IMS4 Remote Observer

Camera Based Remote Human Observer /
Fully Automated AWOS with solutions AeroVIS & AeroCloud

IMS4 Remote Observer significantly enhances the current scope of automated weather observation. AUTOMETAR currently contains some weather elements reported in simplified form or omitted completely. IMS4 Remote Observer also supports human MET Observer in observation of some weather parameters suffering from the observer's subjectivity and thus enhances the quality of weather observation in general. It enables also to compose standard METAR messages remotely (e.g. from a central office or home office).

SESAR verified solution

Prevailing visibility (AeroVIS) & cloud coverage (AeroCloud) observation

Mitigation of current observation drawbacks

Cost-effective solution for small airports

Possibility of centralized observations for multiple airports

Fully automated solution available

Large distances, challenging topography, the need for efficiency of airport operations, and quality requirements - all these factors put pressure on the airport's Automated Weather Observation System (AWOS) performance at small or medium-sized airports. The level of automatization offered by the current state-of-the-art AWOS systems is not sufficient to address the observations of the weather phenomena, cloud coverage, and prevailing visibility (especially in inhomogeneous situations such as patchy fog, fog or dust raised differently in various directions, different cloud cover above ceilometer and in the airport vicinity, etc.).

IMS4 Remote Observer (Camera-Based system with AeroVis/ AeroCloud solution), in combination with the standard AWOS system, enables full remote MET observations. By employing automated recognition and image processing, a

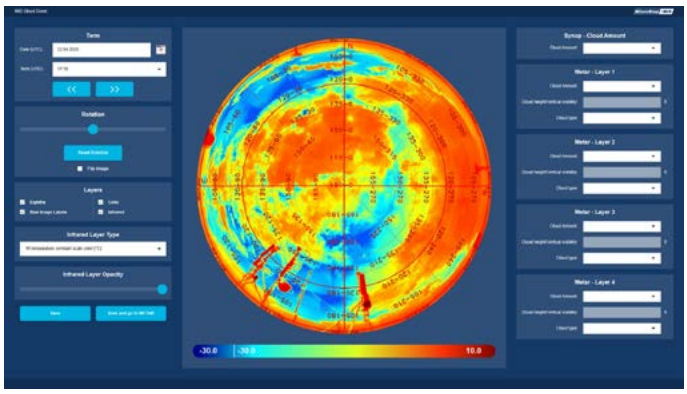
fully automated solution for cloud and/or prevailing visibility observations is also available.

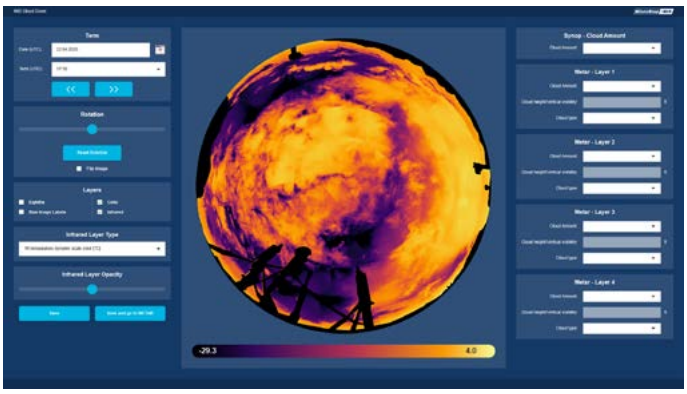
Validated as a solution for the Single European Sky ATM Research PJ.05 project (SESAR), IMS4 Remote Observer also brings the possibility to centralize MET observations at multiple airports/observation points supporting the cost-effectiveness of airport operations.

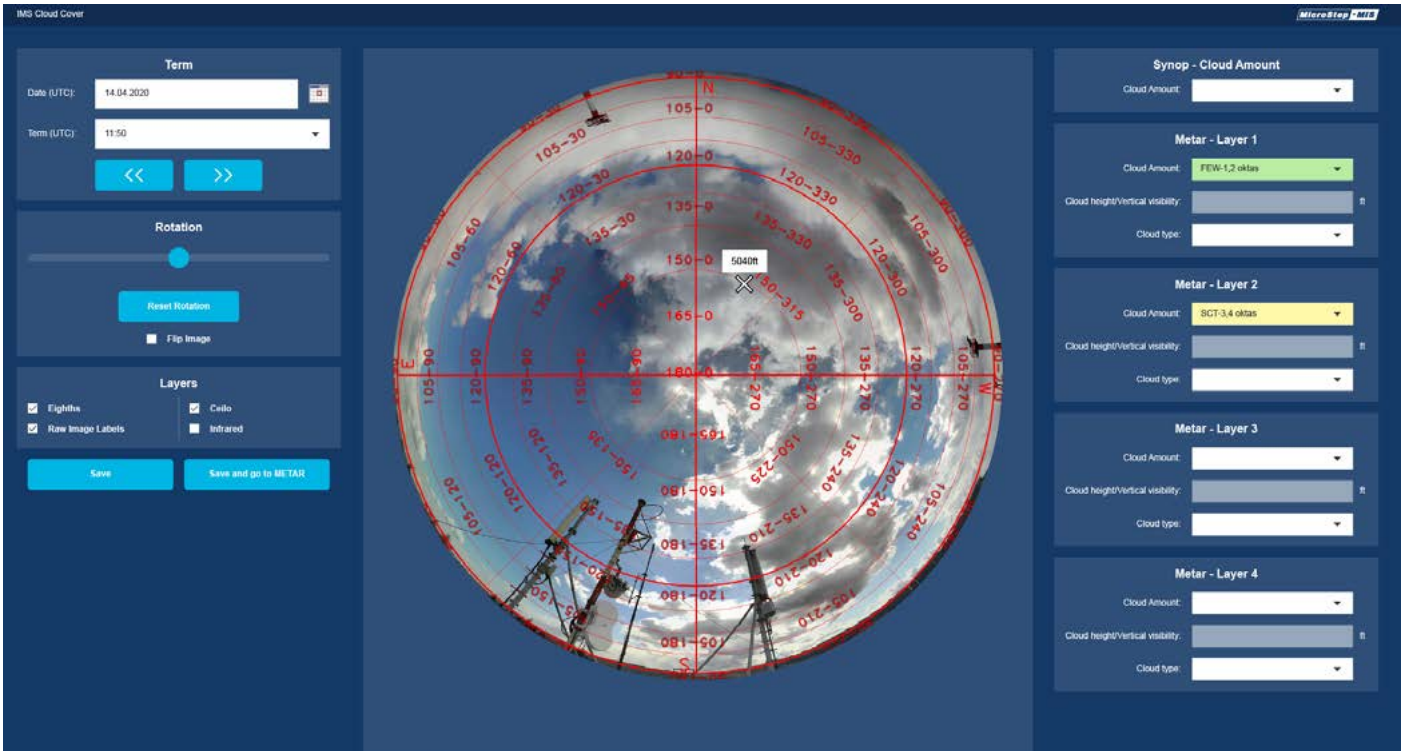
[1] *For advanced weather phenomena detection, see MicroStep-MIS Phenomen 61 multi-sensor kit.*

Remote Human Observer (RHO)

With the help of the visible spectrum as well as infrared cameras, IMS4 AeroVIS / AeroCloud RHO provides easy-to-use HMI for the observation of the cloud coverage (cloud base, cloud layers) as well as tools for prevailing visibility observation as close to the local observer as possible. The remote observer can easily access the current image, history of images, or images of ideal conditions for quick comparison. System setting also eases METAR message generation.



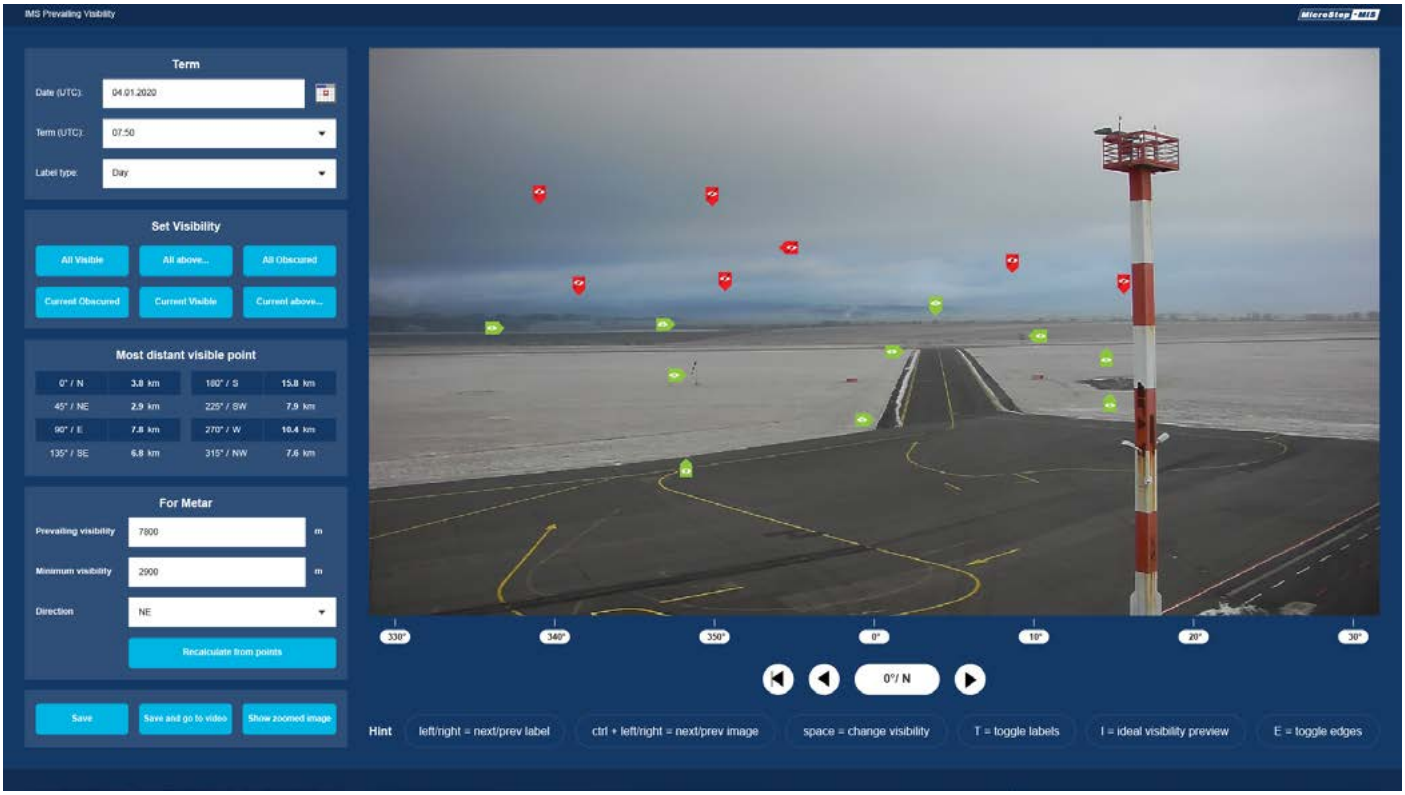




Graphical user interface for remote human cloud observation (AeroCloud RHO)

Full automation

The fully automated prevailing visibility IMS4 AeroVIS calculation mimics the manual observation. During the calibration process, the 360° horizon image is preprocessed and the set of reference points at known distance is identified. During the system operation, the camera captures the horizon image, the IMS4 AeroVIS software identifies the visible reference points and by comparison with the database of the identified reference points assumes the prevailing visibility, including the minimum visibility and direction. The IMS4 AeroCloud system captures and stitches the whole sky image by visible spectra as well as infra-red camera, performs image processing (corrections calculation of sky/grayness index, clustering, segmentation) and automated decision making, with cloud cover already decomposed into aeronautically significant cloud layers (base and coverage) on the output.



Graphical user interface for remote human visibility observation (AeroVIS RHO)

Other advantages

- Possibility to observe cloud coverage, cloud layers and clouds height during night
- Additional information about clouds height from IR camera
- Better view for local observer
- Additional information for local/remote observation
- Possibility of exact weather information storage
- Provision of real cloud coverage compared to one-point measurements provided by ceilometer
- Provision of real prevailing visibility compared to one-point measurements provided by standard visibility meters
- Visibility and cloudiness assessment well justified with records for verification

Enhancement of IMS4 Remote Observer to AUTOMETAR reporting

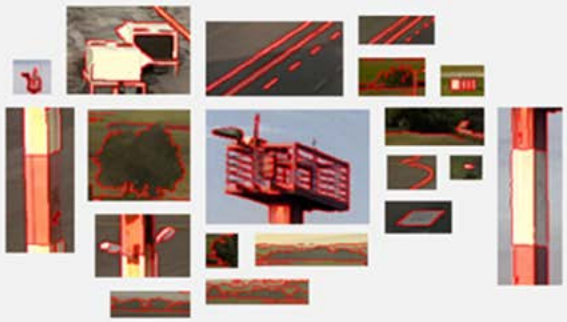
Type	Available by AWOS	Available in Solution	Improvements to AUTOMETAR[2]
CLOUD AMOUNT	Simplified	RHO[3] / fully automated	Calculated from whole sky not just single point measurement (standard laser ceilometer).
CLOUD TYPE TCU / CB	x	RHO	Reporting Towering cumulus (TCU) and Cumulonimbus (CB) cloud types is omitted in automated MET reports.
PREVAILING VISIBILITY	Simplified	RHO / fully automated	Calculated from visibility points at horizontal 360 deg panorama image around airport not just single-point measurement from visibility sensor based on MOR.
DIRECTIONAL VARIATIONS OF PREVAILING VISIBILITY	x	RHO / fully automated	Directional variation results from examination of horizontal visibility in all directions.
PRECIPITATION TYPES	Yes	RHO	Proposed solution takes into account standard present weather sensor outputs with short videos captured by camera which improves overall observation of seven basic precipitation types and multitude of their combinations.
FOG TYPES	x	RHO	Improved recognition of horizontally inhomogeneous fog types (PRFG, BCFG).
SHOWERS IN VICINTY	x	RHO	Improved possibility to report spatial phenomena like showers in vicinity (VCSH).

[2] *If approved by local ANSP all RHO improvements enhance also METAR report*

[3] *RHO - Remote Human Observer*

Prevailing visibility decision making process by fully automated module

Image of horizon



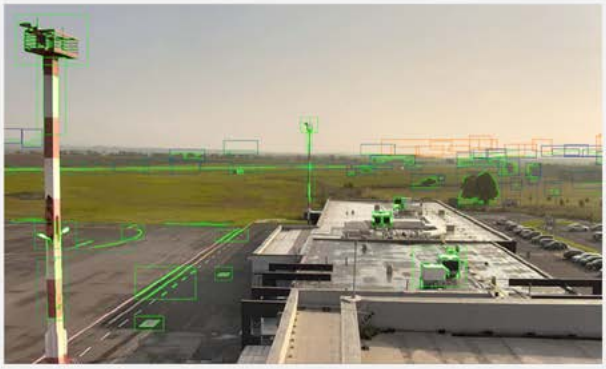
Set of reference points with known distances

RECOGNITION

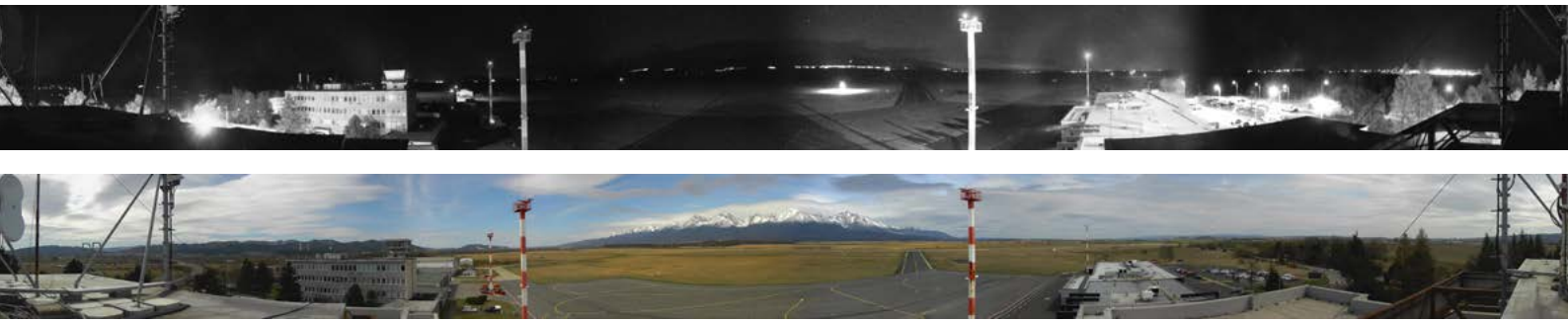
8 000 m

Prevailing visibility value

DECISION

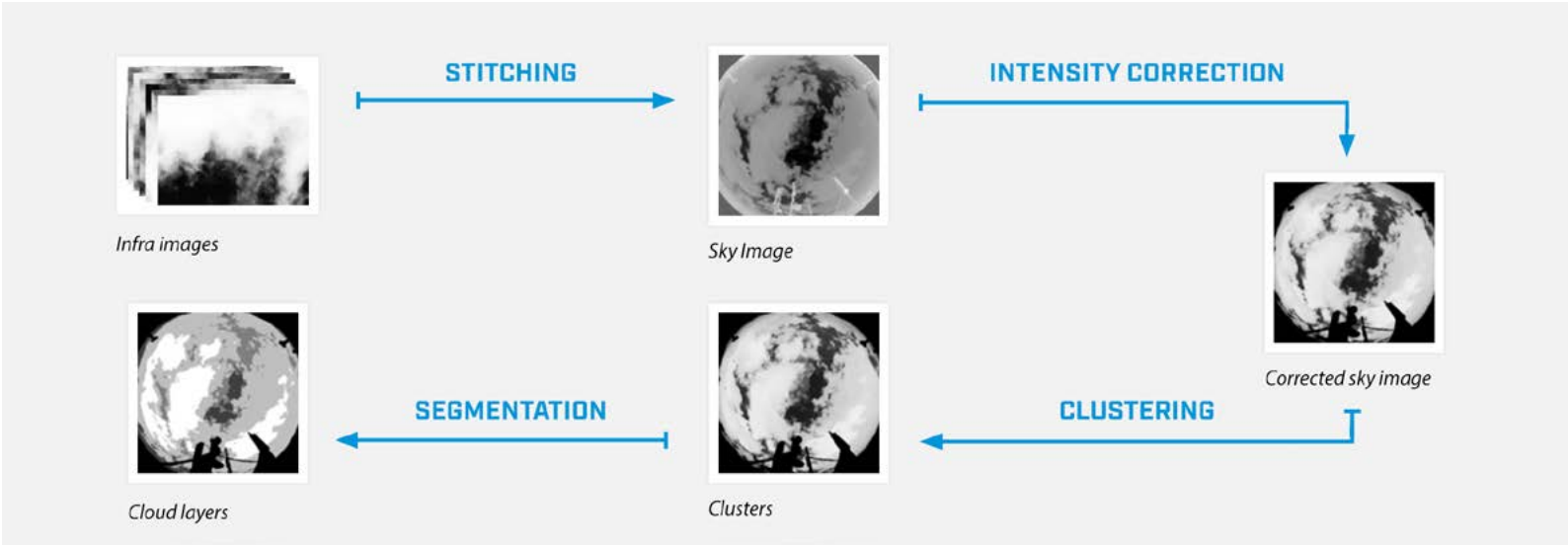


Recognition



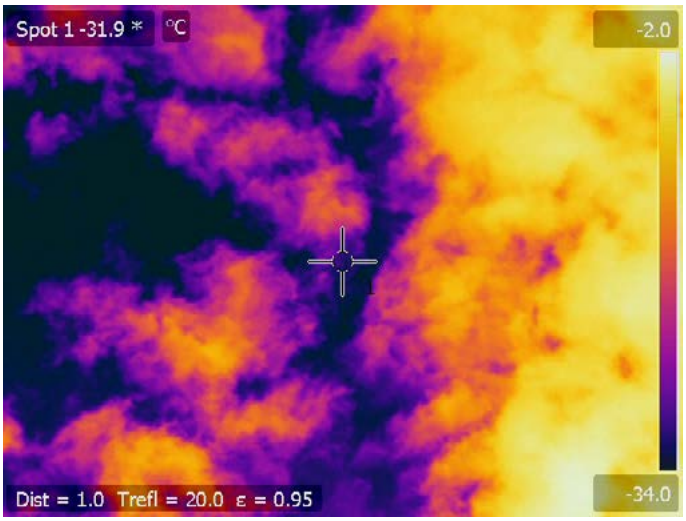
360 Panorama view for prevailing visibility observation

Automated cloud coverage calculation process



Cameras

- Ruggedized cameras for continuous outdoor operation with heating in low temperatures and optional wiper for precipitation conditions
- Pan/tilt functionality 0° - 90° in vertical for full sky view, 0° - 360° full horizontal view
- Color/mono sensor in visible spectrum camera
- Thermal camera with uncooled microbolometer thermal imager working in 7.5 - 13 µm spectral band with thermal sensitivity < 0.05 °C at 30 °C
- Possibility to implement customer-supplied cameras that meet minimal technical specification
- Usage of rotator with housing or multiple fix cameras for visibility observation



Cloud temperature in color scale

Cloud temperature in black and white scale

Examples of visual and infrared cameras with rotation enabled

Operating conditions

IP Protection	IP 66
Operating temperature	–30 °C to +50 °C (with heating)
Storage temperature	–40 °C to +70 °C

Power supply

Voltage	10.5 V to 16 V DC (higher range available on request)
Voltage for heating	24 V DC (other options available on request)

Data volume

AeroVIS raw data	50 MB one run (5 minutes)
AeroVIS processed data	40 MB one run (5 minutes)
AeroCloud raw data	200 MB one run (5 minutes)
AeroCloud processed data	15 MB one run (5 minutes)

Note: Camera parameters depend on camera selection, system setting and are subject of change, due to quick development in camera segment. Please request most actual values. Output frequency stated in data volume can be optimized to customer needs.

Options available

Option	Components	Order code
Prevailing visibility Remote Human Observer	IMS4 AeroVIS/AeroCloud Camera (including rotator, junction box and accessories)	MIS:IMS.Camera.VIS
	IMS4 AeroVIS Prevailing Visibility Remote Observer Software	MIS:IMS.AeroVis.RHO
Cloud base, cloud coverage Remote Human Observer	IMS4 AeroCloud IR Camera	MIS:IMS.Camera.IR
	IMS4 AeroVIS/AeroCloud Camera (including rotator, junction box and accessories)	MIS:IMS.Camera.VIS
	IMS4 AeroCloud Cloud coverage Remote Observer Software	MIS:IMS.AeroCloud.RHO
Fully automated AI solution	IMS4 AeroVIS Prevailing visibility fully automated module	MIS:IMS.AeroVis
	IMS4 AeroCloud Cloud coverage fully automated module	MIS:IMS.AeroCloud