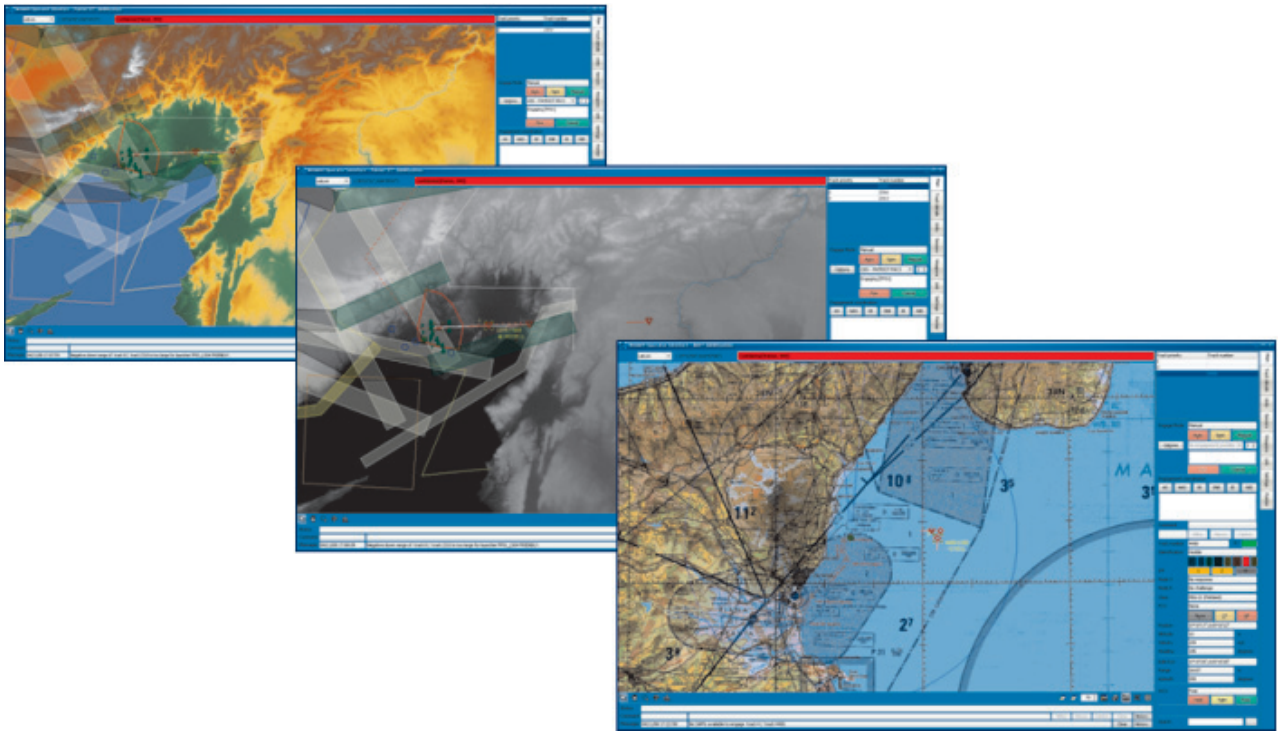
JROADS



TNO innovation for life

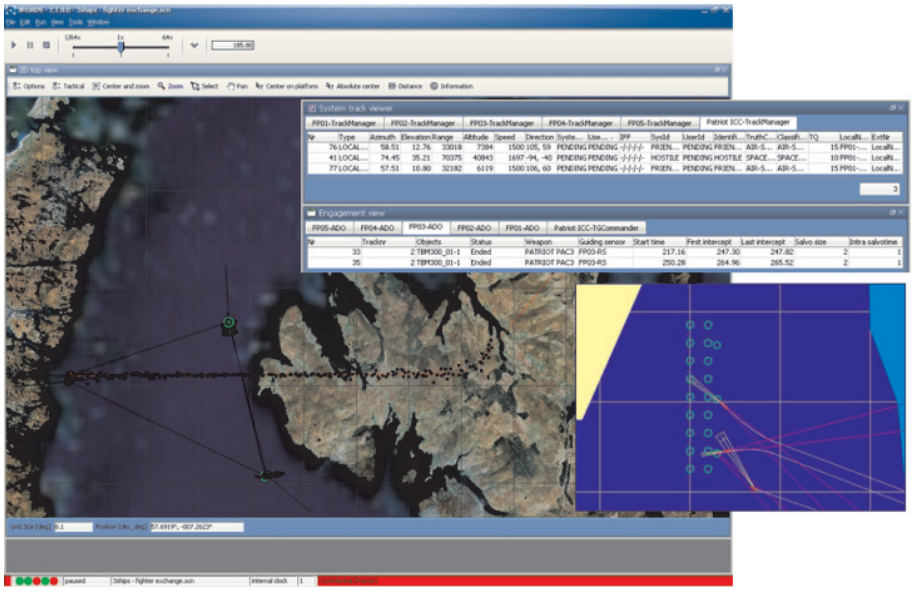
Whether evaluating the effectiveness and performance of new or existing air defence weapon systems and subsystems or conducting experiments with hardware in the loop, JROADS provides a flexible simulation environment for answering your Joint Air & Missile Defence questions.

WHAT IS JROADS?

JROADS (Joint Research on Air Defence Systems) is an extensive modular software environment comprising of simulators and tools targeted towards joint theatre air and missile defence. Due to its diversity and flexibility, it is actively used for concept development and experimentation in real-time air defence exercises and wargames, for analysis of extended air defence scenarios, and as a testbed for specific (sub)systems or capabilities. Operating either stand-alone, running Monte-Carlo simulations, or controlled by an operator, JROADS can aid in solving strategic and tactical JAMD challenges. Furthermore, through its versatile communication layers, JROADS can be connected to other simulators and live weapon systems using Simulation Networks (e.g. HLA/DIS) and Tactical Data Link connections.

A BIT OF HISTORY

JROADS, formerly known as SeaRoads, was initially developed for the Royal Netherlands Navy as a system specific simulator before the Royal Netherlands Air Force and Army joined the simulator development. Although commercial simulators existed at the time, they proved to be too rigid and inflexible to fulfil their requirements, so the strategic decision was made to develop a simulation environment ‘in-house’. After 20 years of incremental development, JROADS has become one of the leading simulators for answering questions in the JAMD domain. Applications range from operational analysis of the third Global Missile Defence site in Europe to modelling the operational capabilities of the Joint Strike Fighter. JROADS has grown from a simple simulator to an advanced simulation environment, capable of



simulating in a high-level of detail most modern air defence systems, such as PATRIOT, ADCF (Air Defence and Command Frigate), AGBADS (Army Ground Based Air Defence System), missile threats, radars and satellites. In addition, it also provides support for mission planning, post processing and after-action review, e.g. 3D replays with analysis.

USER SCENARIOS

Via our graphical editor or in text, users can accurately specify your theatre air and missile defence scenarios. Each simulated air defence system is built from detailed, highly configurable sensor and weapon subsystems, track management, firing doctrines, communication and (optional) co-ordination between systems. With our comprehensive scripting engine, blue and red forces, neutrals and civilians can express intelligent behaviour.
Environmental factors such as terrain and weather conditions are incorporated in the model, affecting aspects like line-of-sight and radar detection probability.

FIDELITY

JROADS has undergone extensive test and verification processes. The fidelity of the simulation model was tested and evaluated both as a standalone application (e.g. in NATO's Modelling and Simulation Team under CNAD's Missile Defence Project Group) and as an application participating in complex networks during international exercises (e.g. JPOW and NATO - Russian Federation CPX). But also simulations of specific sensors were industrially verified, such as Thales' SMART-L radar.

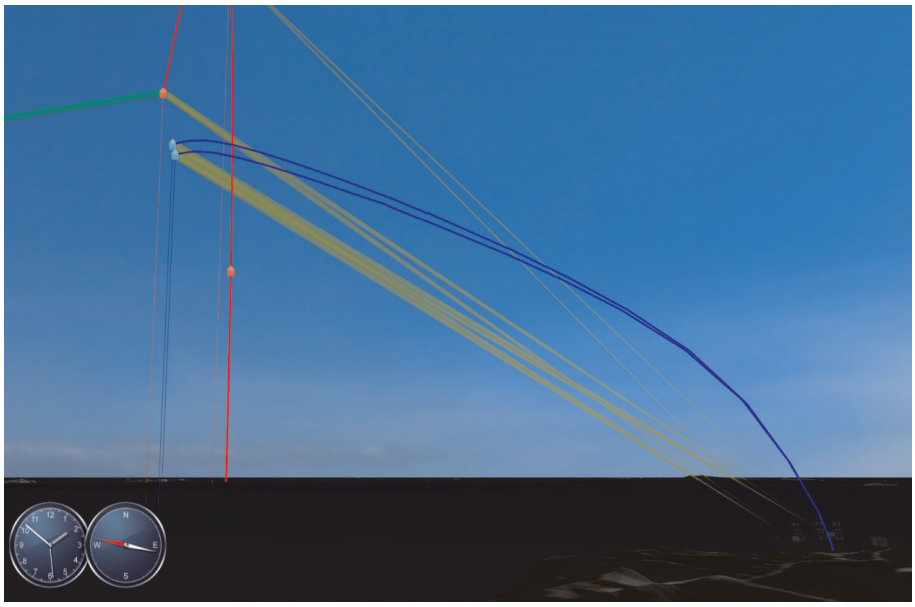
EXERCISE SUPPORT

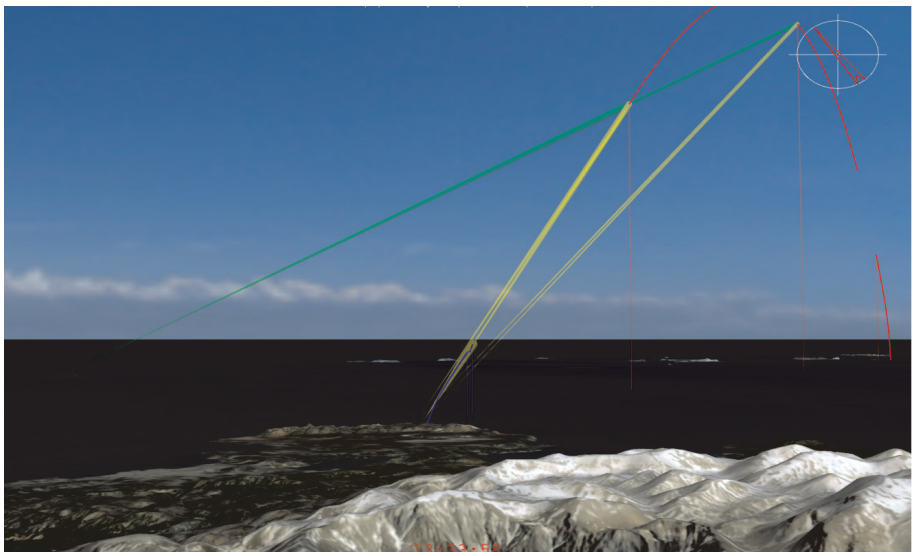
In exercises, JROADS is used to simulate one or more air defence systems co-operating in theatre air and missile defence architectures. Military personnel operate JROADS and control their own air defence unit using the JROADS human-in-the-loop operator interface, allowing for manual engagement orders, fire control orders, weapon selection, identification, classification, engagement coordination, etc.
Through the use of NATO symbology and terminology JROADS is highly accessible to every warfighter.
Using a DIS and HLA interface, a JROADS simulation can connect to other simulations in a (real-time) network. Through our Link-16 interface, JROADS can exchange tactical data link information with live and simulated systems on a Link-16 network.
JROADS has participated for many years in the JPOW (Joint Project Optic Windmill) NATO exercise, simulating Dutch, Italian, German and US BMD forces. For the NATO - Russian Federation CPX and the European Capability (ECAP) conference, JROADS was responsible for the entire simulation part of the exercise, simulating NATO and Russian BMD forces, EW satellite and radars, and TBM threats.

ANALYSIS TOOL

JROADS has extensive analysis capabilities, many of which are offered via our user-friendly Joint Planning Tool. Scenarios composed of highly detailed air defence systems and various threat types can be simulated in two modes: real-time single run mode with graphical output or fast statistical mode for Monte Carlo type analyses. During these runs, measures of effectiveness (MOEs) are calculated automatically to quantify and analyse the capabilities of air defence systems. Due to its modular nature, it is also possible to replace existing functionality with your own models, e.g. your own radar model.

JROADS has proven to be a very suitable tool for analysis purposes, and we have conducted a wide range of naval Anti-Air Warfare, Above-Water Warfare, and NATO TBMD studies. For instance, JROADS supported the determination of the air defence staff requirements for the "De Zeven Provinciën" class frigates (ADCF), and it is also used to carry out effectiveness studies for specific sensors and weapon systems like Thales' SMART-L radar or the Joint Strike Fighter.





JROADS - ANSWERING YOUR JOINT AIR & MISSILE DEFENCE QUESTIONS

Besides the more traditional JAMD analysis, JROADS is moving into adjacent domains as well, e.g. to test new military message protocols such as DAMA (Defence Against Mortar Attack) or to analyse coastal security.

CONCEPT DEVELOPMENT & EXPERIMENTATION (CD&E)

Testing new technologies and concepts for Defence in a realistic environment is a costly operation: many people and resources are involved. JROADS offers a virtual world in which experiments can be methodically conducted on, say, new weapon systems. This means considerable cost and time savings for Defence. JROADS typically either provides a flexible and realistic air defence environment for high-fidelity models or for live weapon systems. Examples of the former are the coupling of JROADS via DIS, HLA or DLL to detailed radar or electronic warfare models, or to very realistic missile trajectory models. An example of the latter is testing the DIS interface of the newly acquired Army Ground Based Air Defence System.

3D VISUALISATION

The JROADS viewer presents a 3D visualisation of all events on the virtual battlefield, both in real-time during simulation runs as well as in playback mode for after action reviews. Incorporated AI camera directors automatically focus on the most important events, which allow dynamic standalone use.

JROADS

MAJOR FUNCTIONALITY

In brief, JROADS offers you the following functionalities:

- Accurate representation of extended air defence systems
- Extensive modelling of firing doctrines and communication
- Threat modelling including TBM, ASM, AAM, Aircraft, Cruise Missiles and Mortars
- Lua scripting to enable various levels of intelligent behaviour
- DIS and HLA interface
- Link-16 SIMPLE interface, consisting of J-messages, Reporting Responsibility and track correlation
- Military operator interface
- Digital terrain for visualisation and (radar) line-of-sight calculations
- Round-earth modelling
- Flexible structure, enabling easy creation, coupling and incorporation of new systems and capabilities
- Measures of Effectiveness for analysis purposes
- 3D visualisation of the virtual battlefield, recording and replay

TNO.NL

TNO
TNO is an independent innovation organisation. TNO connects people and knowledge to create innovations that sustainably boost the competitive strength of industry and the welfare of society.

TNO focuses its efforts on seven themes including Defence, Safety and Security: TNO focuses on a safe and secure society by creating innovations for people working in the armed forces, law-enforcement agencies, emergency services and industry.

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