



Dedicated to innovation in aerospace

Fit for purpose training environments



Royal NLR - Netherlands Aerospace Centre



Welcome to Royal NLR. We invite you to discover more about innovative training and simulation programmes we develop for military forces and other clients. The common goal is to make training more effective and efficient.

Our vision of military training is founded on competency-based and performance-based training (PBT) concepts using integration and interoperability of live, virtual and constructive elements. Our approach focuses on a thorough process of analysis, design, development and implementation with the client.

Our staff have detailed knowledge of and expertise in training, simulation, human behavioural assessment and regulations for military forces. This knowledge is combined with applied technical research and development in simulation. NLR actively develops innovative training technologies and training media. These capabilities and our in-house research infrastructure ensures that NLR can oversee the entire spectrum and stay on top and ahead of – new developments and innovations in military training and simulation.

Our approach has resulted among other things: in international used interconnected tactical simulators for fighter pilots, a training needs analysis and competency based training redesign for helicopter crews, and the development of new concepts and doctrines for 5th generation Air Forces. Overall, the result is an optimum blend of live and low, medium and high-fidelity simulator training for our clients. This offers you the best possible service and advice. The projects in this brochure showcase our unique approach.

Royal NLR – Netherlands Aerospace Centre

Fit for purpose training environments

To assure continuous deployment and mission readiness, military forces need to make their training more effective and efficient. The time spent flying must be as effective as possible. This means more customised and less expensive training. This can be achieved through an optimum blend of live, low-level and high-level fidelity simulated training, along with learning analytics, to be able to continue tailoring the training towards personal or broader training needs.

Royal NLR believes a modern vision of training requires a holistic instructional design approach that is well-prepared for the high level of integration and interoperability of systems. Only then a thorough genuine understanding of training needs, analysis of simulation and evaluation requirements can be guaranteed.

The design approach from Royal NLR is based on 4C/ID instructional design system. This stands for learning complex skills in a realistic context using four main ingredients: whole task training, part task practice, supporting theory and just-in-time information. In addition to 4C/ID, we advocate Performance Based Training, in which each individual receives customized training on the most suitable moment and blend of training media, based on learning analytics. Finally, qualification and certification close the (re)design cycle.



TRAINING NEEDS ANALYSIS (TNA)

Analyse operational training needs and determine of the required competences through a Training Needs Analysis. The result is a competency based qualification profile that can be used as input for the training design

TRAINING DESIGN

Produce a rough outline of the training course. Define the learner scenarios and goals in line with the training needs. Determine and assemble the required whole tasks and part tasks and position the supporting and procedural information where required. The result is a blueprint of the training that can be used to develop the training syllabus and to define training media requirements.

TRAINING MEDIA ANALYSIS (TMA)

Develop the training syllabus and select training media like simulation, AR/VR, after action review support tools, books, e-learning etc. In case no suitable media is available, user requirements need to be specified. The result is a training ‘fit for purpose training environment’ in which the training media are well balanced and properly integrated into the competency-based training design.

TRAINING TECHNOLOGY & ECOSYSTEMS

Assuring that the training media adhere to the defined user requirement often requires technical development or improvement. E.g. development of targeted fidelity VR based simulators, interconnectivity between different simulation platforms or data gathering in support of learning analytics are requirements that might not be available in current systems. Complex training systems for large organisations will benefit from a well-defined perspective and well-integrated components of the total system: a learning ecosystem.

LEARNING ANALYTICS

Critical to Competency and Performance Based training is learning analytics. It is the engine of modern learning ecosystems, providing a process to select, gather and analyse more detailed data on proficiencies.



Project partners

Government (NL):

Project Bureau NH-90, Test Flight Office

Research organisation: Royal NLR

Start: July 2014

Duration: ongoing

NH-90 Full Mission Flight Trainer Evaluation

Evaluation on the compliance of the NH-90 simulation devices

THE CHALLENGE

The purpose is to perform evaluations on the compliance of the NH-90 simulation devices to their respective regulations and/or standards. The NH-90 simulation can be split into two separate devices that can be used separately for specific crew training and combined for full mission flight training.

- Full Flight Simulator (FFS) used for pilot training
- Virtual Sensor Trainer (VST) used for sensor operator training
- Full Mission Flight Trainer (FMFT), used for mission training with Pilots, Tactical Coordinator and Sensor Operator.

WHAT DID WE DO

For evaluation of the FFS, the NLR evaluation team will first evaluate the Qualification Test Guide (QTG) of the FFS. Based on the results of this evaluation, the project team will determine if an on-site evaluation can be conducted. The on-site evaluation will take several days in which the devices are assessed objectively by re-running QTG tests, functionally, and subjectively as per regulation set. The VST is not able to provide objective data, so all tests performed on the VST will be subjective and functional tests.

Furthermore, the military aspects of the devices are not accounted for in the civil regulations agreed between simulator operator and manufacturer. In order to gain an understanding in the military/tactical capabilities of the devices, interviews will be conducted with experts of all crew types involved in operations on the devices.

THE SOLUTION

The result of the project will be an evaluation process (including V&V reports) making it possible to determine:

- Whether the NH-90 FFS, VST, and FMFT are performing in accordance with the relevant regulations that will ensure safe operation of the NH-90 and its subsystems
- Whether devices are suitable for training Pilots, Sensor Operators and Tactical Coordinators in both individual tasks, as well as in a mission setting.

Multi-Ship Multi-Type Helicopter Simulation Training Capability

Acquisition & Deployment Support

THE CHALLENGE

The RNLAf is currently acquiring and deploying a unique multi-ship multi-type (MSMT) helicopter simulation training capability to support the fight, tactical and whole task mission training of CH-47F and AH-64E crews at all operational levels. The MSMT capability will incorporate a large number of high-end simulation training devices, a tactical control center (TCC), AAR and training mission development systems within a single flexible, scalable and easily expandable training environment that will have to cover a wide range of versatile training needs. Together with the many RNLAf stakeholders and industry parties involved in the acquisition and deployment of the capability makes the MSMT program an utterly demanding undertaking with many challenges and risks in achieving the envisioned objectives.

WHAT DID WE DO

The MSMT program was shaped as a staged process where each phase results in an already deployable training capability with limited but clearly scoped functionality. To guide the process the envisioned MSMT training capability concept of operations (ConOps) has been developed with the RNLAf end users along with an overarching simulation training system architecture.

Throughout each program phase a multi-disciplinary team of NLR experts conducted activities that include:

- Corporate and platform specific TNA/TMA
- PoR development for simulators, TCC and AAR
- RFI/RFP development and response assessment
- Engaging and challenging industry parties
- Integration testing and validation of industry deliverables
- Simulation training method and technology CD&E
- RoI analysis and decision-making assessment
- Training program optimization for using the capability
- Training mission development and operations support

THE SOLUTION

The project results in a full life-cycle support process that unburdens both the Dutch Defense Material Organization (DMO) and the RNLAf in acquiring and deploying the MSMT capability. A support process that ultimately leads to the highest-level possible interactive and most versatile mission simulation training environment for the RNLAf within the program budget and time-frame. Continuous availability and direct access to a dedicated pool of NLR training and simulation experts deployable at key positions within the DMO, RNLAf and contracted industry parties.

**Project partners**

Dutch MoD (Defence Material Organisation)
Royal Netherlands Air Force Defence Helicopter Command
Research organisation: Royal NLR

Duration: 2018 - ongoing



Project partners

Defence Helicopter Command (DHC) of the
Royal Netherlands Air Force
Joint IV Commando (JIVC) of the Ministry of Defence
Research organisation: Royal NLR

Start: June 2016

Duration: 2.5 years

Redesign of helicopter training

A common, modernized approach for the qualification training of the platforms

THE CHALLENGE

The Defence Helicopter Command of the Royal Netherlands Airforce expressed a need for a common, modernized approach for the qualification training of all their platforms.

WHAT DID WE DO

In cooperation with Subject Matter Experts (operational pilots/load masters and instructors), a competency based training needs analysis was performed. Competency profiles were identified for CH-47 pilots and load masters and for the AH-64 pilots. Idealized Mission Qualification Training (MQT) outlines were designed, that would lead to fully combat-ready pilots and load-masters for a wide range of (adverse) operational conditions. This is based on the assumption that modern tactical simulators are available, suitable live ranges are available and scheduling issues do not exist. Such ideal training conditions are important for creating and working with a clear vision of training.

With the idealized training setups in mind, actual MQT were developed, implemented and evaluated.

User requirements for a multi-ship/multi-type (MSMT) simulation facility were also identified and a roadmap to a future idealised MSMT system concept was suggested.

All activities were facilitated by NLR and new, science-based approaches were applied as far as acceptable for the SMEs, who are the 'owners' of the products.

THE SOLUTION

The project produced ideal and actual MQT for AH-64 and CH-47 crews. Furthermore, user requirements, a system concept and a roadmap for an MSMT simulation facility was provided.

The method applied is a competency-based training approach that applies the train-as-you-fight principle from the start. This primarily whole-task training setup is built up according to principles (for example gradually increasing complexity) that optimize cognitive load throughout the training.

Virtual Cockpit

Low-cost and high-fidelity training technology

THE CHALLENGE

Training devices that fit your training needs often require large investments and are usually type specific. There are currently no training devices that allow a highly realistic interaction between the pilot and cockpit instruments, without the disadvantages associated with expensive high-end devices. Virtual Cockpit bridges this gap by providing the technology to do just that: low-cost and high-fidelity training technology.

WHAT DID WE DO

By combining NLRs state-of-the-art modelling & simulation and customer operational knowledge we created a radical new low-cost mixed reality cockpit solution with natural human machine interaction capabilities. Our concept involves the smart integration of Commercial Off-The-Shelf (COTS) products, 3D printing, Virtual Reality, and finger/hand tracking into a type-customisable simulated working environment with a natural feel.

The concept was evaluated and improved with operational experts in several iterations throughout the project.

Virtual cockpit has been used by international and national customers to execute concept development and experimentation, and projects on evasive manoeuvre training.

THE SOLUTION

The result is a concept demonstrator that allows highly realistic interaction and provides pilots with all the visual, auditory and haptic experience and feedback that they need for a high-fidelity training experience. This technology concept also provides the ability to build a highly configurable and mobile setup with a small footprint that is still low-cost.



Project partners

Industry (NL):

Cinoptics, provision of high-res VR-optics

Research organisation: Royal NLR

Start:

October 2016

Duration:

2.5 years



Videolist

Edit Mode

INTRO

Les 01

Les 02

Les 03

Les 04

Les 05

Play Settings



Restart



Play



Pause



Stop

Playback Time

00:00:16 / 00:00:42

360 Volume

Project partners

NL MOD

Research organisation: Royal NLR

Start: February 2018

Duration: 3 months

JLV 360

Virtual Reality training made easy for both trainee and instructor

THE CHALLENGE

Shooting 360 videos is easy and is used more and more to familiarise and even train people in various situations by immersing them using Virtual Reality goggles. Supporting flight training using these 360 videos in combination with VR goggles however, is more difficult.

The resolution of video capturing and VR hardware is typically too low to allow reading displays, which is of particular importance to flight training. Although high end equipment may offer some relieve, it still does not solve the problem completely and lowers the accessibility, ease of use and affordability of the setup.

WHAT DID WE DO

NLR and NL MOD joined forces to incorporate VR in the initial flight training curriculum of military pilots. By using an agile design and development approach, we were able to co-create an application that allows incorporating the benefits of VR training to re-experience earlier training flights and get the most out of the actual flight time with instructors.

THE SOLUTION

NLR has developed a VR application that makes it easy for both flight instructors and trainees to use VR as training support. Trainees can easily re-experience a flight, including readable instruments, whenever and wherever they want. Instructors can easily add and configure new training content. Combining 360 video with high resolution insets ensure readable imagery and smart editing options to counter the resolution limitations from current VR devices.

Replacement of initial training capacity

Flexible and scalable future training

THE CHALLENGE

The PC-7 training aircraft of the Royal Netherlands Air Force (RNLAf) needs to be replaced. Therefore, a Training Needs Analysis (TNA) and Training Media Analysis (TMA) aimed to provide a solution for the replacement of the entire initial training capacity has been performed. This training capacity needs to be flexible and scalable in order to meet the changing training needs in the future. As a result, the following questions should be answered clearly:

- What is the end goal of the training
- What is the desired training concept
- What are the most suitable training media

THE SOLUTION

To answer these questions NLR uses the Comprehensive Analysis Process for Aircraft Blended Learning Environments (CAPABLE) approach. CAPABLE is a structured approach towards an integrated training solution. This approach is complemented with a TMA aimed to maintain flexibility in the long term. The TMA takes current and possible future technological developments in the field of training into account in order to arrive at an optimal training medium or an optimal blend of Training Media.

WHAT DID WE DO

NLR, in cooperation with the RNLAf and DMO (Dutch Defence Materiel Organisation) has performed a Training Needs Analysis (TNA), which served as input for a training design blueprint. Subsequently, using the blueprint a future proof Training Media Analysis based on user and functional requirements for training media, has been performed. The RNLAf instructors then develop the actual training design using the blue print and TMA as reference documents. Finally, the results of the TMA can be utilised by the RNLAf for Requests for Information (RfI) from Original Equipment Manufacturers (OEMs) for training resources, which will be carried out by the DMO.



Project partners

Client: Royal Netherlands Air Force,
Dutch Defence Materiel Organisation
Research organisation: Royal NLR

Period: February - May 2021

Smart Bandits

Intelligent opponents in mission simulation

THE CHALLENGE

In military simulations, computer-generated forces (CGFs) are autonomous entities that represent friendly, neutral or hostile air, ground surface, or sub surface-based units, platforms or individuals. The behaviour that CGFs display in the simulations is modelled to resemble realistic human behaviour. CGFs are typically used in application areas such as training, mission rehearsal, concept development and experimentation (CD&E) or decision support. For each application, the CGFs require different behaviour models. However, traditional modelling techniques do not give scope for expression and keep modellers from quickly developing new models. Therefore, new approaches to behaviour modelling are required.

WHAT DID WE DO

The aim of the Smart Bandits project is to explore various approaches to modelling human-like behaviour. To this end, we carried out research in two main directions, namely human behaviour and computational modelling. In the area of human behaviour, we specifically studied situational awareness (i.e. the perception of the environment) and theory of mind (i.e. beliefs, desires and intentions). In the area of computational modelling, we studied the use of machine learning techniques for enhancing classical modelling techniques such as finite-state machines and behaviour trees. A key component of the Smart Bandits project was the evaluation of newly developed techniques in human-in-the-loop simulations, such as in NLR's Fighter 4-Ship networked F-16 simulator.

Project partners

Research organisations:

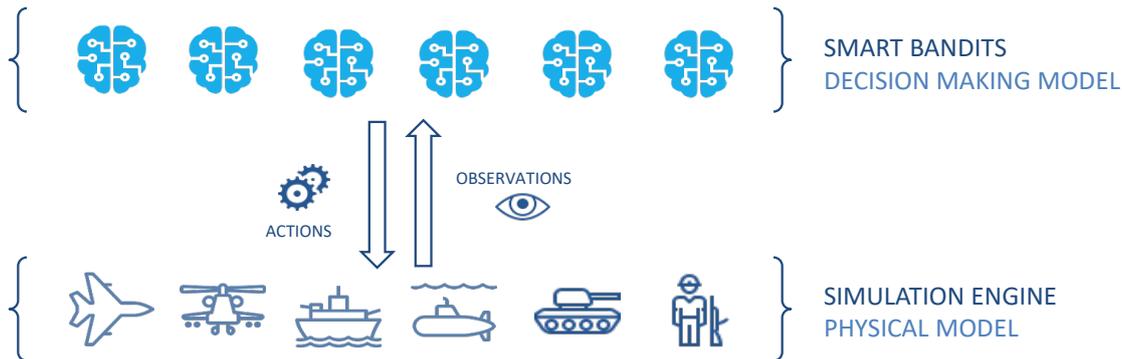
Royal NLR, VU University Amsterdam

Start: 2010

Duration: improvements ongoing

THE SOLUTION

The results of the studies are combined in a user-friendly graphical behaviour modeling tool. The tool is named Smart Bandits after the project. It enables modelers to quickly implement behaviour models and to link the new models to the CGFs in a simulation engine. While the CGFs make their observations in the simulated world, the Smart Bandits tool calculates their next actions. During simulations, the behaviour models can easily be inspected to see what the CGFs are thinking. Apart from being an intuitive modeling tool, Smart Bandits continues to be a platform for behaviour modelling research. NLR is continuously experimenting with new modelling techniques and new ways of interacting with CGFs.



CONTROL/OBSERVE:

-  SCENARIO CONTROL
-  OBSERVERS
-  RECORDING
-  ANALYSIS
-  DEBRIEF

BACKBONE:

-  CORE SERVICES: GEODATABASE, SIMULATION SUPPORT, ...
-  CONNECTIVITY: DIS/HLA, EXTERNAL BATTLELABS
-  LIVE ASSETS CONNECTIONS (LVC)

TACTICAL LEVEL:

-  FIGHTERS: F-16 & F-35
-  HELICOPTERS: AH-64, CH-47, NH90
-  TRANSPORT & TANKERS: C-130, KDC-10
-  UAV'S: MQ-9, SCAN EAGLE
-  SPACE ASSETS: SPACE SA, BRIK-II
-  WEST
-  TACTICAL REFERENCE MANUAL
-  SMART BANDITS
-  F35 CDEF

OPERATIONAL LEVEL:

-  AOC: MASE, SCOTT
-  ISRD: INFORMATION FUSION & SHARED SU DASHBOARD
-  AIR C2: RESOURCE MANAGEMENT, PLANNING & MONITORING/CONTROL
-  SMART MISSION PLANNING & DEBRIEF

The NLR Battle lab Cerebro will be operation mid-2023

NLR Battle lab Cerebro

Testing environment for military study, demonstration, and research purposes

NLR provides a battle lab capability by integrating high fidelity platform simulators with additional proof of concept demonstrators and extension to other battle labs. Cerebro can ultimately also be coupled with live systems when connected to e.g. a Link-16, DIS or HLA gateway.

Cerebro can be used for both small and larger projects that require multiple simulators to work in an integrated environment. The extensive use of platform simulators and computer generated forces will reduce the costs while enabling testing of new functionalities concepts in a safe and classified environment.

BROAD RANGE OF RESEARCH AND TESTING APPLICATIONS



OPERATIONAL AND
TACTICAL DOCTRINE
DEVELOPMENT



MULTINATIONAL
COLLABORATIVE
DEVELOPMENTS



5TH GEN
AIRFORCE



INFORMATION-DRIVEN
OPERATIONS



CONCEPT DEVELOPMENT
& EVALUATION FOR
OPERATIONS AND TRAINING



SERIOUS
WARGAMING

TECHNICAL SPECIFICATIONS – SIMULATION SET-UP

The steps for concept development in Cerebro are cyclical, as is usual in CD&E and DT&E processes. Before starting development, relevant background information is collected, experiment questions are formulated and ultimately conclusions are drawn and a report is written.

BATTLE LAB BASED ON VIRTUALISATION

The Cerebro infrastructure is fully based on a virtualisation solution, enabling rapid configuration and deployment of exercises with various tools, services, and simulators:

- Quick configuration of simulation tooling and scenarios
- Rapid deployment of simulation exercises to end-users
- Core services readily integrated, i.e. terrain databases, scenarios, chat, simulation backbone
- Promotes quick and agile development of simulation experiments

SCOTT: Smart Controller Training Tool

Diverse and realistic scenarios for Fighter Controller training

Fighter Controllers are essential for the safety and effectivity of fighter pilots. They provide the pilots with a complete and correct air picture. Fighter Controllers must be well trained to observe, assess and communicate in rapidly evolving situations. This includes training scenarios that are diverse and have realistic fidelity and scale in terms of involved platforms and their behavior.

THE CHALLENGE

The training and education of Fighter Controllers is often highly labour-intensive due to the fact that well designed and user-friendly tools to simulate air engagements are not readily available. Frequent training with live assets in the air is inhibitive costly in terms of logistics, coordination and required number of platforms (blue and red) to be involved. Generating realistic behaviours of constructive platforms is typically not available without human inputs. The challenge is to create the desired level of realism in an environment where the minimal required human involvement is low.

THE SOLUTION

Royal NLR designed and developed SCOTT as an easy to use tool for instructors and pseudo-pilots for Fighter Controller training. SCOTT is a tool that can create realistic tactical simulation exercises using Artificial Intelligence (AI), consisting of both Blue and Red air platforms. SCOTT can run autonomously Air-to-Air combat scenarios, but a human can intervene in the tactical

decisions of the constructed air platforms. Since the scenarios are easier to control, larger tactically relevant scenarios can be implemented. SCOTT presents these scenarios via DIS to the operational system for Fighter Controllers. Interoperability between SCOTT and other simulator systems are also possible, e.g. for LVC or MTDS exercises.

WHAT DID WE DO

NLR developed the SCOTT tool to allow the design and execution of Air-to-Air combat scenarios and contain (semi-) autonomous tactical constructive entities. NLR added realistic tactics and missile performance which can be specified to national performances. These are based on in-house developed tools Smart Bandits (AI behaviours) and WEST (missile performance). This resulted in a low effort tool to easily control the scenario and adjust to the desired learning objectives.



SCOTT





Project customers:

Royal Netherlands Air Force (RNLAF)

Defence Equipment Organisation (DMO)

Research organisations: Royal NLR

Netherlands Organisation for Applied Scientific Research (TNO)

Start: February 2000

Duration: ongoing

F-35 Acquisition & Operational Readiness Preparation

Design and construction of multiple training and evaluation plans

THE CHALLENGE

NLR helped the RNLAf with the F-35 acquisition and operational readiness by focussing on transforming the Defence Equipment Organisation (DMO) into a smart buyer and by assisting the Air Force with a smooth transition from F-16 to F-35. Within this programme, multiple training & education projects have been carried out to design and improve training for pilots, maintenance staff, and mission support crew.

WHAT DID WE DO

Several training methods, tools and activities conducted by NLR throughout the F-35 programme include:

- Training Needs Analysis (TNA) for pilot maintenance staff, and mission-support roles
- Design of a F-35 Pilot Competency Profile, initial and recurrent training course content
- Training Media Selection Analysis (TMA)
- Business case for a Maintainer Training Centre (MTC)
- Multi Spectrale DataBase (MSDB)
- Continuation Training including Performance Based Training (PBT)

THE SOLUTION

The activities mentioned helped to develop a variety of products and services, including:

- Initial and recurrent training course content for pilots and maintenance staff
- Design and execution of an Operational Test & Evaluation plan for Continuation Training
- Design and construction of a WLT (Weapons Loader Trainer) including Augmented Reality applications.

Competency based maintenance training

Development of maintenance training as result of changed regulations

THE CHALLENGE

The development of the European Military Aviation Regulations (EMAR) resulted in changes in the Dutch military aviation regulations. The content and levels of the maintenance type training for the F-16, AH-64D, CH-47D/F and the NH-90NFH therefore needed to be updated. Besides, the training did not fully meet the needs of the (novice) maintenance mechanic and the training did not always represent the actual work of the mechanic accurately. The focus of the training was merely on theory, practice was not offered in an integrated manner.

WHAT DID WE DO

In cooperation with maintenance mechanics and instructors, the different steps in an instructional design process have been carried out. To analyse the training needs, several workshops were held with both experienced and inexperienced maintenance mechanics. Throughout the process, different presentations and discussions were held to explain and define the desired training concept.

Working sessions with the instructors and developers were subsequently held, in order to develop a training in accordance with this concept.

THE SOLUTION

First, a competency based training concept was defined in line with the 4 components instructional design principles (4C/ID). This concept focuses on whole task training. Theory and part task practice are integrated to support the whole task scenario. Based on the outcome of the training needs analysis, qualification profiles were defined. Finally the training, including supporting materials, was developed. Besides training materials, an assessment method also was developed, allowing student coaching and evaluation. This method comprises competencies including their observable behaviours and can be used for continuous coaching and assessment.



Project partners

Royal Netherlands Air Force:
Royal Military Air Force School (KMSL)
Research organisation: Royal NLR

Start: May 2014
Duration: 3 years



Project partners

Royal Dutch Airlines KLM
Research organisation: Royal NLR

Start: June 2016

Duration: 2.5 years

Augmented reality for maintenance training

Problem-based training with increased trainee activity

THE CHALLENGE

KLM expressed the need for more innovative training media to modernise and improve maintenance training.

WHAT DID WE DO

To ensure well integrated use of training media, the project started with a review of the current training design and analysis of current training content. Subsequently, there was a study of whether Augmented Reality (AR) could add value for the aircraft systems that are difficult to train through traditional classroom training. Requirements for the AR application and training design were defined before starting actual development. Finally the prototype was evaluated through an experiment.

The project is performed in a highly interactive and agile way. Bi-weekly sprints were held with experts from relevant areas such as maintenance experts, application developers, human machine interface experts and educational experts, which ensured accuracy and acceptance of intermediate and final results.

THE SOLUTION

The result of the project is a modernised, problem-based training design for maintenance training that enhances understanding of the systems and system interaction. This design comprises less traditional instruction and more trainee activity via paper-based assignments and problem-based AR scenarios.

The experiments proved that trainees score better using AR when it is fully integrated in the training design; trainees retained more of what they learned, had deeper understanding and retention time was longer compared to the traditional classroom training. Important lessons learned are the importance of shared AR and a maximum of 20 minutes wearing the AR goggles.

IDTEAM

Development of a learner experience platform and recommender algorithm for tracking performance and providing recommendations for learning

THE CHALLENGE

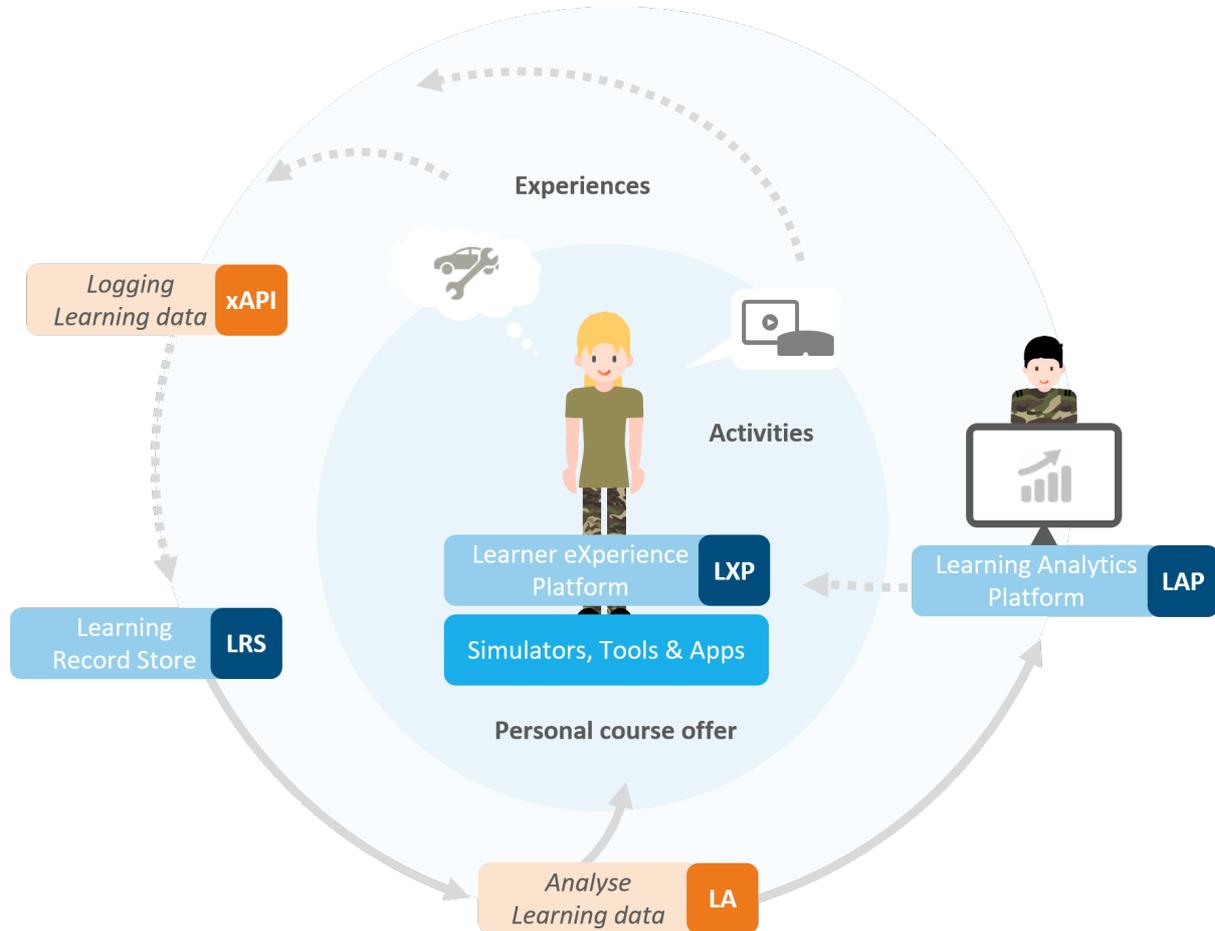
To ensure readiness and availability of 5th generation Air Force weapon platforms and systems, maintenance personnel must be flexible deployable and have the correct competencies and qualifications for aircraft maintenance. To meet these demands effectively, current training of maintenance personnel must change from a formalised, classroom, pre-planned and one-size-fits-all training strategy, to a more distributed and personalised training strategy.

WHAT DID WE DO

In support of personalized training IDTEAM explored the possibilities and benefits of using an integrated digital learning environment also known as a 'Learning EcoSystem' over traditional learning means for 5th Gen Airforce maintenance. During evaluations with the Dutch Ministry of Defense, multiple components of the Learning Eco System have been prototyped and evaluated. These sessions were performed with a broad range of users (students, instructors, and staff members).

THE SOLUTION

In collaboration with BlueTeam, a training application was developed that allows part of pre-flight inspection to be practiced at each student's individual level. Easy and harder difficulty levels have been added for students looking for more of a challenge. During each scenario, students receive personalized feedback and instructions. During play, data is logged to a Learning Record Store (LRS). The logging of data is done via an Experience Application Integrator (xAPI), which translates the data from the training application so it can be stored in the LRS. Additionally, an early version of an observation application was tested. This app allows instructors to quickly make digital notes and evaluate the performance of the students performing a task on the aircraft. Data coming from this application can also be logged in the LRS using xAPI. To recommend the next learning activity a "recommender algorithm" is developed, which tracks performance and provides recommendations for learning activities that fits the students profile. Finally, in a "Learner eXperience Platform" (LXP) demonstrator the students can observe their progression for the different learning tasks and competencies and they can see and start the recommended training activities.



	Option 0 No Change	Option 1 Minimize Change	Option 2 Richly Blended	Option 3 Lean & Agile
Sustainability & Future Proofing	Green	Green	Green	Green
Accessibility & Availability	Yellow	Yellow	Green	Green
Interoperability & Integration	Red	Yellow	Green	Yellow
Modularity & Reusability	Yellow	Yellow	Green	Green
Scalability & Adaptability	Red	Yellow	Green	Green
Openness & Standardization	Green	Green	Green	Green

Project partners

Armasuisse, Swiss Armed Forces
 Hulleman Expertise
 Research organisation: Royal NLR

Start: September 2017

Duration: 1.5 years

Note – given ratings are fictive and don't represent the Swiss Armed Forces situation

Swiss Armed Forces Simulator Portfolio Rationalisation

Formulation of training and simulation vision including a roadmap for implementation

THE CHALLENGE

Many nations are facing the question what to do with their end-of-life simulators and how to ensure their replacements will be more (cost-) effective, efficient, and future-ready. The Swiss Armed Forces are investigating possible options for developing a new portfolio of training simulators. The options should fit the envisaged Swiss Armed Forces future training needs and budget for 2030 and beyond.

WHAT DID WE DO

A corporate TNA was carried out to identify current and future demands and to review the major training facilities. A training and technology scan was carried out, together with a small benchmarking activity. This led to the formulation of a training & simulation vision advisory, including measures for an integrated simulation architecture and infrastructure.

Three different options were formulated for realising the training demands and constraints. One option aimed for simulator replacement with limited change

(‘Minimize Change’), a second option aimed to take advantage of the large variety of envisaged training media, including VR, AR, MR, and PC-based simulation (‘Richly Blended’). A third option aimed to maximize PC-based simulation (‘Lean & Agile’). All options require a considerable level of integrated simulation infrastructure. The three options were compared in terms of initial investments, cost reduction and training value against the current situation (‘business as usual’) as baseline.

A roadmap was outlined towards implementation of the selected option.

THE SOLUTION

The project provided guidance for a high-level outline of options for a future training simulator portfolio with a broad outline of an implementation roadmap and plan for the Swiss Armed Forces. The key to the success of the selected option is to formulate a modern vision on training and simulation.

NLR in brief



One-stop-shop



Global player with
Dutch roots

100+

Since 1919



Amsterdam, Noordwijk
Marknesse, Rotterdam, Volkel



Innovative, engaged
and practical



For industry and
government



For fixed and
rotary wing



690 employees



€ 91 M turnover



73% Dutch, 23% EU
and 4% international



Active in 30 countries



Extremely high
client satisfaction

About NLR

Royal Netherlands Aerospace Centre

NLR is a leading international research centre for aerospace. Its mission is to make air transport safer, more efficient, more effective and more sustainable. Bolstered by its multidisciplinary expertise and unrivalled research facilities, NLR provides innovative and comprehensive solutions to the complex challenges of the aerospace sector.

NLR's activities span the full spectrum of Research, Development, Testing & Evaluation (RDT & E). Given NLR's specialist knowledge and state-of-the-art facilities, companies turn to NLR for validation, verification, qualification, simulation and evaluation. They also turn to NLR because of its deep engagement with the challenges facing our clients. In this way, NLR bridges the gap between research and practical applications, while working for both government and industry at home and abroad.

Royal NLR stands for practical and innovative solutions, technical expertise and a long-term design vision, regarding their fixed wing aircraft, helicopter, drones and space exploration projects. This allows NLR's cutting-edge technology to find its way also into successful aerospace programmes of OEMs like Airbus, Boeing and Embraer.

NLR supports military forces in solving any challenge in modelling & simulation, ensuring effective realism and cost efficiency.

Royal NLR

- defines training & simulation vision
- performs operational training needs analysis
- designs training blue prints
- defines training media in line with training needs
- supports training implementation
- carries out training evaluation

For more information:

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