1. Introduction

Safety is fundamental to air traffic management (ATM), ensuring that flights remain clear of each other and of other hazards - such as adverse weather - affecting their safety; also the regularity and efficiency of flights are dependent on the use of weather data for planning purposes, as described later.

Romanian Air Traffic Services, ROMATSA, is responsible for providing air navigation services (ANS) to civil aviation in Romania, including:
- Air Traffic Services,
- Aeronautical Information Services,
- MET (aeronautical meteorological information),
- Communications,
- Search And Rescue (partially).

Therefore, ROMATSA supplies all aeronautical meteorological information to the following users: IFR flights, VFR flights, air traffic services (ATS), aerodrome services, search and rescue services (SAR).

2. MET RADAR DATA AND ATM

Into the ATM context, the general directions for change in accordance with the current ATM strategy are focused on:

- core operational processes of ATM,
- services provided,
- means of applications.

Core processes are dependent on meteorological information (including MET radar data), hence ATM activities will require accurate, sufficient, timely, and high-integrity MET data on the operational environment.

If we take into account the MET context, MET data contributes to the safety, regularity and efficiency of flights.

**NOTE:** Safety (fundamental to ATM): ensures that flights remain clear of each other and of other hazards (including adverse weather). Regularity and efficiency: are subject to unplanned events such as adverse weather, which can change or disrupt any plan.

New evolution trends for MET related to its role in the ATM context include:

- less an end-user oriented support and more a system-oriented support;
- emphasis laid on the decisive role of MET within ATM context instead of its current informative role;
- replacement of the similar or complementary MET products by unique products and finally by dedicated MET services for ATM.

The following ATM domains are influenced by the impact of MET radar data:

- Air-Ground Datalink,
- Flight Data Processing and Distribution (FDP&D)
- Air Traffic Services (ATS).
2.1. Impact of MET radar data on Air-Ground Datalink

Problems of air traffic controllers’s workload associated with long or complicated R/T communications, including MET broadcasts, are eased considerably by air-ground datalink between the ATCO and flight-crew.

Tentative requirements fulfilled by MET radar data:
- information on the occurrence and nowcast of adverse weather phenomena affecting en-route or terminal areas.

2.2. Impact of MET radar data on FDP&D

Air traffic controllers’s workload is reduced with significant improvements for: trajectory prediction, flexible route processing and data distribution;

Tentative requirements fulfilled by MET radar data:
- information on adverse weather for creating MET objects designing prohibited areas (e.g. deep convectiveness), are indispensable in predicting accurate trajectories or determining the ceiling/floor of some airspaces.

2.3. Impact of MET radar data on ATS

ATS is the most important element in ATM due to the safety implications of the services provided.

Most impact of MET radar data is on these two ATS sub-domains:

- ATC Tools, including amongst others:
  - Ground-based safety nets,
  - Medium term conflict detection (MTCD),
  - Monitoring aids.
- ATC-Human factor/Controller HMI

2.3.1. Impact of MET radar data on ground-based safety nets

The role of ground-based safety nets is to alert the controller in due time, of all potential conflicts and provide appropriate information to issue the necessary corrective actions.

Tentative requirements fulfilled by MET radar data:
- On MET side, the most probable conflicts expected to be identified by the safety net are between an aircraft and a weather hazard (especially thunderstorms).

2.3.2. Impact of MET radar data on medium term conflict detection (MTCD)

By the means of a MTCD system, all conflicts between approximately 2 and 20 minutes ahead of the present position of the aircraft, are detected and made available for display or for other functions.

Tentative requirements fulfilled by MET radar data:
- Trajectory prediction and airspace limitation, both involving information derived from MET radar data, are parts of the data inputs for MTCD.

2.3.3. Impact of MET radar data on monitoring aids

The aids monitor the air traffic situation and warn the controller, if any deviation from the trajectory is detected.

Tentative requirements fulfilled by MET satellite data:
- Trajectory processing also includes information derived from MET satellite data.

2.3.4. Impact of MET radar data on ATC-human factor/controller HMI

Suitable formats and content of weather information are available for the ATCOs, either for direct use through a HMI or by using the specific automated support tools (ATC tools). Decision-making is assigned to expert-systems based also on the analysis of meteorological conditions.

Tentative requirements fulfilled by MET radar data:
- now: Areas of severe weather presented either on separate display (Next Information Display System – NIDS),
- in the future: 2D/3D MET objects on the ATC screen, with attributes on safety (safe area or unsafe area), location, extent and trend of movement (speed and direction).

2.4. ROMATSA N(ex) I(nformation) D(isplay) S(system)

ROMATSA NIDS is an in-house developed Windows-type software application. The purpose of the NIDS is to permit the display through a user-friendly HMI, of different types of operational data contained in a single dedicated system.
The users of IDS are the ATCOs from all types of ATS (ACC, APP, TWR); the types of data included in the IDS: MET, APP, FLOW, PROCEDURES, NOTAM, AIS, SAR, etc. The IDS is located in the ATC room and is integrated in the ATC console.

![Traffic control display](image)

Fig. 1 NIDS in ATC console

Through the MET menu the following kind of MET data are available:

- OPMET data,
- MET sensors area from the aerodromes,
- weather satellite data,
- **Doppler MET radar data**,
- upper wind data.

Doppler MET radar data available on NIDS include:

- Basic Reflectivity and Cloud Top Height every 10 minutes;
- Currently: images in a land-mask presentation;
- Dual presentation formats: “Local” and “Mosaic integrated”;
- Customizable overlays including boundaries, airport location, distance circles easily to activate/desactivate;
- Animations back to 3 hours available for both products.

Meteorological hazards such as convective cells, active fronts, thunderstorms can be identified and their time-evolutions estimated.

Direct impact of MET radar data on different phases of flight is assessed, as it may affect:

- the safety for aircrafts in an unsafe (restricted) area due to adverse weather,
- the flow due to congestions and conflicts points determined by restricted areas,
- flight data processing, in order to perform trajectory prediction with sufficient accuracy or to determine the ceiling/floor an airspace.

2.5. Further developments in using MET radar data for ATM

Applying the concepts of the future ATM strategy, ROMATSA intends to further develop the use of the MET radar data. Therefore, in the near future we expect to:

- display MET radar information, directly on the air traffic controller’s screen.
- present information as transparent 2D/3D MET objects highlighting **safe, potentially dangerous** and **unsafe (restricted)** areas. In the construction of the MET objects other types of meteorological data (SAT, NWP wind) will be used.
More in the future by putting together information derived from MET satellite, MET radar, NWP, ATC information, air traffic flow management (ATFM) information, decision-making tools for optimal flight profiles will be made available.

2.6. Conclusions

By integrating MET radar data in ATM the expected benefits are:

- time and fuel savings and reduced operating costs,
- more timely information on the need for diversion of the aircraft around adverse weather,
- improvements on time-based separation for the final approach,
- optimisation of air-side capacity during adverse weather.