# IMS4 ARWIS

Airport Runway Weather Information System

IMS4 ARWIS provides the airport authorities with essential runway surface condition data. Using the real-time collected measurements from the field sensors, aircrafts, and forecasts from the integrated model, the system detects and predicts the runway surface conditions to support decision-making on runway treatment and to report runway conditions in a standardized way.

FULLY COMPLIANT WITH GLOBAL REPORTING FORMAT
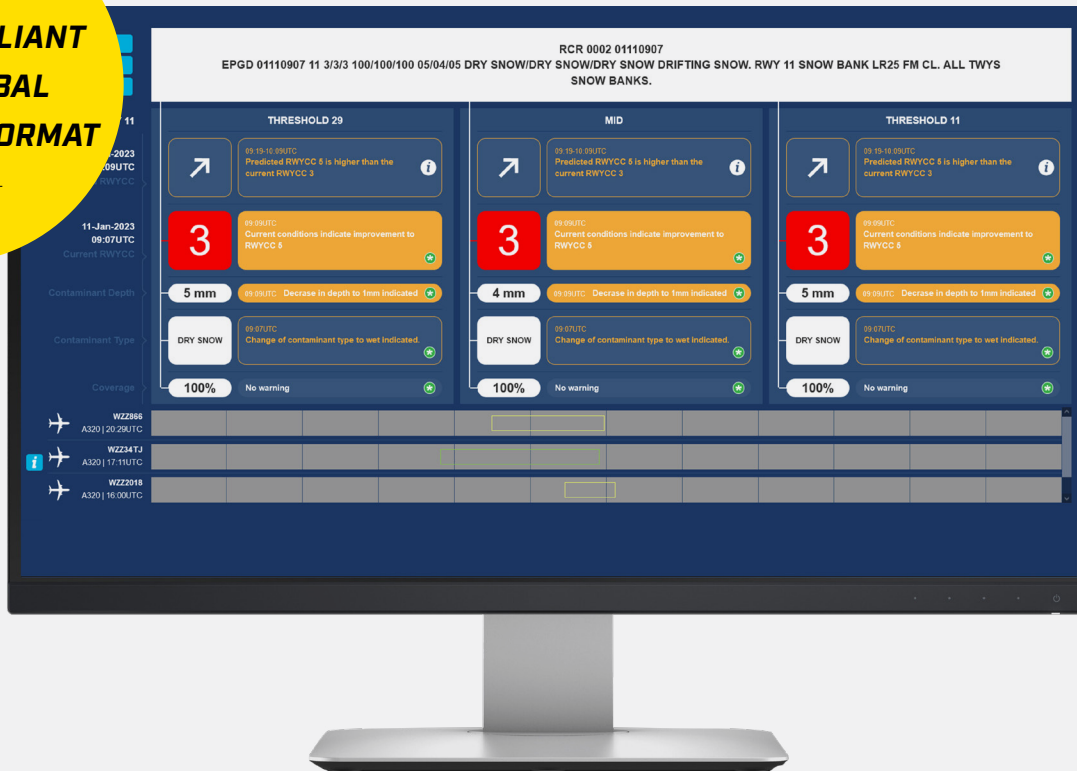
- **Detection and prediction of runway conditions**
- **Compliant with ICAO Annex 14 and ICAO Doc 9981 (GRF implementation)**
- **Operational alerts on hazardous phenomena detected or forecast**
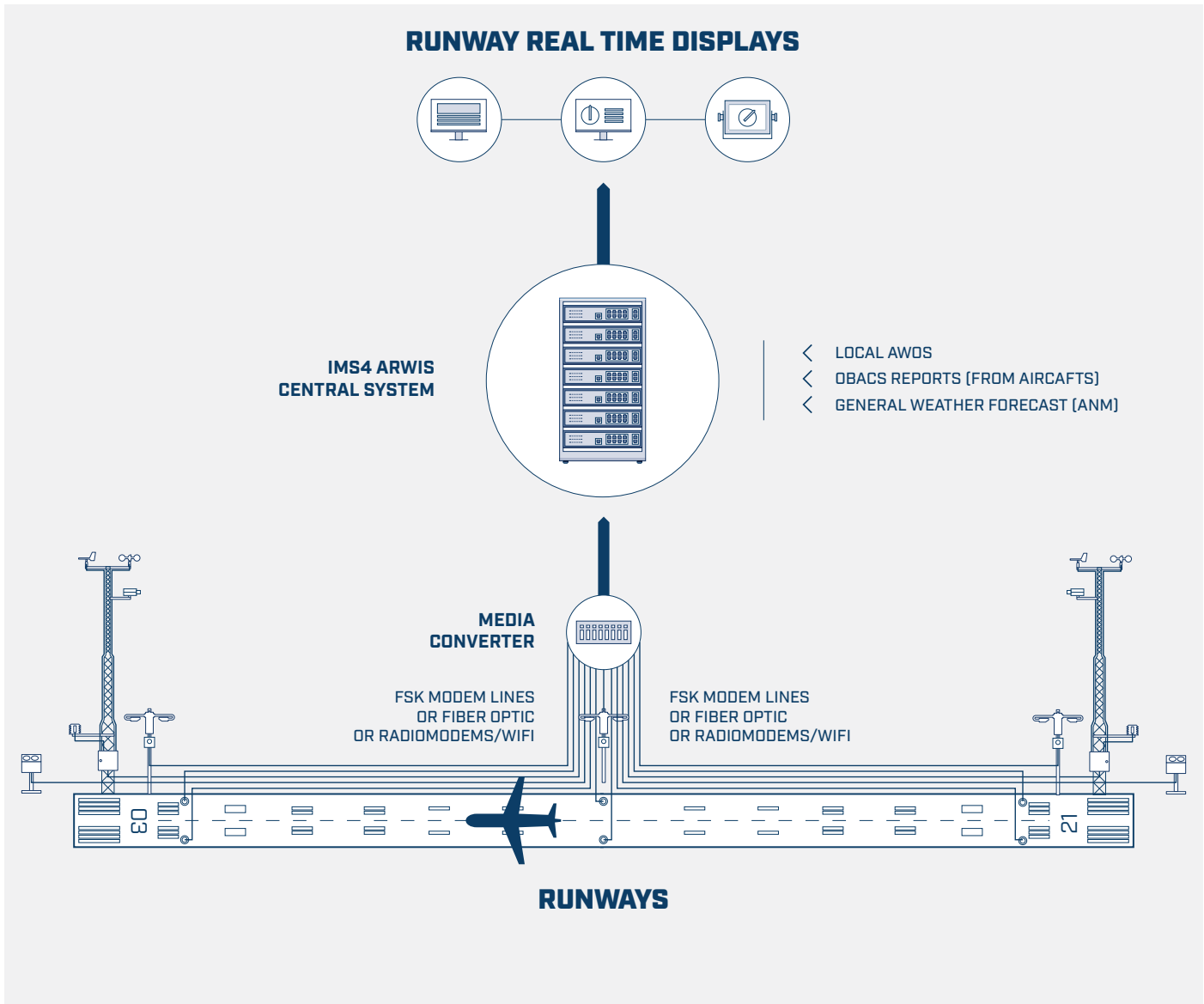- **Standalone system or integrated within AWOS / AWDSS**
- **Aquaplaning**
- **Integration of OBACS reports**

The detected and/or manually observed runway conditions are translated using Runway Condition Assessment Matrix (RCAM) into Runway Condition Code (RWYCC, ranging from 0 to 6) and disseminated in the form of the Runway Code Report (RCR), thus ensuring compliance of the system with ICAO Annex 14 and ICAO Doc 9981 in effect from 2021.

The measurements and forecasts-based early warnings contribute to air traffic safety and help in planning runway maintenance activities. The system can be installed as a standalone one with options for upgrades during the system's lifetime or can be fully integrated within the IMS4 Automated Weather Observation System. The system can be customized also for airports that face only water-related contaminants.

RUNWAY REAL TIME DISPLAYS

IMS4 ARWIS CENTRAL SYSTEM

< LOCAL AWOS
< OBACS REPORTS (FROM AIRCAFTS)
< GENERAL WEATHER FORECAST (ANM)

MEDIA CONVERTER

FSK MODEM LINES OR FIBER OPTIC OR RADIOMODEMS/WIFI

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21

RUNWAYS

System components scheme

Field sensors

The IMS4 ARWIS can interface numerous types of sensors and data loggers. The active/passive intrusive runway surface and subsurface sensors or non-intrusive optical sensors provides runway and subsurface temperature, freezing point, water film thickness and runway condition (e.g. dry, wet, snow, ice, etc.).

The optional automatic weather stations are measuring wind speed, temperature/dew point, present weather, precipitation (indicator and amount), solar radiation, and snow depth, and the system is open for measuring and processing the other quantities if needed. These additional weather data can be integrated from the existing AWOS system at the airport.

With modularity and scalability in the mind, the system can be easily adapted to the existing airport communication infrastructure and allows adding of the sensors and data loggers when the expanding operations need them.

- Interfaces to the various sensors and data loggers: RS-232 / 422 / 485, fiber optic, TCP / IP, wireless
- Numerous input data formats supported (raw text/ binary, XML),
- Quality control: data format validation, sensor BITE data evaluation, verification of measured data (range checks, cross checks)

Braking action reports from aircrafts

The IMS4 ARWIS can interface and display also data from On-board Braking Action Computing System (OBACS). OBACS reports provide useful information about aircraft braking performance and can be used as a downgrade criterion for reported RWYCC.

IMS4 ARWIS server

Standard COTS server or a dual hot failover cluster, the IMS4 ARWIS server collects the measurements, performs the validations and recalculations, distributes data to the

displays and 3rd party systems and runs the runway condition model.

Runway Condition Code, Runway Code Report

The detected and/or manually observed runway conditions are translated using RCAM into RWYCC ranging from 0 to 6. The RCR or SNOWTAM can be created by the operator using a dedicated Editor with many implemented quality controls and speed-up features (e.g. most frequent messages by one click, "summer" version for water-related contaminants only, etc.). The mobile version of IMS ARWIS enables the creation of reports even from a car during runway inspection. The final report can be then disseminated via data exchange networks (AFTN, AMHS, WMO GTS, etc.).
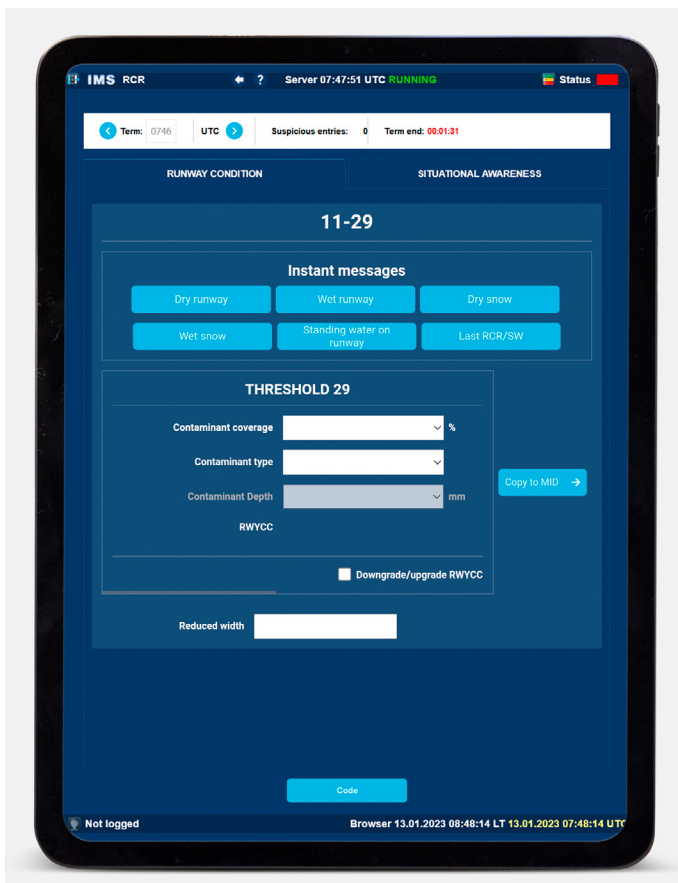
Forecasts and early warnings

For the runway condition prediction, IMS4 ARWIS includes interfaces to the Numerical Weather Prediction model (deployed by MicroStep-MIS or operated by the airport / local met service) or imports the TAF/TREND forecasts and the IMS4 ARWIS built-in runway condition model provides the nowcasts (1 - 3 hour forecasts) and 12-hour predictions of the air and runway temperature and runway conditions for all system locations. The system also compares predicted RWYCC with the reported one to warn users about expected changes.

The factory-configured set of prioritized alarms alerts the operators upon the detection of hazardous phenomena or changes in runway conditions calculated by the rule-based or data-mining model in comparison with the last issued RCR/SNOWTAM. Taking the forecasts into account, the system issues early warnings even in case of the possible approaching hazard resp. change of RWYCC, thus giving the maintenance staff time to act proactively. The alarm set of hazardous phenomena is entirely user configurable to make runway maintenance cost-effective without safety compromises.

ARWIS displays

Customizable displays report the RWYCC, RCR/SNOWTAM, runway condition data, OBACS reports from recently landed aircrafts, and warning status of detected or expected hazardous phenomena and change of runway conditions with reliability indicators of the identified change. This is reported for the multiple runways/multiple locations along the runways in accordance with the respective airport authority requirements. The Chart screen displays both measured and forecast data.

The built-in aviation web server provides the local airport controllers as well as remote users with a powerful and efficient web interface adapted for both PC screens and mobile devices usage.

An integrated part of the Aviation Weather Decision Support System

IMS4 ARWIS with its built-in runway condition forecast model makes an integral part of the Aviation Weather Decision Support System.

IMS ARWIS for water-related contaminants (aquaplaning)

IMS4 ARWIS is customizable also for usage at airports where seasonally or permanently occur only water-related contaminants. As a high water film on the runway represents the risk of aquaplaning, GRF requires its reporting the whole-year round, not only for snow-related water. IMS ARWIS contains a simplified version of RCR/SNOWTAM Editor and also a dedicated screen with aquaplaning alerts (concerning water on the runway and precipitation intensity).

IMS4 Application Software Platform

IMS4 ARWIS benefits from the long-term development of the IMS4 application software:

- Built-in web and application server: an authorized user has access to all data, statistics, and full functionality from

any computer on the LAN/WAN/internet/VPN.

- Configuration wizards: web-based interface to the configuration data stored as XML files or database records. Station/sensor/variable metadata, communication settings, and maintenance activities – all are easily configurable using menus, drop-down lists, or standard text boxes.

- Security: The built-in security mechanisms provide user-configurable tools for limiting user access to particular system modules, stations, or channels according to the permissions related to user names, user roles, or IP addresses of remote users.
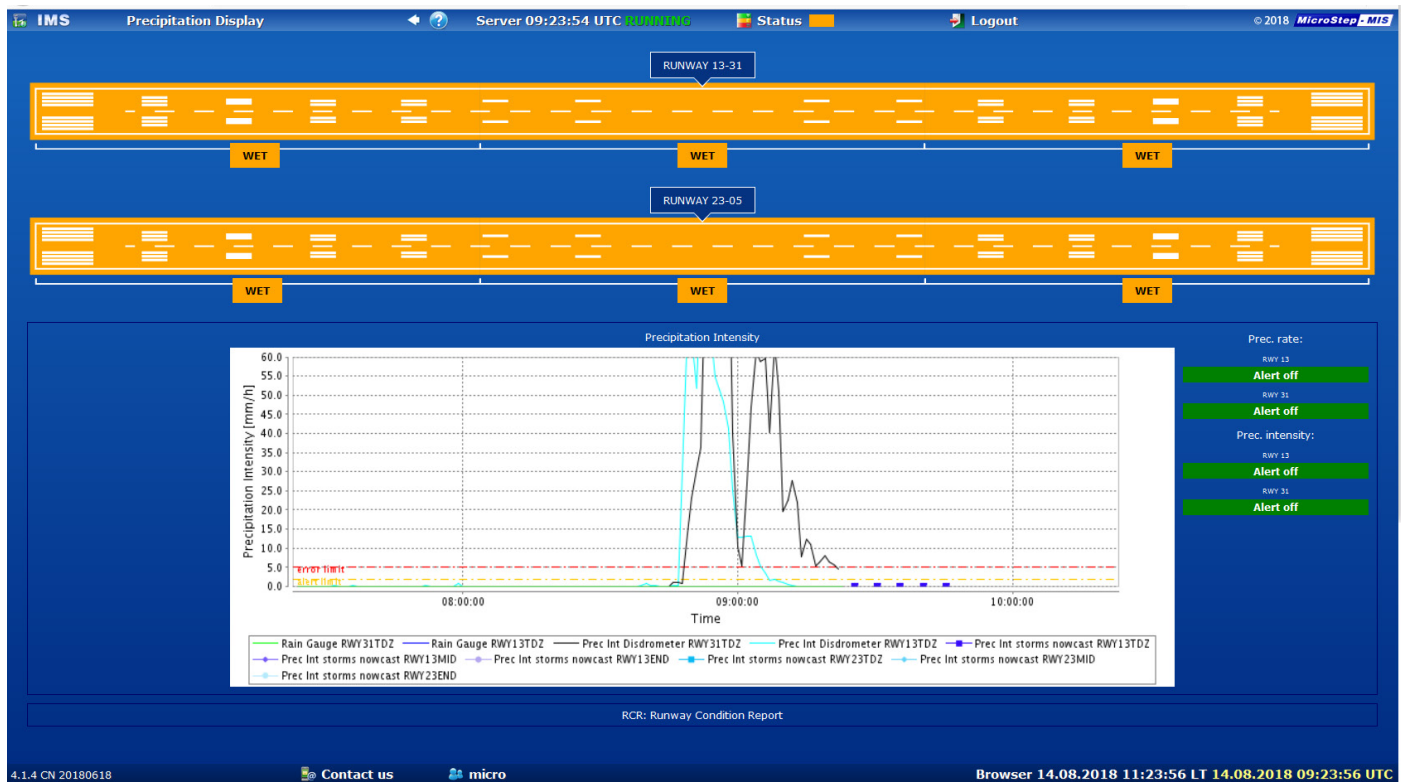
Aquaplaning / precipitation display shortly after the storm

System requirements

- Standard server or a dual hot-failover cluster
- Linux (CentOS, RedHat, etc.) or Microsoft Windows 10/Server 201x operating system
- Mozilla Firefox compatible browser supported

Compliance with standards

- CAA Certified (Type approval, applicable standards)
- ICAO Annex 3 and 10 for Data Processing and Reporting Practices
- ICAO Annex 14 Aerodrome Design and Operations
- ICAO Doc 8896 for Aeronautical Meteorological Practices
- ICAO Doc 9981 Procedures for Air Navigatiom Services - Aerodromes
- ISO 9001: 2015 for quality assurance