interactIVe

Accident avoidance by active intervention for Intelligent Vehicles

Safety Assessment Methodology in interactIVe

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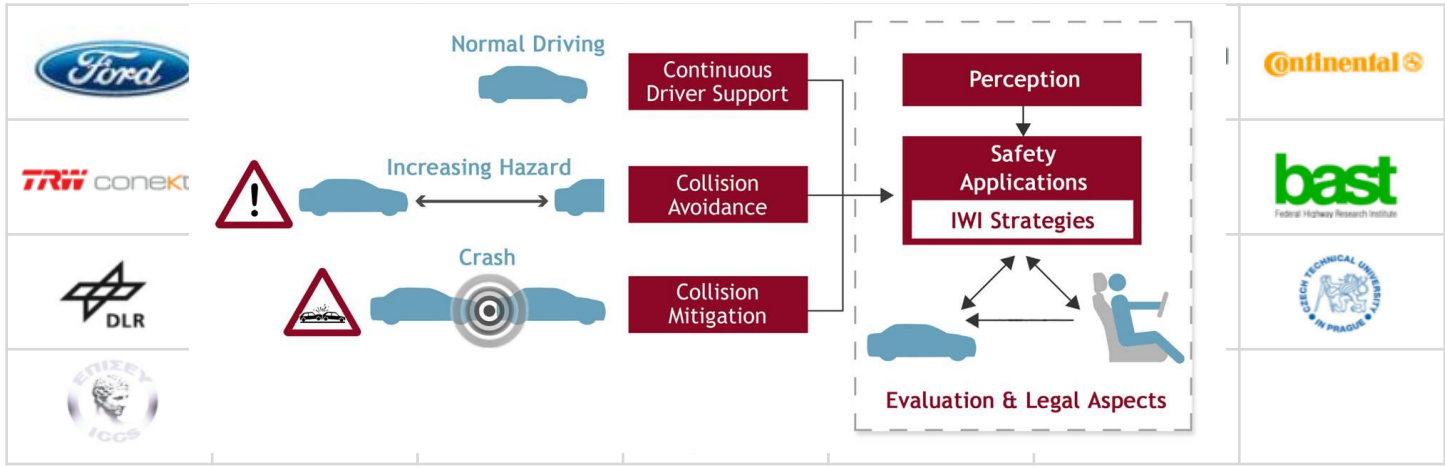
interactIVe - Project overview

The interactIVe vision:
Accident-free traffic and active safety systems in all vehicles

- Facts:
  - Duration: 48 months (January 2010 – November 2013)
  - 29 partners of 10 countries
  - Budget: 30 Million € (Founding by the European Commission: 17 Million €)
- interactIVe systems:
  - SECONDS (Safety enhancement through continuous driver support)
  - INCA (Integrated collision avoidance and vehicle path control)
  - EMIC (Cost-efficient emergency intervention for collision mitigation)



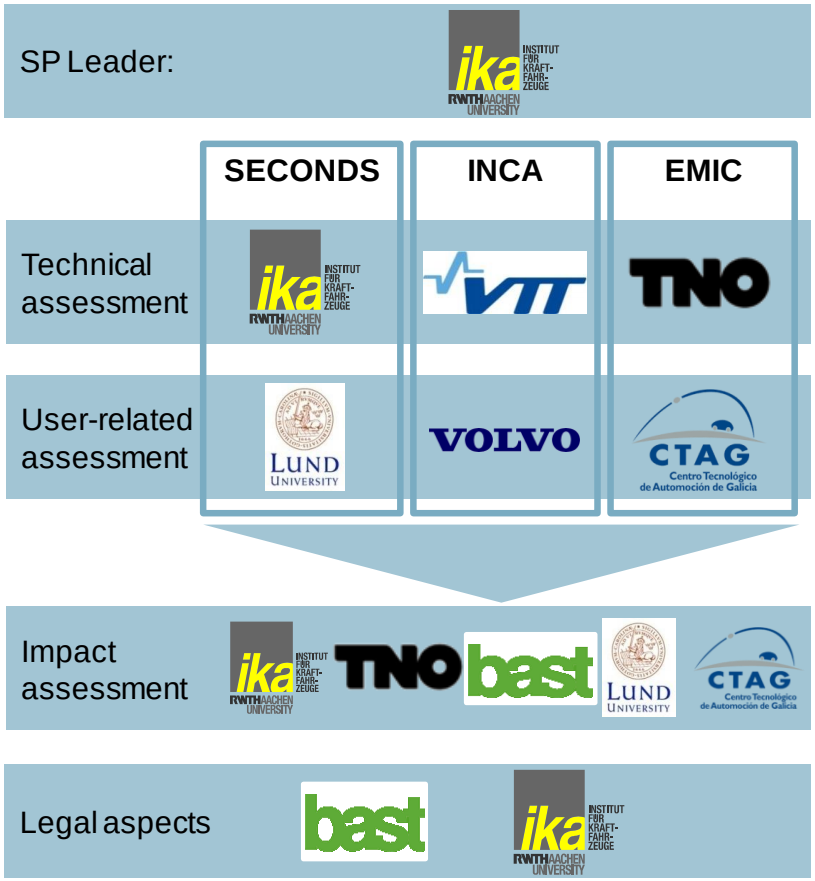
SP7 “Evaluation and legal aspects” - Overview

SP7 role in interactIVe:

- Definition of a test and evaluation framework for each application with respect to human factors and technical performance
- Development of test scenarios, procedures, and evaluation methods
- Provision of tools for evaluation like equipment, test catalogues, questionnaires or software and support for testing
- Definition of test and evaluation criteria
- Analysis of legal aspects for broad exploitation of the applications

Evaluation for interactIVe is divided into:

- Technical assessment
- User-related assessment
- Impact assessment



Safety Impact Assessment – Methodology

- Literature review on impact assessment methodologies:
  - Safety Mechanisms
  - Accident Reconstruction
  - Neural Network
  - FOT – Approach
- Chose appropriate methodology by considering the available data as well as advantage and disadvantages of the methodologies:
  - Nine Safety Mechanisms

- Direct effects
  1. Direct in-car modification of the driving task,
  2. Direct modification of communications,
- Indirect effects on user
  3. Indirect modification of user behaviour,
- Effects on non-users
  4. Indirect modification of non-user behaviour,
  5. Modification of interaction between users and non-users,
- Exposure effects
  6. Modification of road user exposure,
  7. Modification of modal choice,
  8. Modification of route choice,
- Effects on post-accident consequence modification
  9. Modification of post-crash consequences.

Only in-car functions

Exposure effects, typically small

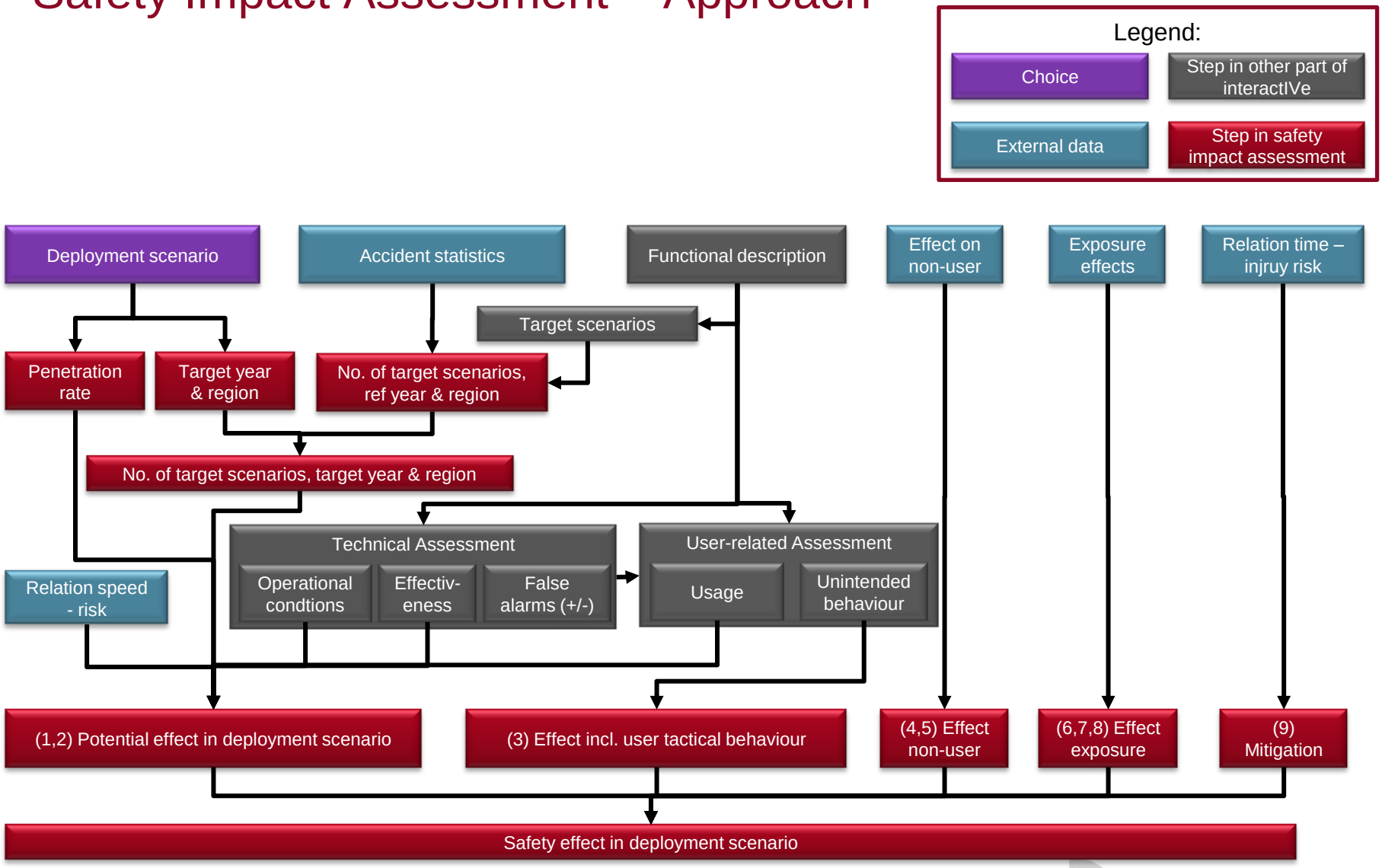
Only post-collision

Safety Impact Assessment – Planned improvements

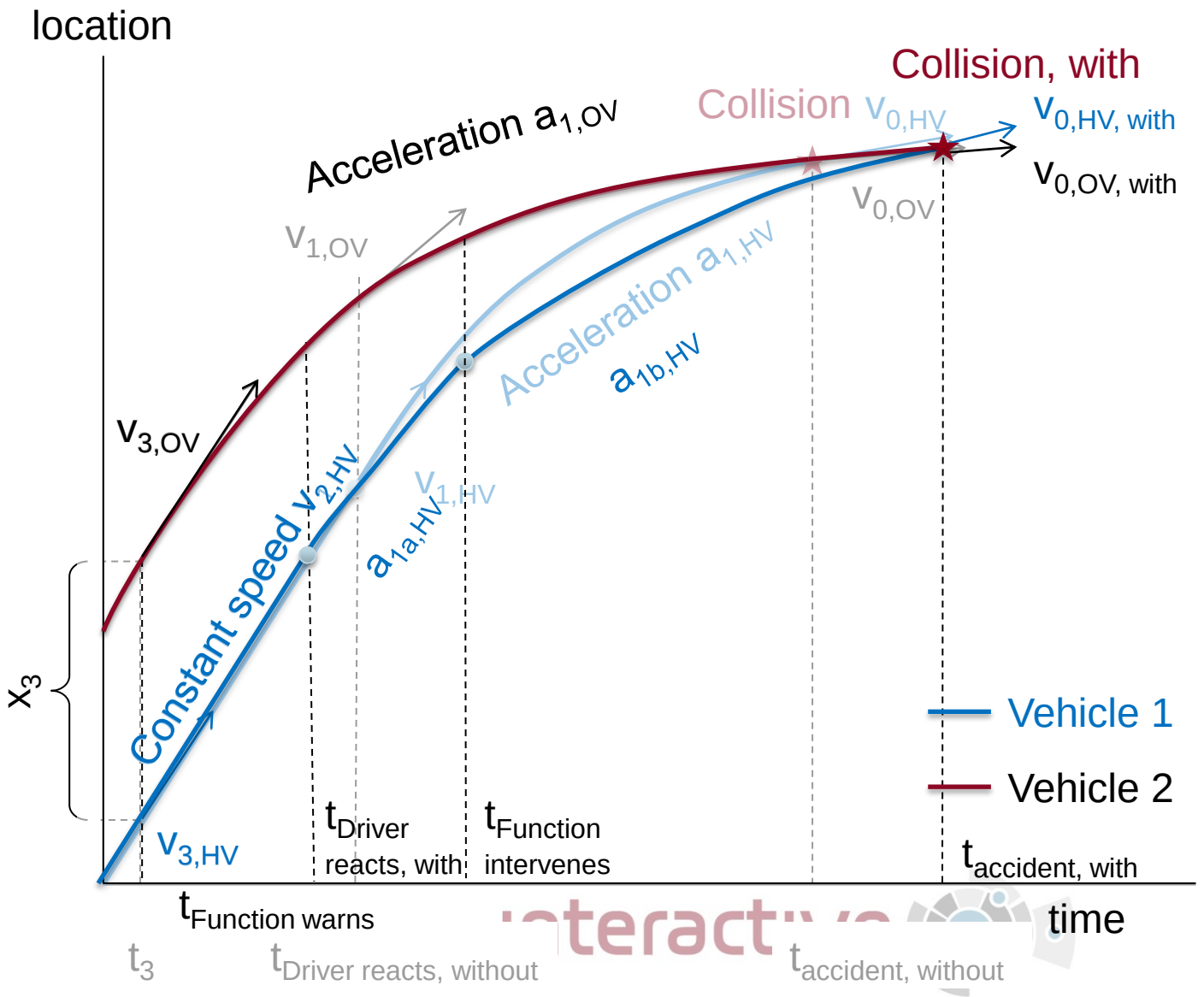
interactIVe moving beyond the state of the art

State of the Art (eIMPACT, PreVAL, …)	Planned improvements by interactIVe
Modification factors for safety mechanisms determined by “black box” (e.g. direct effects)	Provide a method for the most important factors, by detailing contributing factors
Safety effects scale linear in penetration rate	Take nonlinear interaction effects into account
Determine safety effects for a few main accident types	Provide more detailed categorization to allow more detailed analysis of manoeuvres or impact zones

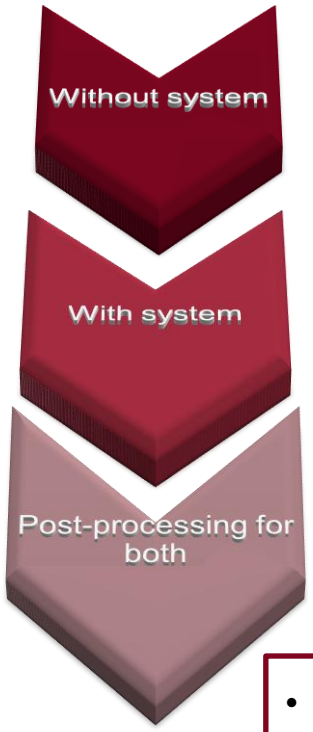
Safety Impact Assessment – Approach

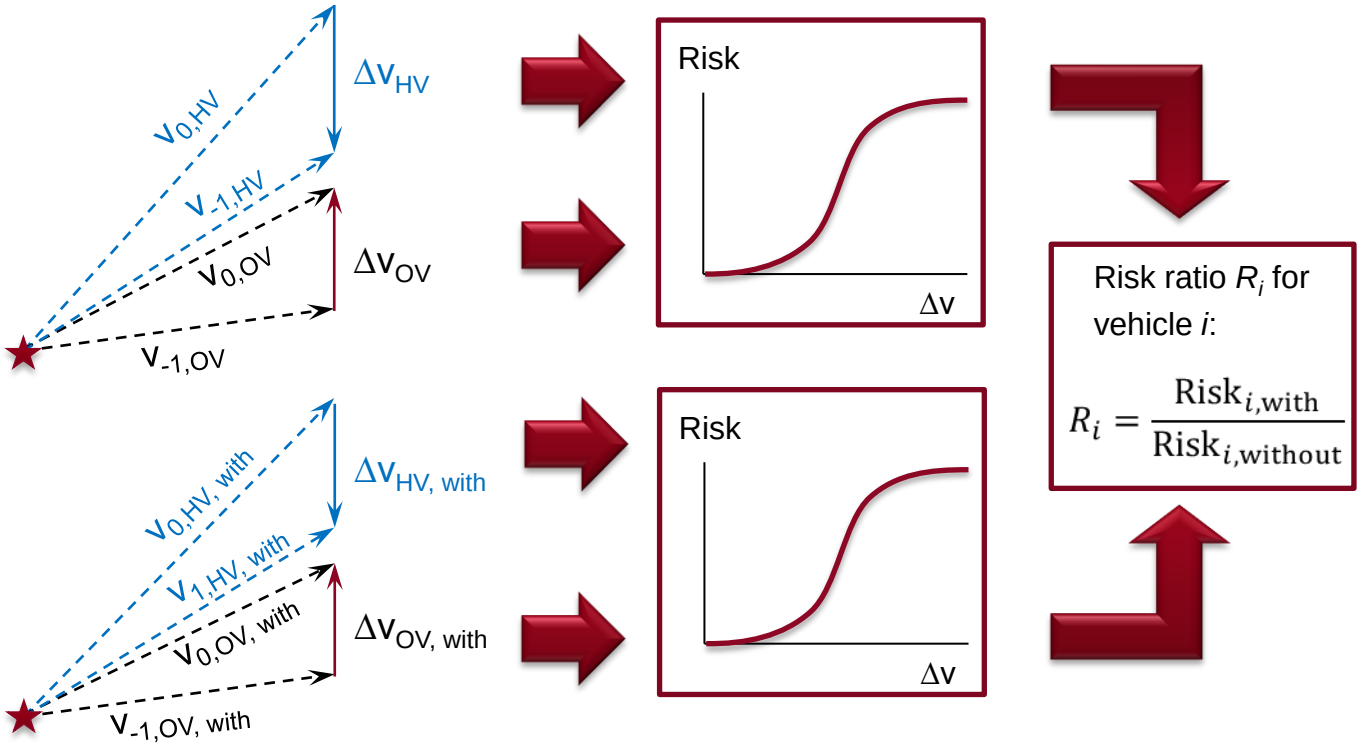


Safety Impact Assessment – Direct effects



Safety Impact Assessment – Direct effects





- Speed $v_{0,i,with}$ and $v_{0,i}$ for vehicle i from just before collision are known!
- Derive speed $v_{-1,i,with}$ and $v_{-1,i}$ from just after collision based billiard mechanics
- Calculate $\Delta v_{i,with} = v_{1,i,with} - v_{0,i,with}$ and $\Delta v_i = v_{1,i} - v_{0,i}$, the change of speed at collision for the host and the other vehicle, with and without the system
- Use known relations between Δv and injury risk…
- … to determine change in risk R_i between with and without, for both vehicles

Safety Impact Assessment – Scaling up

- The traditional approach for the scaling up as followed in eIMPACT and other projects is to consider the effect of the penetration rate (p) to be linear
  - SMF(p) = p SMF(1).
- However, this is too simplistic, because
  - for some use cases it is necessary that only one specific vehicle is equipped, for others it can be one of several
  - some of the nine safety mechanisms specifically address the effect on non-equipped vehicles, so these need to be incorporated.
- **Two-vehicle accidents**
  - The linear scaling is replaced by a combination of nonlinear ones
  - $SMF(p) = (a * p^2 + b * p(1-p) + c * (1-p)^2)$
- **Single-vehicle accidents**
  - $SMF(p) = p * r_1 * r_2 * r_3 * r_6 * r_7 * r_8 * r_9 + (1-p) * r_4$
  - r_4 indirect modification of non-user behaviour

Summary & Next steps

- Impact assessment in interactIVe
  - Methodology for interactIVe bases on the nine safety mechanism approach
  - Improvements by interactIVe:
    - Safety effects scales linear in penetration rate
    - Determine modification factors for safety mechanisms
    - Determine safety effects for a few main accident types

- Next steps
  - Carry out impact assessment in interactIVe
  - Results are expected for October / November 2013

→More information on interactIVe:

→Special Interest Session (SIS76), tomorrow, 9:00 - 10:30, Lehar 2

Thank you.

Co-funded and supported by the European Commission

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