On-line decision making at TNO-FEL

TNO Physics and Electronics Laboratory
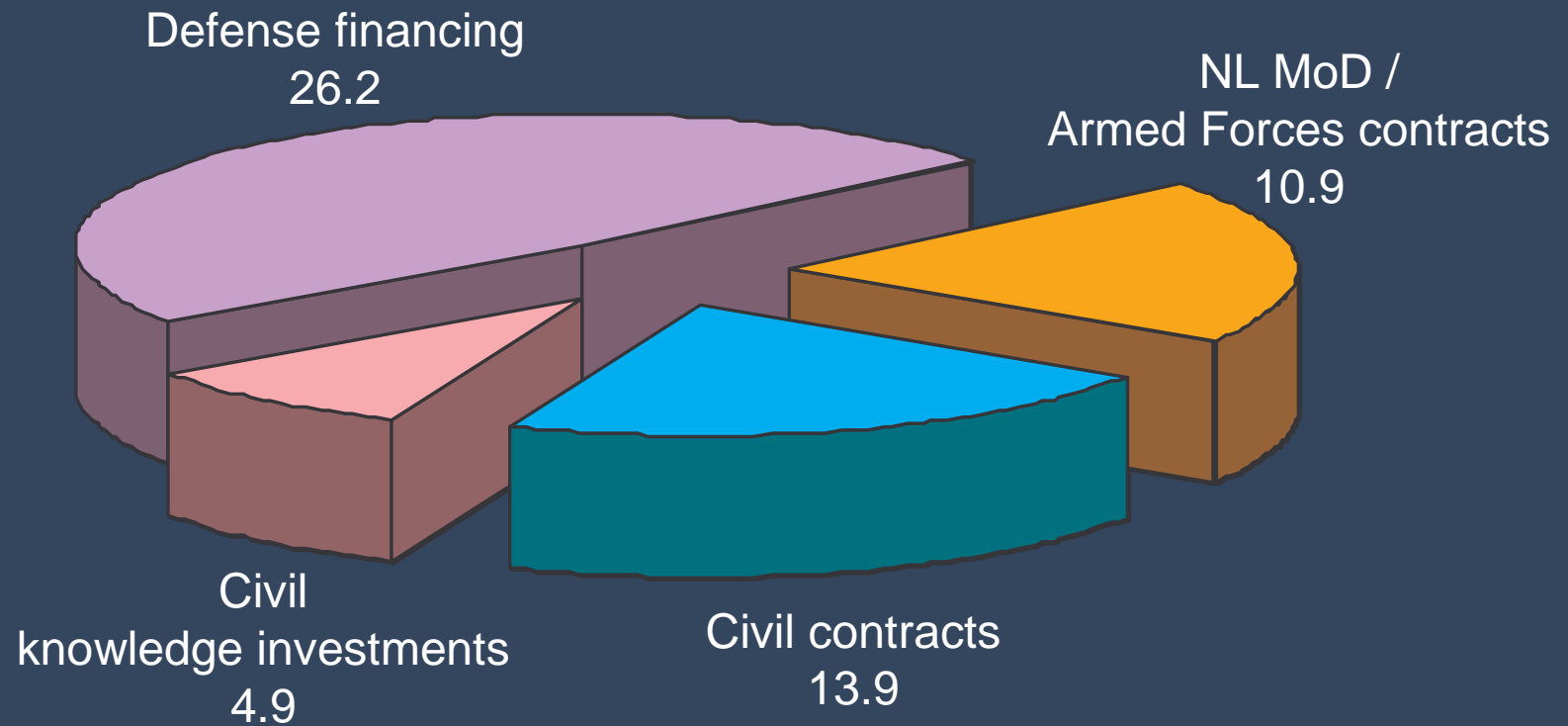
Contents

- **TNO-FEL in short**
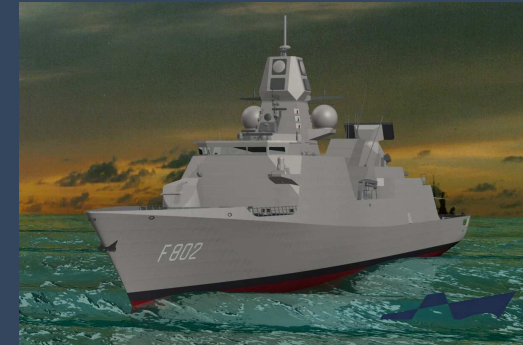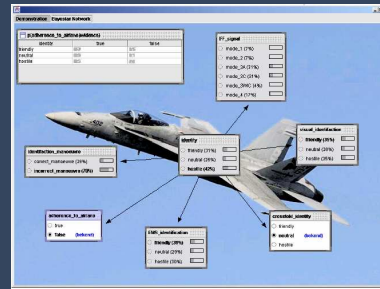- **Real-time decision applications**

Mission TNO-FEL

- **Support the public sector in solving social and business management issues on products and services related to the information chain**

- **Develop innovative electronics and ICT applications as a partner of private companies**

Turnover 2002 (56.2 M€)

Defense financing
26.2

NL MoD /
Armed Forces contracts
10.9

Civil
knowledge investments
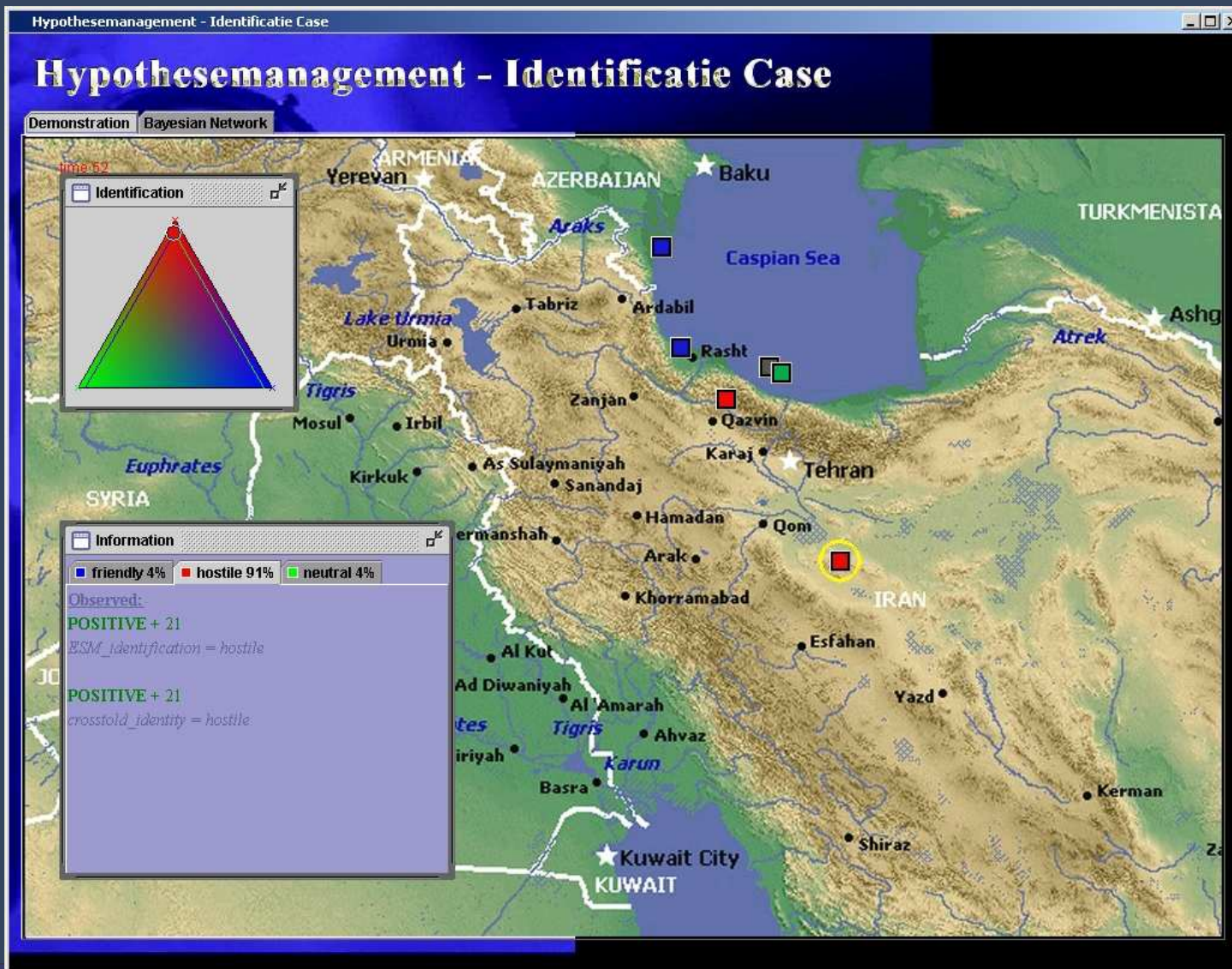4.9

Civil contracts
13.9

Applications

- Threat assessment

- Real-time air defense of a frigate

- Dynamic traffic modeling

- Innovation in e-fulfillment

Threat assessment
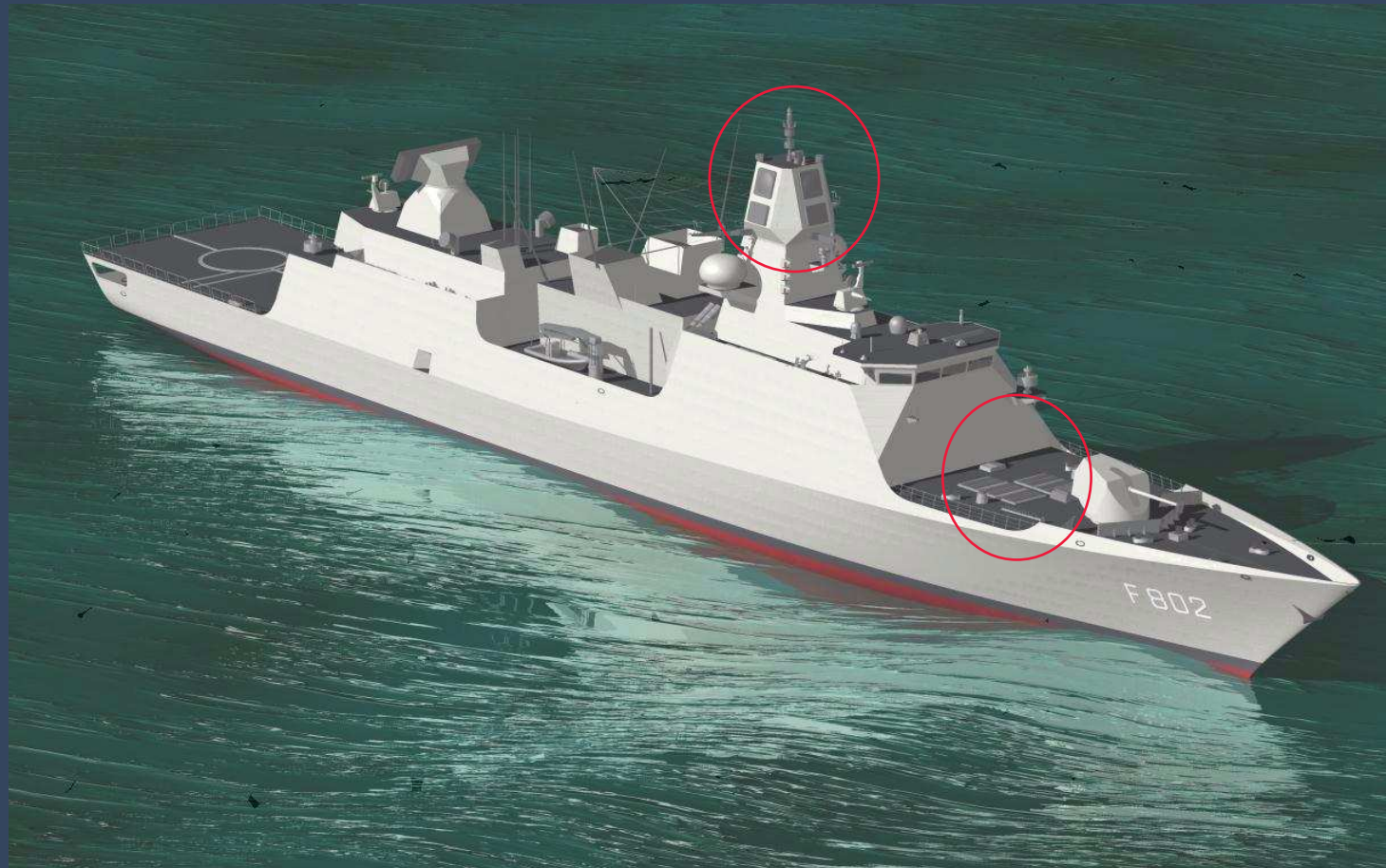
Maritime Air defense: Then and Now

Maritime Air Defense

Maritime Air defence

Enemy Fighter

Enemy Anti-Ship Missile (ASM)

HVU

HVU

ADCF

Surface to Air Missile (SAM) salvos

SAM salvos

ASM

ASM

ASM

ASM
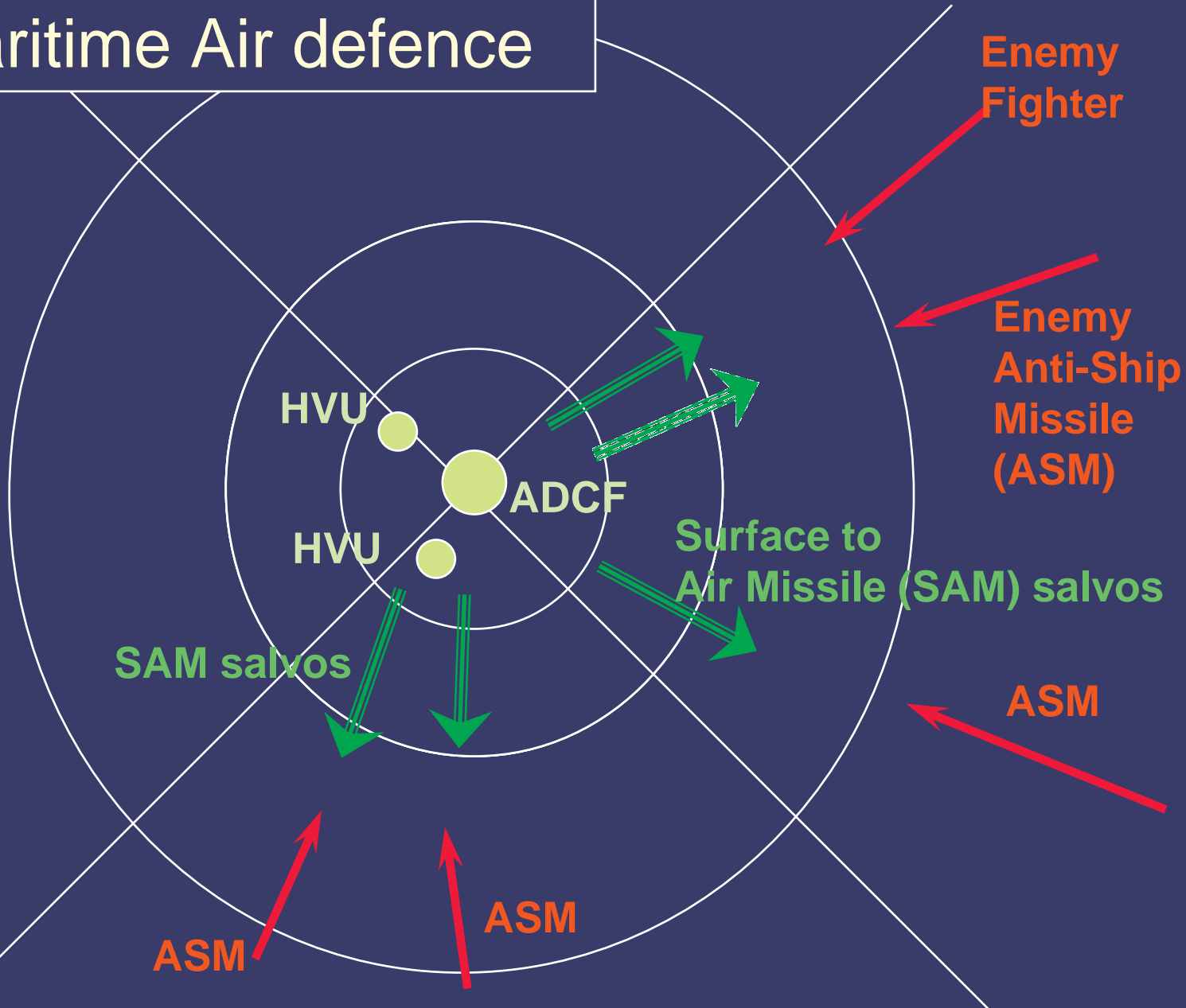
Objective

Construct a launch schedule, taking into account the actual situation, within one second, such that the expected number of eliminated targets (related to the survivability of the frigate) is maximized

Launch schedule

[Salvo 1, Salvo 2 ; Salvo 1, Salvo 2 ; …….]

target 1   target 2

Launch schedule constraints

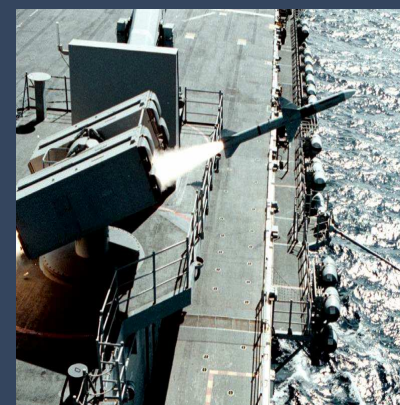Depends on on-going launches

- **Re-engagement constraint**
  - Launch of new salvo after kill-assessment previous salvo
- **Illumination constraint**
  - Number of simultaneously illuminated targets is limited and depends on chosen waveform
- **Launcher constraint**
  - Maximum of one SAM launch per second
- **Deadline constraint**
  - No intercept allowed after target crosses a given position
- **Priority constraint**
  - Engagements against high priority targets always before engagements of lower priority targets

Judicious ADCF Weapon Scheduler (JAWS)

Dynamic traffic modeling

Richting Eindhoven
↑ A16   3 km file
        A59/A27   file vrij ↗

bij groen één aut
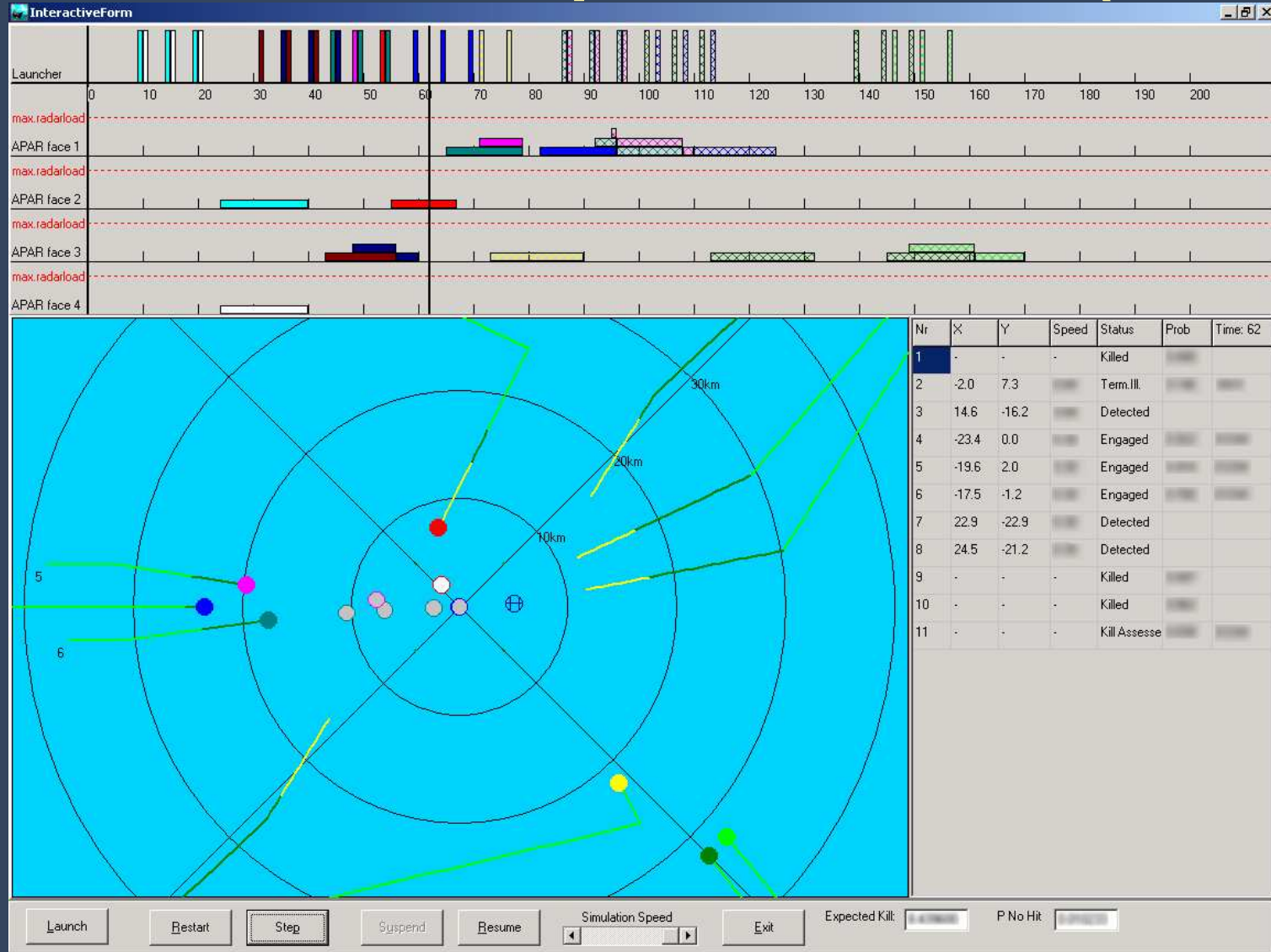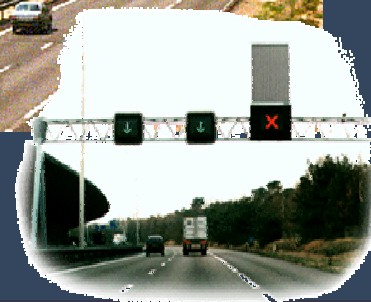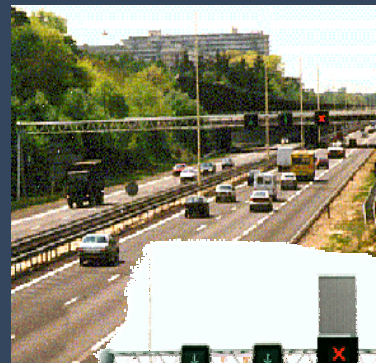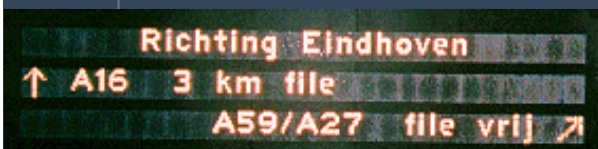
A new analytical multi-class dynamic traffic assignment model

INDY 1.0

What is INDY ?

- **Dynamic traffic model**
- **Includes macroscopic analytical traffic simulator**
- **Runs on general networks, mainly highways**
- **Models different vehicle characteristics (e.g. cars and trucks)**
- **Models different route choice behavior (preferences, full information, tolls, ...)**

TO Be used

- **Long term strategic transportation planning**
- **Offline evaluation dynamic traffic management measures**
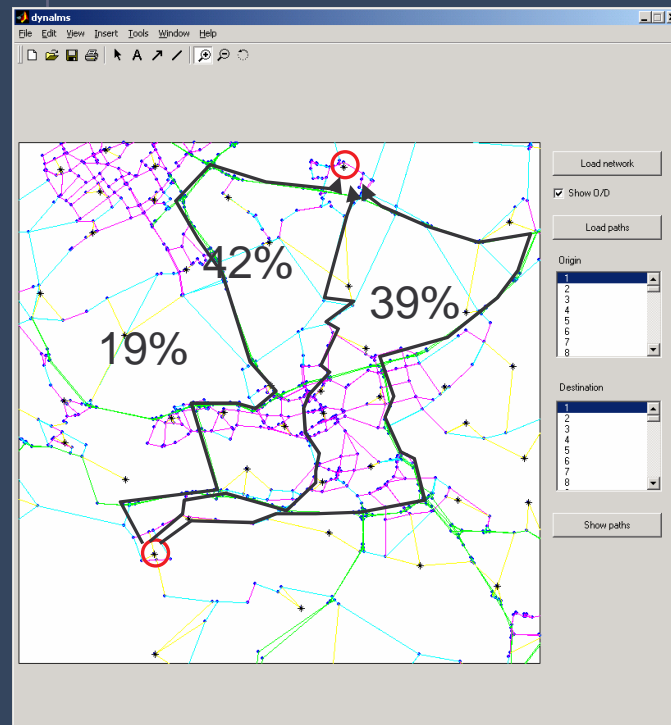
INDY framework

INDY 1.0

```
                              ┌─────────────┐
                              │   dynamic   │
                              │  O/D matrix │
                              └──────┬──────┘
                                     │
                                     ▼
┌──────────────────┐  ┌────────┐  ┌──────────────────┐
│ route generation │→ │ routes │→ │   route choice   │ ←┐
│      model       │  └────────┘  │      model       │  │
└──────────────────┘              └────────┬─────────┘  │
         ▲                                 │            │
         │                                 ▼            │
         │                          ┌────────────┐  ┌──────────────┐
         │                          │ route flows│  │  route costs │
         │                          └─────┬──────┘  └──────▲───────┘
┌──────────────┐                          │                │
│   network    │────────────┐             ▼                │
└──────────────┘            ▼      ┌──────────────────┐    │
                    ┌──────────────│ dynamic network  │────┘
                                   │  loading model   │
                                   └───┬──────────┬───┘
                                       │          │
                                       ▼          ▼
                              ┌────────────┐  ┌──────────────────┐
                              │ link flows │  │ link travel times│
                              └────────────┘  └──────────────────┘
```
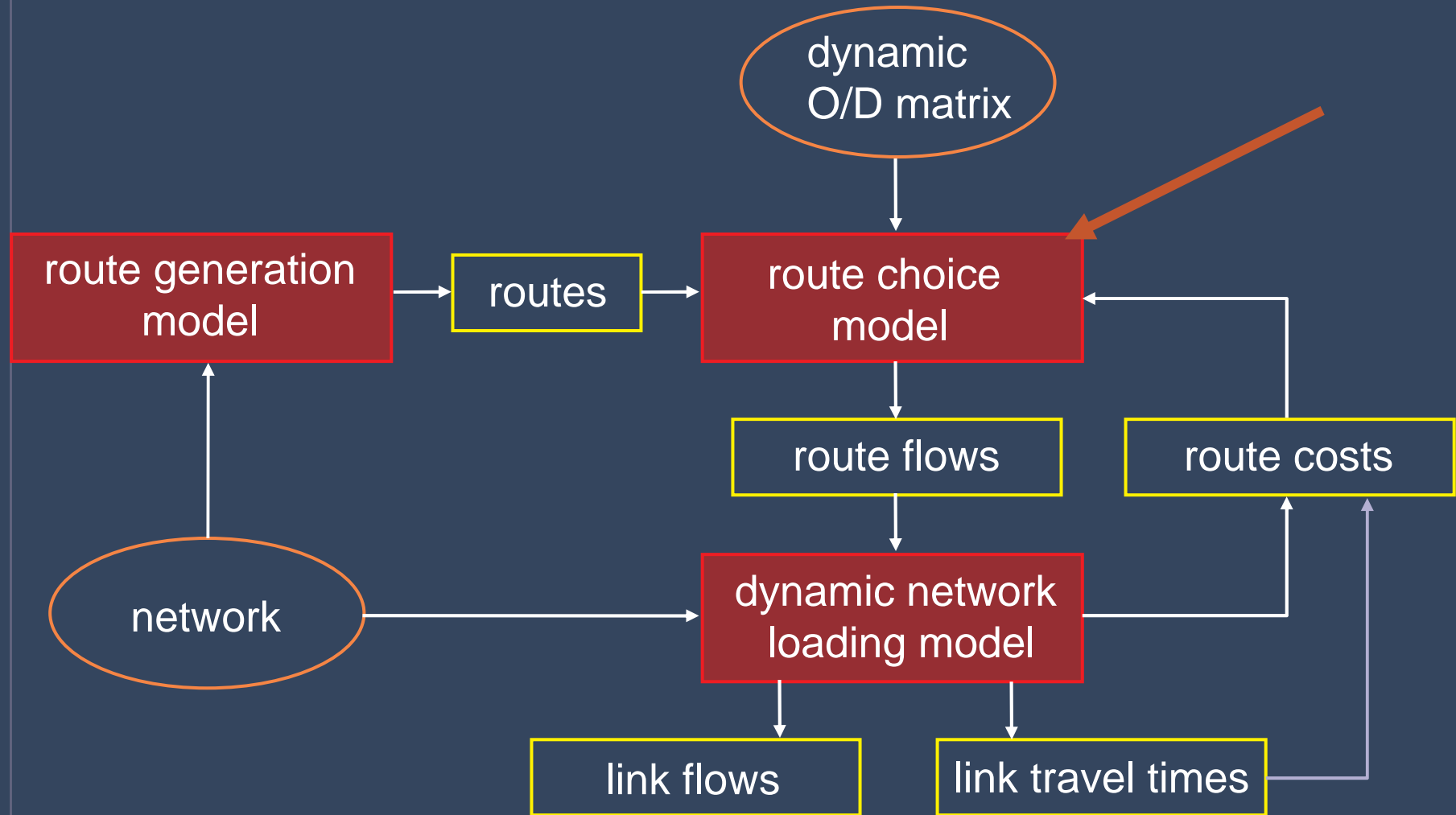
Route choice

"Given the available routes, which routes do the travelers choose considering the prevailing traffic conditions?"

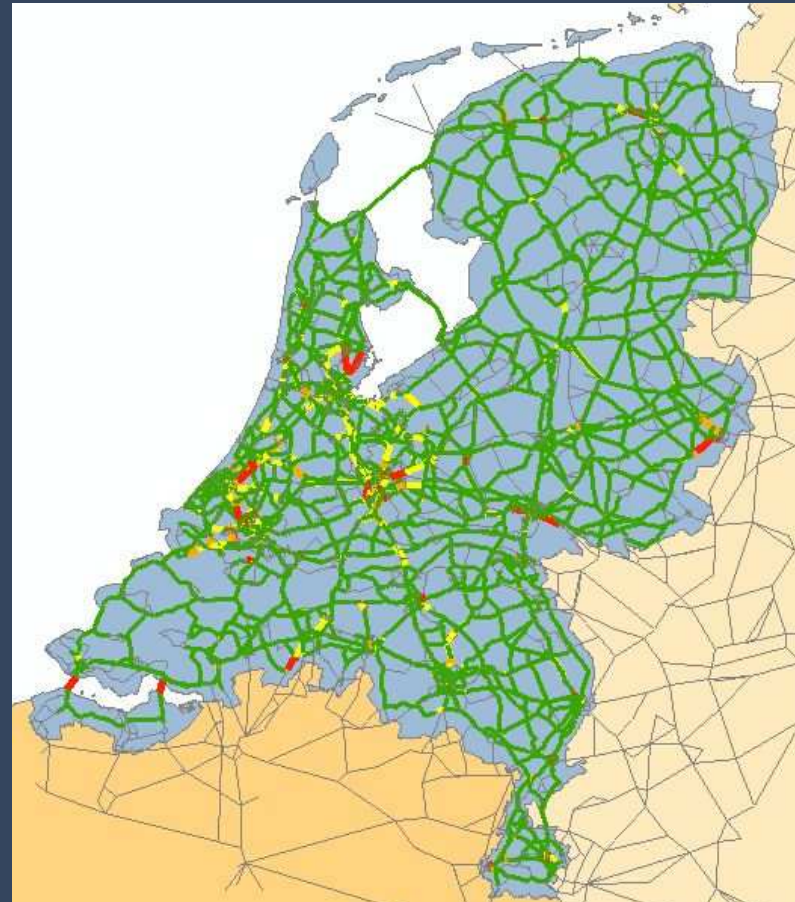**"Habit" drivers**
    always take the same (given) route

Drivers with perfect information
    take the dynamic fastest route

Drivers with imperfect information
    take the perceived dynamic fastest route

Case Study - Dutch network

Innovation in e-fulfillment