AIRTOP™

Airport and Airspace modeling

Unique rule-based gate-to-gate fast-time simulation

airtopsoft

a Transoft Solutions company

Airtopsoft, a Transoft Solutions company, develops AirTOP, a leading fast-time air traffic complexity modeling, simulation and assessment software. Today, AirTOP users include major air navigation service providers (ANSPs), airport authorities, airlines, research labs and consulting companies globally. AirTOP is used to assess air traffic and airport complexity, measure controller workload, improve airspace and airport capacity, and much more.

AIRTOP™

Unique rule-based gate-to-gate fast-time simulation

AirTOP is a leading modeling platform providing support to assess and improve airspace, airport airside and passenger terminal capacities. The modular software allows scenario editing, simulation and reporting for airspace and airport environments through a single sophisticated interface that includes highly interactive 2D maps and 3D views. The WIZer module for ACCs and Airports connects to live data streams, presents short term forecasts of air traffic complexity, controller workload, airport performance indicators, and offer real-time what-if-analysis functions to provide airport and airspace demand capacity balancing.

Multi-agent based modeling

The multi-agent based modeling of AirTOP leads to a better capture of controller roles and tasks for various stakeholders (ATC and Airport controllers, flow managers, airport authorities, aircraft operator centers, etc). It allows for an accurate and customizable measure of controller workload demand.

Integrated table and map-based application

Scenario editing, project check & debug, simulation run and playback – all reporting in one single application. AirTOP also supports various external import formats.

Integrated reporting

The reporting functions and possibilities of AirTOP are vast. It includes hundreds of built-in reports that are ready to use, while also allowing the user to customize both reporting and plotting to fit specific needs and ad-hoc analysis. The reports are then easily exportable into SQL databases or CSV files, allowing further analysis using external software if necessary.

Open, modular and extensible

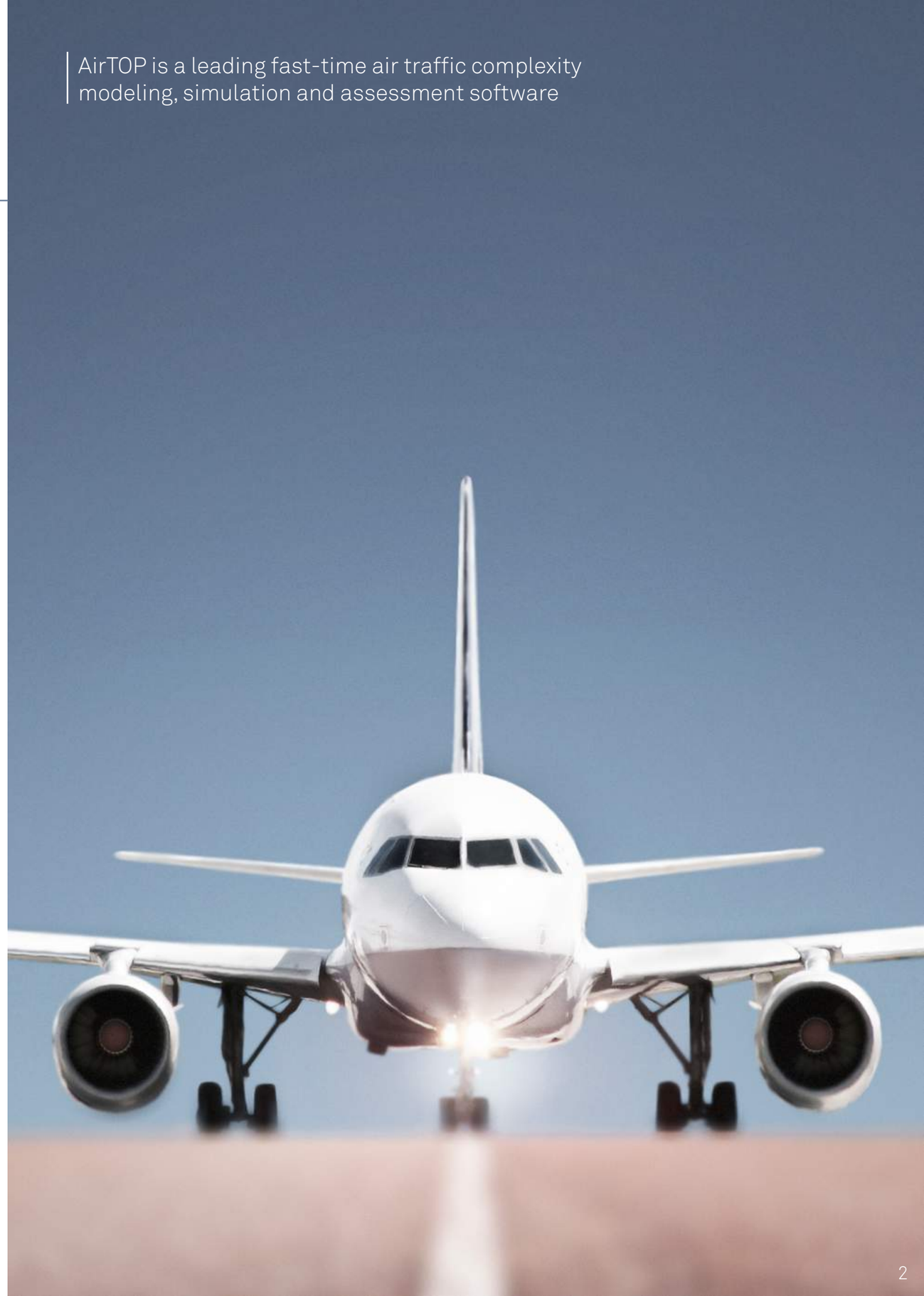
AirTOP is an open, modular and extensible software which allows you to write custom extensions using the AirTOP development suite. This leads to reductions in operational costs and enhancement delays.

AIRTOP AIRPORT™ | Airport Modeling and Simulation

AIRTOP AIRSPACE™ | Airspace Modeling and Simulation

AIRTOP WIZER™ | Operational Decision Support

AirTOP is a leading fast-time air traffic complexity modeling, simulation and assessment software



Airside Aircraft Movements

The Airside Aircraft Movements module allows airport authorities or operators to assess and improve airport capacity. When reorganizing taxi routes, implementing mixed-mode runway configurations, or implementing new ground equipment, the potential bottlenecks of the airport's operation can be visualized, and alternative scenarios can be tested. Detailed airport layouts and procedures can be easily created, modified, simulated and compared using the powerful integrated 2D and 3D graphical user interface.

Scenario Definition

AirTOP Airport features all ground airport structures including runway entries/exits, crossings, stop bars, parking, aprons, and much more. Parking position and gate allocation can either be imported from external files or generated/optimized by AirTOP built-in tools considering aircraft and airline constraints and preferences.

Ground Movement Modeling

The powerful AirTOP rule-based engine lets end-users define all typical airport controller tasks with ease. These tasks can be runway entry selection, runway crossing procedures, allocation of gates, allocation of parking positions, flight plan connections, turnaround management, and much more. AirTOP also supports the modeling of random gate delay, push back or take-off target time. Have a look at the TMA/TRACON module description for an overview of the advanced concepts that can be introduced in the simulation in combination with the Airside Aircraft Movements module.

Departure Management

AirTOP can model the tasks of a runway controller receiving the departure of taxiing aircraft inside their area of responsibility. AirTOP can also model the effect of a DMAN (Departure MANager) system, which can generate an optimized take-off sequence while aircraft are taxiing or still at the gate.

Reporting

Controller workload can be simulated dynamically and can be customized for all types of airport controllers. A customizable event log can easily be created by the user and exported to Excel or an SQL database for external specific analysis.

Departure Apron

Airside Vehicle Movements

The Airside Vehicle Movements module allows airport authorities or operators to assess and improve airport capacity. The high-fidelity modeling of all ground handling equipment, vehicles and aircraft behaving correctly in terms of processes, rules and speeds, provides the proper information to avoid wrong investments or expectations in terms of future capacity and delay. Furthermore, alternative solutions can easily be built and validated. The modeling of vehicle and aircraft movements provides an in-depth understanding of potential bottlenecks when testing and comparing different airport airside layout and procedures.

The powerful 2D and 3D visualization capabilities makes it easier to explain scenarios and validation outcome to all stakeholders.

Scenario Definition

AirTOP allows simulation of all common airport ground vehicles. Airfield vehicles that do not operate on an aircraft, such as airfield inspection, fire and ambulance vehicles, can also be defined.
Each vehicle is simulated as an individual entity interacting with other entities and with aircraft on taxiways and stands. The vehicle movements on service roads are based on a high-fidelity road traffic movements. AirTOP can simulate vehicles' individual driving behaviours, traffic rules and interactions with aircraft moving on taxiways. Service road closures can also be modeled using rules.

Reporting

A customizable event log can easily be created by the user and exported to Excel files or an SQL database for external specific analysis. AirTOP also provides statistics for groups of vehicles to measure airport operation activity and efficiency throughout the simulation. Moreover, the uses of each portion of the service road during the day is recorded by AirTOP hour by hour throughout the simulation.

Airside vehicle movements

The modular software allows scenario editing, simulation and reporting for airspace and airport environments through a single sophisticated interface

Runway Capacity Analysis

Estimating runway capacities is fundamental to all airport planning. As more and more airports become capacity constrained, optimizing the usage of runway resources is often their primary objective. AirTOP has a module to accurately assess existing or future runway capacity of a given airport.

Key Benefits

AirTOP's Runway Capacity Analyzer overcomes the limitations of existing analytical capacity assessments by applying the Monte Carlo simulation method to evaluate runway throughput. With this tool it is possible to evaluate existing or future capacity of the airport's runway system, test future traffic demands, study the impact of runway capacity changes taking several different variables into consideration, obtain delay statistics and much more.

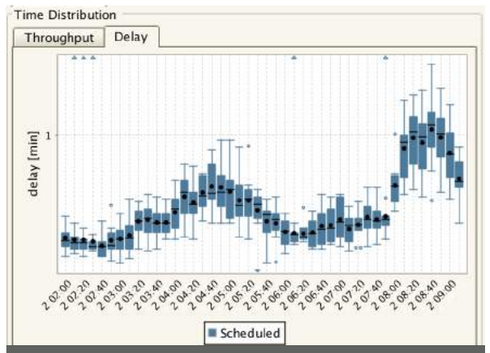
Scenario Definition

Runway Capacity Analysis re-uses existing AirTOP airport model set-up. To establish the throughput, the runway system is considered independently of constraints in the airspace or on the airport airside. All the constraints linked to adequately separating flights on the runway are considered by applying AirTOP's Runway Dependency modeling capabilities, where the separation rules and values to be applied for pairs of departure and arrival operations are defined.

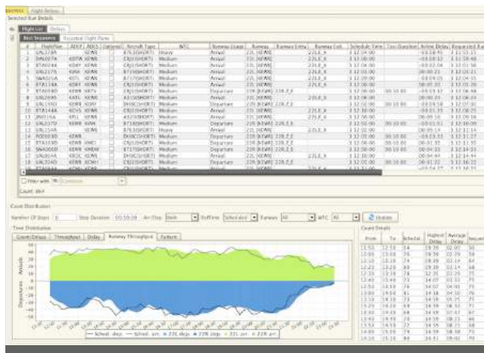
A certain level of randomization can be added to the analysis at several levels. This allows the testing of the sensitivity of the runway system to the uncertainty and resulting variation in operation.
When optimizing the flight sequence, the Runway Capacity Analysis tool can be configured to consider the Level of Service (LOS) concept.

Reporting

Runway Capacity Analyzer allows the execution of multiple runs of the same analysis in a series. This allows for increased statistical robustness in the analysis. The results from the Runway Capacity Analyzer are presented both numerically and graphically in various formats.



Delay distribution over multiple runs



Sequence flight list

TMA/TRACON

AirTOP realistically simulates all aircraft movements in the airport's TMA/TRACON airspace, including all the required departure and approach controller tasks. By linking all the processes and events that take place on the airport surface and in the Terminal Area with their related ATC tasks, advanced concepts such as DMAN and AMAN can be modeled with realism. This link also enables the emulation of ATFCM and CDM events. AirTOP will assist airports in understanding capacity issues and underlying delay factors.

Scenario Definition

When defining the scenario, en-route domain objects, runways, SIDs, holding stacks, STARS and transition vectoring can easily be created/edited directly on the map or by using the adjacent information displays. The key static or dynamic (rule-based) restrictions to these objects are all supported by AirTOP, such as speed and altitude restrictions, wake turbulence separations and more.

AirTOP can import actual track trajectory records from various file formats, and users can derive transition vectoring areas by using the built-in styled and filtered trajectory display and playback.

Reporting

With the TMA/TRACON module, events can be related to any action taken by a controller or an aircraft. These events can be logged together with information related to the current status of an aircraft. Built-in event plots and displays with statistic queries are available and ready to use by default.

Point-merge approach procedures

En-route simulation

AirTOP supports all key en-route structures and controller tasks, as well as all static or dynamic restrictions related to them, thus providing realistic en-route simulation. The en-route module include rule-based modeling of controller workload, conflict detection & resolution, letter of agreement and more.

Scenario Definition and Modeling

With AirTOP en-route, you can easily define waypoints, FLAS areas, ATS routes etc. by simply clicking on the map or via an adjacent information display. It is also possible to completely or partially import data from external data sources. AirTOP's routing concept provides an easy way to quickly create an en-route traffic simulation. It supports the modeling of sectors, control centers as well as regional airspace.

With the user editable conflict resolution rule base, AirTOP en-route allows for the modeling of conflict detection and resolution. This rule base includes resolution strategies which can be customized by the user, taking into account potential conflicts, destination of aircraft, routing merging, distance to TOD etc.

Reporting

It is possible to easily generate and export reports with the built-in statistics per sector, flight, airport and runway. With this module, exportable report events can be generated, which can be used offline to realistically calculate the controller's workload based on aircraft movements and controller tasks such as conflict resolution demand, sector movements, flight events etc.

Simulation model of the US National Airspace System

AIRTOP AIRSPACE™

TBOs and Flow Management

This AirTOP module supports the modeling of 4D Trajectory Based Operations (TBOs), including planned 4D trajectory synchronization and negotiation, airspace planned entry load and occupancy monitoring, flow management and Demand Capacity Balancing (DCB) as well as Time based (TTA/CTA/RTA) or distance based point-in-space metering. It is recognized as the state-of-the-art ATFCM model. The presentation of performance indicators can be tailored to your needs and easily shared with stakeholders.

Planned 4D Trajectory Synchronization

- Shared by all actors involved in the negotiation of the 4D trajectory (Network/Flow Management actors, ATC actors, AOCs/Aircraft Operators, flight crews).
- Updated dynamically during simulation in response to controller actions, unexpected delays or DCB measures.
- Each update of planned trajectory contains a waypoint profile and an airspace profile, providing valuable information.

Airspace planned entry load and occupancy monitoring

- Dynamically update sector, airspace, waypoint or airport entry and occupancy count ahead of simulation time with the load monitoring tool.
- Possible to model and test different strategies to solve anticipated capacity problems.

Flow management and Demand/Capacity Balancing (DCB)

- Model various flow management strategies in order to achieve airspace DCB, including queueing at sector entry, re-routing, airspace/sector re-configuration and level capping.
- AMAN/TMA can anticipate demand of touch down and build a desired and feasible touch down sequence, respecting minimum runway separation.
- Supports modeling of multiple AMAN/TMA running together on different runway systems.

Planned 4D Trajectory Negotiation

- Model negotiation between actors with user-settable rule bases, determining chain of actors involved in a negotiation
- User settable duration and conditions to determine what a Network/Flow management actor will propose (re-route, level-capping etc.). Conditions can be based on location, duration and severity of the anticipated demand problem

Time based (RTA/CTA/TTA) or distance based point-in-space metering

User-settable strategies to achieve given target times or separation, including speed control, en-route path stretching, holding stack and delay at gate or take-off.

Reporting

The workload model can associate work duration to any event and take into account time spent waiting for a reply from other actors or the monitoring of flights. Measure actor workload along specific traffic flows and customize for different waypoint pairs or sequences. Measures planned and unplanned delays accurately per flight. Log information such as flight distance, and fuel burn in absolute terms or as a percentage. Create and export customizable event logs to export into Excel files or an SQL database.

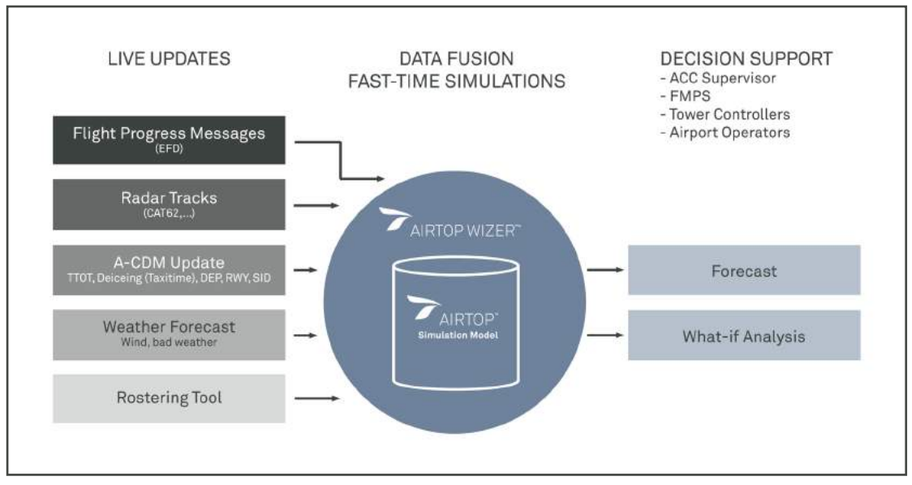
AirTOP users include major air navigation service providers (ANSPs), airport authorities, airlines, research labs and consulting companies globally

What-if-analyzer

The core concept of WIZer is that it provides live forecast of future situations and real-time what-if-analysis which supports decision making. WIZer mainly supports ACC supervisors and flow managers with its forecasts of the air traffic situation and sector loads, with the what-if-analysis testing alternative sector configurations, altitudes and/or routes.

The functional architecture of WIZer

WIZer takes in input data from multiple points such as flight progress messages, radar tracks and weather forecasts, which is then displayed in the graphical interface of AirTOP. It highlights periods during which the demand is forecast to exceed capacity and provides options to display the results that a reduction in demand, or increase of capacity, would have on the forecast. This allows the user to perform interactive what-if-analysis on the available options.



WIZer can model the full operational environment of any ACC or group of ACCs. It provides complexity and controller workload measurements for all types of sector (e.g. en-route sectors, TMAs, etc.), or for tower controllers, and provides ways to manage this complexity and workload. The workload and complexity model is specified using a GUI within the WIZer application which allows the WIZer administrator to modify, parameterize or customize the model.

The expandable and modular design of the WIZer application allows it to easily be customized to fit the specific needs of our clients. New modules can be added to the application without modifying the system architecture to support:

- Different data sources
- Different workload/complexity calculations
- New traffic counts
- New systems of sector and airspace organizations

Input Data Processing

AirTOP WIZer can acquire input data and transmit output data via multiple interfaces. The WIZer architecture enables additional Data Links to be easily integrated by AirTOP, such as a local flight data processing system, or custom flight CPR messages. WIZer supports the connection and data exchange with local HR/rostering plan management tools and the acquisition of military airspace activation plans from multiple sources and formats.

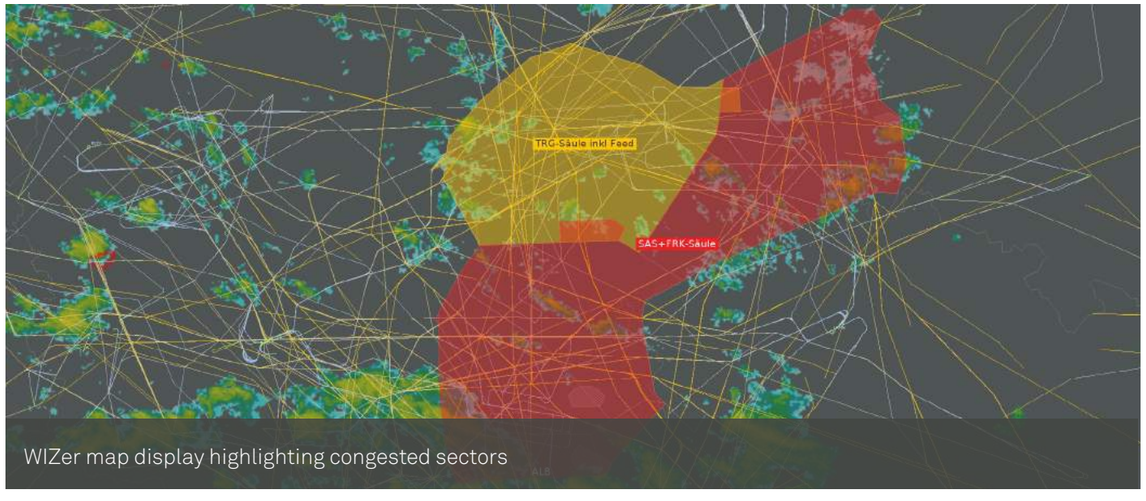
Performance

- Number of pre-defined scenarios: limited only by disk space
- Changing a scenario: < 60s
- Number of pre-defined sector configurations: 2500+
- Simultaneously simulated flights: 5000+
- Computation of workload and complexity values: < 60s
- Number of controller working positions (20+)

AirTOP WIZer ACC software can run 24h a day, 7 days a week, with an availability above 99.9%. Some reliability and availability is provided by various auto-correction, auto-recovery and calibration functionalities integrated into the system.

Testing

WIZer contains a specific testing environment which allows for the system to be tested, validated, and calibrated for operational use. A collection of unit tests is included in the testing environment. Non-regression tests are based on the replay feature and on the profiling traces generated by the system when started in Test Mode and provide information about model validation, forecast quality, global performance of the software components on the background side as well as graphical performance of the WIZer Client. Additional procedures for manual testing are also part of the non-regression tests in order to test and stress the HMI of the WIZer Client.



WIZer map display highlighting congested sectors

The development of AirTOP

Development of AirTOP began in 2006, the same year Airtopsoft commenced operations. AirTOP utilities a flexible, multi-agent based modular architecture, including open-standards where possible, resulting in short development cycles and fast software update deliveries. Formalized, documented processes were implemented as early as 2008. Advancements have been carried out through prototyping and industrialization phases with a strong reliance on the operational requirements, experiences and feedback of existing and potential customers.

To this day, AirTOP's users play an active role in determining the software's development roadmap. In June 2018, Airtopsoft was acquired by Transoft Solutions, a company that offers innovative, state-of-the-art software and services for transportation professionals.

Visit www.transoftsolutions.com to find out more.

Maintenance Assurance Program

Our technical support personnel are always well informed of new product functionality and issues can be quickly resolved. With our Maintenance Assurance Program (MAP), you receive premium assistance for all your technical needs. Subscribing to the MAP gives you freedom from costly upgrades, unexpected staff downtime, or any disruptions due to operating and CAD system conflicts without the concern of per incident charges.

The benefits of being on MAP includes; cost protection, priority support treatment and exclusive privileges.

Contact the AirTOP team

AirTOP development head office:

Airtopsoft S.A.
c/o Hive 5
Rue de Francs, 79 - bte 1
1040 Brussels, Belgium

Phone: +32 2 787 08 23
Email: support@airtopsoft.com

Transoft Solutions Aviation head office:

Transoft Solutions (Aviation) AB
Krokslätts Fabriker 30
431 37 Mölndal
Sweden

Phone: +46 (0)31 60 43 60
Email: infoaviation@transoftsolutions.com

AirTOP regional sales offices:

Europe, Middle East and Africa

Transoft Solutions B.V. Europe
Wijnhaven 60
3011 WS Rotterdam
The Netherlands

Phone:+31 10 258 78 78
Email: eusales@transoftsolutions.com

Asia Pacific

Transoft Solutions (Australia) Pty Ltd
Level 24, 300 Barangaroo Ave
Sydney
NSW 2000, Australia

Phone: +61 2 8067 8414
Email: salesAPAC@transoftsolutions.com

North and South America

Transoft Solutions Inc.
Suite 350 – 13700 International Place
Richmond, BC, Canada
V6V 2X8

Phone: 604.244.8387
Email: sales@transoftsolutions.com

Airtopsoft was acquired by Transoft Solutions in June 2018, after which all commercial activity was transitioned to Transoft Solutions regional offices around the globe. AirTOP research and development still maintains in Brussels, Belgium, supported by the Transoft Solutions Aviation team in Gothenburg, Sweden.

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Transoft Solutions offers innovative, state-of-the-art software and services for the aviation industry. Whether a project involves airport or airspace modeling, airside planning and design, obstacle limitation compliance or terminal simulation, Transoft Solutions has a solution to help complete the task confidently and accurately in a time-efficient manner.

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