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## ODSJEK AERONAUTIKA

ZAVOD ZA AERONAUTIKU

Laboratorij za kontrolu zračne plovidbe



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## DIVISION OF AERONAUTICS

DEPARTMENT OF AERONAUTICS



Laboratory for Control of Air Navigation



Head

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### Naziv opreme / Equipment name

Simulator za radarsku kontrolu zračnog prometa  
Air traffic control radar simulator  
(MICRONAV BEST RADAR SIMULATOR)

### Proizvođač / Manufacturer

Micro Nav Ltd., Bournemouth, UK

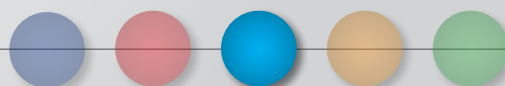


### Namjena i opis / Purpose and description

Simulator za radarsku kontrolu zračnog prometa je simulator utemeljen na osobnom računaru. Koristi se za simulaciju kontrole zračnog prometa. Sastoji se od hardverske opreme i aplikacije. Hardver čine 2 radne pozicije za kontrolora zračnog prometa (2 PC-a s ostalom pripadajućom opremom), 2 radne pozicije za pseudo-pilote od kojih jedna služi i kao pozicija upravitelja sustava (2 PC-a s ostalom pripadajućom opremom) i 1 rezervna radna stanica (1 PC s ostalom pripadajućom opremom). BEST simulator ima nastavnu i znanstveno-istraživačku namjenu. Koristi se u nastavi na preddiplomskom studiju aeronautike te prilikom organiziranja osposobljavanja kroz cjeloživotno učenje. Simulator omogućava kreiranje zračnog prostora, vježbi oblasne i prilazne radarske kontrole zračnog prometa te meteoroloških podataka. Studenti kontrolori imaju nadležnost nad definiranim prostorom, a na elektroničkom obrascu za praćenje napredovanja leta zrakoplova upisuju sve promjene i odobrenja koja su izdali pilotima. Pseudo-piloti simuliraju kretanje zrakoplova u prostoru svojim naredbama. Komunikacija između kontrolora i pilota je govorna radio-telefonska komunikacija. Vježbe se izvode uz nadzor ovlaštenih instruktora kontrole zračnog prometa. Znanstvena istraživanja koja se provode na simulatoru vezana su uz proces osposobljavanja kontrolora zračnog prometa (izračun i analiza radnih zadataka i ukupnog radnog opterećenja kontrolora, primjena u provođenju radio-telefonske komunikacije i istraživanju pojavnosti pogrešaka, analiza nepredviđenih situacija u zračnom prometu i dr.) te analizu i uvođenje tehnoloških rješenja u sustavu kontrole zračnog prometa i upravljanju zračnim prometom (izrada i implementacija novih ruta za planiranje prometa, reorganizacija zračnog prostora, sektorizacija, studije sigurnosti i dr.). Fakultet prometnih znanosti posjeduje trajnu licencu za korištenje simulatora.

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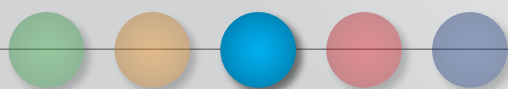
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BEST radar simulator is a PC-based simulator. It is used for simulation of air traffic control service. It contains: 2 air traffic controller (ATCO) working positions (2 PCs with ancillary equipment), 2 pseudo-pilot working positions (2 PCs with ancillary equipment) and licensed application. One of these positions is used as system manager working position. Best simulator also gains 1 spare working position (1 PCs with ancillary equipment). BEST simulator is used for air traffic controller training and for scientific research. Simulator is used within the program of undergraduate study of aeronautics, module air traffic control (ATC) and within the modular basic ATC training courses. It enables creation of airspace, exercises of area and approach control services and meteorological data. ATC students are authorized to provide air traffic services (ATS) within the airspace of its jurisdiction. They use specially designed electronic flight strips to note all clearances and instructions given to aircraft. Pseudo-pilots simulate movement of aircraft in the air. Air traffic controllers and pseudo-pilots communicate via radiotelephony communication. Communication system is a part of the simulator. Exercises are conducted under the supervision of certified air traffic control instructors. Scientific research is provided within the field of air traffic controller training (determination and analysis of air traffic controller tasks and workload, analysis of errors occurrence in radio-telephony communication, contingency analysis etc.). Simulator is also used for analysis and implementation of new technological solution within the fields of air traffic management (ATM) and air traffic control (ATS route design and implementation, airspace reorganization, sectorization analysis, safety studies etc.).

Software is licensed according to the agreement with Micronav ltd.

Faculty of Transport and Traffic Sciences owns permanent license for BEST simulator.



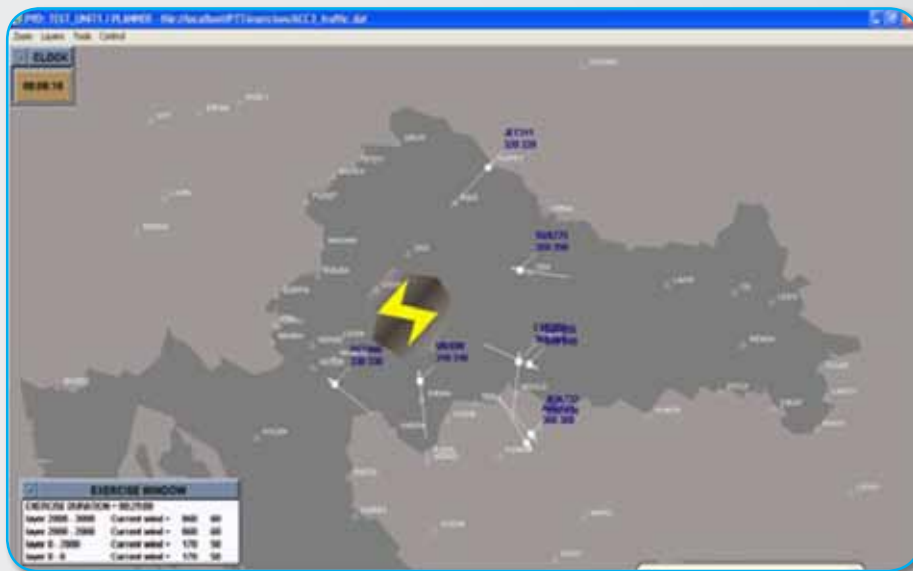


### Naziv opreme / Equipment name

Radarski trenažer  
Radar Skills Trainer (RST)

### Proizvođač / Manufacturer

EUROCONTROL, IANS, Luxembourg



### Namjena i opis / Purpose and description

RST radarski trenažer je simulator utemeljen na osobnom računaru. Korištenje u nastavi na preddiplomskom studiju aeronautike te prilikom organiziranja osposobljavanja kroz cjeloživotno učenje. Program omogućuje samostalno kreiranje vježbi za uvježbavanje osnovnih funkcija radarskog vektoriranja te ostalih radarskih funkcija oblasne i prilazne kontrole zračnog prometa. Ne omogućava potpunu simulaciju kontrole zračnog prometa jer ne uključuje simulaciju direktne radio-telefonske komunikacije između pseudo-pilota i kontrololora. Provođi se uz nadzor ovlaštenih nastavnika.

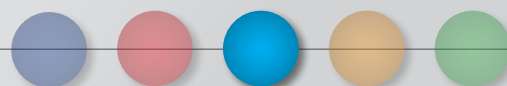
*Napomena:* zahtijeva LAN mrežu i server, u slučaju korištenja zahtjevnijih modova rada programa (Distributed stand-alone i Full CMS).

RST is a PC-based simulator. Simulator is used within the program of undergraduate study of aeronautics, module ATC and within the modular basic ATCO training courses. It enables creation of airspace, exercises of area and approach control services. It is used for practicing basic radar vectoring and basic radar functions for both area and approach control. It cannot simulate complete air traffic control service since it doesn't involve simulation of radiotelephony communication between pseudo-pilots and controllers. Students perform exercises under the supervision of certified tutors.

*Note:* requires a LAN network and server when using more demanding modes (Distributed stand-alone and Full CMS).

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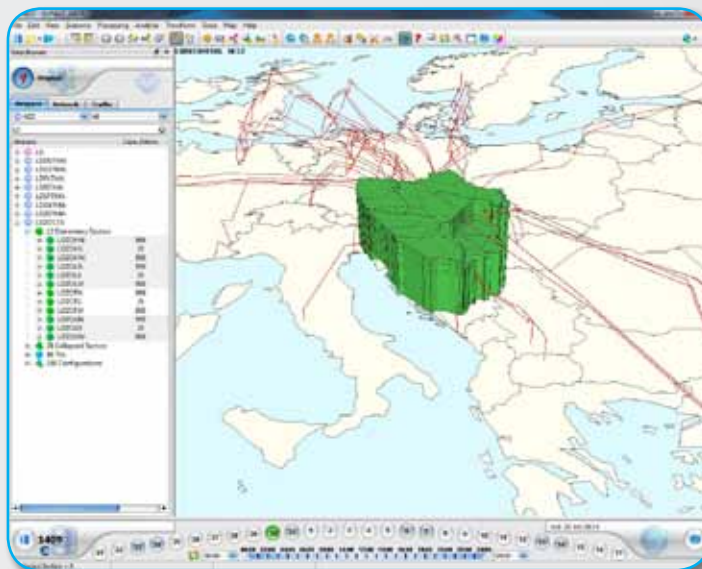


### Naziv opreme / Equipment name

Program za modeliranje i simulaciju zračnog prostora i tokova prometa  
Program for airspace and air traffic flows simulation and modelling (NEST – Network Strategic Tool)

### Proizvođač / Manufacturer

EUROCONTROL, Brussels, Belgium



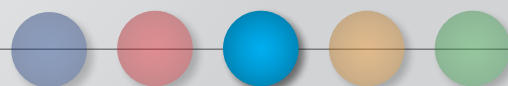
### Namjena i opis / Purpose and description

Korištenje u nastavi na preddiplomskom i diplomskom studiju aeronautike te prilikom organiziranja osposobljavanja kroz cjeloživotno učenje. Program omogućuje analizu i istraživanje prometnog opterećenja na mreži ruta, segmentima ruta, na aerodromima te na strukturi zračnog prostora s mogućnošću izrade različitih scenarija. Omogućava vizualizaciju i animaciju 3D prometa kroz neki prostor. Omogućava filtriranje prometa za zadane uvjete. Korišti se za usporedbu duljine ruta te izračun prijedanih NM, ušteda na gorivu i onečišćenju okoliša. Omogućava strateško planiranje uvođenja te simulacije izmjenjenih karakteristika prostora ili mreže ruta te njihov utjecaj na tokove prometa. Nadogradnja programa i ulazni podaci uzimaju se sa servera EUROCONTROL-a (Demand Data Repository - DDR2). Napomena: zahtijeva LAN mrežu i server.

Program is used within the program of graduate and undergraduate study of aeronautics, module ATC and within the modular basic ATCO training courses. It enables research and analysis of traffic load on ATS routes, route segments, significant points, aerodromes and airspace structure with different scenarios creations. Visual presentation and animations of 3D traffic through certain airspace can be provided. It allows filtering of traffic according to the conditions set by the query function. It is used to compare ATS route distances, shortest route calculation in nautical miles, savings on fuel and environmental pollution. It enables simulations of different scenarios with different airspace and network settings. Upgrading the program and input data are taken from the EUROCONTROL server (Demand Data Repository - DDR2). Note: Requires LAN and server.

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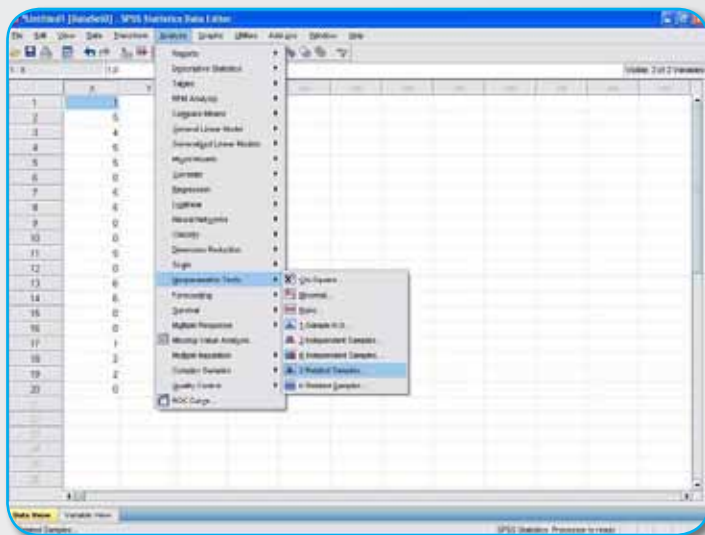
### Naziv opreme / Equipment name

Programski paket za statističku obradu podataka

Program for statistical data analysis IBM SPSS Statistics – Standard Edition

### Proizvođač / Manufacturer

IBM, New York, USA



### Namjena i opis / Purpose and description

IBM SPSS omogućuje provođenje osnovnih statističkih procedura koje istraživači trebaju pri rješavanju temeljnih istraživačkih pitanja. Ovaj softver nudi alate koji omogućuju brzo pregledavanje podataka, formuliranje hipoteza za dodatno testiranje, te provođenje postupaka koji mogu razjasniti odnose između varijabli, udruživanje u klustere, identificiranje trendova i predviđanja.

IBM SPSS uključuje sljedeće ključne mogućnosti:

- Linearni modeli nude razne vrste regresije i naprednih statističkih postupaka dizajniranih kako bi dali odgovarajuće inherentne karakteristike podataka kojima se opisuju složeni odnosi.
- Nelinearni modeli pružaju mogućnost izrade sofisticiranijih modela prema postojećim podatcima.

Geoprostorne analitičke tehnike omogućuju korisnicima integriranje, istraživanje i modeliranje lokacijskih i vremenskih podataka. Simulacije mogu pomoći istraživačima automatski oblikovati više mogućih ishoda kad ulazni podatci nisu potpuno poznati te na taj način poboljšati analizu rizika i donošenje odluka. Prilagođene tablice omogućuju korisnicima lako razumijevanje podataka i brzu izradu rezultata u različitim stilovima za različite publike.

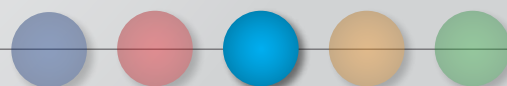
The IBM SPSS Statistics Standard Edition offers the core statistical procedures analysts need to address fundamental research questions. This software provides tools that allow users to quickly view data, formulate hypotheses for additional testing, and carry out procedures to clarify relationships between variables, create clusters, identify trends and make predictions.

The IBM SPSS Statistics Standard edition includes the following key capabilities:

- Linear models offer a variety of regression and advanced statistical procedures designed to fit the in-

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herent characteristics of data describing complex relationships.

- Nonlinear models provide the ability to apply more sophisticated models to data.

Geospatial analytics techniques enable users to integrate, explore and model location and time data. Simulation capabilities help analysts automatically model many possible outcomes when inputs are uncertain, improving risk analysis and decision making. Customized tables enable users to easily understand their data and quickly summarize results in different styles for different audiences.

