Monitor of European System Safety for Aviation (MESSA)

The MESSA Vision

Imagine that every aviation company, Airbus, Eurocontrol and European Aviation Safety Agency have several absolutely identical screens, say 4x6 meters. These screens (Fig 1) show the continuously updated movements of *all existing aircraft showing their identity and direction* overlaid on a map of Europe, probably even with 3D image of its surface.

Each aircraft is coloured to show its current safety condition, for instance: "green" means that everything is normal and OK. When there is a known threat to safety to any aircraft the picture Immediately changes in real time of flight to reflect the current 'safety health' status. This overview would be of enormous benefit to safety management bodies and companies as well as aviation manufacturers, flight operators and passengers so they can be aware of what is happening and where *in real time of flight*. Each type of user then derives the information that is relevant to their primary business.

Also imagine that flight details and conditions are available and visible to all screen owners and viewers. The flight data, and safety information derived from it now goes straight to those *who can and must react*. All the relevant safety information is available for immediate analysis from the MESSA system.

Recently a new European global communication GPSS system has become available and this could provide the communications needed from the aircraft safety monitors to the MESSA system. Main required functions of the new GPSS are:

- Precise detection of aircraft and secure distribution of their positions
- Flight data transmission from each aircraft to update information around Europe for screens holders for further specialized processing. Thus full flight information and a preliminary scenario goes for example to Eurocontrol as the primary destination and would be available for accident or incident investigations.
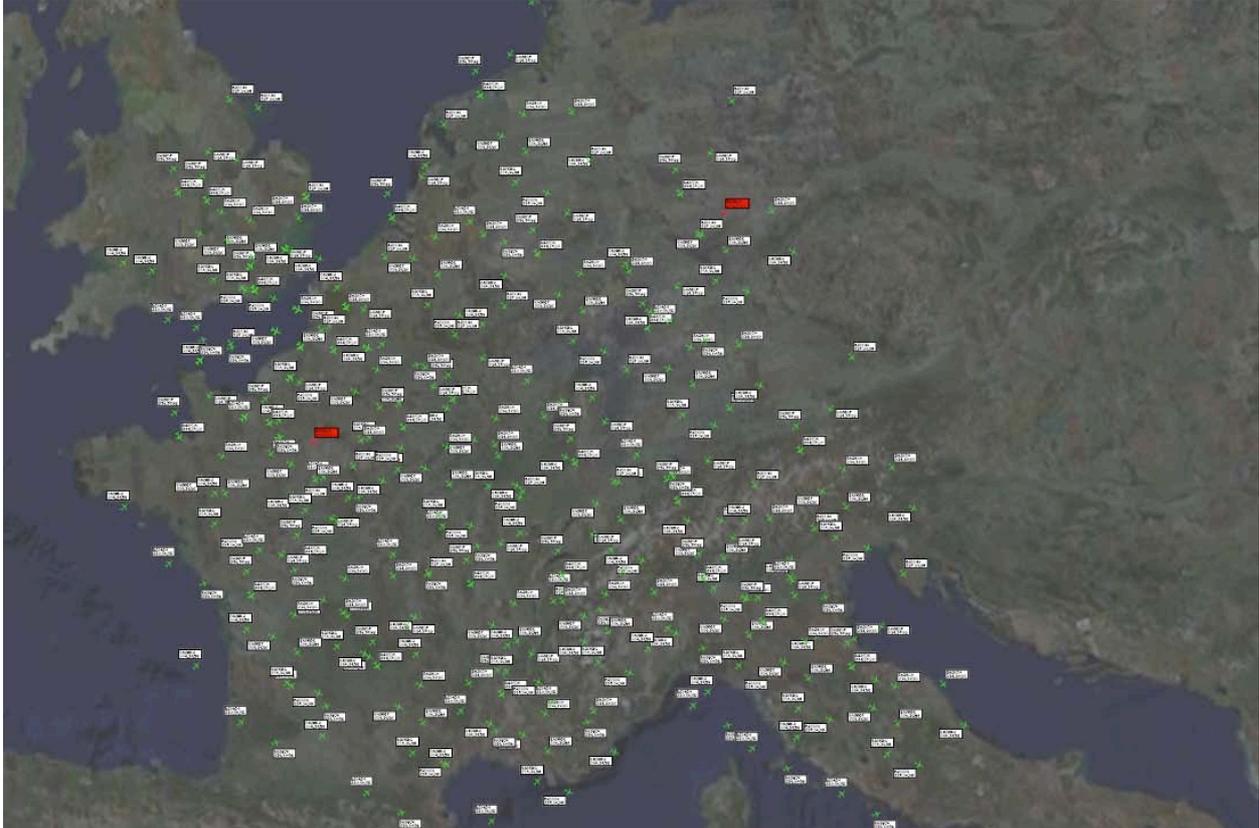
Fig 1 MESSA in action

Safety Information for different Users

In order to produce the safety display on the screen the flight information from every aircraft must be processed in terms of safety in real time of flight and a snapshot distributed on a regular basis, say once per second.

Every customer of the system i.e. Airbus, Eurocontrol, EASA, flight operators and the general public will need their own specific information to match their needs. For example: aspects of safety management/monitoring, Air Traffic Control, behaviour of the aircraft, human factors (pilot/crew behavior and detected errors, slips, misconducts) and also any direct violations of existing regulations in safety and security.

The fact that from the same information flow we are able to derive various consequences and aspects is pretty interesting and challenging. What we are going to do here is to use *information processing principles* for improving the current infrastructure of safety management in Europe. More crucially this will be done in REAL TIME of flight, as soon as information is available and so the decision making process

can occur as quickly as feasible and so **help to save the lives of passengers, crew and people on the ground**. This can be achieved by using *applied computer science* in the service of the safety of European aviation, in this case applied to European Aviation Safety Monitoring.

Additionally this real time flight safety model might be used to analyse the efficiency of decision making in safety monitoring and the effectiveness of the whole European safety system infrastructure including safety regulations. It can make possible the ability to check particular aspects of safety in relation to any regulations, either old or proposed new ones, and detect violations and/or inefficiency.

The same information flow might be used for completely different reasons but this scheme provides the main features:

- Real time safety management /monitoring
- Possibility to use real time information in the safety decision making process
- Analyse in context global and local information about trends in flight for every aircraft and the whole fleet both in flight and over the long term

All the required individual technologies are available in and from Europe. The number of clients who are concerned and can benefit is huge: not just aviation manufacturers or regulators, in fact *the whole population of Europe*.

To implement the project of this kind requires good will, substantial investment and further maintenance, as it is in fact on-going concern business and new market for Europe, but various Eurocontrol and ESA programs including Galileo and new Eurocontrol safety strategic program might benefit by making safety and safety efforts visible for every citizen.

How can MESSA be achieved?

There are three main approaches needed for the realisation of MESSA:

1) *Theoretically* by continued research and development of on-board active processing (and if possible avoidance of harm) already being prototyped in the ONBASS project, www.onbass.org , that is currently in progress; potential partners here are: SAP, EADS/Airbus. This involves:

    a) Developing a new real time interface safety bus for connection of and communication with the devices on the aircraft, efficient for both for current aircraft and future ones. Here the roles of Airbus and all relevant and affiliated companies such avionic manufacturers, EASA, Eurocontrol, European Space Agency are crucial;
    b) Designing and developing a new communication channel for information exchange using on-ground and satellite communication channels for secure aviation use(European Space Agency);
    c) Design, develop and installation of reliable dual technology screens for real time monitoring of safety conditions;
    d) Designing intuitive representations and data filters that extract relevant information from flight data and distribute it to ATC (Eurocontrol), European Aviation Safety Agency, flight operators and aircraft users;
    e) Designing algorithms for flight data processing that will produce results in real time of flight (ONBASS) and be transparent for on-ground and on-board application and ability to upgrade/ expand, let us call it scalability and dynamic binding. (Airbus, ONBASS, EASA, Eurocontrol, SAP, ITACS)

2) Also, *technologically* this data flow must be achieved and processed using existing communication channels, but above all there must efficient distribution of this new information must be possible for its users.

3) Finally, the *managerial* and *regulatory* aspects need to be analysed to investigate how a proposed system safety level for European aviation can be delivered and administered. Simulation might be used to envisage the effect of such legislation on the overall safety of flight in Europe, and hence the effectiveness of MESSA and benefits to the EC. Then analysis of decision making efficiency could be justified rigorously.

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