EISC–ESA ‘Space for Sustainability’ Award

EISC 2016 Plenary Conference - Bucharest
03/10/2016
Marion Mirailles

space for sustainability

Space for Sustainability Award

PURPOSE OF THE AWARD

Stimulate the debate and raise awareness on space and sustainability issues among the young Europeans

Be a tool for innovative and creative project ideas in those areas

The 'Space for Sustainability Award' is rewarded annually to the best Project Idea that integrates application areas focusing on sustainability linked to space

THE AWARD SO FAR IN A NUTSCHELL

- 4 Editions
- 68 participants
- 17 European countries represented
- Age average: 25 years old
- 3 launches attended:
  - GAIA in December 2013
  - Galileo Satellite in March 2015
  - Galileo Satellite in December 2015
- High level Jury
  - 7 Members
  - Multi-dsciplinary perspectives

Space for Sustainability Award

ERIC HERRERO 'Satellite prediction of illegal wildlife trafficking routes'
Winner of the Award

- To use a network of satellites to predict the routes of vessels and to look for strange behaviours in order to interfere the criminal activity before its completion.

FRANCESCA LETIZIA 'Eco-labelling for spacecraft: a debris index'
Special Mention of the Jury

- To propose an index for spacecraft to reflect its environmental impact in terms of space debris

CRISTIAN LAZAR 'Traffic Eyes from Above'
Special Mention of the Jury

- To bring benefits from space to ground to facilitate a safe driving way

Satellite Prediction of Illegal Wildlife Trafficking Routes

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Eric HERRERO

The black market

Orangutan

US$45.000

Rhino horns

US$65.000 per Kg

Tiger (Live)

US$50.000

Baby elephant

US$7.000

European Interparliamentary Space Conference (EISC)

A needle in a haystack

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Over 19.000.000

The number of **containers**
that the port of Hong Kong processes in **one year**

Less than 5 %

The percentage of **containers**
physically inspected

Satellite Automatic Identification System

SAT-AIS artists impression by ESA

European Interparliamentary Space Conference (EISC)

Revealing the invisible

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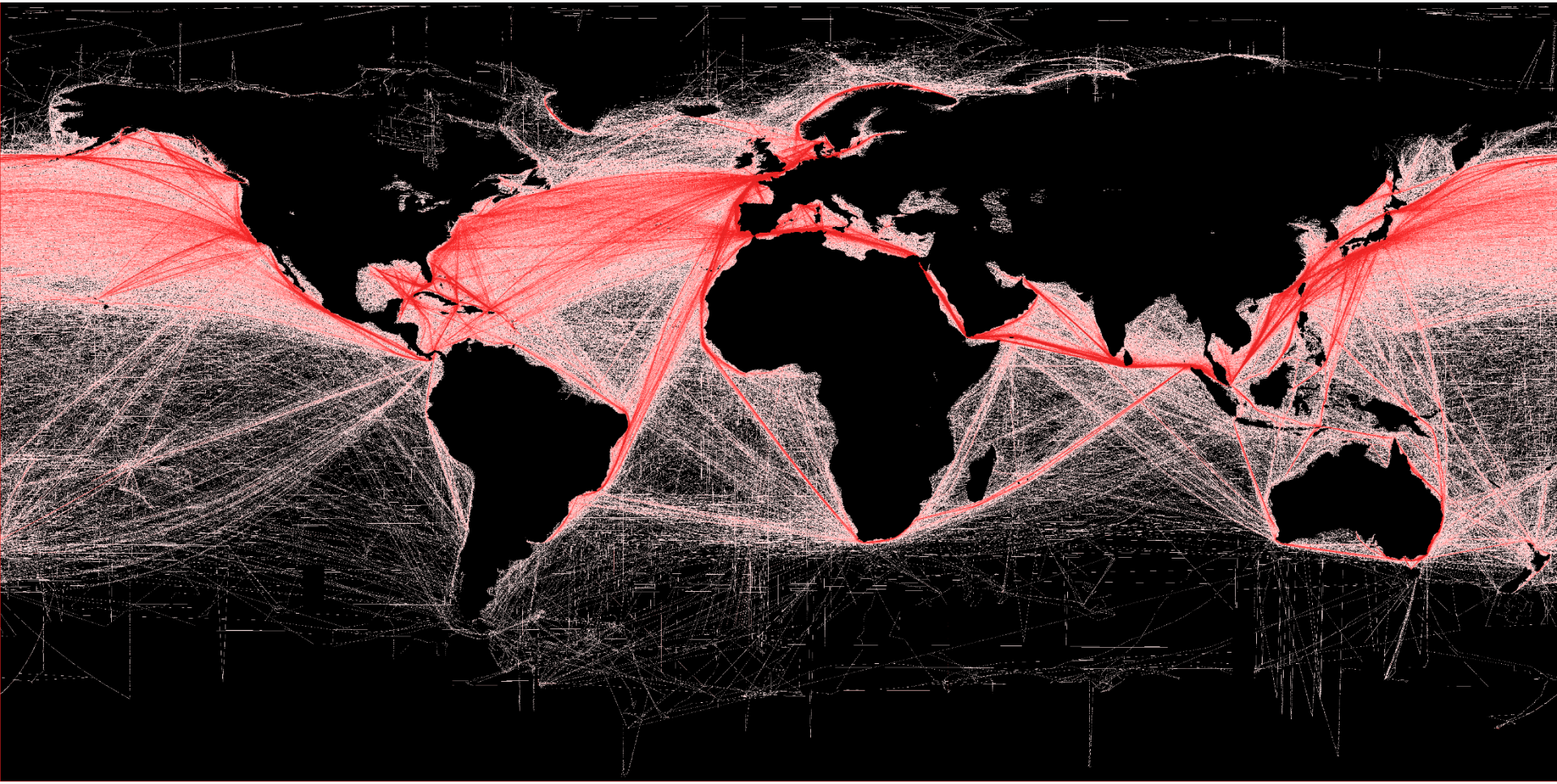
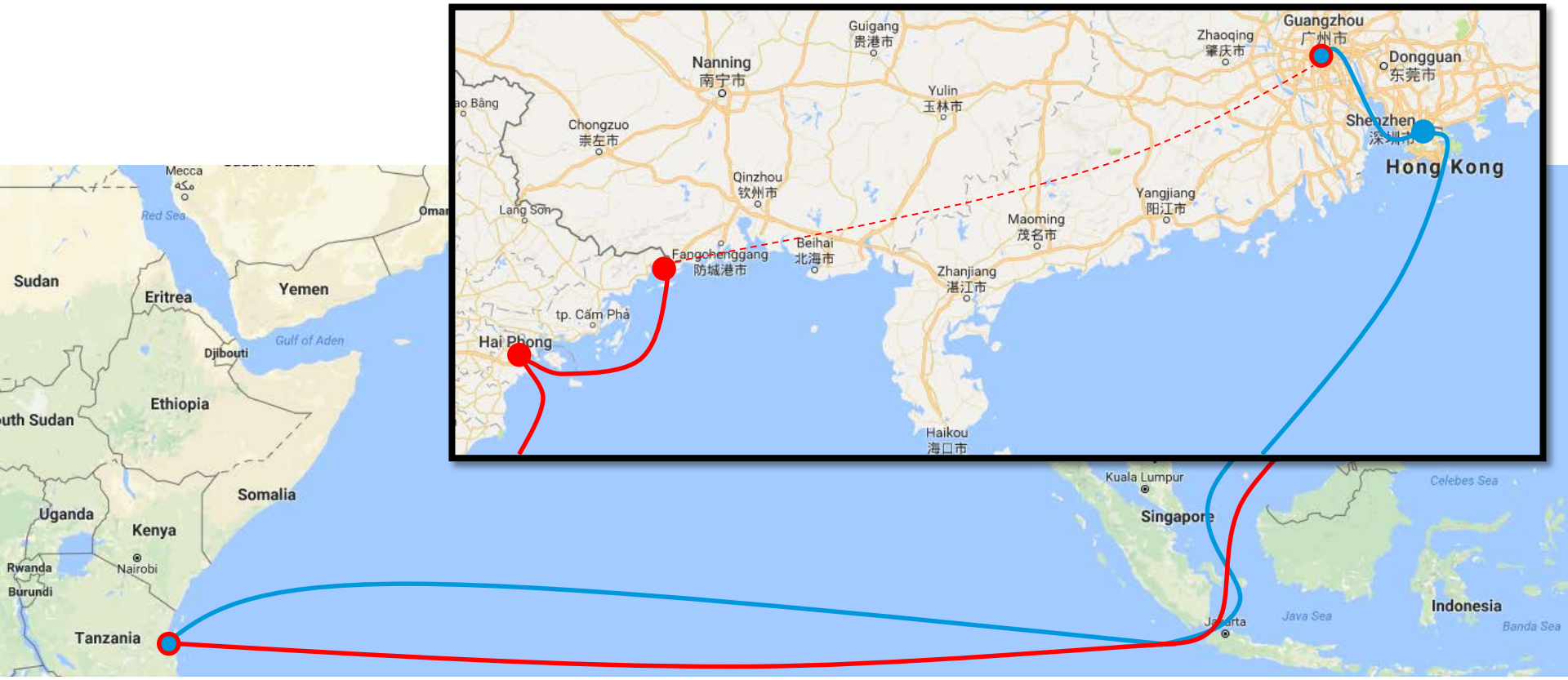


Relative density of commercial shipping in the world's oceans

Revealing the invisible



The cost of the RED ROUTE is US$2.480

The cost of the BLUE ROUTE is US$1.683

Conclusion

Thank you

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Eco-labelling for spacecraft: a debris index

EISC 2016 Plenary Conference - Bucharest
03/10/2016
Francesca Letizia

Eco-labelling for spacecraft

Space debris issue

how can we promote a sustainable use of the resource “Space”?
= ensure, in the future, the same level of access & availability

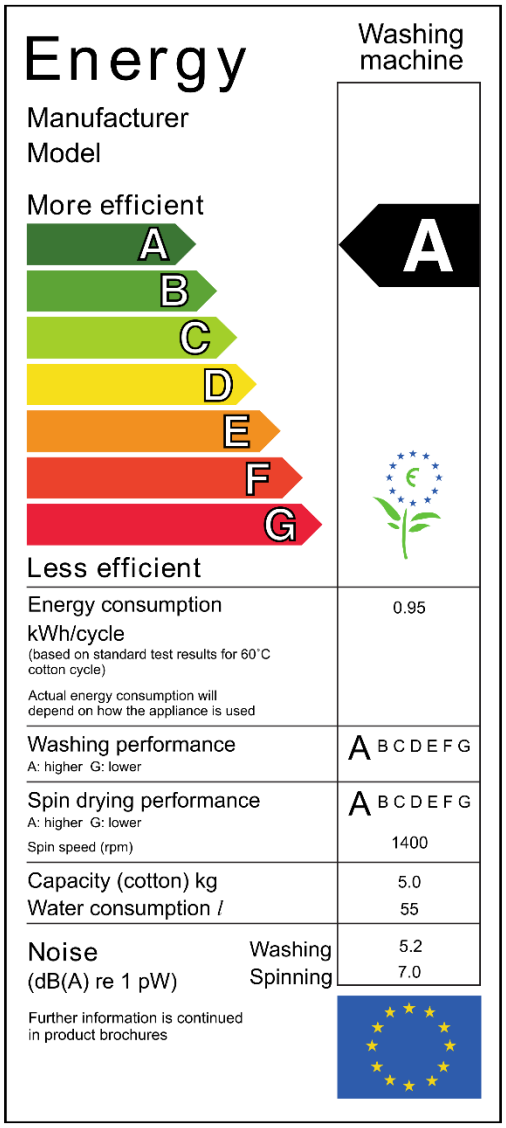
> **10 cm** | **22000** objects
catalogued & **tracked** from the Earth
can be avoided with **manoeuvers**

1-10 cm | **500000** objects
too **small** to be tracked
big enough to destroy a satellite

1 mm-1 cm | **millions** of objects
too **small** to be detected
can cause **anomalies** in spacecraft operations

Population of objects larger than 10 cm in 2009 according to DAMAGE (University of Southampton)

Eco-labelling for spacecraft



European **energy label** introduced in 1994 (initially for cold appliances, then extended)

Meant to fill the **energy-efficiency gap**: consumers not aware of the consumption of their appliances

Private cost (bills) and **society cost** (energy demand & environmental consequences)

It contributed to **orient the market** towards more efficient products, to **define a minimum level of efficiency**, to **create awareness** in the consumers

Sammer & Wüstenhagen, 2006 | Mills & Schleich, 2010 | Heinzle & Wüstenhagen, 2012

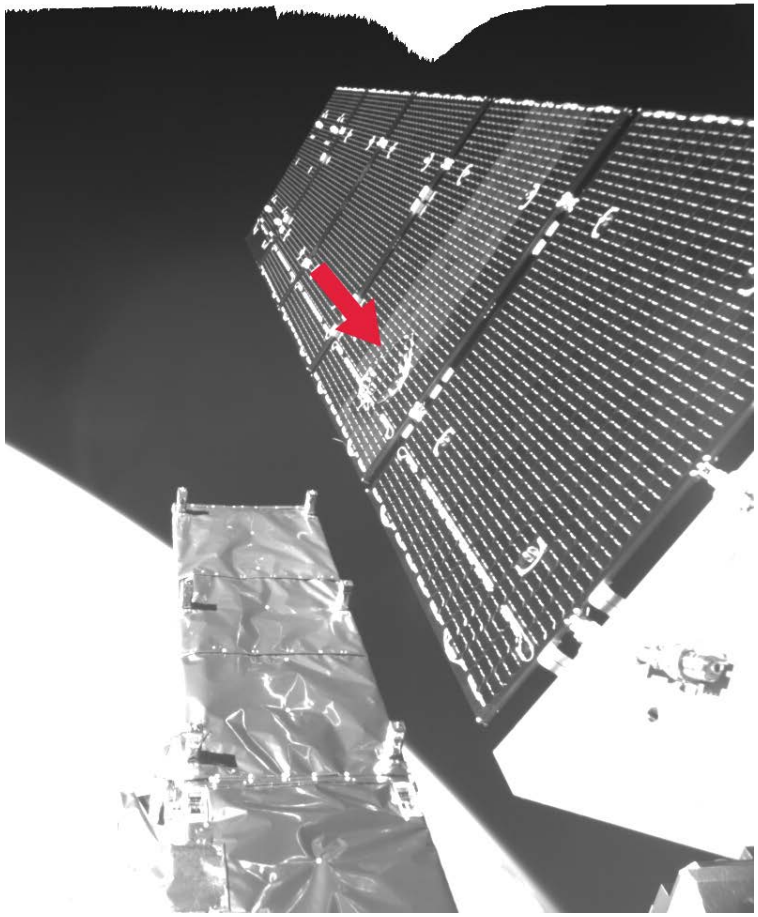
Eco-labelling for spacecraft

Proposal for a **debris index**

Target group: **operators**, on their interface with space agencies and other organisations

Private cost (collision avoidance manoeuvres) and **society cost** (environmental consequences)

What to measure?
Effect of **fragmentations** on **operational satellites**



Sentinel-1A's solar array after the impact of a millimetre-size particle (31/08/2016). Credits: ESA

Eco-labelling for spacecraft

$$I = p_c \cdot e_c + e_e \cdot p_e$$

Collision probability

Explosion probability

Collision effect

Explosion effect

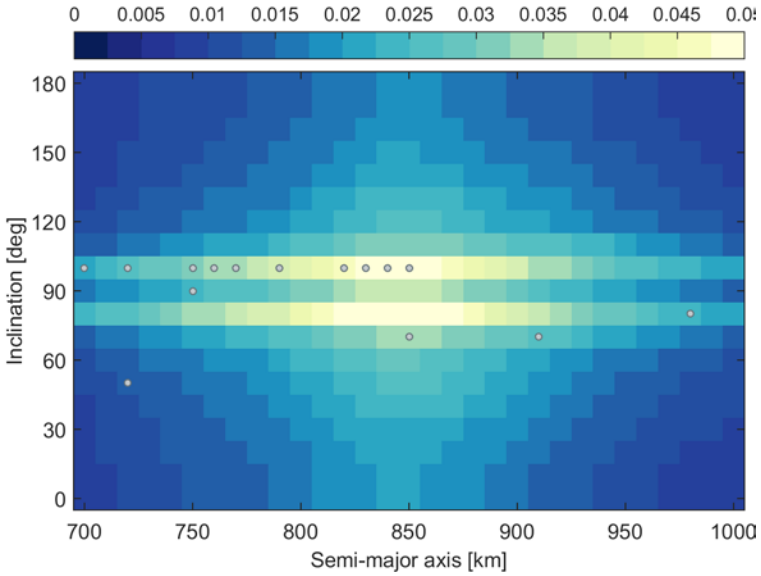
Debris population

Object type

Spacecraft size

Orbit

Distribution of operational satellites



Estimation of the effect of fragmentations with different initial conditions on operational satellites (Letizia et al, 2016)

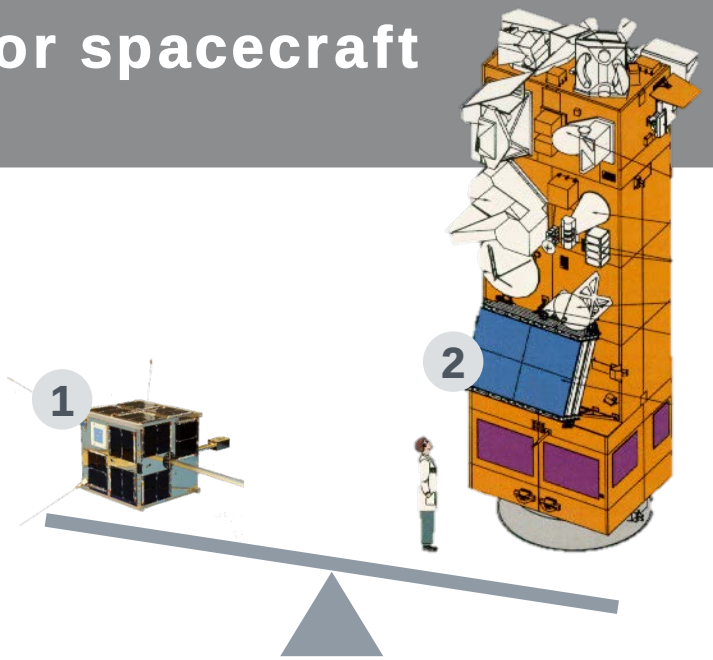
It can be computed along **mission profiles** to take into account the implementation of **end-of-life strategies**

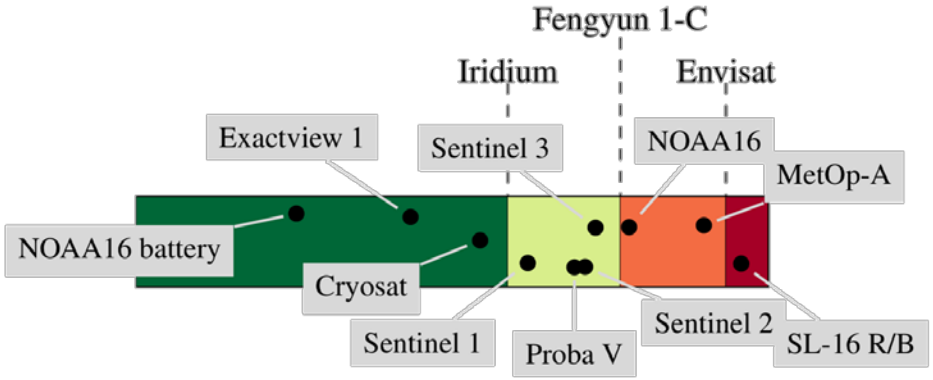
All the terms can be **pre-computed** for general values of the spacecraft parameters and stored: the **final value** can be easily computed by any **user**

Eco-labelling for spacecraft

Distinguish **different classes of satellites** and **orbital regimes**

- identification of candidates for **active debris removal**
- support to **spacecraft licensing**





Classification of missions based on the effect of their breakup, due to a collision, on operation satellites (Letizia et al. 2016)

A classification will be **accepted** only if all the **stakeholders** are involved in its **definition** (i.e. agencies, operators, manufacturers)

It should be associated to processes such as **licensing**, collision avoidance services & combined with a **positive message** for virtuous operators (e.g. lean licensing process)

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Traffic Eyes from Above

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Cristian Florin LAZĂR

Introduction

Automobiles - most common mode of transportation in Europe and worldwide

- Desire to increase the road safety and reliability;
- Increase the driving self-confidence;
- Reduce the number of road accidents;
- Avoid traffic jams;
- Decrease CO_2 emissions over a zone

!! According to European Commision:

- 2011, >30,000 people died on the roads of the European Union (i.e. the equivalent of a medium town)

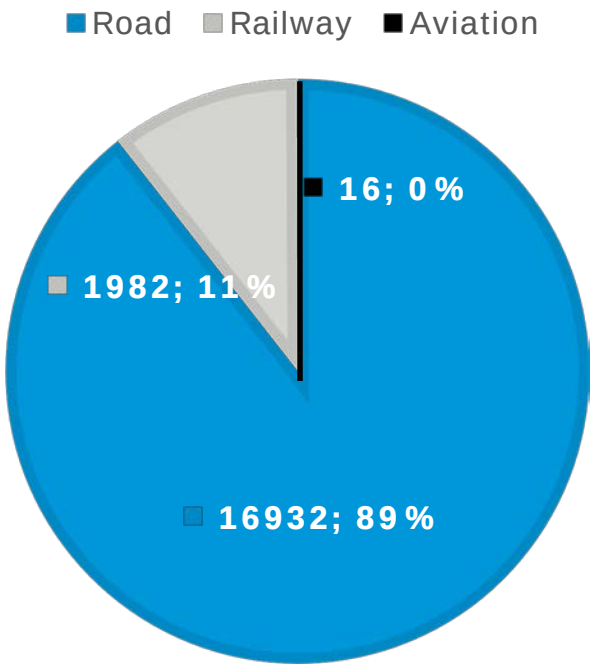
!! According to National Safety Council:

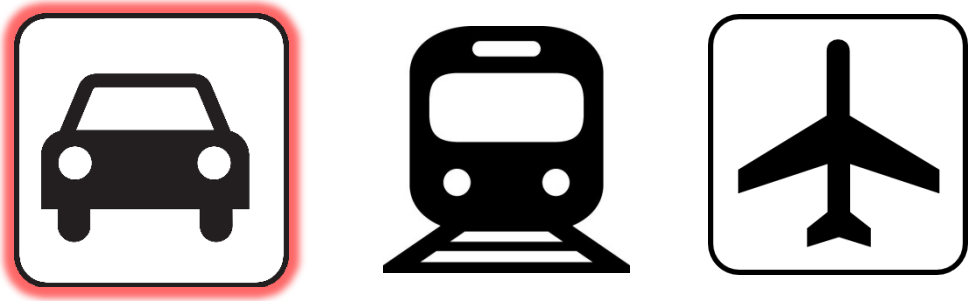
- buses, trains, and airlines have much lower death rates than automobiles when the risk is expressed as passenger deaths per mile of travel

Background

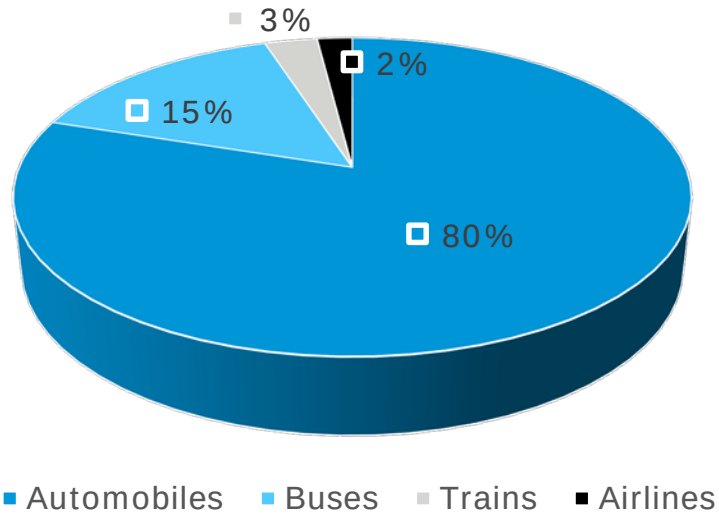
NUMBER OF ACCIDENTS

EU Comission Statistics in 2013, EU-28





DEATH RATE /100MIL PASSENGER/KM



- Road fatalities: 84,589 (EU,2015)

Proposal idea

- Display automobile traffic presence in the near-area
- Observe the direction of movement and speed
- Real-time interface position indicator
- All vehicles equipped with a navigation system:
  - On-board integrated navigation system
  - GPS navigation device
  - Smartphone software application

*Prototype

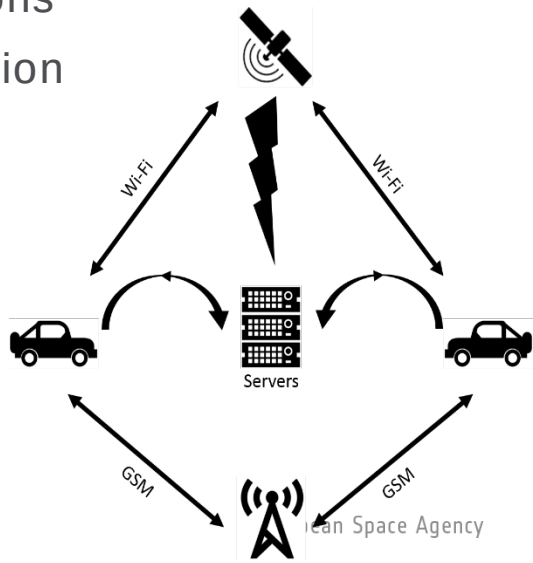
personal vehicle

other vehicles

request-for-aid vehicles

Multiple Benefits

1. Increase driving reliability and safety
2. Decrease number of automobile accidents due to unreliable or risky overtaking
    - Low visibility (curve, slope road)
    - Weather conditions (dense fog, dust, heavy rainstorm, hale)
    - Mirror blind spot
3. Help in critical or emergency situations
4. Traffic jam avoidance and optimal re-route
5. “Indirect visibility” in blind street-junctions and intersections
6. Involve multiple business-field opportunities and cooperation with multi-national stakeholders
    - Google Maps
    - Automobile manufacturers (producers)
    - Software developers
    - ‘OneWeb’ satellite constellation
    - Galileo GNSS (for European cooperation and space data usage)
7. High-accuracy and Real-time data (speed, time, distance)



Extra benefits: Server services

1. Data Mining
    - Traffic density
    - Less time in traffic jam
    - Record average speed of vehicles / area
        - Business: insurance companies – better rates
        - Possible check of overspeed limitation violation

2. Electric Cars
    - S/W predict total discharge of batteries
    - Search for closest charging center on the route
    - S/W track other car's discharging rate in an area

3. Autonomous Cars
    - Positioning info + find optimal route
    - Reduce risk of potential accidents
    - Redundant information system for autopilot

4. Planes ?
5. Motorcycles ?

Conclusion

Future navigation systems

- more features
- interconnected with others
- more reliable
- safer driving

Environment	• real car routing • reduce trafic jam • reduce pollution in an area • increase CO_2 gas absorbance in an area
Economy	• people in traffic jams are not productive nor effective (lost time = lost money)
Society	• improve everyday life by reducing the risks of road accidents • optimize automobile transport methods

THANK YOU FOR YOUR ATTENTION !