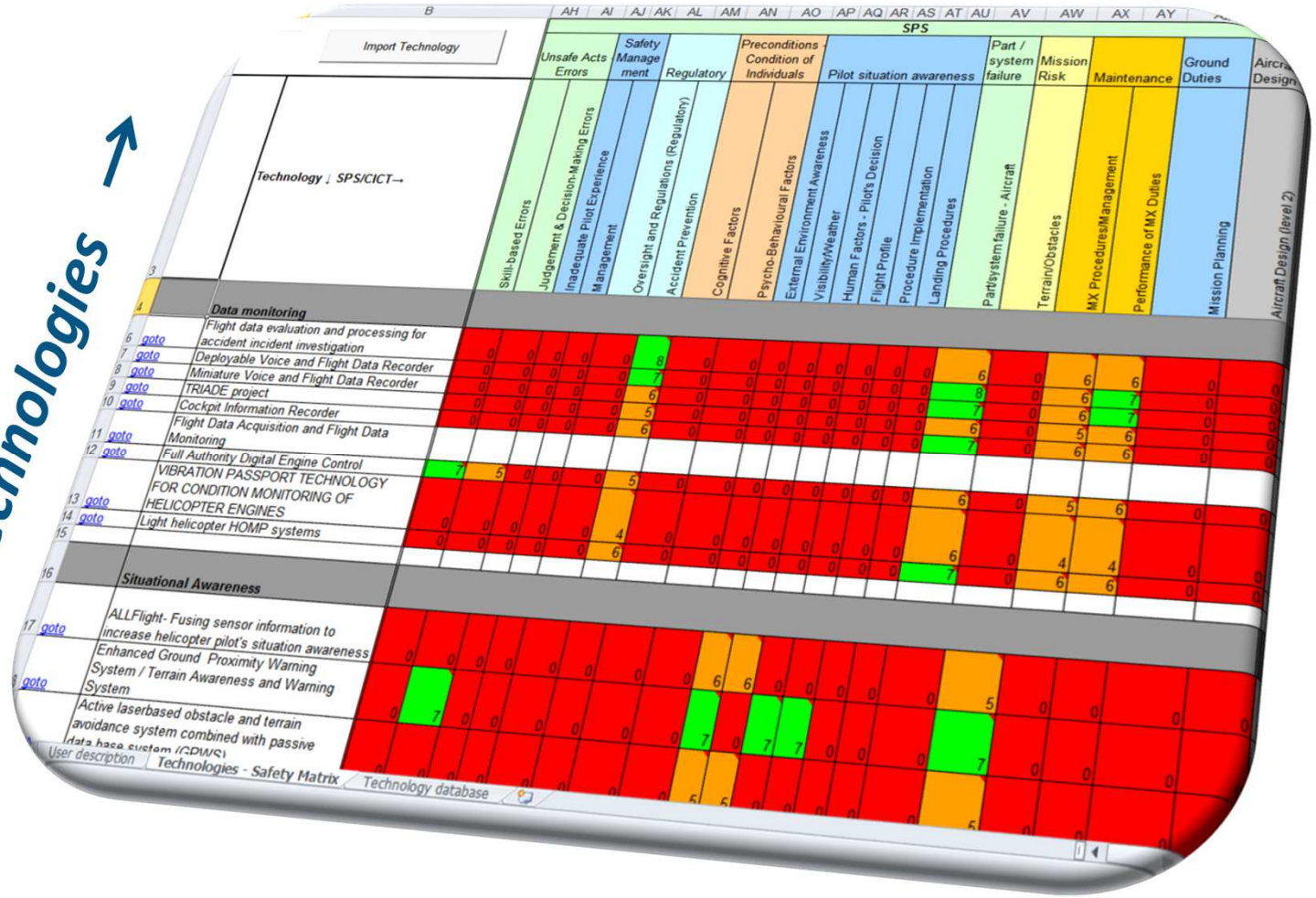
Methodology – Define a tool

EHEST Component of ESSI European Helicopter Safety Team

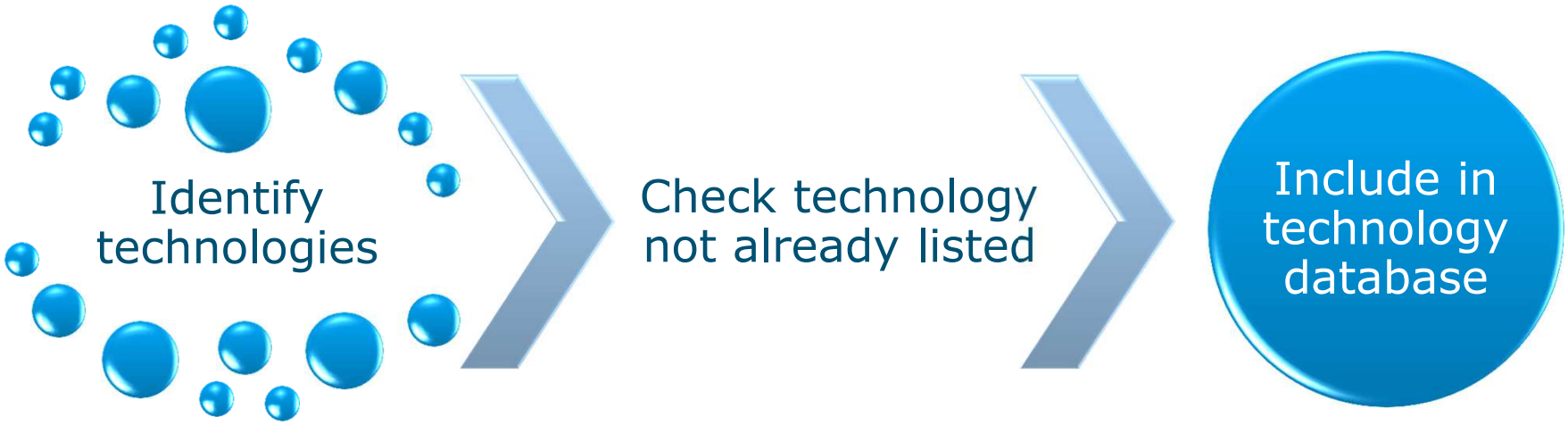
NLR

← Safety Issues →

↑ Technologies ↓



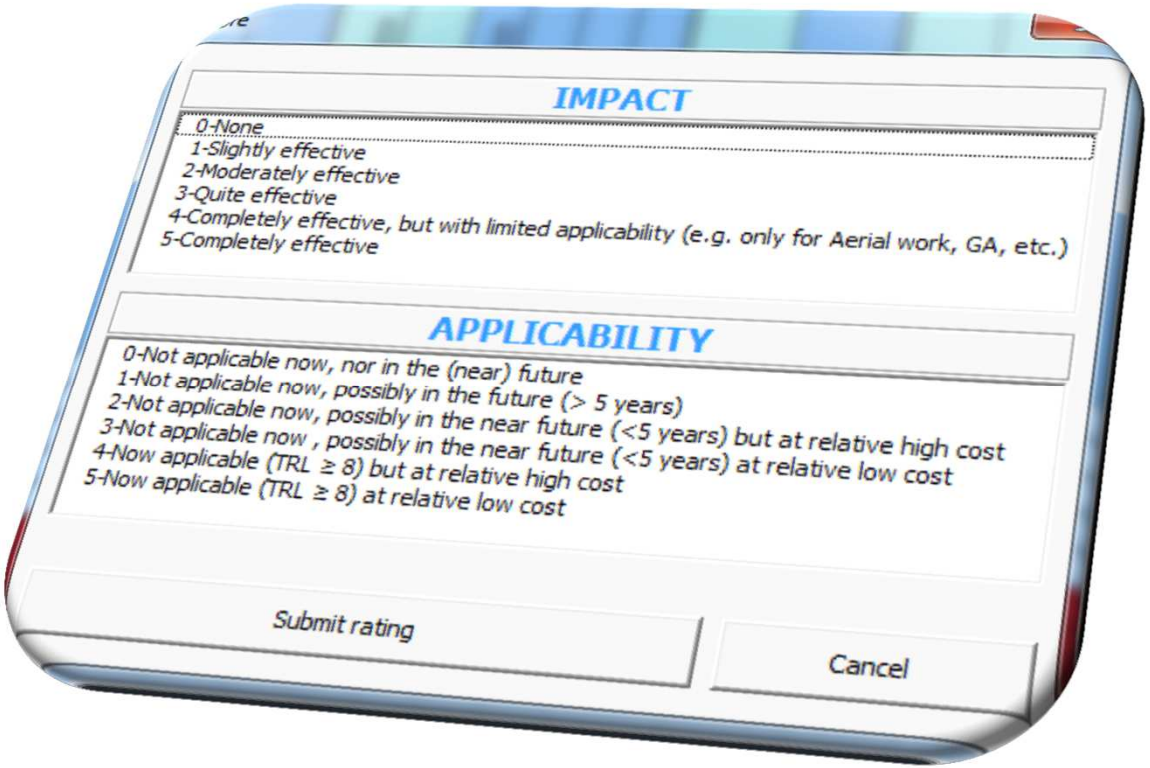
Methodology - List technologies



Consolidated tool: 145 technologies in 11 categories

Methodology - Rate technologies

Group of experts rated technologies for each safety issue on impact and applicability, leading to colour-coded results



Highly promising

Moderately promising

Not / Slightly promising

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Results – Overview of rated technologies

Technology group	Total	Rated	Non-rated	% rated
Aircraft design	9	6	3	67%
Avionics	25	9	16	36%
Crashworthiness	10	6	4	60%
Data monitoring	18	17	1	94%
Dynamic system	9	2	7	22%
Maintenance	7	3	4	43%
Operational support	2	1	1	50%
Other	7	5	2	71%
Situational awareness	50	39	10	78%
Vibrations	4	2	2	50%
Workload	4	3	1	75%
(for information only)	(4)	(0)	(4)	
TOTALS	145 (149)	93	52 (56)	64%

67-100%
33-67%
0-33%

Non-rated: for information only, rather old sources or missing information

Results - 15 highly promising technologies

A	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ
	SPS																			
	Unsafe Acts - Errors		Safety Management		Regulatory		Preconditions - Condition of Individuals		Pilot situation awareness		Pilot judgement & actions				Part / system failure	Mission Risk	Maintenance		Ground Duties	Aircraft Design
Technology ↓ SPS →	Skill-based Errors	Judgement & Decision-Making Errors		Management	Oversight and Regulations (Regulatory)	Accident Prevention	Cognitive Factors	Psycho-Behavioural Factors	External Environment Awareness	Visibility/Weather	Human Factors - Pilot's Decision	Flight Profile	Procedure Implementation	Landing Procedures	Part/system failure - Aircraft	Terrain/Obstacles	MX Procedures/Management	Performance of MX Duties	Mission Planning	Aircraft Design (level 2)
Data monitoring																				
Flight data evaluation and processing for accident incident investigation	0	0	0	0	0	8	0	0	0	0	0	0	0	0	6	0	6	6	0	0
Deployable Voice and Flight Data Recorder	0	0	0	0	0	7	0	0	0	0	0	0	0	0	8	0	6	7	0	0
Miniature Voice and Flight Data Recorder	0	0	0	0	0	6	0	0	0	0	0	0	0	0	7	0	6	7	0	0
Cockpit Information Recorder	0	0	0	0	0	6	0	0	0	0	0	0	0	0	7	0	6	6	0	0
Full Authority Digital Engine Control	7	5	0	0	0	5	0	0	0	0	0	0	0	0	6	0	5	6	0	0
Light helicopter HOMP systems	0	0	0	0	0	6	0	0	0	0	0	0	0	0	7	0	6	6	0	0
Situational Awareness																				
Digital Range Image Algorithms for Flight Guidance Aids for Helicopter-Low-Level-Flight	0	8	0	0	0	0	0	0	8	5	6	8	0	5	0	6	0	0	0	0
Efficient Numerical Approaches for On-Board Rotorcraft Flight Performance Modeling	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	6	0
Enhanced Ground Proximity Warning System / Terrain Awareness and Warning System	0	7	0	0	0	0	0	0	7	0	7	7	0	0	0	7	0	0	0	0
Radar Altimeter for altidue measurement	0	0	0	0	0	0	0	0	8	0	0	6	0	0	0	6	0	0	0	0
Passive Tower based system (Obstacle Collision Avoidance System; OCAS)	0	0	0	0	0	0	0	0	7	6	6	6	0	6	0	7	0	0	0	0
Laser radar obstacle and terrain avoidance system	0	0	0	0	0	0	0	0	7	7	5	5	0	5	0	7	0	0	0	0
Other																				
Immersive Visualisation	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Avionics																				
Digital Map	0	0	0	0	0	0	0	0	8	0	0	7	0	0	0	7	0	0	0	0
Aircraft Design																				
Wire Strike Protection System	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	8

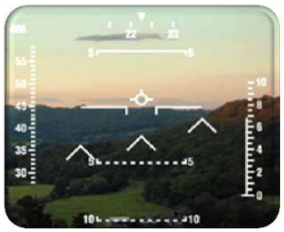
User description | Technologies - Safety Matrix | Technology database | SPS Level 3

These can jointly potentially mitigate 11 of the top 20 safety issues (SPS)

Results - Highly promising for ≥ 3 SPS

- Enhanced Ground Proximity Warning System / Terrain Awareness and Warning System
- Laser radar obstacle and terrain avoidance system
- Digital range image algorithms for flight guidance aids for helicopter low-level flight
- Digital Map
- (Deployable) Voice and Flight Data Recorder

Obstacle and terrain avoidance system



Digital range image for flight guidance

Digital moving map

Voice and Flight Data Recorder

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Challenges

- **Continuation of activities**
  - New technologies emerge
  - Current technologies evolve
  - Safety issues change

  - Recommended to constantly update technology tool

- **Translate results into concrete technology implementation**
  - Disseminate results to helicopter community and beyond
  - Community to pick up challenges to improve safety through use of technologies

  - Recommendations for industry, regulators, and research institutes & universities

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Conclusions

- **Tool defined: Excel matrix**
- **Technologies 145 listed / 93 rated**
- **15 highly rated technologies jointly can mitigate 11 of the top 20 safety issues**
- **Recommendations:**
  - Continuation of ST Technology activities
  - Industry to channel their technological development in line with study results
  - Regulator to find ways to improve safety by adopting the technologies
  - Researchers and universities to concentrate efforts on developing lacking and low TRL technologies

Download full report

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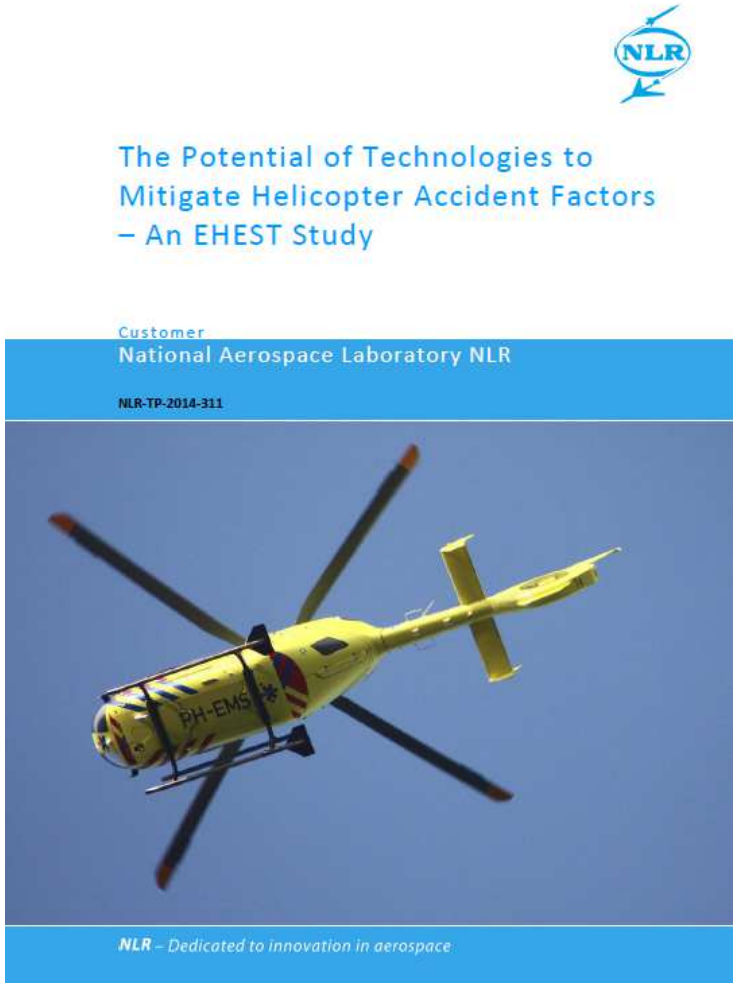

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