MAEVA

A Master ATM European VAlidation Plan

D 2.3 Scenario Definition for Validation Exercises

Document Change Log

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1. Introduction

1.1. Purpose

This document presents guidelines for the development of scenarios to be used in the conduct of validation exercises of developed ATM Concepts in support to the European Commission's (EC) Fifth Framework Work Programme (5th FP). Use of these guidelines aims at ensuring overall consistency in the scenarios used by the projects involved – thus ensuring quality and assisting in any comparative analysis.

This document represents deliverable D2.3 of Work Package 2.3 of the MAEVA project.

1.2. Background

The work programmes within the ATM related elements of DG TREN's 5th FP are primarily concerned with the continued development and validation of the TORCH concept. Such validation will be conducted through the employment of well-established Validation Techniques within an overall Validation Lifecycle using a defined Validation Methodology; the methodology is based on a five-step validation exercise framework. It is expected that the majority of this work will be conducted using either fast-time or real-time validation techniques on an accepted Validation Platform. The methodology and advice on its application has been consolidated in the Validation Guideline Handbook (VGH) [1] and made available to all ATM related DG TREN 5th FP projects through Dissemination Forum and a dedicated web-site [3].

When conducting a simulation – be it fast-time or real-time – a variety of inputs are required, both to define the initial conditions under which the simulation will start and to control the simulation as it progresses. When combined, these inputs define those elements of the scenario that are under the control of the validation team.

Such a loose definition of scenario would be unworkable, and the wide variety of inputs assumed to be "standard" inputs available to all those conducting 5th FP validation exercises, is likely to lead to incomparable results – thus violating a primary aim of DG TREN's 5th FP. It is therefore desirable to produce a set of guidelines for the development of the scenarios to be used within DG TREN's 5th FP. These will also be applicable for other ATM validation related projects.

1.3. Context within MAEVA project

Within the 5th FP, the European Commission's Accompanying Measure "A Master ATM European Validation Plan (MAEVA)", will provide the EC with an overall validation strategy for projects centred on the future European Air Traffic Management Programme. MAEVA will also provide the decision-making support in managing all 5th FP validation projects of the European Commission in co-ordination with EUROCONTROL and member states within an overall European validation initiative.

One of the objectives of MAEVA, is to identify clearly the basic steps that have to be undertaken to perform a successful validation exercise, in particular in the context of the 5th FP. The validation framework within MAEVA is developed to obtain a common understanding on ATM validation. The original exercise framework developed in WP1 has been 'fleshed out' through the activities in WP2 by provision of advice on the methods that can be used and in the definition of the scenario for the exercises.

WP 2.3 aims at providing a common reference to support the common understanding of the ATM scenarios for validation exercises to challenge their appropriateness against predetermined objectives. The scope of a scenario is therefore defined in detail to ensure a common understanding of terminology. This is then developed into practical guidance for the definition of scenarios for validation exercises. This is presented as a set of basic steps for developing ATM scenarios for the validation exercises envisaged.

WP2.3 uses WP1 deliverables as inputs. It has been assumed that the reader is familiar with the VGH, therefore frequent reference will be made to this document in preference to repeating significant elements of this document herein. It must also be remembered that this deliverable will be combined with in the VGH [1] prior to external publication, thus making multiple explanations documents nugatory.

1.4. Document Structure

The structure of this document is as follows:

- Chapter 1 is the Introduction.
- Chapter 2 describes the general guidelines that must drive "scenario definition", its contents and the approach enabling the identification of inconsistencies between performance targets, proposed improvements (ATM Concepts) and related validation.
- Chapter 3 describes the "scenario definition method"; a top-down approach to the identification and representation of the elements constituting ATM scenarios for validation exercises subject to validation processes.
- Chapter 4 presents a summary of the approach.

1.5. Glossary, Abbreviations and Acronyms

Term:	*Description:*
ATM	Air Traffic Management
DG TREN	Directorate General Transport and Environment
ECAC	European Civil Aviation Conference
Enabler	Technological, operational, socio-economic or human factors which support the introduction of operational improvements
FP	Framework Programme
OCD	Operational Concept Document

Term:	*Description:*
OI	Operational Improvement
Performance Target	Within a specific performance area, the benefit which is sought through the implementation of an operational improvement.
Scenario	A scenario is the ATM environment and operational circumstances within which an ATM concept is employed

Term:	*Description:*
SS	Scenario Specification Step
STATFOR	Air Traffic Statistics and Forecasts (Eurocontrol)
TMA	Terminal Area
VGH	Validation Guideline Handbook
VMP	Validation Master Plan

1.6. Reference Documents

LIST OF REFERENCE DOCUMENTS	
Reference	**Author / Organisation, Title, Edition and Date**
[1]	Isdefe, Validation Guideline Handbook, V0.3, 03/04/01, MVA\ISD\WP1\13DI__03
[2]	EUROCONTROL, Operational Concept Document, Edition 1.1, 4 Jan 99, FCO.ET1.ST07.DEL01
[3]	Isdefe, MAEVA Web site, www.maeva.isdefe.es

2. SCENARIO DEFINITION

2.1. Introduction

The aim of this chapter is to develop a general definition of "scenario" and to discuss the individual elements of which a scenario is constructed.

2.2. Scenario Definition

Like validation, the word “scenario” can mean many things to many people. Within the MAEVA context, and in line with the Framework for Validation Exercises developed in WP1 and described in the VGH [1], the following definition of scenario has been developed:

A scenario is the ATM environment and operational circumstances within which an ATM concept is employed.

As such, the scenario includes:

- The ATM concept itself;
- The environment within which it is deployed;
- The traffic situation and any specific processes or events that need to be represented to exercise the ATM concept so that the validation exercise meets the Validation Aims and Objectives [1];

This is shown in Figure 2-1.

These individual elements are discussed in the sections that follow.

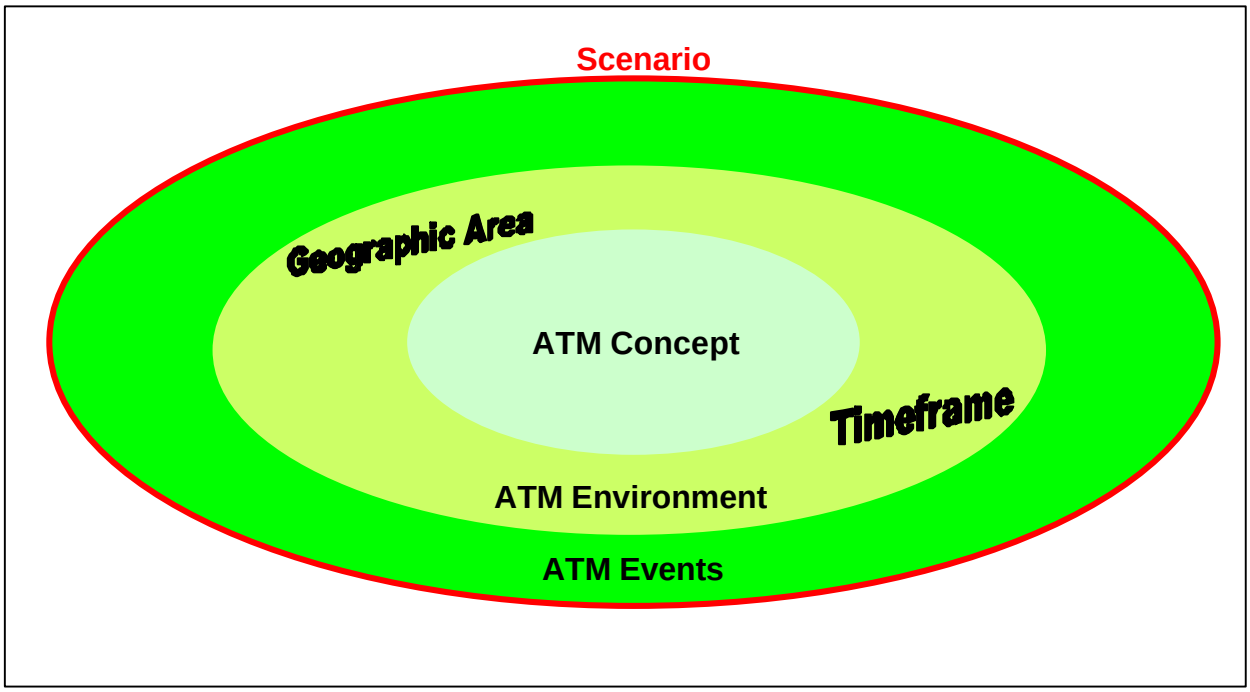

Figure 2-1 Scenario Elements

2.3. Relationship of Scenario within Exercise Framework

Before considering each element of the scenario in detail, it is important to consider the requirements of the scenario and how the scenario relates to other elements of the validation exercise framework.

The objective of the scenario is to represent the ATM Concept in an operational context that is sufficiently detailed to establish whether it delivers the required benefits to solve the ATM Problem it is addressing (i.e. does it meet the perceived need). The ‘need’ should be captured within performance targets for the claimed operational improvements (labelled OI in the figure below) and thus be related to the validation aims and objectives developed in Activities 1.3 and 1.4 of Step 1 of the VGH. The ATM Concept must necessarily address the Invariant Processes that are pertinent to the ATM Problem and the Enablers (technological, operational, socio-economic or human factors), which will support the operational improvements it is meant to produce. Figure 2-2 attempts to present the relationship between these aspects. These aspects should be considered at various points in the process of scenario

development and every effort made to ensure that the variable elements of the scenario critically and objectively exercise the ATM concept, and are not merely configured to show it off to advantage.
A scenario, or set of scenarios, should be developed for each validation exercise. The scenario(s) used in an individual exercise may not fully address all of the performance aspects that should be investigated in the complete validation lifecycle for an ATM concept. The process described in here only covers the steps required for the development of scenario(s) for individual exercises.

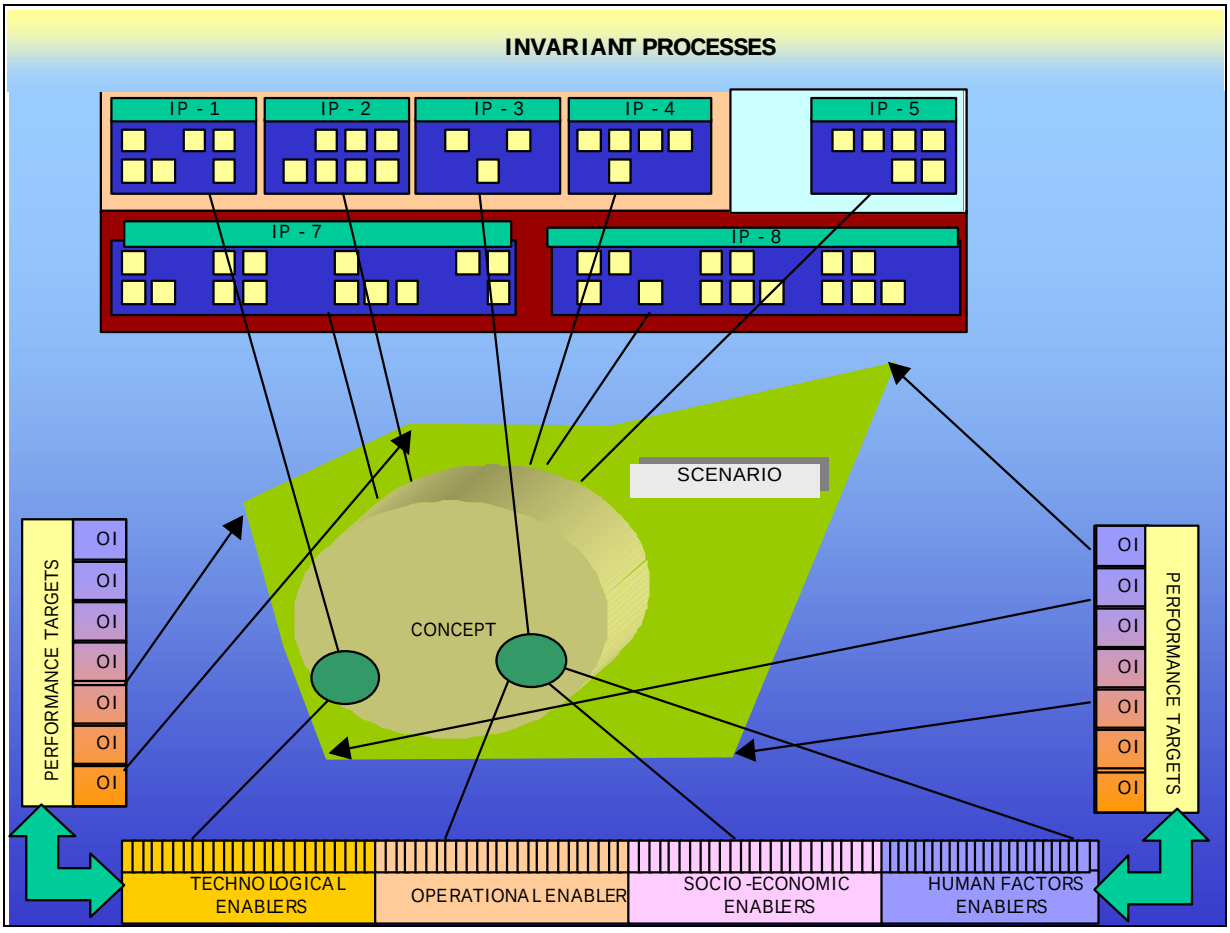

Figure 2-2 Relationship of Concept within Scenario

2.4. ATM Concept

Developing an understanding of the ATM problem and Operational Concept is the first stage in Step 1 of the VGH [1]. It has been assumed that this task will be completed prior to the development of the scenario and is covered by Activity 1.1 in the VGH [1]; therefore, the definition of the ATM Concept developed in that step needs to be available to those responsible for developing the scenario. The ATM concept may be a revolutionary approach to ATM (in whole or in part) or limited to changes to the current operational concept.

The most important element of the ATM Concept that must be considered when defining the scenario is that of the required performance level. The ATM Concept will have been developed to address a specific ATM Problem, which will have been defined in terms of a disparity between predicted performance and predicted demand. This performance shortfall will be in one of the ATM 2000+ Strategic Objectives (safety, economics, capacity, environment, national security and defence requirements, uniformity, quality, human involvement and commitment – see [1]). A typical statement of such a problem may be *"the increase in traffic demand over the next 10 years is predicted to be 6% per annum; however, the increase in capacity through resectorisation is expected to be 3% per annum – an expected year-on-year deficit of 3%"*. This performance shortfall that the ATM Concept has been developed to address will thus influence the selection of the ATM Environment (see Section 2.5).

2.5. ATM Environment

The ATM Environment, in terms of the simulation being conducted, is the depiction of the real world within which the

ATM Concept is to be validated. It may be thought of as addressing two simple questions:

- When? – i.e. the time-frame of interest;
- Where? – i.e. the geographical area of interest.

The time-frame and geographical area of interest will be discussed in Sections 3.5.2 and 3.5.3.

2.6. ATM Events

The scenario must represent the traffic situation. This will cover the range of normal operational conditions, but dependent upon the Validation Aims and Objectives, it may be necessary to introduce specific events or contingencies into the scenario. Such events would need to be 'scripted' into the validation exercise. These events will be discussed in Section 3.5.4.

3. SCENARIO DEVELOPMENT

3.1. Introduction

The establishment of guidelines to be followed when developing a scenario to be used in any of the 5th FP being monitored by MAEVA, is to assure due consideration of all the necessary aspects in the analysis of ATM scenarios within validation exercises so as to verify their:

- *Correctness*: does the proposed scenario description address the stated level of requirements and objectives of the exercise?
- *Completeness*: does the proposed scenario content cover all necessary areas to the required level of detail?
- *Consistency*: are the contents of the proposed scenario coherently related?
- *Traceability*: do the proposed scenario areas identify the correlation between the solutions and problems they're addressing?
- *Usability*: is the defined scenario fit to be employed within a given validation process and purpose?

The Scenario Development Methodology developed herein is designed to encompass all the above questions.

3.2. Pre-requisites

Scenario specification and development is an integral element of Step 2 (Validation Design) of the Validation Framework [1], therefore it must be assumed that Step 1 (Identification of Validation Aims, Objectives and Hypotheses) has been previously conducted. Those conducting the scenario development will, therefore, have a good understanding of the ATM Problem that the ATM Concept is addressing as well as a good insight into the concept itself. The Validation Aims and Objectives will have been developed [1], the platform to be used for the validation exercise will have been selected in accordance with the platform requirement specification and the experimental design should be well developed.

3.3. Step Process

The following steps have been defined to assist the definition of the scenarios to be used within 5th FP validation projects monitored by MAEVA. The steps will be conducted within the "Scenario Specification (2.3)" activity of the Step 2 process [1]. These steps are:

- Activity SS1: Collate and Review inputs to Scenario Definition;
- Activity SS2: Develop Baseline and Advanced Operational Concept Scenarios;
- Activity SS3: Develop Traffic Samples;
- Activity SS4: List Scenario Assumptions;
- Activity SS5: Review Scenario Definition;
- Activity SS6 Get Approval for Use of Scenario.

These activities are discussed in Sections 3.4 to 3.8 below.

3.4. SS1 Collate and Review Inputs to Scenario Definition

3.4.1. Restate the Validation Aims

It is always important before starting any task to remind a team of the requirements it should be addressing. For the validation exercise, this was clarified in the validation aims that were mapped to quantifiable high level objectives. This process of clarifying the aims and developing the objectives must necessarily have captured the intended Operational Improvements and any Performance Targets that the ATM Concept being validated should achieve. The scenario definition document should restate the validation aims and high level objectives.

3.4.2. Consider Experimental Design Specification and Metrics

The experimental design specification produced through Steps 1 and 2 [1] also provides information needed for defining the scenario. First and foremost it will indicate whether the baseline operational concept needs to be explicitly represented in the validation exercise.

The selection of metrics in Step 1 also needs to be reviewed and considered when developing the scenario to ensure that the measurements of the metrics will be sensitive to changes in the input parameters to the scenario.

The statistical significance requirements, the experimental design and the statistical tests to be applied will affect the number of independent measurements required. This will determine the number of traffic samples required.

3.4.3. Review the Platform Requirements Document

The level of detail and flexibility that can be captured in the scenario will be determined by the platform to be used. For example, a real time platform will be able to represent a scenario in more detail than is possible with a fast time platform. The analysis undertaken when developing the platform requirements can be re-used when developing the scenario definition and will have given initial ideas on the likely characteristics of the scenario.

3.5. SS2 Develop Baseline and Advanced ATM Concept Scenarios

The detailed analysis of the ATM Concept in Step 1 and the Platform Requirement Specification should be to hand when performing this activity. As shown in Figure 2-1, the scenario comprises three main elements:

- ATM Concept, this will be different for the Baseline and advanced concepts,
- ATM Environment comprising geographical scope and Timeframe (the same for both concepts);
- Events (the same for both concepts).

Each of these elements needs to be considered in turn and this is described in the following sub-activities.

3.5.1. ATM Concept

Where the experimental design specifies a baseline, two concepts will need to be considered in this sub-activity, the Advanced ATM concept being assessed and the baseline ATM concept against which it is being compared. It is important that there is agreement on the baseline ATM concept. The baseline concept may be represented by current day operations or it may represent an intermediate step towards the advanced ATM concept.

The concept is the fundamental element of the scenario and it needs to be adequately represented and exercised in the validation exercise. Where a baseline concept is required for the experimental design, this needs to be defined to the same level as the advanced ATM concept.

In Step 1 the ATM problem and concept were analysed to establish the Invariant Processes that needed to be represented. This needs to be repeated for the baseline concept. The exercise is illustrated in Figure 3-1 below.

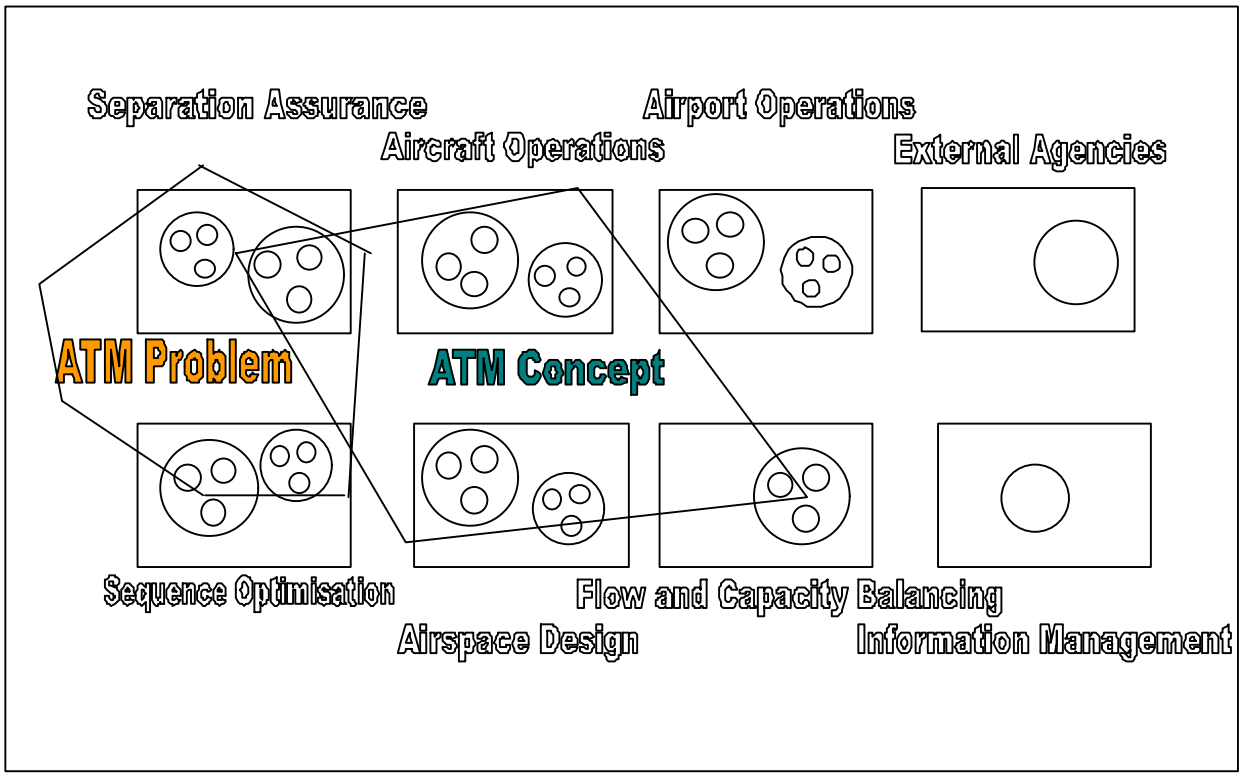

Figure 3-1 Mapping of ATM Concept on to Invariant Processes

At this point all the constituent elements (components & sub-components) of the Invariant Processes involved must be identified and the nature of their "change" from the baseline concept to the future concept must be made explicit. These "changes" are the operational improvements of the advanced ATM concept that must be demonstrated when the scenario is run.

Likewise, the enablers of the operational improvements of the advanced ATM concept (technologies, human factors, procedures, etc that it is thought will enable an operational improvement to be achieved) should be clearly identified and their known characteristics and sensitivities recognised. This understanding should then be used to ensure that the scenario is devised in such that the enablers are exercised thoroughly.

3.5.2. Geographic Area

The term "Geographic Area" covers a number of distinct elements:

- The actual physical size and location – i.e. a plan view of the area within Europe to be covered;
- The aircraft routes to be used – i.e. where the aircraft are coming from and going to;
- The terrain – i.e. the 3D aspect of the geography;
- The weather (or meteo).

These elements are discussed below.

3.5.2.1. Physical Location

The possibilities for a choice of physical location for a European based ATM validation exercise are wide and varied. The following possible location categories have been identified:

- ECAC area;
- European Union (including Norway and Switzerland);
- Group of states;
- Single state;
- Group of ATC facilities (including cross border; e.g. LECM + LFRR);
- Single ATC facility;
- Unit of an ATC facility (e.g. Madrid Approach: TMA Airspace);
- Selected Origin / Destination routes: specific traffic flows to/from specific areas;
- Group of sectors (including cross border);
- Single sector;
- Group of Airports;
- Single airport.

It is essential to choose a category from the above list that relates to the ATM problem and concepts under validation. Within Step 1, Activity 1.5, Establishing Validation Platform Requirements, described in the VGH [1], addresses this. This methodology involves mapping the ATM problem and ATM concept on to the Invariant Processes[1] [2] – as shown in Figure 3-1 above, taken from [1].

Execution of this mapping will also assist in defining which of the above categories of Geographical Area will satisfy the components and sub-components of the mapped invariant processes. However, as with the platform requirement methodology described in [1], the requirements of the Validation Context – as described by the Validation Aims and Objectives – must also be considered. For example, if the Validation Aim is to examine that element of controller workload associated with transferring aircraft from one sector to another, then – logically – at least two sectors must be involved in the validation exercise. It is during the mapping exercise that the requirements of the enablers within the Operational Concept must be considered.

Once the location category has been chosen from the above list, then an actual geographical area within Europe must be selected. This has, historically, been dictated by two criteria within past European Validation Exercises:

- The nationality of the organisation conducting the exercise;
- The desire to address the problems within high density traffic areas or most challenging, performance wise, circumstances (Core Europe and elsewhere).

The scenario locations selected should include the locations where it is anticipated the operational concept will be deployed.

3.5.2.2. Routes

The establishment of the aircraft routes within the Geographical Area selected will depend on two main criteria:

- The origin and destination pairs that impinge on the selected area;
- The operational concept under investigation;
- Forecast traffic development trends.

The selection of aircraft routes is generally part of the development of the traffic samples, and will be further discussed in Section 3.6.3.

3.5.2.3. Terrain

Whether the terrain of the selected Geographical Area needs to be incorporated in the Validation Exercise is highly dependent upon the aims of that exercise. For the majority of work to be conducted in the 5th FP, it is unlikely that terrain considerations will be important; however, for airport related studies this may not be the case. The design of approach and departure routes will be highly affected by the local terrain, not only in terms of CFIT considerations, but also with respect to environmental considerations for the local urban conurbations.

3.5.2.4. Weather

If weather is a factor in the validation exercise, this will undoubtedly be affected by the chosen Geographical Area;

[1] Aircraft Operations; Airspace Organisation and Management; Flow and Capacity Management; Sequence Optimisation and Management; Separation Assurance; Airport Operations; Information Management; External Agencies Operations

however, it must be noted that there are two types of weather – typical and unusual. "Typical" is the day to day weather pattern for the selected region (daily temperature profiles, prevailing wind, etc); "unusual" are weather events such as thunderstorms. Unusual weather events will be discussed in Section 3.5.4.

3.5.3. Timeframe

When deciding the timeframes, within which the operational concept under investigation will be validated, there are three clear and distinct references that can be made:

1. Baseline Date – i.e. the date against which the future performance of the operational concept will be compared;

2. In Service Date – i.e. the date on which the operation concept may be expected to start operation within the European ATM system;

3. Evaluation Dates – i.e. dates in the future on which the performance of the operational concept will be evaluated against a known target – e.g. demand on that date.

These three reference dates are discussed below. The term "date" will only be used within this section as referring to a year – e.g. 2000, 2010, etc; it will not be used to identify a specific day within a year, this will be discussed in Section 3.6.1.

3.5.3.1. Baseline Date

The baseline date is the date against which the percentage performance gains are measured. This should have been taken into account during the development of the validation aims and objectives based on the performance targets to be achieved. It may be necessary in a validation exercise to assess the ATM concept or baseline concept at that date.

3.5.3.2. In Service Date

The expected in service date of the operational concept should be known to all involved in the project. It may not necessarily be used as an evaluation date for the validation exercise, but it should be taken account because, the in service date is the represents the earliest date that benefits from the ATM concept can accrue. The timeframes selected should therefore be after that date.

If it is feasible for the ATM Concept to be brought into service at an earlier date, it may be beneficial to assess it at this date to establish whether there are benefits to be gained from speeding up the development and implementation programmes.

If information relating to the immediate benefit of the operational concept upon its entry into service is required, the in-service date will need to be one of the timeframes selected.

3.5.3.3. Evaluation Dates

Evaluation dates are chosen to assess the capability of the system against different demand levels – e.g. "*how will the system cope at 2005, 2010 and 2015 demand levels*?". These evaluation dates should encompass the performance targets identified in Activity SS1. They should necessarily also test the system well into its operational life – it is, generally, not worth introducing a new operational system that will not continue to deliver improvements for the next five to 10 years. However, it is recognised that predicting the state of European air traffic too far into the future is exceedingly difficult.

On this basis two or more dates should be selected for the validation exercise to represent varying traffic demands within the expected operational life of the ATM Concept.

3.5.4. Events

All proposed advanced ATM concepts should be able to perform effectively in normal operations. It also is important that the performance, when there are unusual events, possibly safety critical, should be considered. Types of events that might be considered here include:

- Ground or Airborne Equipment failures;
- Extreme weather conditions, storms, cross winds, fog;
- Aerial photography and surveying;
- Military missions
- Emergency flights.

Early on in the development lifecycle, the types of contingencies may be considered using judgmental techniques in parallel to the simulation exercises. However, it is important at some stage in the development of the concept that they are considered in as realistic a situation as possible. Of course, where ATM concepts are developed specifically to improve operational performance for specific events, it is essential that these are fully represented in the validation exercise scenarios.

In this activity, a decision needs to be made on whether the scenarios are to include events or represent purely normal operations. If events are to be represented, the types of event should be selected and scripts must then be prepared for the controllers, pilots/pseudo-pilots or simulation so that the events can be triggered correctly.

3.6. SS3 Develop Traffic Samples

All the information needed to generate traffic samples should now be available. The next stage is to develop the samples. This activity will also make use of information from other activities in the MAEVA five-step process. For example, the number of traffic samples needed will have been determined by the experimental design and the length of the traffic sample will have been determined in the platform requirement step. Development of the traffic samples is as follows:

- Base traffic sample (the real life samples used);
- Timeframe;
- Generate traffic sample.

These activities are described in the sections that follow.

3.6.1. Base Traffic Sample

Traffic samples employed in simulator based Validation Exercises (fast-time and real-time) are mainly developed from actual, real-life traffic plans and/or recordings. In these cases, it is vitally important that the selected traffic samples – referred to herein as the base traffic samples – are carefully selected.

Daily traffic is defined by two main criteria – the traffic pattern and the events that occurred on the selected day. In turn, the traffic pattern will be defined by the prevailing weather and the time of year, day of the week and time of the day. These three criteria – events, weather and time – are discussed below.

3.6.1.1. Events

For most validation exercise, it will be necessary that no unusual events are contained within the traffic sample, since they introduce peaks in controller workload that are not representative of normal operations. If such events are an integral element of the validation exercise, they should be introduced separately into the traffic sample in a controlled manner rather than being an integral element of the original sample.

It is therefore recommended that the base traffic sample should not contain any unusual ATC events.

3.6.1.2. Weather

Many aspects of traffic flows within Europe are dependent upon local weather patterns. Those sectors bordering the Atlantic, and their dependent sectors, whether the traffic is following a North-about or a South-about pattern will play an important part in defining the traffic sample. Similarly, airports generally accept traffic from either end of their runways (e.g. Easterlies or Westerlies at Heathrow).

The ATC procedures are highly likely to be affected by these differences in traffic patterns – therefore **it is recommended that traffic in the chosen geographic area is assessed for variations in pattern and that significant differences in traffic pattern are reflected in the selected base traffic samples**.

3.6.1.3. Time

There are three elements of time that should be considered when choosing the basic traffic sample – the time of year, the day of the week, the time of the day. These are discussed below.

3.6.1.3.1. Time of the Year

The time of the year selected for the base traffic sample is dictated by the traffic levels encountered. Historically, the summer period was – within Europe – the time of greatest traffic; however, this summer peak is slowing being eroded as traffic demand increases throughout the year. **It is recommended that the base traffic sample is chosen from a time period when the controllers are working at – or close to – the declared capacity for the sectors within the airspace under consideration**.

3.6.1.3.2. Day of the Week

The traffic pattern and aircraft mix may well be affected by the day of the week. Across Europe, week-day traffic patterns tend to be dictated by the demand of business traffic; however, at the weekends, holiday charter traffic greatly affects the demand pattern. Therefore, **it is recommended that both a weekday and a weekend day be used in the base traffic samples**.

3.6.1.3.3. Time of the Day

As with the day of the week, the time of the day can greatly affect the traffic demand; however, the early morning and late evening peaks traditionally seen at European airports is – like the yearly demand pattern – slowly being eroded. However, the diurnal effect of the traffic pattern must be represented in the base traffic samples if a restricted period (e.g. an hour long sample as may be used in a real-time simulation) is used as opposed to a complete 24 hour sample (as may be used in a fast-time simulation).

3.6.1.4. Characteristics of Base Traffic Samples

A number of base traffic samples should, therefore, be captured that:

- Contain no unusual events that may introduce controller workload unrepresentative of normal operations;
- Incorporate traffic levels representative of operations at or close to the declared capacity of the geographic area under consideration;
- Represent difference in traffic patterns that may be encountered due to diurnal and/or weather effects;
- Represent difference in traffic patterns that may be encountered due to weekday versus weekend effects.

It is recommended that two or three base traffic samples are generated.

When preparing traffic samples for a validation exercise to be conducted on a real-time simulator, it must be remembered that participants should be trained on different traffic samples than those to be used in the measured runs. Thus, an additional set of traffic samples must be generated to cover this.

3.6.2. Traffic Growth

In order to develop traffic samples representative of the timeframes chosen in Activity SS2 above from the base

traffic samples; it is necessary to predict the traffic growth that will occur. Most organisations involved in ATM research have developed their own methodology for growing traffic; however, these tend to be country specific and often contain sensitive information that cannot be released.

It is desirable to have a common assumption over all the projects in the VMP of the expected traffic growth. However, as the growth patterns will vary across Europe according to economic, geographic and capacity constraints, this ideal will be difficult to achieve. All models predicting the traffic growth over a number of years consider the following issues:

- Will the growth on the various origin destination pairs differ?
- What changes will there be to aircraft type and mix?
- What factors affecting growth need to be taken into account (alternative means of transport, economic factors, and demographic factors)?
- Are there any physical limitations to growth that need to be taken into account (airport capacity)?
- Are there any trends in growth?

The answers to the questions above are the assumptions used for the calculation of the growth factors applied to the base traffic samples. These assumptions should be recorded. The application of the growth model will result in the calculation of a set of annual growth figures, an illustrative example is provided in Table 3-1. The overall figures estimated by the growth model to be applied to the traffic samples should also be recorded.

Year	Growth (%)
2001	5
2002	4
2003	6
2004	5

Table 3-1 Example table of growth figures

Where there is no strong reason for using the local growth model, the STATFOR methodology is recommended as it is currently widely used across Europe.

3.6.3. Generate Traffic Samples

The traffic samples will be developed using tools specific to the validation platform being used for the exercise. Operational experts should support the individual or team responsible for developing the traffic samples. Traffic samples generated should take into account any differential growth over the airspace organisation and limitations in forecast runway capacity.

Detailed guidance on traffic sample generation cannot be given here, as it would need to be specific to the tools available for the data preparation and the target validation platform.

3.7. SS4 List Scenario Assumptions

Frequently, it is not possible to represent everything in the scenario to the desired level of fidelity or for the feasible range of values. In these cases the scenario designer has to make assumptions on the fidelity of representation that is deemed adequate and on the 'typical' values to use for these parameters. It greatly supports the integration and consolidation of validation exercise results if these assumptions are documented and available when the results are being analysed.

MAEVA recommends that assumptions are included as part of the validation scenario definition document.

3.8. SS5 Review Scenario Definition

The scenario definition produced by following the activities so far needs to be reviewed to ensure that it meets the requirements identified in SS1. The scenario definition is the set of documentation developed so far and the input files and scripts for use with during the exercise. A visualisation tool for the traffic samples will assist those involved in this activity.

The following issues should be addressed:

- *Correctness*: does the proposed scenario description address the stated level of requirements and objectives of the exercise?
- *Completeness*: does the proposed scenario content cover all necessary areas to the required level of detail?
- *Consistency*: are the contents of the proposed scenario coherently related?
- *Traceability*: do the proposed scenario areas identify the correlation between the solutions and problems they're addressing?
- *Usability*: is the defined scenario fit to be employed within a given validation process and purpose?
- With development team - will it test out the areas of interest in the advanced concept?
- With operational staff - is the scenario operationally reasonable?

3.9. SS6 Obtain approval for use of scenario

Before the scenario and the associated traffic samples are used in the validation exercises or for training, final approval should be given by the customer for the validation exercise. Again a visualisation tool will help in the identification of the characteristics of the main traffic flows. If the scenario development process is going to take significant time and effort, it is clearly important to keep the customer informed of significant decisions and assumptions so that effort is not wasted.

4. SUMMARY AND CONCLUSIONS

This report has developed and presented a step-wise process for the definition of scenarios for ATM validation exercises. The step process follows the process given below:

- Activity SS1: Collate and Review inputs to Scenario Definition.
- Activity SS2: Develop Baseline and Advanced Operational Concept Scenarios.
  - Define ATM Concepts;
  - Define ATM Environment;
  - Geographic Area;
  - Timeframe;
  - Define Events (normal operations or contingencies);
- Activity SS3: Develop Traffic Samples;
  - Select Base traffic samples (the real life traffic samples used);
  - Select Timeframes;
  - Generate traffic sample;
- Activity SS4: List Scenario Assumptions;
- Activity SS5: Review Scenario Definition;
- Activity SS6 Get approval for use of scenario.

Deliverable <D2.3>
Scenario Definition D2.3 for Validation Exercises

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