<ATC-WAKE>

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<D5_3: ATC-Wake Final Technological Implementation Plan>

ATC-Wake Final Technological Implementation Plan

(ATC Wake D5_3)

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ATC-WAKE WP5000

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EUROCONTROL Experimental Centre (EEC)
Thales Air Defence (TAD)
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Acronyms

ACC	Air traffic Control Centre (en route)
AGL	Altitude above Ground Level
AMAN	Arrival Manager
APP	Approach ATC Unit
ARS	Airport Radar System
ATCO	Air Traffic Control Officer
ATIS	Air Traffic Information Service
ATS	Air Traffic System
ATSU	Air Traffic Service Unit
AVOL	Aerodrome Visibility Operational Level
CONOPS	Concept of Operations
CSPR	Closely Spaced Parallel Runways
DEP	Departure
DGPS	Differential Global Positioning System
DMAN	Departure MANAGER
DME	Distance Measuring Equipment
EAT	Expected Approach Time
ESARR	European Safety Regulatory Requirements
ETA	Estimated Time of Arrival
FAP	Final Approach Point
FDPS	Flight Data Processing System
FIR	Flight Information Region
GND	Ground Controller
HALS / DTOP	High Altitude Landing System (HALS) / Dual Threshold Operations (DTOP)
HMI	Human Man Interface
IAF	Initial Approach Fix
IAS	Indicated Air Speed
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
INI	Initial Approach Controller
IP	Integrated Platform
ITM	Intermediate Approach Controller
LDA	Localizer Directional Aid
LVP	Low Visibility Procedure
MAP	Missed Approach Point
MLS	Micro Wave Landing System
MTOW	Maximum Take-Off Weight
NARSIM	NLR Air Traffic Control Research Simulator
NDB	Non-Directional Beacon
NOWVIV	Nowcasting Wake Vortex Impact Variables
NTZ	Non Transgression Zone
P2P	Probabilistic Two-Phase wake vortex decay model
PRM	Precision Radar Monitor
PVFS	Probabilistic Vortex Forecast System
ROT	Runway Occupancy Time
RWY	Runway
SMP	Separation Mode Planner
SMR	Surface Movement Radar
SOIA	Simultaneous Offset Instrument Approaches
SMGCS	Surface Movement Guidance Control System
SPADE	Supporting Platform for Airport Decision making and Efficiency
SRU	Safety Regulation Unit
STAR	Standard Arrival Route
TAAM	Total Airspace Airport Modeller
THR	Runway Threshold

TMA	Terminal Manoeuvring Area
TWR	Tower Controller
UAC	Upper Airspace Centre
VFS	Vortex Forecast System
VHF	Very High Frequency
WAVIR	Wake Vortex Induced Risk Assessment
WP	Work Package
WSWS	Wirbelschleppen-Warnsystem
WV PMS	Wake Vortex Prediction and Monitoring System
WV	Wake Vortex

Executive Summary

The document presents the Final Technological Implementation Plan (TIP) of the ATC-Wake project according to the guidelines from the European Commission. The description of the project is made of the executive summary of the ATC-Wake project, the overview of the main project results, the quantified data on the dissemination and use of the project results, the comment on European interest and the overall project impact. The results of the ATC-Wake project are listed and described in detail. The main results are identified as:

- ATC-Wake Integrated Platform (with the interfaces between already existing subsystems and tools and the new ATC-Wake components; all implemented using SPINEware middleware);
- Connection with an on-board wake detection, warning, and avoidance system for wake vortex and other atmospheric hazards;
- ATC-Wake Separation Mode Planner;
- ATC-Wake Predictors;
- ATC-Wake Monitoring and Alerts;
- ATC-Wake Detectors;
- Probabilistic simulation tool for assessment of wake vortex safety of new ATM operational concepts and procedures for wake vortex avoidance;
- Wake vortex safety assessment results (arrivals and departures);
- Proposed new wake vortex safety regulation;
- Fast-time simulation tool for the assessment of capacity related to new ATM operational concepts and procedures for wake vortex avoidance;
- Capacity assessment results (in relation to the ATC-Wake concept used at a generic airport);
- ATC-Wake Human Machine Interfaces for controllers (and the associated ATC real time simulation software);
- Operational requirements, operational concepts, user requirements, working methods for the air traffic controllers (Tower and Approach controllers and ATC supervisors).

For each of the companies involved in the ATC-Wake project, an exploitation plan is given.

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1 Description of project

DESCRIPTION OF PROJECT

EC programme:	**IST-2001-1.5.2**
Project title:	Integrated Air Traffic Control wake vortex safety and capacity system
Acronym:	**ATC-WAKE**
Programme type:	Research and Technological development project
Contract number:	IST-2001-34729
Project web site (if any):	http://www.nlr.nl/projects/ATC-Wake (restricted site for consortium) http://www.nlr.nl/public/hosted-sites/atc-wake (public web-site)
Start date:	01.07.2002
End date:	31.12.2005
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1.1 Executive Summary

EXECUTIVE SUMMARY

Original research objectives

The current generation of airport systems will be subject to major enhancements in order to handle the increase in air traffic demand and safety requirements. The project ATC-Wake will provide a major step towards the realisation (and subsequent installation) of new and advanced airport systems through the provision of an integrated ATC wake vortex safety and capacity Platform (IP), which will be used:

- To assess the interoperability of the integrated ATC system with existing ATC systems currently used at various European airports;
- To assess the safety and capacity improvements that can be obtained by local installation of the integrated system at various European airports;
- To evaluate the operational usability and acceptability of the integrated system;
- To make a Technology Implementation Plan (TIP) to guide the local installation of an ATC system that facilitates dynamic and weather dependant aircraft separation at European airports.

This integrated platform will support the evaluation of the safety and capacity implications of different operational concepts at selected European airports, with various runway configurations and multiple infrastructure systems. Subsystems concern weather and wake sensors, weather forecasting and nowcasting systems, wake vortex prediction systems, aircraft spacing predictors, and an advanced Human Machine Interface (HMI) for the future end-users of the system: the air traffic controllers.

ATC-Wake will be a first step to induce future new standard procedures for adapting separation minima between aircrafts during landing and departure phases.

Expected deliverables

The main expected exploitable project outputs is the Integrated ATC Wake vortex safety and capacity platform, which contains as further exploitable elements (resulting from the project):

- ATC-Wake Separation Mode Planner
- ATC-Wake Predictors
- ATC-Wake Monitoring and Alerts
- ATC-Wake Detectors
- Air Traffic Controller Human Machine Interfaces (HMIs).

In addition to this exploitable project output, the consortium has proposed new modified wake vortex safety regulation. This will enhance the introduction of new systems and procedures to alleviate the wake vortex problem. Necessary and already existing subsystems (weather and wake sensors, weather forecasting and nowcasting systems, wake vortex prediction systems, wake vortex safety assessment tools and capacity assessment tools) have been upgraded following definition of the ATC-Wake system requirements, operational concept, procedures, user requirements & working methods.

In addition to the ATC-Wake Integrated Platform (software), the following documentation results:

- 35 high quality reviewed deliverables, describing the work and the results obtained in the different Work Packages (including design and specification documentation of all IP subsystems)
- Publishable final Reports for Each of the five Work Packages:
  - WP1: System Requirements
  - WP2: Integrated System Design and Evaluation
  - WP3: Safety and Capacity Analysis
  - WP4: Evaluation of Operational feasibility
  - WP5: Technological Implementation Plan
- A Publishable Final Report of the ATC-Wake project with main conclusions and recommendations.
- Technical notes describing ATC-Wake operational requirements, operational concept, users requirements, and system requirements (this documentation has been used, assessed, and evaluated by US and European Wake Vortex Concepts of Operations (ConOps) development teams.
- Technical notes describing the design and specification of the ATC-Wake Integrated Platform (including new system components (ATC-Wake Separation Mode Planner, Predictors, Monitoring and Alerts, Detector) and the upgraded subsystems that were already available to the partners)
- Technical notes describing the usability and acceptability of the ATC-Wake system by air traffic controllers. This documentation is based on 1) actual experiments with air traffic controllers from four European countries, who have tested ATC-Wake Human Machine Interfaces on the NLR Air Traffic Control Research simulators and 2) questionnaires submitted to the User Group and controllers.

- A User Manual of the ATC-Wake Integrated Platform (available to research and development centres and industrial organisations for further exploitation into a system that can be installed at European airports)
- A technical note describing the risk requirements and capacity aims for the ATC-Wake system
- Technical notes describing the wake vortex safety assessment model used to assess the risk of incidents/accidents during ATC-Wake operations (the documentation has been made available to the Safety Regulation Unit, responsible for the European Safety Regulatory Requirements (ESARR))
- Technical notes describing the safety assessment of ATC-Wake operations on single runway as well as closely spaced parallel runways (both departures and arrival operations have been considered)
- Technical notes describing the validation of the wake vortex safety assessment models and results
- A technical note describing the evaluation of safe separation distances and capacity for a variety of aircraft traffic mixes and different runway operations (both departures and arrival are considered)
- A technical note describing the interoperability with existing ATC systems currently used at airports
- A technical note describing the expected benefits of ATC-Wake in terms of capacity enhancement for a generic airport.

Project's actual outcome

The ATC-Wake platform will enable European ATS providers, airport authorities, and ATM research and development centres to join their efforts (and plan their investments) to adequately adapt their airport systems and enhance the efficient use of airports restricted by the wake vortex problem. In this sense ATC-WAKE is a key enabler of the European ATM strategy for the years 2000+ ; Wake Vortex is included in the Single European Sky ATM Masterplan activities (joint Eurocontrol/EC SESAME project); ATC-Wake is also included in the Eurocontrol Wake Vortex Separations Management Plan. The main project results are:

- ATC-Wake Integrated Platform (with the interfaces between already existing subsystems and tools and the new ATC-Wake components; implemented using SPINEware middleware);
- Connection with an on-board wake detection, warning, and avoidance system for wake vortex and other atmospheric hazards;
- ATC-Wake Separation Mode Planner;
- ATC-Wake Predictors;
- ATC-Wake Monitoring and Alerts;
- ATC-Wake Detectors;
- Probabilistic simulation tool for assessment of wake vortex safety of new ATM operational concepts and procedures for wake vortex avoidance;
- Wake vortex safety assessment results (arrivals and departures);
- Proposed new wake vortex safety regulation;
- Fast-time simulation tool for the assessment of capacity related to new ATM operational concepts and procedures for wake vortex avoidance;
- Capacity assessment results (for a generic airport);
- ATC-Wake Human Machine Interfaces for controllers (and the associated ATC real time simulation software);
- Operational requirements, operational concepts, user requirements, working methods for the air traffic controllers (Tower and Approach controllers and ATC supervisors).

In addition to the above main project results, existing subsystems and tools (weather and wake sensors, weather forecasting and nowcasting systems, wake vortex prediction systems, wake vortex safety assessment tools and capacity assessment tools) have been upgraded following definition of the ATC-Wake system requirements, operational concept, procedures, user requirements & working methods.

Broad dissemination and use intentions for the expected outputs

Final ATC-Wake publishable report and the Final Work Package reports will be placed on the ATC-Wake and WakeNet 2 Europe public web-sites and will be distributed by e-mail to the WakeNet 2 Europe and USA communities. These documents will also be made available to the FAA/Eurocontrol Action Plan 14 "Wake Vortex". Further dissemination of project results has been achieved through presentations at conferences and publications (already publications and presentations resulted fully or partly from the ATC-Wake project and about 12 presentations were given at WakeNet Europe and USA workshops). The ATC-Wake Concept of Operations was presented by the European Wake Vortex Conops development team in parallel with the US team who work on a similar concept WakeVAS.

A user group has been formally involved within ATC-Wake, and has been consulted throughout the project: two ATS providers, the European Association of Aerospace Industries, one aircraft manufacturer, one ATM development center, the cooperative effort between the European and US ATM authorities, and Canadian ATM organizations. Thales ATM as ATM system manufacturer will benefit of the ATC-Wake results in terms of the ATM system evolutions to be planned (Area Control centers, integrated airports, SMGCS…). Its main user group member analysis will be concerned with marketing of the new system, full system mock-up, formal evolution of ATM systems and procedures, contribution to system final specification and industrialization. The outcomes of the study have the following application areas :

Installation and use of an ATC-Wake system for reduced separation at European airports

For airports operating near their maximum throughput limits dynamic (weather dependent) wake vortex separation rules may lead to a substantial decrease in average delay time and large potential economic savings. Potential gains will depend on the traffic mix, the prevailing weather climatology at the particular airport and the available run-way topology. Essential new elements for installation of an operational system with dynamic (weather dependent) separation rules at an airport are the four ATC-Wake components: *Separation Mode Planner, Predictor, Monitoring and Alert, and Detector*, as well as the new ATCo Human Machine Interfaces, which have been tested at the NLR ATC research simulators. Crosswinds and strong headwinds are candidates to be used in dynamic weather dependent Separation Mode Planning. It should be noted that results from S-Wake have also been used to assess appropriate reduced separation distances for a variety of aircraft using the ATC-Wake Concept of Operations.

Possible harmonization and re-definition of the current wake vortex separation rules.

The current arrival separation rules define separation ***distances*** depending on the MTOW of the paired aircraft. At present different countries apply somewhat different rules for the separation minima. ATC-Wake outcomes and tools can be used for assessing the wake vortex safety and capacity implications of new wake vortex operational concepts (such as time based separation and crosswind departures).

Safety assessment of wakes behind a scheduled Very Large Transport Aircraft (VLTA).

The tools developed in Work packages 3 of ATC-Wake can also be used to compare the levels of safety of future Very Large Transport Aircraft (VLTA) with current very heavy aircraft, when operating at an airport with an ATC-Wake system in use (provided the wake characteristics of the VLTA are known, and also made available). The tools developed in WP4 can in principle be used to assess the capacity enhancement when a new VLTA operates at an airport with an ATC-Wake system. For all such safety assessments it is expected that ***local*** weather and wake data will be needed to build the safety case.

Besides direct application of the ATC-Wake results and outputs, **two follow-up European Research and Development projects are foreseen** before actual capacity increase at airports can be realised:

- **CREDOS (or CROWS)**: elaboration & testing of an operational concept for crosswind departures through real-time ATC simulations, wake vortex data collection and analysis, risk assessment, construction of a safety case and human factors case, and a WV safety management system.
- **ATC-Wake2**: installation and testing of an ATC-Wake system at selected airport(s), through shadow-mode field trials and evaluation of the experiences with the new working methods. The EC/IST recommends that this will be done as integrated project (together with I-Wake & TALIS).

Both potential EC projects are part of the Eurocontrol Wake Vortex Separation Management Plan.

1.2 Overview of all main project results

OVERVIEW OF ALL MAIN PROJECT RESULTS			
No.	**Self-descriptive title of the result**	**Category A, B or C***	**Partner(s) owning the result(s) (referring in particular to specific patents, copyrights, etc.) & involved in their further use**
1	ATC-Wake Integrated Platform (with the interfaces between subsystems & tools)	A/B	NLR, DLR, UCL, Eurocontrol, Thales AD, Thales Avionics (all partners)
2	Connection with onboard wake vortex detection, warning & avoidance system	A/B	Thales Avionics
3	ATC-Wake Separation Mode Planner	A/B	NLR, DLR
4	ATC-Wake Predictor	A/B	UCL, DLR, NLR
5	ATC-Wake Monitoring and Alerts	A/B	DLR, Thales AD, NLR
6	ATC-Wake Detector	A/B	DLR, Thales AD
7	Probabilistic simulation tool for the assessment of wake vortex safety	A/B	NLR
8	Wake vortex safety assessment results	A/B	NLR, Eurocontrol, UCL, DLR
9	Proposed wake vortex safety regulation	A	Public (Eurocontrol)
10	Simulation tool for the assessment of capacity	A/B	Eurocontrol, NLR
11	Total airspace and airport capacity simulation results	A	Public (Eurocontrol)
12	ATC-Wake Human Machine Interfaces for Controllers (and ATC real-time simulation software implemented on NARSIM/TRS)	B	NLR
13	Operational concepts, procedures, and working methods (for controllers)	A	Public (Eurocontrol)

A: results usable outside the consortium

B: results usable within the consortium

C: non usable results

1.3 Quantified data on the dissemination and use of the project results

QUANTIFIED DATA ON THE DISSEMINATION AND USE OF THE PROJECT RESULTS		
Items about the dissemination and use of the project results (consolidated numbers)	**Currently achieved quantity**	**Estimated future* quantity**
Product innovations	4	4
Process innovations	0	2
New services (commercial)	3	3
New services (public)	3	3
New methods	3	3
Scientific breakthrough	0	0
Technical standards to which this project has contributed	0	0
EU regulations/directives to which this project has contributed	0	1
International regulations to which this project has contributed	0	3
PhDs generated by the project	0	3
Grantees/trainees including trans-national exchange of personnel	3	3

* "Future" means expectations within the next 3 years following the end of the project

1.4 Comment on European Interest

COMMENT ON EUROPEAN INTEREST

COMMUNITY ADDED VALUE AND CONTRIBUTION TO EU POLICIES
European dimension of the problem An increase of airport and runway capacity without reducing the level of safety is an issue that requires attention in view of the used steady increase in air traffic in Europe. ATC-Wake has addressed this need by developing and building an integrated ATC wake vortex safety and capacity platform. Such integrated platform is an essential step to guide operational measures to increase capacity (without loss of safety) or even the installation of new weather based “wake avoidance” systems (and associated ATM procedures) at European airports to increase capacity. Clearly foreseen delays in the air transport system might have an adverse effect on the environment, leading to increased fuel consumption and pollution. This shows that ATC-Wake addresses a European problem, that is the concern of many nations. Addressing this problem at national levels would lead to redundancies and a waste of money, together with solutions that might not be compatible at a European level. The required technologies are not all available at a single national level and European-wide expertise is compulsory.

Contribution to developing S&T co-operation at international level.European added value
The different aspects involved in the definition, development, testing and evaluation of an integrated ATC wake vortex system have required a highly interdisciplinary approach with experts from aeronautical industry, research institutes, and universities. The 'critical mass' of complementary expertise has been found at a European level, as follows :

- NLR has the tools to assess separation minima for different operational, weather and wind conditions (WAVIR) and to predict associated capacity improvements. NLR also has supporting middleware facilities (SPINEware technology) for integration of wake vortex subsystems available to the consortium. NLR has the ATM experience to help design and evaluate ATM concepts and procedures and to design, build, and test the new air traffic controller Human Machine Interfaces (for ATC tower and approach controllers and supervisors).
- EEC has provided technology watch and assessed beyond state of the art developments on Wake vortex matters. EEC is responsible for defining new operational concepts and working methods & supporting their validation through simulations and other operational experiments
- TAD has developed for civil radar applications some image & signal processing algorithms that have been adapted for Weather forecasting and Wake-vortex monitoring from Doppler meteorological radar measurements. In image processing, TAD has designed an algorithm to track fluid deformation applied for forecasting rain clouds by Meteorological Radar.
- TAV and DLR have worked on MFLAME EC project to verify that wake-vortices could be seen and detected by a laser-based sensor in an airborne-like measurement configuration. Each has gained a unique expertise in Europe in the wake-vortex detection area. TAV has a good expertise in Lidar application, especially in the field of air data systems (air data measurement): since 1991, the Airbus air data systems are calibrated by a TAV Lidar
- DLR has developed and combined components of a Wake Vortex Prediction and Monitoring System (WVPMS) such as Weather predictor (NOWVIV), weather monitor (wind lidar, C-band weather radar, wind/temperature profilers, radiosondes), wake predictors (VORTEX (developed by CERFACS), P2P) and wake monitors (wind/wake lidars). The components have been tested during WakeOP, the forecasting tools run operationally in real time.
- UCL brings the expertise in wake vortex predictions (transport and decay, given atmospheric and ground proximity conditions). It brings the state-of-the-art Vortex Forecast System (VFS) to the project: an operational tool based on the method of discrete vortices, developed by an international team (of which prof. G. Winckelmans of UCL), in the framework of the 1994-2000 Transport Canada wake vortex project, including close collaboration/validation with the Aircraft VOrtex Spacing System (AVOSS) project in the USA. UCL will participate in technical support and expertise activities calling for operational prediction fed by the atmospheric and aircraft data, including possible use of "weather classes".

Contribution to policy design or implementation
With the results of ATC-Wake, future infrastructure development of European airports can be done more efficiently to improve both safety and capacity. Since airports are crucial nodes in an inter-modal trans-European transport network, the project fits well in the EU common Transport Policy.

To enhance acceptability of the future integrated system, possible end-users and regulatory authorities have been involved – as participant of the User Group – and will be consulted regularly. Feedback will focus on interoperability with existing ATC systems and on new modified wake vortex safety regulation. Integration, inter-working, openness, and interoperability of the subsystems (building blocks) is a necessary key requirement before the ATC wake vortex safety and capacity platform can be used within a test bed environment role. This will be realized through the use of state-of-the-art middleware facilities, including a variety of methods for integration (e.g. static/dynamic interaction, tool chaining, workflow chains). The realization of an advanced controller HMI – which will be tested by different controller teams, e.g. future users of the integrated ATC system – clearly shows the emphasis placed on operational usability and acceptability. This project therefore clearly contributes strongly to the Information Society Technologies Policy.

CONTRIBUTION TO COMMUNITY SOCIAL OBJECTIVES
Improving the quality of life in the Community: An integrated ATC wake vortex safety and capacity system will improve the efficient use of runways for weather conditions under which a safe reduction of current separation rules might be allowed. Such system will thus also provide the means to predict – using weather monitoring, nowcasting and forecasting data – the conditions under which strong and dangerous wake vortices might occur. Combined use with instrumentation for wake detection on-board aircraft, and avoidance of possible encounters will reduce the probability of incidents, thus increase safety. An integrated wake vortex safety and capacity system will provide strategic and tactical increases in airport capacity. Strategic improvements (e.g. number of allocated slots) can be realised by new operational procedures. Weather dependent tactical improvements are essential to reduce waiting time for take off or landings. Prevention of delays at airports improves the quality of life for the air passengers and the environmental impact on the surroundings of the airports. The safety issue addressed by the ATC-Wake project contributes directly to the safety of the passengers and the people living in the vicinity of airports. Strategic benefits for long-term declared airport capacity for airline schedule planning would contribute to the satisfaction of the social needs for safer, easier and more comfortable mobility.
Provision of appropriate incentives for monitoring and creating jobs in the Community (including use and development of skills): Besides its effect on passengers and people living in the vicinity of airports, the aircraft industry will benefit from a wake vortex safety and capacity system. The new Airbus A380 will also increase airport capacity and the proposed wake vortex safety and capacity system can play an important role in the smooth introduction of this new aircraft. The related development and implementation of new airport infrastructure systems integrating existing advanced IST technologies with state-of-the-art new IST developments clearly stimulates the Information Society Technologies Programme. Specific fields of application include weather sensors and forecast systems, wake predictors and monitors, separation minima predictors, as well as ICT tools to facilitate integration of these subsystems. This will have positive effects on the education of young technicians and engineers and require substantial training of already employed personnel to improve their professional skills. The ATC wake vortex system will enhance a safe mitigation of separation rules, which leads to an increase of airport capacity and consequently a sustainable growth of the air transport system with large consequences for employment. Although the air transportation industry is clearly the main driver behind ATC-Wake, the Information Society Technology will have to provide the necessary means to enable the integration of subsystems. ATC-Wake will therefore contribute to the creation of jobs in all services related to Air Transport (e.g. airline crews, air traffic management people, airport management and employees, local transport) and the Information Society Technology.
Supporting sustainable development, preserving and/or enhancing the environment (including use/conservation of resources): The main goal of the ATC-Wake project is to develop and build an integrated ATC wake vortex platform that improves the efficient use of airport infrastructures with respect to safety and capacity. Such integrated platform would strongly enhance the successful introduction of the new Airbus A380, having the newest propulsion technologies and aerodynamic design, with significantly lower fuel consumption per passenger-mile than the existing heavily used aircraft. The introduction of very high capacity aircraft will reduce the number of landings at major airports, and thus have a favourable effect on the airport environment. An integrated ATC wake vortex safety and capacity system – when installed at European airports – would also lead to decreased airport delays, and consequently to lower fuel and energy consumption. Increased efficiency of the use of present airport infrastructures reduces the pressure on major European airports to build new runways to meet the steady increase in air traffic. This would lead to reduced consumption of natural resources.

1.5 Overall Project Impact

EXPECTED PROJECT IMPACT

EU Policy Goals	I scale of expected impact over the next 10 years -1 0 1 2 3	II other	
		Not applicable to project	Project Impact too difficult to estimate
1. Improved sustainable economic development and growth, competitiveness	3		
2. Improved employment	2		
3. Improved quality of life and health and safety	3		
4. Improved education	1		
5. Improved preservation and enhancement of the environment	2		
6. Improved scientific and technological quality	1		
7. Regulatory and legislative environment	1		
8. Other		X	

1.5.1 Economic development and growth, competitiveness

1. Economic development and growth, competitiveness	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Increased Turnover for project participants - national markets	1	2
b) Increased Turnover for project participants - international markets	1	3
c) Increased Productivity for project participants	1	3
d) Reduced costs for project participants	0	2
e) Improved output quality/high technology content	2	3

1.5.2 Employment

2. Employment	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Safeguarding of jobs	1	2
b) Net employment growth in projects participants staff	1	2
c) Net employment growth in customer and supply chains	0	2
d) Net employment growth in the European economy at large	0	2

1.5.3 Quality of Life and health and safety

3. Quality of Life and health and safety	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Improved health care	0	0
b) Improved food, nutrition	0	0
c) Improved safety (incl. consumers and workers safety)	2	3
d) Improved quality of life for the elderly and disabled	0	0
e) Improved life expectancy	0	0
f) Improved working conditions	2	3
g) Improved child care	0	0
h) Improved mobility of persons	2	3

1.5.4 Improved education

4. Improved education	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Improved learning processes including lifelong learning	1	2
b) Development of new university curricula	0	1

1.5.5 Preservation and enhancement of the environment

5. Preservation and enhancement of the environment	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Improved prevention of emissions	2	3
b) Improved treatment of emissions	0	0
c) Improved preservation of natural resources and cultural heritage	0	0
d) Reduced energy consumption	1	2

1.5.6 S & T quality

6. S&T quality	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Production of new knowledge	2	3
b) Safeguarding or development of expertise in a research area	3	3
c) Acceleration of RTD, transfer or uptake	3	3
d) Enhance skills of RTD staff	3	3
e) Transfer expertise/know-how/technology	3	3
f) Improved access to knowledge-based networks	3	3
g) Identifying appropriate partners and expertise	3	3
h) Develop international S&T co-operation	2	3
i) Increased gender equality	0	0

1.5.7 Regulatory and legislative environment

7. Regulatory and legislative environment	Scale of Expected Impacts over the next 10 years (2)	
	By Project End -1 0 1 2 3	After Project End -1 0 1 2 3
a) Contribution to EU policy formulation	1	2
b)Contribution to EU policy implementation	1	2

2 Results

2.1 Result No.1 : ATC-Wake Integrated Platform

DESCRIPTION OF RESULT No. 1

No.	Title
1	Integrated ATC wake vortex safety & capacity platform

CONTACT PERSON FOR THIS RESULT	
Name	Lennaert SPEIJKER
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URL	http://www.nlr.nl
Specific Result URL	http://www.nlr.nl/public/hosted-sites/atc-wake (public web-site)

SUMMARY

The main expected exploitable project output is the Integrated ATC Wake vortex safety and capacity platform, which contains as further exploitable elements (resulting from the project):

- ATC-Wake Separation Mode Planner
- ATC-Wake Predictors
- ATC-Wake Monitoring and Alerts
- ATC-Wake Detectors
- Air Traffic Controller Human Machine Interfaces (HMIs).

The ATC-Wake Integrated Platform (IP) has been built using the SPINEware middleware technology, which provides an integrated view on an heterogeneous network of different computer platforms (located at the premises of the ATC-Wake consortium partners) enabling access to the different subsystems and tools of the different partners. The IP will be presented to users (research and development centres and industrial organisations) as a user-centred working environment, at terms to be negotiated and agreed upon through a specific license agreement with the ATC-Wake consortium.

The ATC-Wake IP comprises all the designed and implemented interfaces between the subsystems and tools of the individual partners. The Intellectual Property Rights (IPRs) of these individual subsystems and tools are described in ATC-Wake D5_1 (Dissemination & Use Plan).

2.1.1 Subject descriptors codes

SUBJECT DESCRIPTORS CODES
7 Aeronautics
17 ATC operations, procedures, slot allocations
18 Air Traffic Management/Flow management
19 Air transport technology
20 Aircraft
21 Airport operations/procedures
152 Decision support tools
219 European studies
550 Safety technology
565 Simulation, simulation engineering
635 Transport safety/security

2.1.2 Documentation and information on the result

DOCUMENTATION AND INFORMATION ON THE RESULT		
Documentation type	**Details (Title, ref. number, general description, language)**	**Status: PU=Public CO=Confidential**
ATC-Wake D2_1	Architecture concepts and design of the ATC-Wake IP	CO
ATC-Wake D2_2	Assessment and selection of technical concepts	CO
ATC-Wake D2_3	Interface Specification Report (IRS)	CO
ATC-Wake D2_4	Software Requirement Specification (SRS)	CO
ATC-Wake D2_8	User Manual of ATC-Wake Integrated Platform	CO

ATC-Wake D2_9	Software Test Description of the ATC-Wake IP	CO
ATC-Wake D2_10	Software Test Report of the ATC-Wake IP	CO
ATC-Wake D2_11	Technical feasibility of building the ATC-Wake system	CO
ATC-Wake D2_12	Final Report WP2000 Integrated System	PU
ATC-Wake D5_1	ATC-Wake Dissemination and Use Plan	CO
ATC-Wake D5_3	ATC-Wake Technological Implementation Plan	PU
ATC-Wake D6_3	ATC-Wake Final Report	PU

2.1.3 Intellectual Property Rights

INTELLECTUAL PROPERTY RIGHTS							
Type of IPR	**KNOWLEDGE: Tick a box and give the corresponding details(reference numbers, etc) if appropriate**					**Pre-existing know-how Tick a box and give the corresponding details (reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP[1)]**	**NoI[2)]**	**Details**	**Tick**		
Patent applied for							
Patent granted							
Patent search carried out							
Registered design							
Trademark applications							
Copyrights					X		
Secret know-how							
Other - please specify:							

1) Number of **P**riority (national) applications/patents

2) Number of **I**nternationally extended applications/patents

2.1.4 Market application sectors

MARKET APPLICATION SECTORS
53.3 Manufacture of aircraft and spacecraft, and aeroplanes for the transport of goods or passengers

62h Air Transport / Transport of passenger or freight by airlines
73 Research and development

2.1.5 Current stage of development

CURRENT STAGE OF DEVELOPMENT	
Current stage of development	The ATC-Wake Integrated Platform has been designed and specified. The four new components (Separation Mode Planner, Predictor, Monitoring and Alerts, and Detectors) have been built and tested. Already existing subsystems and tools available to the consortium have been upgraded following definition of the operational requirements, operational concept, users requirements and system requirements. The ATC-Wake IP has been demonstrated at the ATC-Wake User Group Meeting and the EC Review Meeting on 7/8 April 2005 at UCL, near Brussels. Results of the demonstration trials are also available.
Other:	

2.1.6 Quantified data about the result

QUANTIFIED DATA ABOUT THE RESULT		
Items (about the results)	**Actual current quantity**	**Estimated (or future) quantity**
Time to application / market (in months from the end of the research project)		24 – 96
Number of (public or private) entities potentially involved in the implementation of the result:		8 – 12
of which: number of SMEs:		2 – 4
of which: number of entities in third countries (outside EU):		0
Targeted user audience: of reachable people		500000
S&T publications (referenced publications only)	5	6
publications addressing general public (e.g. CD-ROMs, WEB sites)	3	5
publications addressing decision takers / public authorities / etc.	6	15
Visibility for the general public (yes or no)	Yes	

2.1.7 Further collaboration, dissemination and use of the result

FURTHER COLLABORATION, DISSEMINATION AND USE OF THE RESULT

COLLABORATIONS SOUGHT					
R&D	Further research or development	X	**FIN**	Financial support	X
LIC	Licence agreement	X	**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement		**PPP**	Private-public partnership	
MKT	Marketing agreement		**INFO**	Information exchange/training	
JV	Establish a joint enterprise or partnership	X	**CONS**	Available for consultancy	X
Other	(please specify)				
Details:					

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE
The ATC-Wake project benefits from a User Group, which has shown interest in the exploitation of the project results: DFS, NATS, ASD, Airbus, FAA, NASA, Transport Canada, and Nav Canada. The ATC-Wake IP is directly available for such users (including research and development centres and industrial organisations) as a user-centred working environment, at terms to be negotiated and agreed upon through a specific license agreement with the ATC-Wake consortium partners. The IP is useful for simulation of the wake vortex safety and capacity aspects of new ATM operational concepts and procedures to enhance airport capacity. Besides direct application of the ATC-Wake IP for simulation purposes, **two follow-up European R&D projects are foreseen** before actual capacity increase at airports can be realised: • **CREDOS**: elaboration & testing of an operational concept for crosswind departures through real-time ATC simulations, wake vortex data collection and analysis, risk assessment, construction of a safety case and human factors case, and a WV safety management system. • **ATC-Wake2**: installation and testing of an ATC-Wake system at selected airport(s), through shadow-mode field trials and evaluation of the experiences with the new working methods. Besides use in CREDOS (or CROWS) and the potential follow-up project ATC-Wake 2, this project result is also offered for further dissemination and use by the User Group and similar organizations.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE
Local installation of ATC-Wake at an airport requires at least the following additional partners: • Airport and Air Traffic Control centre; • Meteorological institute for analysis of the local airport weather climatology & characteristics (e.g. UK Met Office for Great Britain, Meteo France for France and KNMI for the Netherlands).

2.2 Result No.2 : Connection with on-board wake vortex detection, warning, avoidance system

DESCRIPTION OF RESULT No. 2

No.	Title
2	Connection with an onboard detection, warning and avoidance (DWA) system for wake vortex

CONTACT PERSON FOR THIS RESULT	
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URL	
Specific Result URL	

SUMMARY

The benefits of connecting the ATC-WAKE ground based system with an onboard Detection Warning, and Avoidance (DWA) system for wake vortex surveillance through a data-link have been specified. The means for such a connection are described in terms of requirements, possible technical solutions and recommendations to existing standardisation groups. Both downlink of on-board I-Wake information and uplink of ground-based ATC-Wake information has been considered in the context of enhancing both pilots and controllers performances when dealing with the capacity limitations imposed by wake vortex.

The following on-board I-Wake information might be down-linked to enhance controllers performance:

- Wake vortex detected by the on-board I-Wake system (through the use of a lidar);
- Alert information, possibly leading to the initiation of a missed approach by an aircraft/pilot.

The following ground-based information might be up-linked to enhance the performance of pilots:

- Wake vortex detected by the ATC-Wake Detector;
- Alert information, in case of a discrepancy between the ATC-Wake Predictor and Detector.

NB : additional weather information can also be up-linked or down-linked, in case of need.

2.2.1 Subject descriptors codes

SUBJECT DESCRIPTORS CODES
7 Aeronautics
17 ATC operations, procedures, slot allocations
331 Instrumentation technology
563 Signal processing
588 Standardisation of new technologies

2.2.2 Documentation and information on the result

DOCUMENTATION AND INFORMATION ON THE RESULT		
Documentation type	**Details (Title, ref. number, general description, language)**	**Status: PU=Public CO=Confidential**
IWAKE-1-D-RE-THAV-029	Report on I-Wake System Functional Definition	PU
ATC-Wake D2_12	Final Report WP2000 Integrated System	PU
ATC-Wake D6_3	ATC-Wake Final Report	PU

2.2.3 Intellectual Property Rights

INTELLECTUAL PROPERTY RIGHTS							
Type of IPR	**KNOWLEDGE: Tick a box and give the corresponding details(reference numbers, etc) if appropriate**					**Pre-existing know-how Tick a box and give the corresponding details (reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP[1)]**	**NoI[2)]**	**Details**	**Tick**		
Patent applied for					1		
Patent granted					2		
Patent search carried out					1		

Registered design						
Trademark applications						
Copyrights						
Secret know-how						
Other - please specify:						

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

2.2.4 Market application sectors

MARKET APPLICATION SECTORS
53.3 Manufacture of aircraft and spacecraft, and aeroplanes for the transport of goods or passengers
62h Air Transport / Transport of passenger or freight by airlines

2.2.5 Current stage of development

CURRENT STAGE OF DEVELOPMENT	
Current stage of development	Results of the demonstrator trials of the I-Wake system are available (flight tests have been performed as part of the I-Wake project, using the NLR research aircraft with an on-board lidar installed). A potential I-Wake / ATC-Wake data-link connection has been described in terms of requirements, possible technical solutions and recommendations to existing standardisation groups (details are included in ATC-Wake D2_12 and D6_2). The status of this data-link connection is thus either “scientific and/or technical knowledge (basic research)” or “guidelines”.
Other:	

2.2.6 Quantified data about the result

QUANTIFIED DATA ABOUT THE RESULT		
Items (about the results)	**Actual current quantity**	**Estimated (or future) quantity**
Time to application / market (in months from the end of the research project)	96	96
Number of (public or private) entities potentially involved in the implementation of the result:	8	3

of which: number of SMEs:	1	1
of which: number of entities in third countries (outside EU):	0	1
Targeted user audience: of reachable people		500000
S&T publications (referenced publications only)	1	3
publications addressing general public (e.g. CD-ROMs, WEB sites)	1	1
publications addressing decision takers / public authorities / etc.	0	1
Visibility for the general public (yes or no)	YES	

2.2.7 Further collaboration, dissemination and use of the result

FURTHER COLLABORATION, DISSEMINATION AND USE OF THE RESULT

COLLABORATIONS SOUGHT					
R&D	Further research or development	X	**FIN**	Financial support	
LIC	Licence agreement		**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement	X	**PPP**	Private-public partnership	
MKT	Marketing agreement		**INFO**	Information exchange/training	
JV	Establish a joint enterprise or partnership		**CONS**	Available for consultancy	
Other	(please specify)				
Details:					

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

The ATC-Wake project benefits from a User Group, which has shown interest in the exploitation of the project results: DFS, NATS, ASD, Airbus, FAA, NASA, Transport Canada, and Nav Canada.

Besides use in FLYSAFE and FIDELIO and the potential follow-up project ATC-Wake 2, this project result is also offered for further dissemination and use by this User Group and similar organizations.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

For further dissemination and use, the following partners are foreseen: Standardisation bodies and Information services providers at airports

2.3 Result No.3 : ATC-Wake Separation Mode Planner

DESCRIPTION OF RESULT No. 3

No.	Title
3	ATC-Wake Separation Mode Planner

CONTACT PERSON FOR THIS RESULT	
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E-mail	Speijker@nlr.nl
URL	http://www.nlr.nl
Specific Result URL	http://www.nlr.nl/public/hosted-sites/atc-wake (public web-site)

SUMMARY

The ATC-Wake Separation Mode Planner (SMP) determines the applicable separation mode (ICAO mode or ATC-Wake mode) and advises about minimum aircraft separation. Advisory includes expected time for future mode transitions, indication of aircraft separation minimum applicable.

This project main result includes methodology, design, and specification of the Separation Mode Planner. In the proposed methodology wind forecast data is used to determine time windows where reduced separation is possible. Advice on the separation minima to be applied in these time windows is derived from Wake Vortex Induced Risk assessment (WAVIR) results, which are obtained using offline fast-time simulations. To facilitate the interfacing between the SMP and WAVIR results, a database has been developed and set up. This database also enables users to review the WAVIR parameter settings and retrieve WAVIR results via an interface. In the context of “safety monitoring”, the database can be used to evaluate the wake vortex safety performance indicators at an airport. Further work in this area included the combination of simulated aircraft flight track data (using TAAM) with WAVIR safety assessment results to evaluate the safety and capacity effects of the ATC-Wake system. Results from safety monitoring activities at airports can also be fed back in the WAVIR database to further tailor the database to specific airports, and thereby increase the performance and reliability of the SMP.

2.3.1 Subject descriptors codes

SUBJECT DESCRIPTORS CODES	
17	AIR TRAFFIC CONTROL OPERATIONS/PROCEDURES/SLOT ALLOCATION
18	AIR TRAFFIC MANAGEMENT/FLOW MANAGEMENT
21	AIRPORT OPERATIONS/PROCEDURES
465	PASSENGER TRANSPORT
635	TRANSPORT SAFETY/SECURITY

2.3.2 Documentation and information on the result

DOCUMENTATION AND INFORMATION ON THE RESULT		
Documentation type	**Details (Title, ref. number, general description, language)**	**Status: PU=Public CO=Confidential**
ATC-Wake D3_5a	ATC-Wake Separation Mode Planner	CO
ATC-Wake D3_9	Final Report WP3 Safety and capacity analysis	PU

2.3.3 Intellectual Property Rights

INTELLECTUAL PROPERTY RIGHTS							
Type of IPR	**KNOWLEDGE: Tick a box and give the corresponding details(reference numbers, etc) if appropriate**					**Pre-existing know-how Tick a box and give the corresponding details (reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP[1)]**	**NoI[2)]**	**Details**	**Tick**		
Patent applied for							
Patent granted							
Patent search carried out							
Registered design							
Trademark applications							
Copyrights					X		
Secret know-how							
Other - please specify:							

2.3.4 Market application sectors

MARKET APPLICATION SECTORS
53.3 Manufacture of aircraft and spacecraft, and aeroplanes for the transport of goods or passengers
62h Air Transport / Transport of passenger or freight by airlines
73 Research and development

2.3.5 Current stage of development

CURRENT STAGE OF DEVELOPMENT	
Current stage of development	The SMP has been designed, specified, implemented and tested as part of the ATC-Wake Integrated Platform (IP). AS such, the detailed test results are also included in the D2_10). As part of the IP, the SMP has been demonstrated to the ATC-Wake User Group, the EC and the official reviewers in April 2005. A further demonstration trial/experiment will be performed during the Final Meeting of the ATC-Wake project, at which the potential Human Machine Interface for the ATC supervisor will be frozen for dissemination and use in the CREDOS (or CROWS) and ATC-Wake2 projects.
Other:	

2.3.6 Quantified data about the result

QUANTIFIED DATA ABOUT THE RESULT		
Items (about the results)	**Actual current quantity**	**Estimated (or future) quantity**
Time to application / market (in months from the end of the research project)		24 – 96
Number of (public or private) entities potentially involved in the implementation of the result:		3 – 5
of which: number of SMEs:		1
of which: number of entities in third countries (outside EU):		0
Targeted user audience: of reachable people		1000
S&T publications (referenced publications only)	0	2
publications addressing general public (e.g. CD-ROMs, WEB sites)	3	5
publications addressing decision takers / public authorities / etc.	0	2
Visibility for the general public (yes or no)	Yes	

2.3.7 Further collaboration, dissemination and use of the result

FURTHER COLLABORATION, DISSEMINATION AND USE OF THE RESULT

COLLABORATIONS SOUGHT					
R&D	Further research or development	X	**FIN**	Financial support	X
LIC	Licence agreement	X	**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement		**PPP**	Private-public partnership	X
MKT	Marketing agreement		**INFO**	Information exchange/training	
JV	Establish a joint enterprise or partnership	X	**CONS**	Available for consultancy	X
Other	(please specify)				
Details:					

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE
The ATC-Wake project benefits from a User Group, which has shown interest in the exploitation of the project results: DFS, NATS, ASD, Airbus, FAA, NASA, Transport Canada, and Nav Canada. Besides use in CREDOS (or CROWS) and the follow-up project ATC-Wake 2, this project result is also offered for further dissemination and use by this User Group and similar organizations.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE
Local installation of the Separation Mode Planner at an Air Traffic Control Centre requires at least the following additional partners: • Air Traffic Control centre; • Meteorological institute for analysis of the local airport weather climatology/conditions (e.g. UK Met Office for Great Britain, Meteo France for France and KNMI for the Netherlands)

2.4 Result No.4 : ATC-Wake Predictor

DESCRIPTION OF RESULT No. 4

No.	Title
4	ATC-Wake Predictor

CONTACT PERSON FOR THIS RESULT	
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URL	www.term.ucl.ac.be
Specific Result URL	

SUMMARY

The ATC-Wake Predictor assesses the suitability of the separations suggested by the SMP. It determines the part of the glide slope potentially affected by wake vortices. This information is provided on the Monitoring & Alerting sub-system and on the ATCO_HMI through a Wake Vortex Vector (WVV). Prediction is performed using real-time available meteo data from the time the aircraft reaches the critical arrival area entry until it lands and from the take-off until it leaves the critical departure area. The quality of WV prediction is directly related to the quality of input data (meteo, radar). A safety buffer has to be applied to satisfy accuracy requirements of ATC users. These data consist of the most recent meteo nowcast data as well as ground or down-linked airborne measurements (wind / temperature profiler, wind / temperature aloft). The prediction is updated in short intervals (e.g. 2 min for the meteo data refreshing period and 6 sec for the wake prediction computation period) and is assessed by measurements of WV behaviour of preceding aircraft.

2.4.1 Subject descriptors codes

SUBJECT DESCRIPTORS CODES	
7	AERONAUTICS
17	AIR TRAFFIC CONTROL OPERATIONS/PROCEDURES/SLOT ALLOCATION
18	AIR TRAFFIC MANAGEMENT/FLOW MANAGEMENT
19	AIR TRANSPORT TECHNOLOGY
21	AIRPORT OPERATIONS/PROCEDURES
128	COMPUTATIONAL PHYSICS
150	DATABASES, DATABASE MANAGEMENT, DATA MINING
152	DECISION SUPPORT TOOLS
483	PHYSICS OF FLUIDS
579	SOFTWARE ENGINEERING, MIDDLEWARE, GROUPWARE

2.4.2 Documentation and information on the result

DOCUMENTATION AND INFORMATION ON THE RESULT		
Documentation type	**Details (Title, ref. number, general description, language)**	**Status: PU=Public CO=Confidential**
ATC-Wake D2_1	Architecture concepts and design of the ATC-Wake IP	CO
ATC-Wake D2_12	Final Report WP2000 Integrated System	PU
ATC-Wake D6_3	ATC-Wake Final Report	PU

2.4.3 Intellectual Property Rights

INTELLECTUAL PROPERTY RIGHTS				
Type of IPR	**KNOWLEDGE: Tick a box and give the corresponding details (reference numbers, etc) if appropriate**		**Pre-existing know-how Tick a box and give the corresponding details (reference numbers, etc) if appropriate**	
	Current	**Foreseen**	**Tick**	**Details**

	Tick	NoP[1)]	NoI[2)]	Details	Tick		
Patent applied for							
Patent granted							
Patent search carried out							
Registered design							
Trademark applications							
Copyrights							
Secret know-how							
Other - please specify:							

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

2.4.4 Market application sectors

MARKET APPLICATION SECTORS	
63.2.j	Airport and air-traffic control activities
73	Research and development

2.4.5 Current stage of development

CURRENT STAGE OF DEVELOPMENT	
Current stage of development	The Predictor has been designed, specified, implemented and tested as part of the ATC-Wake Integrated Platform (IP). AS such, the detailed test results are also included in the D2_10). As part of the IP, the Predictor has been demonstrated to the ATC-Wake User Group, the EC and the official reviewers in April 2005. A further demonstration trial/experiment will be performed during the Final Meeting of the ATC-Wake project.
Other:	

2.4.6 Quantified data about the result

QUANTIFIED DATA ABOUT THE RESULT		
Items (about the results)	**Actual current quantity**	**Estimated (or future) quantity**
Time to application / market (in months from the end of the research project)		60

Number of (public or private) entities potentially involved in the implementation of the result:		
of which: number of SMEs:		
of which: number of entities in third countries (outside EU):		
Targeted user audience: of reachable people		
S&T publications (referenced publications only)		
publications addressing general public (e.g. CD-ROMs, WEB sites)	2	
publications addressing decision takers / public authorities / etc.		
Visibility for the general public (yes or no)	yes	

2.4.7 Further collaboration, dissemination and use of the result

FURTHER COLLABORATION, DISSEMINATION AND USE OF THE RESULT

COLLABORATIONS SOUGHT					
R&D	Further research or development	X	**FIN**	Financial support	
LIC	Licence agreement		**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement		**PPP**	Private-public partnership	X
MKT	Marketing agreement		**INFO**	Information exchange/training	X
JV	Establish a joint enterprise or partnership		**CONS**	Available for consultancy	X
Other	(please specify)				
Details:					

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

The ATC-Wake project benefits from a User Group, which has shown interest in the exploitation of the project results: DFS, NATS, ASD, Airbus, FAA, NASA, Transport Canada, and Nav Canada. Besides use in CREDOS or CROWS and the follow-up project ATC-Wake 2, this project result is also offered for further dissemination and use by this User Group and similar organizations.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Local installation of the ATC-Wake Predictor at an Air Traffic Control centre requires, besides the willingness of the Air Traffic Control Centre, also participation of a national meteorological institute.

2.5 Result No.5 : ATC-Wake Monitoring and Alert

DESCRIPTION OF RESULT No. 5

No.	Title
5	ATC-Wake Monitoring and Alert

CONTACT PERSON FOR THIS RESULT	
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URL	
Specific Result URL	

SUMMARY

The ATC-Wake Monitoring and Alerting alerts the ATCO in case of :

- significant deviation between WV detection and WV prediction information which raises the risk of WV encounter ;
- failure of one or several WV components.

This component plays the role of a “safety net” for ATC-Wake operations, its design must be kept simple :

- no connection to airborne equipment is assumed ;
- no use of aircraft behaviour model for WV encounter is assumed.

Therefore, the Monitoring and Alert tool of ATC-Wake has to gather the predictions from SMP and Wake Predictor and to gather measurement data from the Wake Detector. It will check the short-term prediction from the Wake Predictor with the (long term) prediction of the SMP in terms of consistency and applicability of the chosen separation mode. Predictions are compared with the actual measurement data and the ATCO will be alerted in case of inconsistencies or system failure.

2.5.1 Subject descriptors codes

SUBJECT DESCRIPTORS CODES
129 COMPUTER SCIENCE/ENGINEERING, NUMERICAL ANALYSIS, SYSTEMS, CONTROL
331 INSTRUMENTATION TECHNOLOGY
17 AIR TRAFFIC CONTROL OPERATIONS/PROCEDURES/SLOT ALLOCATION
18 AIR TRAFFIC MANAGEMENT/FLOW MANAGEMENT
220 EVALUATION
152 DECISION SUPPORT TOOLS

2.5.2 Documentation and information on the result

DOCUMENTATION AND INFORMATION ON THE RESULT		
Documentation type	**Details (Title, ref. number, general description, language)**	**Status: PU=Public CO=Confidential**
ATC-Wake D2_1	Architecture concepts and design of the ATC-Wake IP	CO
ATC-Wake D2_5	The “weather” and “wake” tools of the ATC-Wake integrated platform	CO
ATC-Wake D2_12	Final Report WP2000 Integrated System	PU
ATC-Wake D6_3	ATC-Wake Final Report	PU

2.5.3 Intellectual Property Rights

INTELLECTUAL PROPERTY RIGHTS							
Type of IPR	**KNOWLEDGE: Tick a box and give the corresponding details(reference numbers, etc) if appropriate**					**Pre-existing know-how Tick a box and give the corresponding details (reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP[1)]**	**NoI[2)]**	**Details**	**Tick**	X	Expertise in building such a tool

Patent applied for							
Patent granted							
Patent search carried out							
Registered design							
Trademark applications							
Copyrights					X		
Secret know-how							
Other – please specify:							

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

2.5.4 Market application sectors

MARKET APPLICATION SECTORS	
63.2.j	Airport and air-traffic control activities
73	Research and development

2.5.5 Current stage of development

CURRENT STAGE OF DEVELOPMENT	
Current stage of development	The components are developed. Improvement and test are in progress. The integration process itself is in progress.
Other:	

2.5.6 Quantified data about the result

QUANTIFIED DATA ABOUT THE RESULT		
Items (about the results)	**Actual current quantity**	**Estimated (or future) quantity**
Time to application / market (in months from the end of the research project)		
Number of (public or private) entities potentially involved in the implementation of the result:		
of which: number of SMEs:		

of which: number of entities in third countries (outside EU):		
Targeted user audience: of reachable people		
S&T publications (referenced publications only)		
publications addressing general public (e.g. CD-ROMs, WEB sites)	9	
publications addressing decision takers / public authorities / etc.		
Visibility for the general public (yes or no)		

2.5.7 Further collaboration, dissemination and use of the result

FURTHER COLLABORATION, DISSEMINATION AND USE OF THE RESULT

COLLABORATIONS SOUGHT					
R&D	Further research or development	X	**FIN**	Financial support	X
LIC	Licence agreement		**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement		**PPP**	Private-public partnership	X
MKT	Marketing agreement		**INFO**	Information exchange/training	
JV	Establish a joint enterprise or partnership		**CONS**	Available for consultancy	
Other	(please specify)				
Details:					

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

The ATC-Wake project benefits from a User Group, which has shown interest in the exploitation of the project results: DFS, NATS, ASD, Airbus, FAA, NASA, Transport Canada, and Nav Canada. Besides use in CREDOS (or CROWS) and the follow-up project ATC-Wake 2, this project result is also offered for further dissemination and use by this User Group and similar organizations.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

Local installation of the ATC-Wake Monitoring and Alerting component at an airport requires at least the following additional partners:

- Airport;
- Air Traffic Control centre.

2.6 Result No.6 : ATC-Wake Detector

DESCRIPTION OF RESULT No. 6

No.	Title
6	ATC-Wake Detector

CONTACT PERSON FOR THIS RESULT	
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URL	
Specific Result URL	

SUMMARY

The ATC-Wake Detector detects for individual aircraft the WV position, extent (“vortex vector”) and - if possible – also its strength in the pre-defined arrival or departure area(s). Detection is performed using ground-based equipment (e.g. pulsed LIDAR) which scan pre-defined parts of the considered critical area (e.g. ILS glide path) in pre-defined windows (size is to be defined, see MFLAME and I-Wake). The ATC-wake detector has to monitor the relevant airspace (glide path) for the presence of wake vortices and, if so, to give a warning to the Monitoring and Alert tool of the Integrated System. The detector in ATC-Wake is a 2µm pulsed LIDAR, capable to detect and also characterise wake vortices in the flight corridor. It monitors the transport and decay of the vortices.

2.6.1 Subject descriptors codes

SUBJECT DESCRIPTORS CODES
43 APPLIED PHYSICS
331 INSTRUMENTATION TECHNOLOGY

17	AIR TRAFFIC CONTROL OPERATIONS/PROCEDURES/SLOT ALLOCATION
220	EVALUATION
152	DECISION SUPPORT TOOLS

2.6.2 Documentation and information on the result

DOCUMENTATION AND INFORMATION ON THE RESULT		
Documentation type	**Details (Title, ref. number, general description, language)**	**Status: PU=Public CO=Confidential**
ATC-Wake D2_1	Architecture concepts and design of the ATC-Wake IP	CO
ATC-Wake D2_5	The “weather” and “wake” tools of the ATC-Wake integrated platform	CO
ATC-Wake D2_12	Final Report WP2000 Integrated System	PU
ATC-Wake D6_3	ATC-Wake Final Report	PU

2.6.3 Intellectual Property Rights

INTELLECTUAL PROPERTY RIGHTS							
Type of IPR	**KNOWLEDGE: Tick a box and give the corresponding details(reference numbers, etc) if appropriate**					**Pre-existing know-how Tick a box and give the corresponding details (reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP[1)]**	**NoI[2)]**	**Details**	**Tick**	X	LIDAR developed in DLR projects
Patent applied for							
Patent granted							
Patent search carried out							
Registered design							
Trademark applications							
Copyrights	X						
Secret know-how							
Other - please specify:							

2.6.4 Market application sectors

MARKET APPLICATION SECTORS	
63.2.j	Airport and air-traffic control activities
73	Research and development

2.6.5 Current stage of development

CURRENT STAGE OF DEVELOPMENT	
Current stage of development	The components are developed. Improvement and test are in progress. The integration process itself is in progress.
Other:	

2.6.6 Quantified data about the result

QUANTIFIED DATA ABOUT THE RESULT		
Items (about the results)	**Actual current quantity**	**Estimated (or future) quantity**
Time to application / market (in months from the end of the research project)		
Number of (public or private) entities potentially involved in the implementation of the result:		
of which: number of SMEs:		
of which: number of entities in third countries (outside EU):		
Targeted user audience: of reachable people		
S&T publications (referenced publications only)		
publications addressing general public (e.g. CD-ROMs, WEB sites)	9	
publications addressing decision takers / public authorities / etc.		
Visibility for the general public (yes or no)		

2.6.7 Further collaboration, dissemination and use of the result

FURTHER COLLABORATION, DISSEMINATION AND USE OF THE RESULT

COLLABORATIONS SOUGHT					
R&D	Further research or development	X	**FIN**	Financial support	X
LIC	Licence agreement		**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement		**PPP**	Private-public partnership	X
MKT	Marketing agreement		**INFO**	Information exchange/training	
JV	Establish a joint enterprise or partnership		**CONS**	Available for consultancy	
Other	(please specify)				
Details:					

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE
The ATC-Wake project benefits from a User Group, which has shown interest in the exploitation of the project results: DFS, NATS, ASD, Airbus, FAA, NASA, Transport Canada, and Nav Canada. Besides use in CREDOS or CROWS and the follow-up project ATC-Wake 2, this project result is also offered for further dissemination and use by this User Group and similar organizations.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE
Local installation of the ATC-Wake Detector component at an airport requires at least the following additional partners: • Airport; • Air Traffic Control centre.

2.7 Result No.7 : Probabilistic tool for assessment of wake vortex safety

DESCRIPTION OF RESULT No. 7

No.	Title
7	Probabilistic tool for assessment of wake vortex safety

CONTACT PERSON FOR THIS RESULT	
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URL	http://www.nlr.nl
Specific Result URL	http://www.nlr.nl/public/hosted-sites/atc-wake (public web-site)

SUMMARY

An existing probabilistic wake-vortex induced risk assessment method of NLR was upgraded, and extended to cover the whole airport environment. A mathematical model for the behaviour of humans working with new wake vortex avoidance systems was also developed. The safety assessment method (WAVIR) enables derivation of safe and appropriate separation distances under different weather and operational conditions, using a Target Level of Safety risk management framework. The probabilistic method has been discussed with the Safety Regulation Unit (SRU), and offers a rational method to investigate the influence of weather conditions, changed ATM procedures and the introduction of larger aircraft in the air transport system. The WAVIR approach is being validated through the use of wake measurement data, flight simulation data (of wake encounters), and Air Safety database information.

Three quantitative safety assessment studies were made. These studies involved safety assessments for different aircraft pairs and specifically focussed on the effects of wind. Safe and appropriate separation distances have been determined for single runways (approaches, departures) and closely spaced parallel runways. A comparison with S-Wake results for single runway arrivals has shown benefits of the ATC-Wake system compared to a situation without such system.

2.7.1 Subject descriptors codes

SUBJECT DESCRIPTORS CODES
17 ATC operations, procedures, slot allocations
18 Air Traffic Management/Flow management
21 Airport operations/procedures
550 Safety technology
565 Simulation, simulation engineering
635 Transport safety/security

2.7.2 Documentation and information on the result

DOCUMENTATION AND INFORMATION ON THE RESULT		
Documentation type	**Details (Title, ref. number, general description, language)**	**Status: PU=Public CO=Confidential**
ATC-Wake D3_2	Mathematical model for pilot and controller behaviour	CO
ATC-Wake D3_4	Validation of the wake vortex risk assessment sub-models	CO
ATC-Wake D3_5b	Wake vortex induced risk assessment model	CO
ATC-Wake D3_9	Final Report WP3 Safety and capacity analysis	PU
Publication (paper)	Assessment of wake vortex separation distance using the WAVIR toolset (submitted to the DASC 2004, Santa Fe)	PU

2.7.3 Intellectual Property Rights

INTELLECTUAL PROPERTY RIGHTS							
Type of IPR	**KNOWLEDGE: Tick a box and give the corresponding details(reference numbers, etc) if appropriate**					**Pre-existing know-how Tick a box and give the corresponding details (reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP[1])**	**NoI[2])**	**Details**	**Tick**		
Patent applied for							
Patent granted							
Patent search carried out							

Registered design						
Trademark applications						
Copyrights						
Secret know-how						
Other - please specify:						

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

2.7.4 Market application sectors

MARKET APPLICATION SECTORS
53.3 Manufacture of aircraft and spacecraft, and aeroplanes for the transport of goods or passengers
62h Air Transport / Transport of passenger or freight by airlines
73 Research and development

2.7.5 Current stage of development

CURRENT STAGE OF DEVELOPMENT	
Current stage of development	The WAVIR tool has been extended (the required upgrades were designed, specified, implemented and tested). Existing subsystems and tools available to the consortium have been upgraded following the outcome of the validation activities. The WAVIR tool has been demonstrated at the ATC-Wake User Group Meeting and the EC Review Meeting on 7/8 April 2005 at UCL, near Brussels. Results of simulations (i.e. the outcome of the wake vortex safety assessments) are also available. Further improvements and validation activities might be necessary.
Other:	

2.7.6 Quantified data about the result

QUANTIFIED DATA ABOUT THE RESULT		
Items (about the results)	**Actual current quantity**	**Estimated (or future) quantity**
Time to application / market (in months from the end of the research project)		0
Number of (public or private) entities potentially involved in the implementation of the result:		2

of which: number of SMEs:		0
of which: number of entities in third countries (outside EU):		0
Targeted user audience: of reachable people		50
S&T publications (referenced publications only)	0	5
publications addressing general public (e.g. CD-ROMs, WEB sites)	3	5
publications addressing decision takers / public authorities / etc.	3	5
Visibility for the general public (yes or no)	Yes	

2.7.7 Further collaboration, dissemination and use of the result

FURTHER COLLABORATION, DISSEMINATION AND USE OF THE RESULT

COLLABORATIONS SOUGHT					
R&D	Further research or development	X	**FIN**	Financial support	X
LIC	Licence agreement	X	**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement		**PPP**	Private-public partnership	
MKT	Marketing agreement		**INFO**	Information exchange/training	
JV	Establish a joint enterprise or partnership		**CONS**	Available for consultancy	X
Other	(please specify)				
Details:					

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE

The WAVIR tool is directly available for users as a user-centred working environment, at terms to be negotiated and agreed upon through a specific license agreement with NLR. WAVIR can be used for simulation of the wake vortex safety aspects of new ATM operational concepts and flight procedures aimed to enhance airport capacity. WAVIR has been used in S-Wake and I-Wake, will be used in Awiator, and could be applied in CREDOS (or CROWS) and *ATC-Wake 2*.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

For building Safety Cases, the intention is to provide authorities and air traffic control centres with a justification for the safe introduction of new operational concepts for reduced (wake vortex) separation at airports. NLR aims to use the WAVIR methodology and toolset to support this.

2.8 Result No.8 : Wake vortex safety assessment results

DESCRIPTION OF RESULT No. 8

No.	Title
8	Wake vortex safety assessment results

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E-mail	Speijker@nlr.nl
URL	http://www.nlr.nl
Specific Result URL	http://www.nlr.nl/public/hosted-sites/atc-wake (public web-site)

SUMMARY
Three quantitative safety assessment studies were made. These studies involved safety assessments for different aircraft pairs and specifically focussed on the effects of wind. Safe and appropriate separation distances have been determined for single runways (approaches, departures) and closely spaced parallel runways. A comparison with S-Wake results for single runway arrivals has shown benefits of the ATC-Wake system compared to a situation without such system.

2.8.1 Subject descriptors codes

SUBJECT DESCRIPTORS CODES

17 AIR TRAFFIC CONTROL OPERATIONS/PROCEDURES/SLOT ALLOCATION
18 AIR TRAFFIC MANAGEMENT/FLOW MANAGEMENT
20 Aircraft
21 AIRPORT OPERATIONS/PROCEDURES
219 EUROPEAN STUDIES
550 Safety technology
565 Simulation, simulation engineering
635 Transport safety/security

2.8.2 Documentation and information on the result

DOCUMENTATION AND INFORMATION ON THE RESULT		
Documentation type	**Details (Title, ref. number, general description, language)**	**Status: PU=Public CO=Confidential**
ATC-Wake D3_3	Qualitative safety assessment of the ATC-Wake operation	CO
ATC-Wake D3_6	Quantitative safety assessment and identified risk measures	CO
ATC-Wake D3_7	Validation of the safety assessment	CO
ATC-Wake D3_8	Safe separation minima and airport capacity improvements	CO
ATC-Wake D3_9	Final Report WP3 Safety and Capacity Analysis	PU
Publication (paper)	Safety assessment of ATC-Wake departure operations	PU

2.8.3 Intellectual Property Rights

INTELLECTUAL PROPERTY RIGHTS							
Type of IPR	**KNOWLEDGE: Tick a box and give the corresponding details(reference numbers, etc) if appropriate**					**Pre-existing know-how Tick a box and give the corresponding details (reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP[1)]**	**NoI[2)]**	**Details**	**Tick**		
Patent applied for							
Patent granted							

Patent search carried out						
Registered design						
Trademark applications						
Copyrights						
Secret know-how						
Other - please specify:						

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

2.8.4 Market application sectors

MARKET APPLICATION SECTORS
53.3 Manufacture of aircraft and spacecraft, and aeroplanes for the transport of goods or passengers
62h Air Transport / Transport of passenger or freight by airlines
73 Research and development

2.8.5 Current stage of development

CURRENT STAGE OF DEVELOPMENT	
Current stage of development	The safety assessment results are directly available for use. No further simulation trials are necessary, though it should be noted that a safety case will need to be performed before the ATC-Wake system can be installed locally at European airports
Other:	

2.8.6 Quantified data about the result

QUANTIFIED DATA ABOUT THE RESULT		
Items (about the results)	**Actual current quantity**	**Estimated (or future) quantity**
Time to application / market (in months from the end of the research project)		0
Number of (public or private) entities potentially involved in the implementation of the result:		5
of which: number of SMEs:		0

of which: number of entities in third countries (outside EU):		0
Targeted user audience: of reachable people		50
S&T publications (referenced publications only)	0	5
publications addressing general public (e.g. CD-ROMs, WEB sites)	3	5
publications addressing decision takers / public authorities / etc.	3	5
Visibility for the general public (yes or no)	Yes	

2.8.7 Further collaboration, dissemination and use of the result

FURTHER COLLABORATION, DISSEMINATION AND USE OF THE RESULT

COLLABORATIONS SOUGHT					
R&D	Further research or development		**FIN**	Financial support	
LIC	Licence agreement		**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement		**PPP**	Private-public partnership	
MKT	Marketing agreement		**INFO**	Information exchange/training	
JV	Establish a joint enterprise or partnership		**CONS**	Available for consultancy	X
Other	(please specify)				
Details:					

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE
The safety assessment results are directly available for users (including ATS providers, regulatory authorities, and ATM research and development centres). The results can be used for definition of new ATM operational concepts and flight procedures aimed to enhance airport capacity, and are expected to be disseminated and used further in WakeNet2 Europe and WakeNet USA, as well as the potential new EC projects *CREDOS (or CROWS)* and *ATC-Wake 2*. Both potential EC projects are part of the Eurocontrol Wake Vortex Separation Management Plan.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE
None. The results can be used directly by authorities and air traffic control centres for justification for the safe introduction of new operational concepts for reduced (wake vortex) separation at airports.

2.9 Result No.9 : Proposed wake vortex safety regulation

DESCRIPTION OF RESULT No. 9

No.	Title
9	Proposed new wake vortex safety regulation

CONTACT PERSON FOR THIS RESULT	
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URL	
Specific Result URL	

SUMMARY

The implementation of a new integrated system, allowing reduce of separation during landing or take-off phase, has to have the same, or even better, level of safety as the current flight procedures. New proposed Wake vortex safety regulation will have to comply with the ESARR 4 (European Safety Regulatory Requirements) to ensure that the new services provided will meet minimum levels of safety. Therefore, the Safety Regulation Unit (SRU) has been contacted, and their feedback has been processed into proposed wake vortex regulation

2.9.1 Subject descriptors codes

SUBJECT DESCRIPTORS CODES	
17	AIR TRAFFIC CONTROL OPERATIONS/PROCEDURES/SLOT ALLOCATION
18	AIR TRAFFIC MANAGEMENT/FLOW MANAGEMENT
19	AIR TRANSPORT TECHNOLOGY
20	AIRCRAFT
21	AIRPORT OPERATIONS/PROCEDURES
243	FORMAL SAFETY AND ENVIRONMENTAL ASSESSMENT
526	R&D POLICY AND PROGRAMME EVALUATION AND IMPACT ASSESSMENT
550	SAFETY TECHNOLOGY
635	TRANSPORT SAFETY/SECURITY

2.9.2 Documentation and information on the result

DOCUMENTATION AND INFORMATION ON THE RESULT		
Documentation type	**Details (Title, ref. number, general description, language)**	**Status: PU=Public CO=Confidential**
ATC-Wake D3_1	Risk requirements and capacity aims	CO

2.9.3 Intellectual Property Rights

INTELLECTUAL PROPERTY RIGHTS							
Type of IPR	**KNOWLEDGE: Tick a box and give the corresponding details (reference numbers, etc) if appropriate**					**Pre-existing know-how Tick a box and give the corresponding details (reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP[1)]**	**NoI[2)]**	**Details**	**Tick**		
Patent applied for							
Patent granted							
Patent search carried out							

Registered design						
Trademark applications						
Copyrights						
Secret know-how						
Other - please specify:						

2.9.4 Market application sectors

MARKET APPLICATION SECTORS
53.3 Manufacture of aircraft and spacecraft, and aeroplanes for the transport of goods or passengers
62h Air Transport / Transport of passenger or freight by airlines

2.9.5 Current stage of development

CURRENT STAGE OF DEVELOPMENT	
Current stage of development	Proposed wake vortex safety regulation to be approved by SRU
Other:	

2.9.6 Quantified data about the result

QUANTIFIED DATA ABOUT THE RESULT		
Items (about the results)	**Actual current quantity**	**Estimated (or future) quantity**
Time to application / market (in months from the end of the research project)		
Number of (public or private) entities potentially involved in the implementation of the result:		
of which: number of SMEs:		
of which: number of entities in third countries (outside EU):		
Targeted user audience: of reachable people		
S&T publications (referenced publications only)		
publications addressing general public (e.g. CD-ROMs, WEB sites)	2	
publications addressing decision takers / public authorities / etc.	1	
Visibility for the general public (yes or no)	YES	

2.9.7 Further collaboration, dissemination and use of the result

FURTHER COLLABORATION, DISSEMINATION AND USE OF THE RESULT

COLLABORATIONS SOUGHT					
R&D	Further research or development	X	**FIN**	Financial support	
LIC	Licence agreement		**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement		**PPP**	Private-public partnership	
MKT	Marketing agreement		**INFO**	Information exchange/training	X
JV	Establish a joint enterprise or partnership		**CONS**	Available for consultancy	
Other	(please specify)				
Details:					

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE
The ATC-Wake project benefits from a User Group, which has shown interest in the exploitation of the project results: DFS, NATS, ASD, Airbus, FAA, NASA, Transport Canada, and Nav Canada. Besides use in CREDOS or CROWS and the follow-up project ATC-Wake 2, this project result is also offered for further dissemination and use by this User Group and similar organizations.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE
None. The results can be used directly by authorities and air traffic control centres for justification for the safe introduction of new operational concepts for reduced (wake vortex) separation at airports.

2.10 Result No.10 : Simulation tool for the assessment of (wake vortex) capacity

DESCRIPTION OF RESULT No. 10

No.	Title
10	Simulation tool for the assessment of (wake vortex induced) capacity

CONTACT PERSON FOR THIS RESULT	
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URL	
Specific Result URL	

SUMMARY

The separations were simulated within TAAM (Total Airspace and Airport Modeller) via Departure /Arrival Sequencing Rules. In all those rules the parameters taken into account were:

- The wake turbulence category to which the actual aircraft and the previous one belong to (and all the combinations of the different wake turbulence categories)
- If the aircraft is actually landing/taking off
- The landing/departing runway
- The timetable

And the action undertaken (and implemented into an upgrade of the simulation tool) :

- Arrival/departure separation set to, according to the scenario run, ICAO or reduced.

2.10.1 Subject descriptors codes

SUBJECT DESCRIPTORS CODES
17 AIR TRAFFIC CONTROL OPERATIONS/PROCEDURES/SLOT ALLOCATION
18 AIR TRAFFIC MANAGEMENT/FLOW MANAGEMENT
19 AIR TRANSPORT TECHNOLOGY
20 AIRCRAFT
21 AIRPORT OPERATIONS/PROCEDURES
243 FORMAL SAFETY AND ENVIRONMENTAL ASSESSMENT
526 R&D POLICY AND PROGRAMME EVALUATION AND IMPACT ASSESSMENT
550 SAFETY TECHNOLOGY
635 TRANSPORT SAFETY/SECURITY

2.10.2 Documentation and information on the result

DOCUMENTATION AND INFORMATION ON THE RESULT		
Documentation type	**Details (Title, ref. number, general description, language)**	**Status: PU=Public CO=Confidential**
ATC-Wake D3_1	Risk requirements and capacity aims	CO
ATC-Wake D4_3	Analysis of airport and airspace simulation results	CO

2.10.3 Intellectual Property Rights

INTELLECTUAL PROPERTY RIGHTS							
Type of IPR	**KNOWLEDGE: Tick a box and give the corresponding details(reference numbers, etc) if appropriate**					**Pre-existing know-how Tick a box and give the corresponding details (reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP[1)]**	**NoI[2)]**	**Details**	**Tick**		
Patent applied for							

Patent granted							
Patent search carried out							
Registered design							
Trademark applications							
Copyrights							
Secret know-how							
Other - please specify:							

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

2.10.4 Market application sectors

MARKET APPLICATION SECTORS
53.3 Manufacture of aircraft and spacecraft, and aeroplanes for the transport of goods or passengers
62h Air Transport / Transport of passenger or freight by airlines

2.10.5 Current stage of development

CURRENT STAGE OF DEVELOPMENT	
Current stage of development	Simulations completed
Other:	

2.10.6 Quantified data about the result

QUANTIFIED DATA ABOUT THE RESULT		
Items (about the results)	**Actual current quantity**	**Estimated (or future) quantity**
Time to application / market (in months from the end of the research project)		
Number of (public or private) entities potentially involved in the implementation of the result:		
of which: number of SMEs:		
of which: number of entities in third countries (outside EU):		
Targeted user audience: of reachable people		

S&T publications (referenced publications only)		
publications addressing general public (e.g. CD-ROMs, WEB sites)	2	
publications addressing decision takers / public authorities / etc.	1	
Visibility for the general public (yes or no)	YES	

2.10.7 Further collaboration, dissemination and use of the result

FURTHER COLLABORATION, DISSEMINATION AND USE OF THE RESULT

COLLABORATIONS SOUGHT					
R&D	Further research or development	X	**FIN**	Financial support	
LIC	Licence agreement		**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement		**PPP**	Private-public partnership	
MKT	Marketing agreement		**INFO**	Information exchange/training	X
JV	Establish a joint enterprise or partnership		**CONS**	Available for consultancy	
Other	(please specify)				
Details:					

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE
The ATC-Wake project benefits from a User Group, which has shown interest in the exploitation of the project results: DFS, NATS, ASD, Airbus, FAA, NASA, Transport Canada, and Nav Canada. Besides use in CREDOS or CROWS and the follow-up project ATC-Wake 2, this project result is also offered for further dissemination and use by this User Group and similar organizations.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE

2.11 Result No.11 : Total airspace and airport capacity simulation results

DESCRIPTION OF RESULT No. 11

No.	Title
11	Total airspace and airport capacity simulation results

CONTACT PERSON FOR THIS RESULT	
Name	Antoine VIDAL
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URL	
Specific Result URL	

SUMMARY

Following the definition of ATC-Wake operational concepts and procedures, fast-time simulations have been performed with a total airspace and airport modeller. This fast-time simulator has been extended to include the foreseen tasks performed by the air traffic controller (when working with the system). This has allowed an assessment of the capacity related to the introduction of ATC-Wake, and an update of the operational concept(s). In Fast-time simulations the tasks performed by the controller are included in the model, and therefore do not require the direct involvement of controllers and operate many times faster than real-time simulations. This enabled a statistically significant number of runs for a particular set of input parameters representing all the various possible operational and weather scenarios, and a comprehensive test of the sensitivity of the system to the variation of particular parameters. The total airspace and airport modeller is a gate-to-gate simulator, i.e. able to simulate ground, terminal area and en-route operations, including weather conditions.

The total airspace and airport simulation activities have resulted in the following results (the simulations have been done for a generic airport): • Airport simulations aims, objectives and hypothesis; • Airport simulation scenarios, including approach, en-route, arrival/departure manager using wake vortex predictor/detector data • Analysis of airspace and airport simulation results, with an assessment of capacity enhancements.

2.11.1 Subject descriptors codes

SUBJECT DESCRIPTORS CODES	
17	AIR TRAFFIC CONTROL OPERATIONS/PROCEDURES/SLOT ALLOCATION
18	AIR TRAFFIC MANAGEMENT/FLOW MANAGEMENT
20	AIRCRAFT
21	AIRPORT OPERATIONS/PROCEDURES
150	DATABASES, DATABASE MANAGEMENT, DATA MINING
219	EUROPEAN STUDIES
565	SIMULATION, SIMULATION ENGINEERING
566	SIMULATOR TRAINING

2.11.2 Documentation and information on the result

DOCUMENTATION AND INFORMATION ON THE RESULT		
Documentation type	**Details (Title, ref. number, general description, language)**	**Status: PU=Public CO=Confidential**
ATC-Wake D4_1	Airport simulation aims, objectives, hypothesis	CO
ATC-Wake D4_2	Airport and airspace simulation scenarios	CO
ATC-Wake D4_3	Analysis of airspace and airport simulation results	CO
ATC-Wake D4_7	Final Report WP4000 Operational Feasibility	PU

2.11.3 Intellectual Property Rights

INTELLECTUAL PROPERTY RIGHTS		
Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**	**Pre-existing know-how** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**

	Current				Foreseen	Tick	Details
	Tick	NoP[1)]	NoI[2)]	Details	Tick		
Patent applied for							
Patent granted							
Patent search carried out							
Registered design							
Trademark applications							
Copyrights							
Secret know-how							
Other - please specify:							

2.11.4 Market application sectors

MARKET APPLICATION SECTORS
53.3 Manufacture of aircraft and spacecraft, and aeroplanes for the transport of goods or passengers
62h Air Transport / Transport of passenger or freight by airlines
73 Research and development

2.11.5 Current stage of development

CURRENT STAGE OF DEVELOPMENT	
Current stage of development	The capacity assessment results are directly available for use in follow R&D projects, and as input for a wake vortex business case of wake vortex avoidance systems. In this respect, it is noted an Airports Benefits study is currently being performed as part of a Eurocontrol TRS to further support these activities.
Other:	

2.11.6 Quantified data about the result

QUANTIFIED DATA ABOUT THE RESULT		
Items (about the results)	**Actual current quantity**	**Estimated (or future) quantity**
Time to application / market (in months from the end of the research project)		
Number of (public or private) entities potentially involved in the		

implementation of the result:		
of which: number of SMEs:		
of which: number of entities in third countries (outside EU):		
Targeted user audience: of reachable people		
S&T publications (referenced publications only)		
publications addressing general public (e.g. CD-ROMs, WEB sites)	2	
publications addressing decision takers / public authorities / etc.	1	
Visibility for the general public (yes or no)	YES	

2.11.7 Further collaboration, dissemination and use of the result

FURTHER COLLABORATION, DISSEMINATION AND USE OF THE RESULT

COLLABORATIONS SOUGHT					
R&D	Further research or development	X	**FIN**	Financial support	
LIC	Licence agreement		**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement		**PPP**	Private-public partnership	
MKT	Marketing agreement		**INFO**	Information exchange/training	X
JV	Establish a joint enterprise or partnership		**CONS**	Available for consultancy	
Other	(please specify)				
Details:					

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE
The capacity assessment results are directly available for users (including ATS providers, regulatory authorities, and ATM research and development centres). The results can be used for definition of new ATM operational concepts and flight procedures aimed to enhance airport capacity, and are expected to be disseminated and used further in WakeNet2 Europe and WakeNet USA, as well as the potential new EC projects *CREDOS (or CROWS)* and *ATC-Wake 2*. Both potential EC projects are part of the Eurocontrol Wake Vortex Separation Management Plan.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE
None. The results can be used directly by authorities and air traffic control centres for justification for the introduction of new operational concepts for reduced (wake vortex) separation at airports.

2.12 Result No.12 : ATC-Wake Human Machine Interfaces for controllers

DESCRIPTION OF RESULT No. 12

No.	Title
12	ATC-Wake Human Machine Interfaces for controllers

CONTACT PERSON FOR THIS RESULT	
Name	Lennaert SPEIJKER
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URL	http://www.nlr.nl
Specific Result URL	http://www.nlr.nl/public/hosted-sites/atc-wake (public web-site)

SUMMARY

One further major innovative output of ATC-Wake are the air traffic controller Human Machine Interfaces (HMI), which have been developed and optimized for tower and Terminal Area (TMA) / en-route controllers, under the commitment to the principles of human centered automation. That means, with priority to providing optimal decision support to the controllers, who will keep the ultimate responsibility for their decisions, the HMIs reflect a synthesis between:

- specific controller needs for information and decision support,
- usability and acceptability of the HMIs,
- airport operational requirements and constraints (e.g. runway availability),
- traffic demands (e.g. amount of inbound/outbound traffic), and
- technical functionality provided by the integrated system, particularly for wake vortex prediction and monitoring, and aircraft spacing prediction.

An issue that has been thoroughly addressed is how to merge those functionalities with other functions at the controller working positions (e.g. approach planning, departure planning). This has been done through an analysis of interoperability with existing ATC systems and usability and acceptability of the system (using questionnaires). ATS providers and User Group members have supported this analysis.

2.12.1 Subject descriptors codes

SUBJECT DESCRIPTORS CODES	
17	AIR TRAFFIC CONTROL OPERATIONS/PROCEDURES/SLOT ALLOCATION
18	AIR TRAFFIC MANAGEMENT/FLOW MANAGEMENT
21	AIRPORT OPERATIONS/PROCEDURES
220	EVALUATION
298	HUMAN FACTORS
465	PASSENGER TRANSPORT
565	SIMULATION
635	TRANSPORT SAFETY/SECURITY

2.12.2 Documentation and information on the result

DOCUMENTATION AND INFORMATION ON THE RESULT		
Documentation type	**Details (Title, ref. number, general description, language)**	**Status: PU=Public CO=Confidential**
ATC-Wake D2_7	ATC-Wake Controller Human Machine Interfaces (HMIs)	CO
ATC-Wake D4_5	Evaluation of interoperability with existing ATC systems	CO
ATC-Wake D4_6	Evaluation of usability and acceptability	CO
ATC-Wake D4_7	Final Report WP4000 Operational Feasibility	PU

2.12.3 Intellectual Property Rights

INTELLECTUAL PROPERTY RIGHTS							
Type of IPR	**KNOWLEDGE: Tick a box and give the corresponding details(reference numbers, etc) if appropriate**					**Pre-existing know-how Tick a box and give the corresponding details (reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP[1)]**	**NoI[2)]**	**Details**	**Tick**		
Patent applied for							

Patent granted							
Patent search carried out							
Registered design							
Trademark applications							
Copyrights							
Secret know-how							
Other - please specify:							

2.12.4 Market application sectors

MARKET APPLICATION SECTORS
62h Air Transport / Transport of passenger or freight by airlines
63.2.j Airport and air-traffic control activities
73 Research and development

2.12.5 Current stage of development

CURRENT STAGE OF DEVELOPMENT	
Current stage of development	The controller Human Machine Interfaces (HMIs) have been designed, specified, implemented and tested at the NLR Air Traffic Control (ATC) research simulators (NARSIM/TRS). Demonstration trials have been performed with participation of the ATC-Wake and I-Wake User Groups and controllers from four different countries (Great Britain, Netherlands, Belgium, and France). A further demonstration trial/experiment will be performed during the Final Meeting of the ATC-Wake project.
Other:	

2.12.6 Quantified data about the result

QUANTIFIED DATA ABOUT THE RESULT		
Items (about the results)	**Actual current quantity**	**Estimated (or future) quantity**
Time to application / market (in months from the end of the research project)		24 – 96
Number of (public or private) entities potentially involved in the implementation of the result:		3

of which: number of SMEs:		0
of which: number of entities in third countries (outside EU):		0
Targeted user audience: of reachable people		1000
S&T publications (referenced publications only)	0	1
publications addressing general public (e.g. CD-ROMs, WEB sites)	3	5
publications addressing decision takers / public authorities / etc.	0	1
Visibility for the general public (yes or no)	Yes	

2.12.7 Further collaboration, dissemination and use of the result

FURTHER COLLABORATION, DISSEMINATION AND USE OF THE RESULT

COLLABORATIONS SOUGHT					
R&D	Further research or development	X	**FIN**	Financial support	
LIC	Licence agreement		**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement		**PPP**	Private-public partnership	
MKT	Marketing agreement		**INFO**	Information exchange/training	X
JV	Establish a joint enterprise or partnership	X	**CONS**	Available for consultancy	X
Other	(please specify)				
Details:					

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE
Application and further use of the HMIs is foreseen in 2 follow-up European R&D projects: • **CREDOS (or CROWS)**: validation of an operational concept for crosswind departures through real-time ATC simulations, wake vortex data collection and analysis, risk assessment, construction of a safety case and human factors case, and a WV safety management system. • **ATC-Wake2**: installation and testing of an ATC-Wake system at selected airport(s), through shadow-mode field trials and evaluation of the experiences with the new working methods.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE
ATS providers, ATM industry and ATM research and development centres.

2.13 Result No.13 : Operational concepts, procedures and working methods

DESCRIPTION OF RESULT No. 13

No.	Title
13	Operational concepts, procedures and working methods

CONTACT PERSON FOR THIS RESULT	
Name	Antoine VIDAL
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URL	
Specific Result URL	

SUMMARY

The ATC-Wake project has designed and specified a decision support system for air traffic controllers. As first step towards a usable and acceptable system, the following elements have been defined:

- Operational requirements;
- Operational concepts and procedures,
- Users requirements;
- System requirements based on operational concepts and users requirements.

As a first step towards implementation of ATC-Wake platform, the system requirements have drawn the preliminary operational concept and the requirements for using separation minima based on WV detection and prediction information. As next step, these requirements have been validated through system design and safety assessment and then operational feasibility evaluation.

During development of ATC-Wake requirements, a number of key issues have been identified and were further assessed:

- Transitions between ATC-Wake and ICAO separation modes
- Aircraft separation and sector loading
- Evaluation of safety requirements
- Evaluation of capacity benefits

During the next phase, operational feasibility of the ATC-wake system has been evaluated. Analysis of interoperability with existing ATC systems, usability and acceptability by its foreseen end-users (air traffic controllers) has been performed. Operational concept and procedures have been evaluated.

2.13.1 Subject descriptors codes

SUBJECT DESCRIPTORS CODES	
7	AERONAUTICS
17	AIR TRAFFIC CONTROL OPERATIONS/PROCEDURES/SLOT ALLOCATION
18	AIR TRAFFIC MANAGEMENT/FLOW MANAGEMENT
20	AIRCRAFT
21	AIRPORT OPERATIONS/PROCEDURES
150	DATABASES, DATABASE MANAGEMENT, DATA MINING
219	EUROPEAN STUDIES
465	PASSENGER TRANSPORT
526	R&D POLICY AND PROGRAMME EVALUATION AND IMPACT ASSESSMENT
548	RTD SYSTEMS AND POLICIES AND THEIR INTERACTION WITH OTHER RELATED POLICIES
635	TRANSPORT SAFETY/SECURITY

2.13.2 Documentation and information on the result

DOCUMENTATION AND INFORMATION ON THE RESULT		
Documentation type	**Details (Title, ref. number, general description, language)**	**Status:** **PU=Public** **CO=Confidential**
ATC-Wake D1_1	Definition of operational requirements	CO
ATC-Wake D1_2	Definition of operational concepts & procedures	CO
ATC-Wake D1_3	Definition of user requirements	CO
ATC-Wake D1_4	Definition of system requirements	CO
ATC-Wake D1_5	Final Report WP1000 System requirements	PU

ATC-Wake D4_4	Evaluation of operational concepts and procedures	CO
ATC-Wake D4_5	Evaluation of interoperability with existing ATC systems	CO
ATC-Wake D4_6	Evaluation of usability and acceptability	CO
ATC-Wake D4_7	Final Report WP4000 Operational Feasibility	PU

2.13.3 Intellectual Property Rights

INTELLECTUAL PROPERTY RIGHTS							
Type of IPR	**KNOWLEDGE:** **Tick a box and give the corresponding details(reference numbers, etc) if appropriate**					**Pre-existing know-how** **Tick a box and give the corresponding details (reference numbers, etc) if appropriate**	
	Current				**Foreseen**	**Tick**	**Details**
	Tick	**NoP[1)]**	**NoI[2)]**	**Details**	**Tick**		
Patent applied for							
Patent granted							
Patent search carried out							
Registered design							
Trademark applications							
Copyrights							
Secret know-how							
Other - please specify:							

1) Number of **P**riority (national) applications/patents
2) Number of **I**nternationally extended applications/patents

2.13.4 Market application sectors

MARKET APPLICATION SECTORS
53.3 Manufacture of aircraft and spacecraft, and aeroplanes for the transport of goods or passengers
62h Air Transport / Transport of passenger or freight by airlines
73 Research and development

2.13.5 Current stage of development

CURRENT STAGE OF DEVELOPMENT	
Current stage of development	The results are directly available for users (including ATS providers, regulators, and ATM research and development centres). The results have been disseminated and used in the WakeNet2 Europe and WakeNet USA (and associated US and Europe wake vortex Concept of Operations development teams).
Other:	

2.13.6 Quantified data about the result

QUANTIFIED DATA ABOUT THE RESULT		
Items (about the results)	**Actual current quantity**	**Estimated (or future) quantity**
Time to application / market (in months from the end of the research project)		
Number of (public or private) entities potentially involved in the implementation of the result:		
of which: number of SMEs:		
of which: number of entities in third countries (outside EU):		
Targeted user audience: of reachable people		
S&T publications (referenced publications only)		
publications addressing general public (e.g. CD-ROMs, WEB sites)	2	
publications addressing decision takers / public authorities / etc.	1	
Visibility for the general public (yes or no)	YES	

2.13.7 Further collaboration, dissemination and use of the result

FURTHER COLLABORATION, DISSEMINATION AND USE OF THE RESULT

COLLABORATIONS SOUGHT					
R&D	Further research or development	X	**FIN**	Financial support	
LIC	Licence agreement		**VC**	Venture capital/spin-off	

				funding	
MAN	Manufacturing agreement		**PPP**	Private-public partnership	
MKT	Marketing agreement		**INFO**	Information exchange/training	X
JV	Establish a joint enterprise or partnership		**CONS**	Available for consultancy	
Other	(please specify)				
Details:					

POTENTIAL OFFERED FOR FURTHER DISSEMINATION AND USE
The ATC-Wake project benefits from a User Group, which has shown interest in the exploitation of the project results: DFS, NATS, ASD, Airbus, FAA, NASA, Transport Canada, and Nav Canada. Besides use in CREDOS or CROWS and the follow-up project ATC-Wake 2, this project result is also offered for further dissemination and use by this User Group and similar organizations.

PROFILE OF ADDITIONAL PARTNER(S) FOR FURTHER DISSEMINATION AND USE
The results can be used directly by air traffic control centres for development of their local ATC procedures and working methods for reduced (wake vortex) separation at their airports/ATC centre.

3 Exploitation Plan (Confidential)

EXPLOITATION PLAN
CONFIDENTIAL

3.1 Exploitation plan of Partner No.1 : NLR

3.1.1 Description of the use and dissemination of result(s)

DESCRIPTION OF THE USE AND THE DISSEMINATION OF RESULT(S)

Contract number:	IST-2001-34729
Partner's name:	NLR

CONTACT PERSON(S):	
Name	Lennaert SPEIJKER
Position/Title	Senior R&D Manager
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TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)
Through its participation in ATC-Wake, NLR will (to an even higher extent) be able to support Air Traffic Control centres and Civil Aviation Authorities with respect to the design and approval of newly proposed ATM procedures and systems. Particular emphasis will be on future (weather based) systems and procedures that might enable safe reduction of separation minima, under specific conditions. After completion of ATC-Wake, NLR will have extended their validated probabilistic wake vortex induced risk model to cover the whole airport environment. The associated tool will enable evaluation of the safety and capacity aspects of different aircraft operations (landing, take-off, mixed mode operations) on different runway configurations (single runways and closely spaced parallel runways) and under various weather and wind conditions. An emulator of this tool will be the Separation Mode Planner, a key element within the new integrated ATC-Wake system. NLR will furthermore have established an advanced – thoroughly tested on usability and acceptability – Human Machine Interface as front-end for controllers, the main foreseen users of the future integrated ATC-Wake *system*. Clearly these tools – integrated within the ATC wake vortex safety and capacity *platform* – constitute critical elements in the future that can be exploited for realisation of the integrated ATC-Wake *system* that might be installed at European airports. NLR exploitable airport safety & capacity *evaluation* tools will be ready for integration within SPADE.

3.1.2 Timetable of the use and dissemination activities

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT	
Activity:	CREDOS (or CROWS)
Timescale(month):	6
Brief description:	CREDOS (or CROWS) is a new project submitted in the 6th RTD framework programme. If funded, it will start in July 2006. Purposes of CREDOS are to demonstrate the feasibility of a concept of operations allowing reduced separations for Single Runway Departures under crosswind, to provide stakeholders with the required information to facilitate the implementation of this concept where appropriate in the near-term (pre-2012), and to increase the body of knowledge concerning wake vortex behaviour during initial climb phase of flight.
Activity:	ATC-Wake 2
Timescale(month):	36
Brief description:	ATC-Wake 2 is a new integrated project that could be submitted in the EU 7th RTD Framework Program. Purpose is to validate and test the feasibility of a *combined* ground based and airborne WV prediction and detection system. This project would include installation and testing of the ATC-Wake system at one or more airports. Shadow mode field trials are foreseen, building on results from ATC-Wake, I-Wake, CREDOS, TALIS.
Activity:	Safety Cases
Timescale(month):	6
Brief description:	The purpose is to provide authorities and air traffic control centres with a justification for the safe introduction of new operational concepts for reduced (wake vortex) separation at airports. NLR aims to use the WAVIR methodology and toolset, possibly in co-operation with other organizations.

3.1.3 Foreseen collaborations with other entities

FORESEEN COLLABORATIONS WITH OTHER ENTITIES					
R&D	Further research or development	X	**FIN**	Financial support	X
LIC	Licence agreement	X	**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement		**PPP**	Private-public partnership	X
MKT	Marketing agreement/Franchising		**INFO**	Information exchange	X
JV	Joint venture	X	**CONS**	Available for consultancy	X
Other	(please specify)				
Details:					

3.1.4 Quantified data

QUANTIFIED DATA		
Items	**Currently achieved quantity**	**Estimated future quantity**
Economic impacts (in EURO)	?	3 M€
number of licenses issued (within EU)	0	5
numberof licenses issued (outside EU)	?	?
Total value of licenses (in EURO)	?	?
number of entrepreneurial actions (start-up company, joint ventures…)	0	0
number of direct jobs created[c]	2	4
number of direct jobs safeguarded[c]	3	3
number of direct jobs lost	0	0

3.2 Exploitation plan of Partner No.2 : DLR

3.2.1 Description of the use and dissemination of result(s)

DESCRIPTION OF THE USE AND THE DISSEMINATION OF RESULT(S)

Contract number:	IST-2001-34729
Partner's name:	DLR

CONTACT PERSON(S):	
Name	Thomas GERZ
Position	Scientist, head of DLR project Wirbelschleppe
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TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)
Completion and Improvement of DLR's tools (i.e. the weather nowcaster as NOWVIV, wake predictor as P2P, weather monitors as radar, lidar and profilers, and the wake detection by lidar) and their combination into an integrated Wake Vortex Prediction and Monitoring System (WVPMS).

3.2.2 Timetable of the use and dissemination activities

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT	
Activity:	**WVPMS employment**
Timescale(month):	12
Brief description:	The WVPMS shall be employed in a test campaign in 2006 at Frankfurt airport to check concept, feasibility and suitability of the WVPMS and its components in an ATC/ATM environment. This could be done in co-operation with the German ATC authorities and the DLR research project WIRBELSCHLEPPE.

3.2.3 Foreseen collaborations with other entities

FORESEEN COLLABORATIONS WITH OTHER ENTITIES					
R&D	Further research or development	X	**FIN**	Financial support	
LIC	Licence agreement		**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement	X	**PPP**	Private-public partnership	
MKT	Marketing agreement/Franchising	X	**INFO**	Information exchange	X
JV	Joint venture	X	**CONS**	Available for consultancy	
Other	(please specify)				
Details:					

3.2.4 Quantified data

QUANTIFIED DATA		
Items	**Currently achieved quantity**	**Estimated future quantity**
Economic impacts (in EURO)	1.2 M€	3 M€
number of licenses issued (within EU)	0	1
numberof licenses issued (outside EU)	?	?
Total value of licenses (in EURO)	?	?
number of entrepreneurial actions (start-up company, joint ventures…)	0	0
number of direct jobs created[c]	1	2
number of direct jobs safeguarded[c]	1	1
number of direct jobs lost	0	0

3.3 Exploitation plan of Partner No.3: Eurocontrol

3.3.1 Description of the use and dissemination of result(s)

DESCRIPTION OF THE USE AND THE DISSEMINATION OF RESULT(S)

Contract number:	IST-2001-34729
Partner's name:	EEC

CONTACT PERSON(S):	
Name	Antoine VIDAL
Position/Title	Senior R&D Manager
Organisation	EEC
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Fax	+ 33 1 69 88 72 44
E-mail	Antoine.vidal@eurocontrol.int

TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)
EEC will benefit from the participation in ATC-WAKE project in the re-use of operational wake-vortex models in its ATC simulators, both Fast-Time and Real-Time, but also in the acquisition of new operational concepts, procedures and appropriate working methods. EEC will also benefit of acquired experience for the conduct of further validation process in the field of Wake-vortex and runways utilisation including S-MGCS. EEC will have learnt on elaborating system definition as well as users requirements definition. Wake vortex characterisation, detection and forecast, are considered to be significant improvements of the ATM2000+ strategy. Wake vortex related improvements are expected to be implemented in the medium term road mapping of the strategy.

3.3.2 Timetable of the use and dissemination activities

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT	
Activity:	Operational concept
Timescale(month):	36
Brief description:	The results can be used for definition of new ATM operational concepts and flight procedures aimed to enhance airport capacity, and are expected to be disseminated and used further in WakeNet2 Europe and WakeNet USA, as well as the potential new EC projects *CREDOS* and *ATC-Wake 2*. Both potential EC projects are part of the Eurocontrol Wake Vortex Separation Management Plan.
Activity:	CREDOS
Timescale(month):	36
Brief description:	CREDOS is a new project submitted in the 6th RTD framework programme. If funded, it will start in July 2006. Purposes of CREDOS are to demonstrate the feasibility of a concept of operations allowing reduced separations for Single Runway Departures under crosswind, to provide stakeholders with the required information to facilitate the implementation of this concept where appropriate in the near-term (pre-2012), and to increase the body of knowledge concerning wake vortex behaviour during initial climb phase of flight.
Activity:	ATC-WAKE 2
Timescale(month):	36
Brief description:	ATC-Wake 2 is a new integrated project that could be submitted in the EU 7th RTD Framework Program. Purpose is to validate and test the feasibility of a *combined* ground based and airborne WV prediction and detection system. This project would include installation and testing of the ATC-Wake system at one or more airports. Shadow mode field trials are foreseen, building on results from ATC-Wake, I-Wake, CREDOS, TALIS.

3.3.3 Foreseen collaborations with other entities

FORESEEN COLLABORATIONS WITH OTHER ENTITIES					
R&D	Further research or development	X	**FIN**	Financial support	
LIC	Licence agreement		**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement		**PPP**	Private-public partnership	
MKT	Marketing agreement/Franchising		**INFO**	Information exchange	X
JV	Joint venture		**CONS**	Available for consultancy	
Other	(please specify)				
Details:					

3.3.4 Quantified data

QUANTIFIED DATA		
Items	**Currently achieved quantity**	**Estimated future quantity**
Economic impacts (in EURO)		
number of licenses issued (within EU)		
numberof licenses issued (outside EU)		
Total value of licenses (in EURO)		
number of entrepreneurial actions (start-up company, joint ventures…)		
number of direct jobs created[c]		
number of direct jobs safeguarded[c]		
number of direct jobs lost		

3.4 Exploitation plan of Partner No.4 : Thales Air Defence

3.4.1 Description of the use and dissemination of result(s)

DESCRIPTION OF THE USE AND THE DISSEMINATION OF RESULT(S)

Contract number:	IST-2001-34729
Partner's name:	TAD

CONTACT PERSON(S):	
Name	Frédéric BARBARESCO
Position/Title	"Radar Detection & Management" Team Manager
Organisation	TAD
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TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)
TAD will benefit from its participation to ATC-WAKE in the completion/improvement of its existing weather/wake monitoring, nowcasting, forecasting tools, based on skeleton tracking algorithms and high resolution doppler spectrum processing techniques. Moreover, TAD as radar manufacturer will benefit in the interest of radar for weather/wake analysis ; the wake radar detection is especially expected to be complementary to the lidar one in order to cope with all weather performances. The main actions will be: • Contribution to the marketing of the new integrated system; • Contribution to the full system mock-up; • Contribution to system final specification and industrialisation.

3.4.2 Timetable of the use and dissemination activities

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT	
Activity:	Continue cooperating to R&D for evaluation of the performances of wake vortex radar detection as complementary to the lidar ones in order to ensure reliable ALL WEATHER detection / location /forecasting of the wakes.
Timescale(month):	36
Brief description:	To propose wake radar measurements campaigns together with lidar ones at some candidate operational airports (e.g. through the potential new EC projects CREDOS (or CROWS) and ATC-Wake 2). Existing available radars in several frequency bands are wishable.
Activity:	ATC-WAKE 2
Timescale(month):	36
Brief description:	ATC-Wake 2 is a new integrated project that could be submitted in the EU 7th RTD Framework Program. Purpose is to validate and test the feasibility of a *combined* ground based and airborne WV prediction and detection system. This project would include installation and testing of the ATC-Wake system at one or more airports. Shadow mode field trials are foreseen, building on results from ATC-Wake, I-Wake, CREDOS, TALIS.
Activity:	
Timescale(month):	
Brief description:	

3.4.3 Foreseen collaborations with other entities

FORESEEN COLLABORATIONS WITH OTHER ENTITIES					
R&D	Further research or development	X	**FIN**	Financial support	X
LIC	Licence agreement	X	**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement	X	**PPP**	Private-public partnership	
MKT	Marketing agreement/Franchising	X	**INFO**	Information exchange	X
JV	Joint venture		**CONS**	Available for consultancy	X
Other	(please specify)				
Details:					

3.4.4 Quantified data

QUANTIFIED DATA		
Items	**Currently achieved quantity**	**Estimated future quantity**
Economic impacts (in EURO)		
number of licenses issued (within EU)		
numberof licenses issued (outside EU)		
Total value of licenses (in EURO)		
number of entrepreneurial actions (start-up company, joint ventures…)		
number of direct jobs created[c]		
number of direct jobs safeguarded[c]		
number of direct jobs lost		

3.5 Exploitation plan of Partner No.5: Thales Avionics

3.5.1 Description of the use and dissemination of result(s)

DESCRIPTION OF THE USE AND THE DISSEMINATION OF RESULT(S)

Contract number:	IST-2001-34729
Partner's name:	TAV

CONTACT PERSON(S):	
Name	Laurence MUTUEL
Position/Title	Project Coordinator for I-WAKE
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TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)
As co-ordinator of I-WAKE, contributor to ATC-WAKE and area co-ordinator for the instrumentation research in WakeNet 2-Europe, THALES Avionics will ensure that these projects develop a synergy such that the ATC-WAKE results benefit not only the current European RTD actions in the field of wake-vortex, but also the expected ones. As avionics systems manufacturer, and starting from I-WAKE results merged with ATC-WAKE conclusions, THALES Avionics will have at disposal the validated definition of the airborne system fully integrated in the global ground and board system. THALES Avionics will progress towards systems production for transport aircraft within 5 to 8 years after the completion of I-WAKE. The main actions will be: • Contribution to the marketing of the new system. • Contribution to full system mock-up. • Contribution to the formal evolution of ATM procedures. • System final specification and industrialisation.

3.5.2 Timetable of the use and dissemination activities

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT	
Activity:	Continue cooperating to R&D projects for the progress toward product development
Timescale(month):	36 months to 48 months
Brief description:	Participation to FIDELIO project (laser technology development, European project) Participation to FLYSAFE project (product specification, European project
Activity:	ATC-WAKE 2
Timescale(month):	36
Brief description:	ATC-Wake 2 is a new integrated project that could be submitted in the EU 7th RTD Framework Program. Purpose is to validate and test the feasibility of a *combined* ground based and airborne WV prediction and detection system. This project would include installation and testing of the ATC-Wake system at one or more airports. Shadow mode field trials are foreseen, building on results from ATC-Wake, I-Wake, CREDOS, TALIS.

3.5.3 Foreseen collaborations with other entities

FORESEEN COLLABORATIONS WITH OTHER ENTITIES					
R&D	Further research or development	X	**FIN**	Financial support	X
LIC	Licence agreement		**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement		**PPP**	Private-public partnership	
MKT	Marketing agreement/Franchising	X	**INFO**	Information exchange	X
JV	Joint venture		**CONS**	Available for consultancy	X
Other	(please specify)				
Details:					

3.5.4 Quantified data

QUANTIFIED DATA		
Items	**Currently achieved quantity**	**Estimated future quantity**
Economic impacts (in EURO)		
number of licenses issued (within EU)		
numberof licenses issued (outside EU)		
Total value of licenses (in EURO)		
number of entrepreneurial actions (start-up company, joint ventures…)		
number of direct jobs created[c]		
number of direct jobs safeguarded[c]		
number of direct jobs lost		

3.6 Exploitation plan of Partner No.6 : UCL

3.6.1 Description of the use and dissemination of result(s)

DESCRIPTION OF THE USE AND THE DISSEMINATION OF RESULT(S)

Contract number:	IST-2001-34729
Partner's name:	UCL

CONTACT PERSON(S):	
Name	Grégoire Winckelmans
Position/Title	Professor
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TITLE AND BRIEF DESCRIPTION OF MAIN RESULT(S)
UCL will benefit scientifically from their participation in ATC-WAKE, especially from the use of the real-time operational wake vortex predictors (the “Vortex Forecast System”, VFS, and its “probabilistic” use, the P-VFS) and their validation as part of an integrated platform: P-VFS integration with wake vortex monitoring, weather forecasting/nowcasting and monitoring, and aircraft data. It will also benefit from its participation in the integration of the P-VFS with the WAVIR tool of NLR, for risk assessment studies, and of the integration of the P-VFS in the ATC-Wake wake vortex prediction and monitoring system (WVPMS). It will also benefit from its participation in the operational feasibility studies for ATC use of an integrated system. All this will also produce material for scientific communications and/or publications, thus also ensure the proper dissemination of the ATC-WAKE project results. The UCL participation in ATC-Wake will also significantly increase the future impact of our research group in the European aerospace community (industry, air traffic control agencies, airports). This will enhance our capacity to enter into further partnerships, especially those which require high level capabilities in efficient and operational (real-time) wake vortex modeling. The VFS tool, in its form prior to the ATC-WAKE project (2000), is owned by its developers (one of which being G. Winckelmans): this corresponds to foreground intellectual property. The VFS tool was further developed and enhanced by UCL since 2000 (stratification model, two-phase decay model, improved wind shear model, improved ground effect model, etc.), also as

part of the ATC-Wake project. As to the P-VFS, it constitutes an upper software layer, also developed by UCL, and for "probabilistic use of the VFS": thus a "probabilistic wake vortex predictor". the P-VFS module is based on parametric multiple runs (Monte Carlo type simulation) of the VFS, each run being a deterministic VFS run. It is able to provide the time evolution of the 3-D danger volume in which the vortices, generated by an aircraft, have a certain probability to be found. It includes what is required to ensure a high level of reliability on the results: it takes into account the effect, on the predicted danger volume, of the variations/uncertainties of the weather profiles, the aircraft generator parameters, and also the physical model parameters used in VFS.

Notice also that the "ground effect" model of the P-VFS will also be further improved during the FAR-Wake project (a new STREP of FP6 of which UCL is partner). The P-VFS will also be used, in connection with WAVIR, for studies in the ongoing AWIATOR project (an IP of FP5 of which UCL is partner). The application of the P-VFS to "wake vortex prediction in cruise" (also on board) is going to be addressed in the project FLYSAFE (a new IP of FP6 of which UCL is partner).

Even if UCL is not part of industry or public bodies, we declare a strong interest in participating, as partner with industry, ATC agencies and airports, to further developments and validations of integrated systems making use of operational wake vortex modelling, for ATC use at real airports (also for new projects addressing "wake vortices on departure").

Future wake research will also call for efficient wake vortex modelling combined with other systems (HMI, flight simulators, displays, etc.). This is a new path of promising future developments, and where UCL will be able to play an important role. In that respect, our long time expertise in efficient 2-D (as in VFS, using 2-D cross-planes wake vortex simulations) and 3-D vortex methods constitutes a unique state-of-the-art technology that could be put to significant operational use in the future: airports and ATC systems, training and flight simulator systems, refueling studies in flight simulators, on board wake vortex sensors enhanced by on board wake vortex behaviour forecasting (as in I-WAKE).

3.6.2 Timetable of the use and dissemination activities

TIMETABLE OF THE USE AND DISSEMINATION ACTIVITIES WITHIN THE NEXT 3 YEARS AFTER THE END OF THE PROJECT	
Activity:	FLYSAFE project
Timescale(month):	24
Brief description:	FLYSAFE is a 6th RTD framework programme project started in February 2005. Its purpose is to design, develop, implement, test and validate a complete *Next Generation Integrated Surveillance System* (NG ISS), going a generation further than the emerging integrated safety. UCL is involved in the WP2 (starting in February 2006 for a duration of 24 months) which aims at developing, validating and testing an innovative, efficient and competitive on-board integrated surveillance system. More specifically, we will be involved in WP2.3.1 "wake vortex prediction (cruise)" for real-time probabilistic modelling, using P-VFS, also in RVSM space and for support to "wake vortex detection enhanced by prediction". The tools developed as well as the experience and knowledge of the ATC-Wake project will be most helpful for FLYSAFE.

Activity:	CREDOS
Timescale(month):	36
Brief description:	CREDOS is a new project submitted in the 6th RTD framework programme. If funded, it will start in July 2006. Purposes of CREDOS are to demonstrate the feasibility of a concept of operations allowing reduced separations for Single Runway Departures under crosswind, to provide stakeholders with the required information to facilitate the implementation of this concept where appropriate in the near-term (pre-2012), and to increase the body of knowledge concerning wake vortex behaviour during initial climb phase of flight. As in ATC-Wake, UCL will be involved in the prediction of wake vortex behaviour (WP2) and in providing vortex models for risk modelling and assessment (WP3).
Activity:	ATC-Wake 2
Timescale(month):	36
Brief description:	ATC-Wake 2 is a new integrated project that could be submitted in the EU 7th RTD Framework Program. Purpose is to validate and test the feasibility of a *combined* ground based and airborne WV prediction and detection system. This project would include installation and testing of the ATC-Wake system at one or more airports. Shadow mode field trials are foreseen, building on results from ATC-Wake, I-Wake, CREDOS, TALIS.

3.6.3 Foreseen collaborations with other entities

FORESEEN COLLABORATIONS WITH OTHER ENTITIES					
R&D	Further research or development	X	**FIN**	Financial support	
LIC	Licence agreement		**VC**	Venture capital/spin-off funding	
MAN	Manufacturing agreement		**PPP**	Private-public partnership	X
MKT	Marketing agreement/Franchising		**INFO**	Information exchange	X
JV	Joint venture		**CONS**	Available for consultancy	X
Other	(please specify)				
Details:					

3.6.4 Quantified data

QUANTIFIED DATA		
Items	**Currently achieved quantity**	**Estimated future quantity**
Economic impacts (in EURO)		
number of licenses issued (within EU)		
numberof licenses issued (outside EU)		
Total value of licenses (in EURO)		
number of entrepreneurial actions (start-up company, joint ventures…)		
number of direct jobs created[c]		
number of direct jobs safeguarded[c]		
number of direct jobs lost		

4 Authorisation of public dissemination of the TIP

I am the Co-ordinator of the above project, and confirm on behalf of the contracted Partners the information contained in this Technological Implementation Plan, and I authorise its public dissemination.	
Signature:	**Name: Lennaert SPEIJKER**
Date:	**Organisation: NLR**