


The NLR ATM & Airports Research Infrastructure – NARSIM Tower



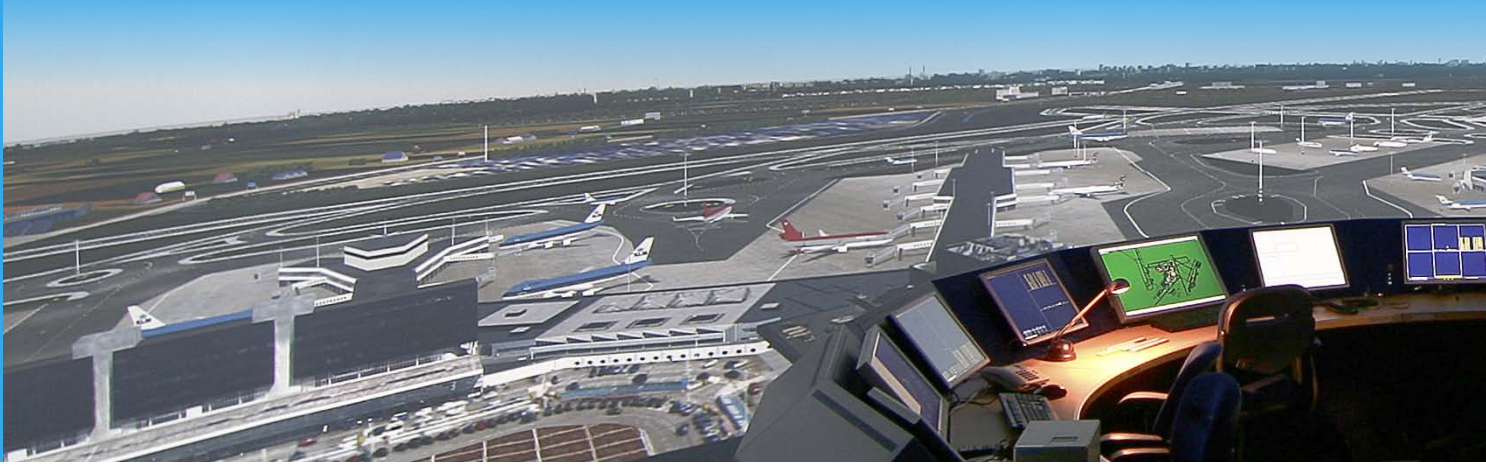
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The NLR of the Netherlands has developed a real-time Tower and Apron Control Research Simulator (NARSIM Tower) to enable research and development in the field of ATM. With NARSIM Tower, the Air Traffic Control process can be simulated with the air traffic controller and the pilot in the loop.

The NARSIM Tower facility has been in operation since its start in 2000, for a wide variety of customers. Based on advanced object-based client/server architecture, NARSIM Tower allows for easy configuration and integration of third party systems whilst maintaining scalability and performance. All software is developed fully in-house with a focus on modularity and configuration, resulting in a platform which can be used to simulate various current and, most important, future airport operations and controller working positions. From large scale validation trials to small scale (even laptop based) prototyping and visualisation. New airports operational concepts and procedures or development of Advanced Surface Movement Guidance and Control Systems (A-SMGCS) and the human factor in the control tower, NARSIM Tower enables the research and development of NLR's ATM and Airports department.



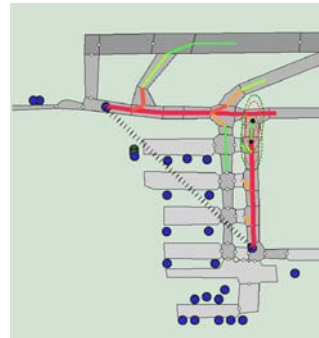
APPLICATIONS

Concept development and visualisation

The NARSIM Tower facility and software infrastructure enables visualisation of new conceptual ideas in a very early stage. Ideas can be quickly evaluated towards operational feasibility and they can be communicated to users and stakeholders in a clear and unambiguous way. Early involvement of the user is generally accepted as the single most important factor for a successful introduction of new or changed ATC system or concept.

ATC tool development

The NARSIM software infrastructure facilitates the development, evaluation and validation of advanced ATC tools by defining strict interfaces between modules and guidelines for the development process itself and by providing development tools and a validation methodology. Interfaces defined in NARSIM Interface Definition Language (IDL) and automated code generation hide communication and language specific implementation details, allowing the application developer to focus on the ATC tool development itself.



HMI development

NARSIM Tower is well suited for applications where the human aspect plays an essential role, such as development of the Human Machine Interface (HMI). Rapid prototyping allows for fast experimental or pre-operational evaluation of new HMI specifications.

Facilitate training

The NARSIM Tower facility simulates a realistic environment for the tower and apron controller and is used in the research into and development of training as well as in the provision of training itself. With NARSIM Tower, NLR has provided training ranging from basic Introduction to Tower Control to replacing (large parts of) the tower controller's on-the-job-training and even large scale (50+ actors involved) recurrency training.

Validation of ATM concepts and procedures

In the development process of airport systems, concepts and procedures, real time simulations are a prerequisite for the assessment of tower and apron controller workload and acceptance. In the validation of operational components, NARSIM Tower serves as a simulation environment for an operational (sub)system or can be used to perform shadow mode trials. In all these cases, the NARSIM Tower facility has proven to be a flexible, scalable and modular ATC simulator.





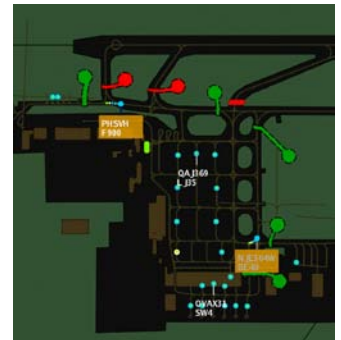
SYSTEM DESCRIPTION

Visual system

The visual system of the NARSIM Tower facility consists of a 360° projection screen with a diameter of 11 meters and a height of 4.5m. The projection system has a high resolution, luminance and contrast ratio. A variety of meteorological phenomena such as rain, snow, fog and clouds can be simulated in different seasons and under daylight and night-time conditions. Detailed databases of many European airports (including Amsterdam Airport Schiphol) are available and can be imported or even created in-house.

Controller working positions

The NARSIM Tower facility features generic controller working positions each equipped with three TFT displays with touch sensitive layers. These displays are able to emulate any commercially available in-hardware systems like stopbar and lighting panels, R/T and communication panels. Each working position can be configured with conventional paper strip printing facilities or dual display electronic flightstrip systems. A Head Mounted Display system (for vision enhancement and augmented reality research) and virtual binoculars are also available. Validation and evaluation of tools and/or concepts is supported by automated questionnaires for expert opinion feedback, run-time Instantaneous Self Assessment, Eye Point of Gaze (eye and head-tracking equipment) and recording of all relevant system performance indicators.



Pseudo pilot working positions

Each pseudo pilot position allows control up to 10 aircraft or vehicles. The pseudo pilot in its working environment is an important factor in the design and execution of the experiment or training. Each working position can be tailored for its specific role or task and the number of positions can be scaled up on demand.

Experiment leader working positions

The simulation can be controlled from an arbitrary working position. System and human performance metrics can be monitored and recorded at will and several closed circuit cameras observe the experimentation room.

Software applications

The NARSIM Tower software is designed around advanced object-based client/server architecture and is inherently scalable. It consists of more than 100 different modules each developed to accurately simulate an existing or future operational entity or system. This modular design allows running the entire simulation distributed among several independent platforms on a local network or even internet in fast-time or real-time.



CONTEXT

The NARSIM Tower simulation facility is an integral part of NLR's ATM and Airports research infrastructure, whereby all tools and development or validation steps, both run-time and off-line, in the research process are integrated and tuned to each other. The NARSIM Tower facility can interoperate with the NARSIM Radar facility (an ATC radar simulator), NARSIM mini-Tower (a mini transportable 180 degrees Field-Of-View tower simulator) and NLR's Flight Simulators and even NLR's laboratory aircraft to form a single simulation environment in which all parties, in all phases of flight, in the different ATC roles up to different cockpit crews, can evaluate or validate a concept at the same time.

Adherence to many industrial interoperability standards (e.g. DIS, HLA) provides the means to easily integrate and validate third party systems and sub-systems. These standards include Asterix, OLDI/SYSCO and many datalink applications (CPDLC, ADS, TIS, FIS, etc.). NARSIM Tower has been used in several large-scale exercises integrated with airport operational databases.

Final remark

With the NARSIM Tower simulation facility, NLR is ready for the ATM challenges that await us now and in the future. Contact us for more information or a demonstration of our facility at our location in Amsterdam, the Netherlands.

