



Identification of the installation/facility: NARSIM-Radar and NARSIM-Tower

Country: The Netherlands
Location (city): Amsterdam
Name of the facility: NLR Real-Time Air Traffic Control Research Simulators
Date of construction or of acquisition:
 Start of realization NARSIM-Radar: 1992
 Start of realization NARSIM-Tower: 1999
Owner: NLR
Contact point: Marcel van Apeldoorn - Dept. Air Traffic Management & Airports
Internet site: <http://www.nlr.nl/NARSIM> and <http://www.narsim.org>

Technical characteristics:

1 - Type of infrastructure

- Wind tunnel
- Propulsion bench
- Structures facility
- Material facility
- Simulator (ex. Flight simulator, tower, ...)
- Flight test bed (aircraft, embedded facilities, ...)
- Supercomputers
- Other

2 - Main technical characteristics

Simulations for Air Traffic Control

At NLR, expert knowledge about air traffic management combined with fast-time and real-time simulators is used to develop systems and procedures to increase the capacity of the Air Traffic Control system, whilst maintaining safety and reducing the environmental effects. NLR has two real-time simulators to conduct research into Air Traffic Control: NARSIM Radar - an Air Traffic Control Radar simulator and NARSIM Tower - an Air Traffic Control Tower simulator.

Using object-oriented, distributed technology and off-the-shelf hardware, a unique, highly configurable simulation platform is available for research, development, demonstration and training purposes. The platform is scalable from notebook demonstration set-up to large-scale validation trials.

NARSIM (NLR Air Traffic Control Research Simulator) is used to evaluate and validate new Air Traffic Management technologies, such as Advanced Surface Movement Guidance and Control Systems (A-SMGCS), Runway Incursion algorithms, Continuous Descent Approaches (CDAs), Arrival and Departure Management, Data link applications, and Human Machine Interface (HMI) prototyping.

All simulation software has been developed in-house by NLR. On a software level, the simulators are equal, and thereby they can assist a flight completely from take-off to landing. Interoperability is guaranteed by adhering to standard domain specific protocols, for instance integration with a flight simulator or even a research aircraft to test or validate new onboard systems.



NARSIM Radar

The NARSIM Radar facility at NLR features 8 air traffic controller working positions equipped with 29 inch flat-panel TFT displays (2Kx2K resolution), and up to 4 auxiliary panels (all equipped with touch sensitive layers).

Depending on the experiment, each position can be configured with two touch-input devices, a trackball or mouse and a keyboard. Each working position can act as a tactical, planner or feeder position for controlling en route, area or approach (terminal area) traffic.

An integrated radio/telephony system allows the controller to communicate with pilots, other controllers or neighbouring sectors or centres. A separate pseudo-pilot area with currently 12 positions allows pseudo-pilots to control up to 20 aircraft per position.

NARSIM Tower

The NARSIM Tower facility has a 360 degrees horizontal and 45 degrees vertical angle Field-of-View with five configured controller working positions, each equipped with three 24 inch LCDs and optional 21 inch Wacom pen tablet LCDs. Additional positions for e.g. supervisor or departure clearance can be added to the stage.

The tower simulator can simulate realistic weather conditions, such as bad visibility, snow, rain and also supports day and night view. Several different major airports can be simulated: among others Amsterdam Schiphol Airport, Paris - Charles de Gaulle, Milan Malpensa Airport and also smaller regional airports like Rotterdam The Hague Airport, Maastricht Aachen Airport, and Groningen Airport Eelde.

All hardware available in a control tower is also available in NLR's tower simulator: stripprinters, R/T system, speakers, microphones, intercom, etc. The pseudo-pilot area of the NARSIM Radar facility can also be used for tower pseudo-pilots. Each pilot position allows a maximum of 10 (actively) controlled aircraft for smooth operations.

3 - Research domains which can be addressed (refer to ACARE taxonomy <http://www.acare4europe.com/docs/ASD-Annex-final-211004-out-asd.pdf>)

Applicable taxonomy areas for the ATM sector (and specific domains):

- € **6. Integrated Design & Validation (methods & tools)**
 - Simulator environment & Virtual reality;
 - Decision Support Systems;
 - Real Time Simulators.
- € **7. Air Traffic Management**
 - Overall ATM;
 - Airspace Management;
 - ATC automation / DSS Decision Support Systems;
 - Airport Traffic Management.
- € **9. Human Factors**
 - Human Information Processing

Applicable taxonomy areas for the Airport sector (and specific domains):

- € **6. Integrated Design & Validation (methods & tools)**
 - Autonomous Operations;
 - Development of synthetic environments & virtual reality tools.
- € **7. Air Traffic Management**



- Airport Traffic Management
- € **8.Airports**
 - A-SMGCS

4 - Main (or specific) associated measurement techniques

Measurement techniques for workload measurement range from subjective techniques using standardised questionnaires and Instantaneous Self Assessment (ISA) to objective techniques like gaze and eye tracking, blink rate, pupil diameter and heart rate measurements. Measurement techniques for concept, system or ATC tool performance can be anything ranging from video and audio recording to custom key performance indicators. Validation strategy is always inline with the European Operational Concept Validation Methodology (E-OCVM) framework.

5 - Operational status

- Fully operational

6 - Picture



NARSIM-Radar



NARSIM-Tower



Financial elements:

Replacement cost (M€uros)

Less than 10

10 to 30

30 to 60

60 to 100

More than 100

Practices concerning:

Access policy: for contracts as well as the NARSIM User Community (NUC):
see <http://www.narsim.org> for more information on NUC.

Support: worldwide

Origin of information ('signature'): author and date

Collin Beers - Dept. Manager Air Traffic Management & Airports

December 2010