IPPA

IST–1999-20569

Innovative Portable Pilot Assistance

Deliverable D 12 : Final Report

Report Version :	0.3	Copy N°.	0
Report Preparation Date :	21.3.2003		
Classification :	PUB		
Contract Start Date :	1.11.2000	Duration :	28 Months
Project Co-ordinator :	Dr M Hadley, QinetiQ		
Partners :			
	AVV	QinetiQ	
	C-MAP	NCD	
	DNV	SINTEF	
	EMPA	SML	
	INTRACOM	TELENOR	
	ISSUS	THETIS	

Project funded by the European Community under the "Information Society Technology" Programme (1998-2002)

IPPA Innovative Portable Pilot Assistance

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	N^{o}.
PAGES	ix + 36
FIGURES	6
TABLES	6
ANNEXES	1

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Version	Status	Date	Authorised by
0.1	Draft version – 2nd Annual Review	5/10/02	Mike Hadley
0.2	Draft version – Consortium Review	28/1/03	Mike Hadley
0.3	Draft version – Peer Review	7/4/03	Mike Hadley
1.0	Initial issue	23/4/03	Mike Hadley

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LIST OF ABBREVIATIONS

AC	Alternating Current
AIS	*Universal* Automatic Identification System
ASCII	American Standard Code for Information Interchange
BBM	Binary Broadcast Message
CTV	Close Circuit Television
CPU	Central Processing Unit
D	Deliverable
DBF	DataBase File
DC	Direct Current
DGPS	Differential Global Positioning System
ECDIS	Electronic Chart Display and Information System
ECS	Electronic Chart System
ESP	External Service Provider
EU	European Union
FTP	File Transfer Protocol
GMDSS	Global Maritime Distress and Safety System
GPRS	General Packet Radio Service
GPS	Global Positioning System
GRIB	GRid In Binary
HAZMAT	Hazardous Material
HTML	Hyper Text Mark-up Language
IEC	International Electrotechnical Commission
IGS	IPPA Ground Station
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
ICMP	Internet Control Message Protocol
IETF	Internet Engineering Task Force
IHMA	International Harbour Masters' Association
IMO	International Maritime Organisation
IMPA	International Maritime Pilots' Association
IPPA	Innovative Portable Pilot Assistance
ISM	International Safety Management Code
ITU	International Telecommunication Union
JSP	Java Server aPplication
KISS	Keep it simple stupid
MARPOL	IMO Convention for the Prevention of Maritime Pollution from Ships 1973 as modified by the 1978 protocol

MFPS	Multi Functional Presentation System
MPX	Master / Pilot Exchange
NAVCO	NAVCO Messages or Notices to Skippers
OTA	Over The Air
PCMCIA	Personal Computer Memory Card International Association
PEU	Portable External Unit
PMU	Portable Mobile Unit
PPP	Point to Point Protocol
PPU	Portable Pilot Unit
RIS	River Information Services
ROT	Rate of Turn
SAR	Search and Rescue
SOAP	Simple Object Access Protocol
SOLAS	International Convention on the Safety Of Life At Sea 1974, as amended
SPIL	Systeem Planning & Inzet Loodsen
SW	Software
SWE	Shallow Water Effect
TCP/IP	Transmission Control Protocol / Internet Protocol
UKC	Under Keel Clearance
UML	Universal Mark-up Language
US	Unites States (of America)
VHF	Very High Frequency (156-162Mhz, maritime)
VTMIS	Vessel Traffic Management and Information Services
VTS	Vessel Traffic Services
WAN	Wide Area Network
WLAN	Wireless Local Area Network
WRC	World Radio Conference
XML	eXtensible Markup Language

1 PROJECT OVERVIEW

1.1 Project Summary

1.1.1 Timescales

The project began on 1 November 2000 and was originally planned to run for 24 months, thus ending on 31 October 2002. However, it has to be admitted that the technical difficulties faced by Work Package 5 (Development and Verification) were considerably more complex than had been first appreciated and there was an additional challenge in providing the shorebased infrastructure to support the shipboard equipment, which was initially seen as the main thrust of the project. The realisation of what the consortium was tackling was apparent at the 1st Annual Review and a re-evaluation of the project's timescales resulted in an application for a 4-month extension, thus meaning that the project would end on 28 February 2003.

1.1.2 Project concept

IPPA sought to develop and validate an advanced prototype portable pilot equipment (technology demonstration) that can receive data from a shorebased Vessel Traffic Services (VTS) centre or other authorised source, such as track and environmental data, and thus, together with its stored data and other vessel's AIS, display a comprehensive traffic image. The equipment was intended to meet the user's needs, be stand alone (apart from a capability to accept power if available) and function autonomously. It was envisaged that with a variety of communications interfaces, production equipment would also be capable of transmitting back to a shorebased VTS centre data required for traffic and port management. The overall effect was expected to be an improvement in navigational safety, a reduction in voice radio communications and provision of a beneficial impact on the efficiency of traffic flow. This 'high end' equipment was seen as leading, in production, to a modular design that would enable IPPA to be configured to meet various user requirements and a wide range of budgets.

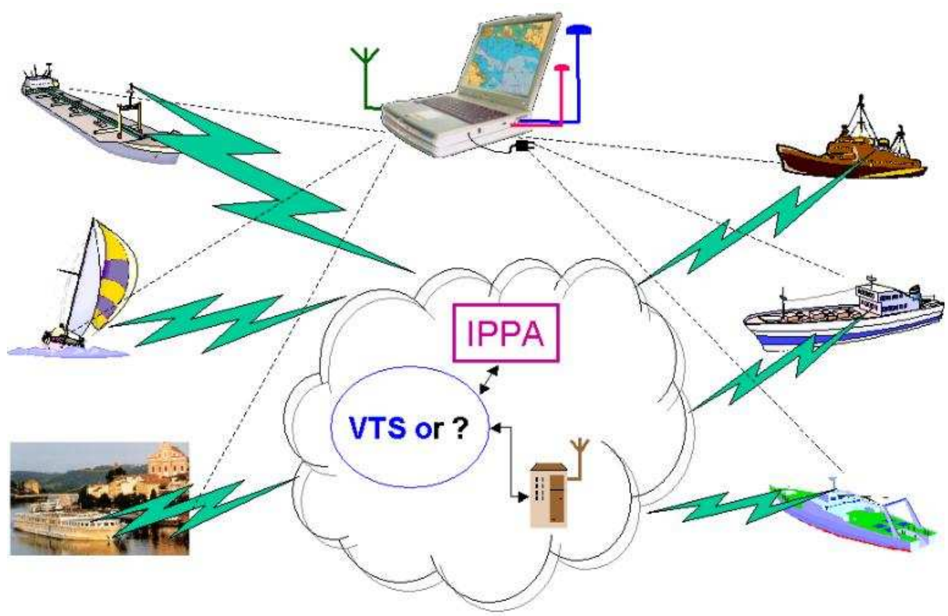

Figure 1 IPPA Concept

Interoperability with international AIS developments were seen as a key requirement and so IPPA also sought to include compatibility between sea and inland waterways users and other vessels not covered by the SOLAS carriage requirements. In the planning stages of the project these areas looked unrecognised by international bodies and thus ripe for exploration and recommendations on standardisation. However, the uncharacteristically high speed of international developments in the fields of AIS technology and standardisation during the project, specifically in the areas of non-binary messages (Category B binary messages) and base / relay station specification has meant that the project quickly concluded that a 'go it alone' solution to AIS for vessels not covered by the carriage requirements of SOLAS was infeasible. To a great extent, it would have been 'shooting at a moving target' as the international developments in AIS moved to a conclusion and expenditure of effort and resources in this area would have been fruitless.

With regard to the all important data flows the concept as envisaged and as finally put into practice is illustrated below.

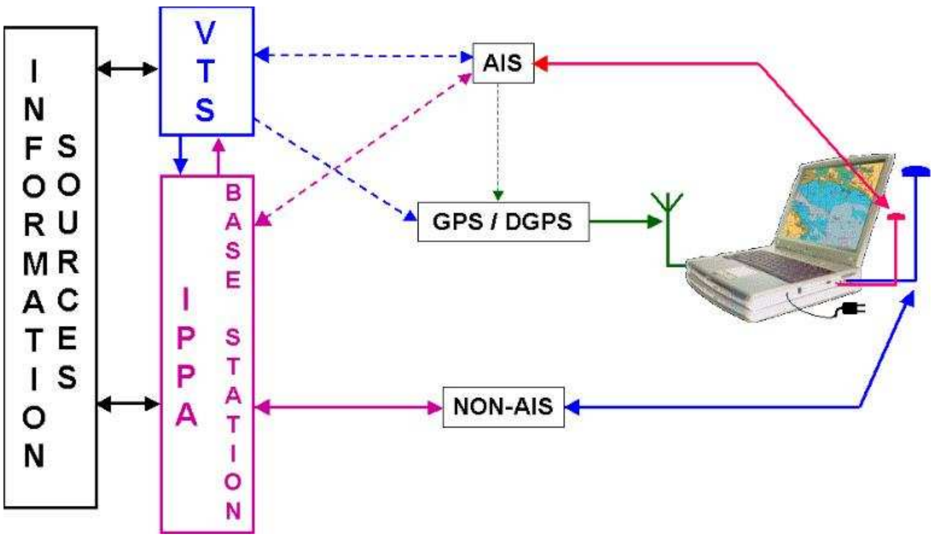

Figure 2 IPPA Data flows

1.1.3 Project achievements

Although reported in greater detail in section 4, the project's significant achievements have been :

⇒ Tangible

- The conduct of a comprehensive user requirement capture;
- The specification and design of an equipment to meet the users' requirement;
- The production of prototype equipment (technology demonstrator), including the integration of a heading device;
- The design and building of a base station to support the onboard equipment;
- The interfacing of the base station to various sources of data for transmission to the onboard equipment;
- The successful demonstration of the IPPA concept to a variety of users and interested bodies;
- The identification of appropriate standards and the provision of recommendations on standards, where these were deemed to be necessary;
- The provision of a tool by which onboard decision support can be enhanced.

⇒ Conceptual

- The validation of the IPPA concept;
- The dissemination of IPPA issues both to public groups and via concertation;

- The shift in understanding of how vessel traffic can be managed by a variety of stakeholders.
- The appreciation of the fact that ships could be more autonomous;
- The possibility that VTS Operators can take on a more strategic role;
- Assisting in accelerating technological development in waterborne transport;
- Acting as an enabling technology for the provision of multi-media services;
- Addressing the need for standardisation.

All of this was achieved in conjunction with the fast moving international development process of AIS, the introduction into service of AIS and being at the forefront of the implementation of new mobile telephone technology (GPRS).

1.2 Consortium composition

The consortium was co-ordinated by QinetiQ (Dr M Hadley) and comprised 12 partners, all at the level of contractor. Their details are as indicated below :

Participant name	**Participant short name**	**Country**
QinetiQ Limited	QinetiQ	United Kingdom
Institute of Ship Operation, Sea Transport and Simulation	ISSUS	Germany
Norwegian National Coastal Administration	NCD	Norway
Transport Research Centre	AVV	The Netherlands
SML Technologies Limited	SML	United Kingdom
THETIS SpA	THETIS	Italy
European Maritime Pilot's Association	EMPA	-
INTRACOM SA	INTRACOM	Greece
SINTEF Telecom and Informatics	SINTEF	Norway
Telenor R&D	Telenor	Norway
C-MAP	C-MAP	Norway
Det Norske Veritas AS	DNV	Norway

Table 1 IPPA Project Composition

1.3 Partner roles

The specific roles of each partner are detailed in section 9.2 of Annex 1 to the project contract and their brief descriptions and CVs of those involved are at Appendix A to the same document.

The principal roles of each partner were as follows :

1.3.1 QinetiQ

Co-ordination and overall project management. Leader for Work Packages 1 (Management) and 6 (Demonstration). Provision of user input, technical co-ordination, quality assurance and the Peer Review process for Deliverables. Assistance in dissemination and concertation. Responsible for the production of the Project Presentation (D11), Final Report (D12), Demonstration report (D61), report of the 1st and 2nd User Workshops (D91 and D93), revision of the User Requirement Specification (D21) and partly responsible for the Technological Implementation Plan (D94). Chairing of consortium level technical meetings.

QinetiQ was assisted by Euronautech, which provided support to Consortium Meetings, the drafting of D12 and D94 and the reports of both User Forums (D91 and D93).

1.3.2 Institute of Ship Operation, Sea Transport and Simulation

Responsible for organising a trial of the IPPA concept in Hamburg and co-ordinated the German national user requirement capture meeting. Leader for Task 7.2 (Assessment) but was unable to complete this role after the project had been extended. Effort and responsibility for the production of D72 was subsequently transferred to SINTEF. Leader for Task 9.1 (Dissemination) and responsible for the production of the Dissemination and Use Plan (D92). Participation in Work Package 3 required close liaison with SINTEF over the development of the information viewpoint. Work Package 5 called for provision of considerable input to the 'Man-Machine Interface' and data presentation aspects, in conjunction with C-Map.

1.3.3 Norwegian National Coastal Administration

Responsible for co-ordination of the 1st demonstration in Tromsø and provision of appropriate hardware, software and access to sources of information to enable the demonstration to take place. Co-ordination of the Norwegian national user requirement capture meeting.

1.3.4 Transport Research Centre

Responsible for co-ordination of the 1st demonstration in Rotterdam. Co-ordinated the Dutch national user requirement capture meeting and because it was so popular an additional meeting too. Key liaison with inland waterways operations and RIS.

1.3.5 THETIS SpA

Production of the Technology Demonstrator (D53) and leader of Work Package 5 (Development and Verification). This work required considerable integration skills, as well as calling for innovative approaches to a number of physical installation challenges. Thetis arranged and co-ordinated a number of technical meetings at the consortium and individual partner level. Close co-operation with SINTEF was required in Work Package 4 so that workable solutions would emerge from the physical viewpoint. Took over the completion of the verification task when INTRACOM could not complete it.

1.3.6 SML Technologies Limited

Leader of Work Package 9 (Exploitation and Dissemination). Production of the AIS and provision of the heading sensor for Work Package 5. Responsible for the integration of the Port of Rotterdam's track table and the production of the Technological Implementation Plan (D94). Close co-operation with SINTEF was required in Work Package 4 so that workable solutions would emerge from the physical viewpoint. Provision of technical support to the demonstrations and trial as required. Completed the verification task at short notice.

1.3.7 European Maritime Pilot's Association

Leader of Work Package 2 (User Requirement).and responsible for production of the User Requirement Specification (D21). Instrumental in the provision of expert user support in all phases of the project. Apart from its own members' expertise it was also able to call on that of the International Maritime Pilots' Association (IMPA). Provision of user support to the demonstrations and trial as required and the subsequent evaluation process. Put considerable effort into project dissemination.

1.3.8 INTRACOM SA

Leader for Task 5.2 (Verification) and responsible for the production of the Verification Plan (D51) and the Verification Report (D52). However, responsibility for the latter task was passed to THETIS. Provided considerable input to the mobile communications and integration aspects of development. Co-ordinated the Greek user requirement capture meeting. Collaboration with

SINTEF was required for the development of the draft verification plan. Close co-operation with SINTEF was required in Work Package 4 so that workable solutions would emerge from the communications viewpoint. In Work Package 5 INTRACOM assisted Telenor in addressing the telecommunications issues. Provision of technical support to the demonstrations and trial as required and communications input to the development of the assessment methodology.

1.3.9 SINTEF Telecom and Informatics

Leader of Work Packages 3 (System Specification), 4 (System Design) and 7 (Evaluation). Sintef was able to draw on its expertise in the field of UML in the production of the IPPA System Specification (D31), IPPA System design (D41), Assessment methodology (D71) and the Final Assessment report (D72). Part of the work in Work Package 7 was the development of a draft verification plan. This latter document was inherited from ISSUS, which was unable to complete Task 7.2 (Assessment) due to the extension of the project. Resources were transferred between ISSUS and SINTEF to compensate for this increased effort and the production of the Evaluation Report (D72). SINTEF were also responsible for reviewing the need to update D31 and D41, in the light of project experience and the impact of actual development.

1.3.10 Telenor R&D

Close co-operation with SINTEF was required in Work Package 4 so that workable solutions would emerge from the communications viewpoint. In Work Package 5 Telenor assisted INTRACOM in addressing the telecommunications issues. Provision of technical support to the demonstrations and trial as required.

1.3.11 C-MAP

The key input was provision of the ECDIS and associated ECS software, which had to be adapted to include the various additional layers of IPPA information. Close co-operation with SINTEF was required in Work Package 4 so that workable solutions would emerge from the physical viewpoint. Provision of technical support to the demonstrations and trial as required.

1.3.12 Det Norske Veritas AS

Leader of Work Package 8 (Standardisation) and responsible for the production of Recommendations on Standardisation (D81). D31 and D41 were reviewed so that an early assessment of standardisation requirements could be established.

1.4 Purpose of the report

This report, which follows the proscribed format, provides a comprehensive view of the results obtained, the methodologies and approaches employed, changes in the state-of-the-art since the project start. The report addresses the objectives of the projects as well as the degree to which these objectives have been reached.

2 PROJECT OBJECTIVES

2.1 Overall objectives

IPPA sought to develop and validate an advanced prototype portable pilot equipment that can receive data from a shorebased Vessel Traffic Services (VTS) centre, such as track and environmental data, and thus, together with its stored data and that from other vessel's AIS, display a comprehensive traffic image. The equipment was expected to meet the user's needs, be stand alone (apart from a capability to accept power if available) and function autonomously. With a variety of communications interfaces, the equipment would also be capable of transmitting back to a VTS centre data required for traffic and port management. The overall effect was anticipated as being to improve navigational safety, reduce voice radio communications and provide a beneficial impact on the efficiency of traffic flow.

Interoperability with AIS was seen from the outset as being a key requirement and so IPPA also sought to include compatibility between sea and inland waterways users and other vessels not covered by the carriage requirements of SOLAS.

With the intention of advancing on existing information technologies, building on existing experience and by taking a modular approach, IPPA's end product was expected to be an extension of available commercial systems and a stand alone 'low cost' option for other vessels not covered by the carriage requirements of SOLAS.

2.2 Specific objectives

The general objectives were decomposed into 28 specific objectives

Objectives	***Outcome***
1. To determine the user's needs in pilotage waters covering coastal waters outside immediate VTS coverage, port / VTS areas and inland waterways.	7 national User Requirement Capture meetings held. Validation of initial concept at 2 workshops. The User Requirement Specification (D21) was produced and then revised in the light of project experience. The finalised document was posted on the project website. We continued to learn throughout the whole project.
2. To build on existing experience and current developments.	Reported in the User Requirement Specification (D21).
3. To determine the minimum data requirement to satisfy the user's needs.	Reported in the User Requirement Specification (D21). Users continually urged the use of the KISS principle.
4. To identify the sources for the required data.	This emerged from the User Requirements Capture meetings and is reported in the User Requirement Specification.
5. To investigate how to capture and present the information required.	This was demonstrated in WP6
6. To investigate the categorisation of data (e.g. urgent, permanent, temporary)	Reported in the User Requirement Specification.
7. To reduce VHF voice communications.	The ability to reduce VHF voice communications was demonstrated in WP6.

Objectives	*Outcomes*
8. To determine which data should be stored in the equipment and which transmitted.	This was reported in the IPPA System Design (D41).
9. To identify relevant update rates.	This was reported in the IPPA System Design (D41).
10. To identify the most appropriate data transfer system(s), taking into account bearer availability and reliability, available bandwidth and usage costs.	This was reported in the IPPA System Design (D41).
11. If AIS cannot (or should not) act as the sole communications bearer, to investigate which other means should be employed.	This emerged as a 'given', during WP2 and alternative communications were being provided. For the IPPA demonstrations we turned to GPRS.
12. To determine a minimum AIS data set that will allow satisfactory interoperability between use on board SOLAS and non-SOLAS ships.	This work was overtaken by the recently emerged Category B standard for AIS messages.
13. To maintain compatibility between AIS and equipment developed for inland waterway craft.	This was demonstrated in Tromsø, Rotterdam and Genoa during Work Package 6.
14. To inform the IMO / IALA decision making process on the use of AIS and the guidelines currently being developed.	This was planned to be ongoing throughout the project. IALA VTS Committee briefed in March 2001. Papers presented at IALA2002, 3IHMA and IMPA2002. Contact was maintained throughout with the Chairman of IEC – TC80.
15. To determine whether a chart based GIS is required and, if so, which one?	Chart based GIS has been determined as being required and finalisation of type was reported in the IPPA System Design (D41).
16. To determine the level of self-sustainability required for a portable pilot support unit.	This was reported in the IPPA System Design (D41). However, there was a wide range of user requirements stated during Work Package 2, although there is clear support for use of ship's power supply.
17. To determine the functionality required of the carryaboard equipment, including how 'intelligent' it needs to be.	Initially reported in the User Requirement Specification (D21) and IPPA System Specification (D31) and finalised in the IPPA System Design (D41).
18. To determine if there is a role in reducing the administration overhead of pilots and VTS centres.	Demonstrated in WP6 (Tromsø) and declared as work to be taken forward by the Norwegian Coast Directorate.
19. To determine the level of infrastructure required to support carryaboard equipment.	Requirement reported in D21 and further specified in D31 (and D41). Developed during WP5 and reported on in D53.
20. To determine appropriate measures of performance.	Requirement reported in the User Requirement Specification (D21) and draft plan in the report on Assessment Methodology (D71). Reported on in D72 – Verification Report

Objectives	***Outcomes***
21. To determine a generic system architecture.	Reported in the IPPA System Design (D41)
22. To build at least one shore based equipment and three mobile equipments, as technology demonstrators.	Completed in Work Package 5 and included one prototype IPPA Ground Station (IGS), which was used both for system test & verification. The IGS was capable of being replicated and personalised, depending on local demonstration site requirements. An AIS Base station prototype was also developed.
23. To verify the correct functioning of the equipment built.	Carried out in Work Package 5 by means of complete functional tests and the Verification activity, as defined by the Verification Plan (D51).
24. To validate the IPPA concept by providing convincing demonstrations to key stakeholders.	Reported on in D72 – Verification Report and endorsed at the Final Workshop (D93)
25. To identify a product development route to a ‘low cost’ AIS for non-SOLAS vessels	The requirement for such a product clearly emerged from Work Package 2. However, work in this area is ongoing commercially and internationally and the scope for large savings in capability (and hence cost and weight) seem very limited.
26. To make recommendations about standardisation.	This was reported in Recommendations on Standardisation (D81).
27. To make the EU maritime community and other relevant bodies aware of the results and benefits of IPPA.	This is ongoing. Papers presented for IALA2002, 3rd IHMA Congress and IMPA2002. Plans for dissemination were reported in the Dissemination and Use Plan (D92).
28. To manage the project in a timely, cost-effective, inclusive and efficient manner.	With the exception of one Deliverable (D94), which was delayed until 16 April, the project completed on 28 February 2003, as designated in the revised contract.

Table 2 IPPA Specific Objectives

3 APPROACH

IPPA planned to advance on existing information technologies, build on existing experience and by taking a modular approach, make the end product an extension of available commercial systems or a stand alone 'low cost' option for vessels not covered by the carriage requirements of SOLAS. This latter point, which seemed to offer wide scope for innovation in the planning stages of the project was rapidly 'overtaken by events' in the shape of the far more swiftly than usual developing international consensus about Category B messages and the associated equipment.

The project's desire to build, where possible, on existing work and technology, rather than start everything from scratch, was assisted by the support of the United States Coastguard and the members of both the European and International Maritime Pilots Associations, who offered to help establish a sound baseline from which to start.

In all there were 9 Work Packages : Management, User Requirement, System Specification, System Design, Development & Verification, Demonstration, Evaluation, Standardisation and Exploitation & Dissemination.

The initial user requirement phase consulted relevant user groups and also identified the state of the art. This was followed by the specification of the equipment's functional requirements, leading to a concise system architecture. Concurrently the specification of the evaluation methodology was developed.

Based on this work, the demonstration equipments were developed to cover both use in SOLAS and other vessels not covered by the carriage requirements of SOLAS. A modular approach to construction was taken, with a view to being able to take the concept forward into production so that a variety of users, with a variety of budgets, would be able to find what they wanted, at a price they could afford. It was recognised from the outset that this process would call for considerable care in data selection, fusion and presentation. To assist in both progress towards development and dissemination, it was planned that two workshops would be held for users. The first towards the end of the user requirement phase (Work Package 2) and the beginning of the system specification phase (Work Package 3) and one co-incident with the demonstration in Rotterdam. In the event, the support for the first meeting was such that a second had to be organised and it was decided, during the project, that it would be beneficial to separate the second meeting from the Rotterdam demonstration, to allow better presentation of issues such as standardisation and evaluation, as well as a mature view of the results of the demonstrations, which were to be used to help verify that the equipment was designed and had then met the users' requirement.

Initially three demonstrations (Venice, Tromsø and Rotterdam) were planned, to give wide exposure to both pilots and other stakeholders, but this was later reduced to two (Tromsø and Rotterdam). However, due to the considerable interest of the Italian Coast Guard, whilst developing their national VTS system, an additional demonstration was held in Genoa. In addition to this, it was also planned that a trial of the IPPA concept would be held in Hamburg. All of these activities were aimed at both validating the equipment developed in representative ports and waterways and assessing the compatibility with regard to SOLAS and other user's requirements. The events also provided significant dissemination events.

An exploitation plan was developed to indicate a product development route.

Throughout the project, opportunities were taken to present its work at exhibitions and conferences and to liaise with other projects.

The relationship between the different Work Packages is shown below.

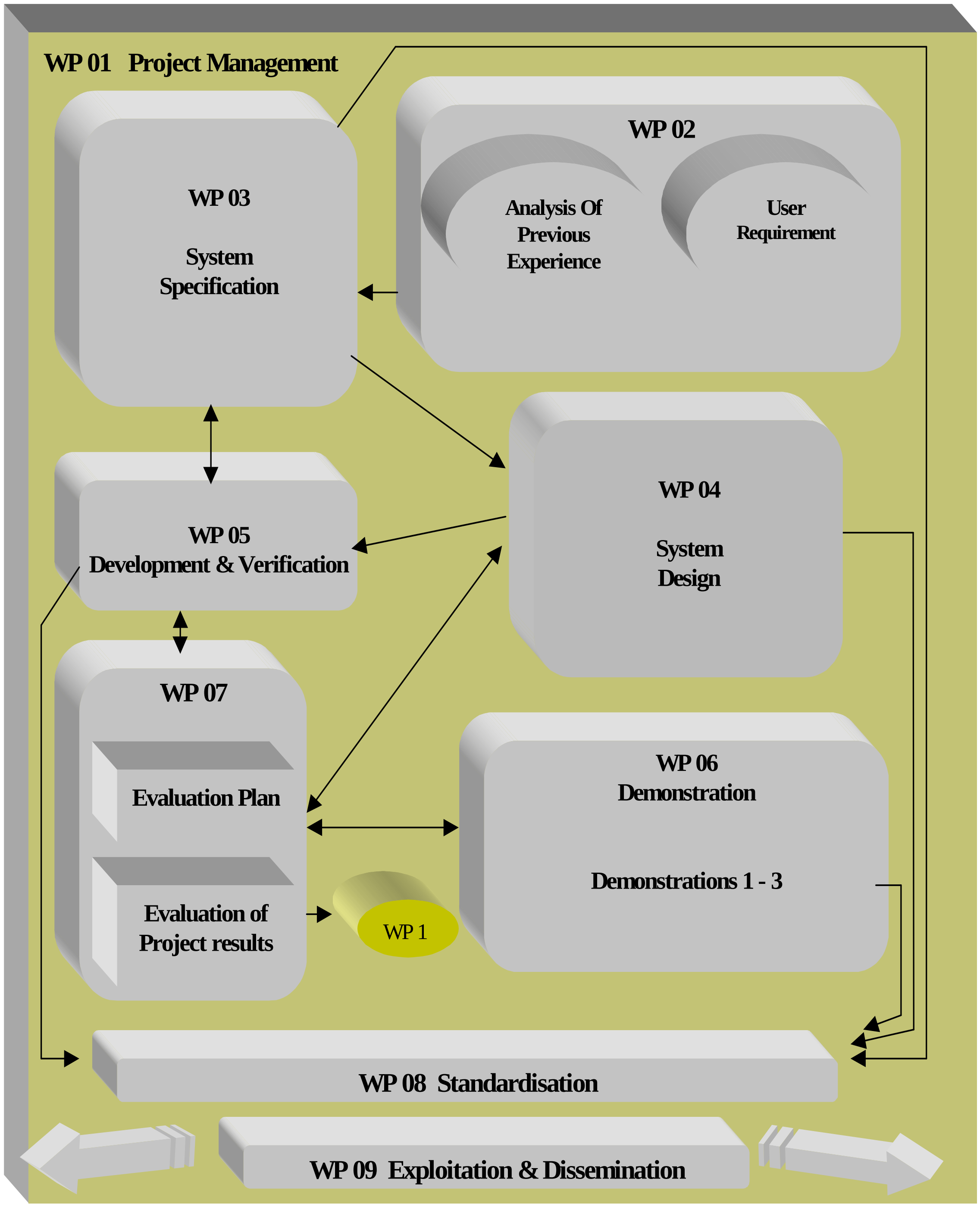

Figure 3 Graphical representation of project components

4 PROJECT RESULTS AND ACHIEVEMENTS

4.1 User requirement capture

Work Package 2 was aimed at determining the user requirements with regard to parameters for functionality, operability, reliability, maintainability, external accessibility, compatibility, availability, workability and effectiveness of a Portable Pilot Unit (PPU) in the operational environment of a maritime infrastructure including VTMIS / RIS, maritime authorities, service providers and information providers. This meant that all the user requirements captured were to be listed, together with all requirements about data flow capacity and supply from shore based infrastructure / Wide Area Network (WAN). The underlying assumption was to use the practical experience of an international group of users and build on existing and maturing technology.

The User Requirement Capture process covered a wide range of users in 7 countries but the international spread was far wider, including input from outside the EU. Using the requirements capture meetings as a firm basis on which to build, the consortium have developed a comprehensive User Requirement Specification, from which the design of a generic IPPA equipment and the development of the demonstration equipment was taken forward.

4.2 Specification and design

The system specification (Deliverable D31) and the system design (Deliverable D41) were established by the means of structured methodologies according to well proved techniques for software engineering. The resulting system architecture is shown in the Figure below.

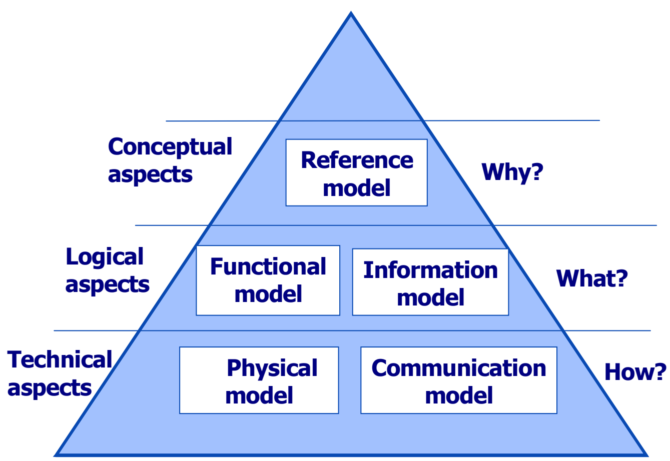

Figure 4 The System Architecture of the PPU

The reference model shows the overall system components. The functional viewpoint specifies the functional requirements by means of use cases. The information model specifies information flows and the conceptual information elements that are involved. The communication model specifies interactions and information exchange. The physical model specifies the realisation of the system.

4.3 Production of prototype equipment

4.3.1 Description

The IPPA PPU consists of the following components: PPU Main Unit (PMU) and PPU External Unit (PEU).

PPU Main Unit (PMU) is a laptop with a software application (the PPU Application) providing the user with an interface and input device as well as local communication via wireless LAN link towards the PEU and external communication via PEU towards the Ground Station.

The PPU Application is based on C-MAP's ECS technology. The following services are combined with standardized ECDIS services:

- ⇒ Services for inland ECDIS;
- ⇒ Information services (chart updates, traffic information, meteorological information, etc.);
- ⇒ Advanced functionality for safer and more efficient navigation (path prediction, route monitoring, etc.);
- ⇒ Communication services for information exchange and report.

The following hardware components are integrated within the PEU:

- ⇒ AIS Unit – by SML Technologies – to provide AIS message exchange with other ships' AIS transponders;
- ⇒ Heading and positioning Sensors – by Novatel – to provide ship's position, heading and rate of turn indication;
- ⇒ WLAN Adapter – by Cisco - to provide local communication solutions for communication with the PMU;
- ⇒ GPRS Terminal – by Siemens - to account for external communication for non-AIS communication with the IPPA Ground Station;
- ⇒ Power supply unit, battery charger circuit and battery pack, to enable PEU to work both independently or replying on ship's power supply;
- ⇒ PEU intelligent controller – to manage all communication links (AIS, WLAN, GPRS), to route messages between PEU components or PMU application and to provide PEU alarm and status messages.

For more detailed info please refer to [IPPA D53]

4.3.2 Difficulties encountered and problems solved

The following table lists the principal technical challenges faced by the project and how they were tackled.

Item	Solution
PPU volume	Careful mechanical design in order to pack all PEU components using less volume, two prototypes developed (first one with black case)
PPU weight	Way to follow is to use carbon fibre for internal mechanical fixing parts, internal PEU lid changed according to this. Weight reduction to be addressed by market product
PEU antennas and electromagnetic interferences	Changed antennas positioning solution for first to second prototype, added PEU internal shielding and high frequency filters
PEU power supply and start up temporary current absorption peaks	Changed AC/DC converters, two independent ones from 5V and 24V
PEU serial ports management and CPU speed	Changed CPU board to increase elaboration speed
PEU heading sensor	Extensive market research, found Novatel Beeline product, then integrated with AIS
PEU AIS and heading sensor integration	Removed GPS receiver from AIS transponder, added custom board and SW to route GPS messages from heading sensor's main GPS receiver to AIS

Table 3 Difficulties encountered

4.3.3 Conclusions

Experience gathered while developing PPU has been summarized in a report containing some guidelines on PPU potential improvements, which will need to be addressed while designing and developing a 'marketable product'.

4.4 Design and building of a base station

IPPA Ground Stations developed for demonstration purposes are characterized as follows :

⇒ IPPA Ground Station, addressing data collection and information exchange with Service Providers, commonly known as IGS;

⇒ IPPA Base station, addressing VTS radar tracks transmission to PPU on board; communication channel could be VHF AIS or GPRS.

In addition to these ground stations PPUs were linked via GPRS and Internet to various external service providers, thus enabling relevant information download on board.

4.4.1 IPPA Ground Station (IGS)

The IGS was developed to interface with two Rotterdam service providers:

⇒ SPIL – Dutch pilots' Informative system;

⇒ MFPS – Multi Functional Presentation System, collection meteorological data from a network of meteo stations.

IGS was distributed over two sites : Telenor premises (IGS database) and Intracom premises (IGS application server)

The IPPA Ground Station physical architecture is depicted in the following figure.

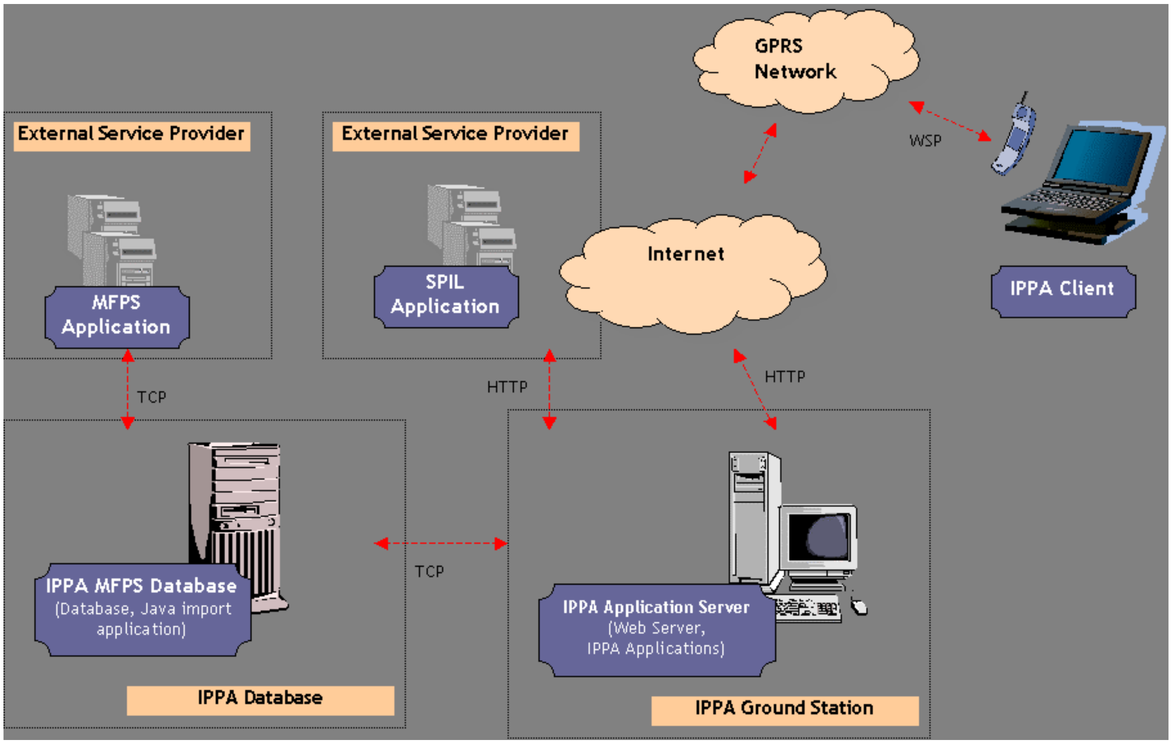

Figure 5   IGS Physical Architecture

The IPPA PPU Client communicates to the IGS via the GPRS network. The IGS Application server hosts the Web Server and the applications developed for IPPA.

The integration with two service providers was configured as follows :

⇒ The SPIL application (pilots' information database and ship database) resides in Loodswezen (Dutch Pilots Association) and SOAP accessible, XML-data web services were developed especially for IPPA. The IGS application accesses the SPIL application directly and receives information as XML-formatted data; there's no need to extract the data and store them in a database. The information is parsed and provided to the IPPA user in a predefined template;

⇒ The MFPS client application resided in AVV's premises in Rotterdam. Periodically (every 10 minutes) data was extracted in ASCII text format and transferred via ftp to the IGS database server at Telenor's premises in Tromso. A Java application program was used to read the ASCII text files, parse the information and import data into the IGS database.

The data from the MFPS database was transferred to a database server at Telenor premises in Tromsø, and entered into a database. The data in the database was available for the SPIL web service, displaying the data as web pages to the user. Historical data as well as forecasts were transferred and available for the pilots as graphical charts.

The IPPA base station at Intracom's premises hosted the following modules :

(1) IGS Application Server, which consist of the following components :

(a) Web Server

Ground Station Server: hosts the client HTML pages, serves the client applet and runs the Java Server applications (JSPs and Servlets).

(b) JSPs

A set of JSPs that generate automatically the client HTML page upon user request from the ECS 2000 SW in the PPU. The user selects the parameters that he/she wants to view. Subsequently the JSP queries the IPPA db and formats the results and as input to the client applet.

(c) Java Servlets

Java servlets have been used to parse the XML messages from the SPIL database and give formatted html output to the user.

(2) User Client

Java Applet (run in Microsoft Internet Explorer HTML pages): request the data to Java Push Application and show received information to users.

For more information refer to [IPPA D53].

4.4.2 IPPA Base Station

Two IPPA Base stations were developed to interface with local VTS systems in Rotterdam and Genoa :

⇒ IPPA AIS Base Station – Rotterdam – Radar tracks were obtained from local VTS radar track table. The tracks were obtained from Rotterdam Port Authority's track table file which, when updated (about every 3 seconds), was read via a network link. The position of these tracks was correlated with the AIS tracks received and any radar tracks that correlated were ignored. The resultant non-correlated radar tracks were then prepared for AIS radar track transmission via BBM messages; a BBM message can hold up to radar target. There were well over 500 radar tracks and 4 to 6 AIS tracks received which produced a radar track table of over 500 tracks for transmission. The throughput of BBM messages was found to be in the order of 1 per second only giving a maximum radar track transmission rate of 14 to 21 tracks per 3 seconds. This is clearly an unsuitable way to transmit radar tracks and it was decided to only transmit one BBM message per 3 seconds. Thus 7 radar tracks were transmitted as a BBM message to the IPPA PPU via AIS VHF link and displayed on PMU via ECS software;

⇒ IPPA Base Station – Genoa - Radar tracks were obtained from local VTS radar track table, elaborated by a PC with a routing SW installed. Radar tracks were encapsulated into TCP/IP messages and sent to a web server. Here a java application made them available via a web page, continuously updated. ECS SW PMU was modified in order to connect via Internet to this web page, retrieve tracks every 5 sec. and display them on charts.

For more information please refer to [IPPA D53].

Although there was no VTS to interface with in Tromsø, NCD developed their own "IPPA Ground Station" and an Administrative interface to cater for USECASE no. 2. The Administrative interface software package was fully integrated with the PPU and demonstrated during the Tromsø demonstration. The Norwegian Pilots remain eager to have a follow up development to cater for all reporting work, which each pilot has to do after a mission. They also want to have an electronic form to register all travel expenses connected to a pilotage trip. This travel form would be integrated into the Administrative package and, in fact, the development work has already started. Further it will be investigated whether it is beneficial or not to make an integration with the pilotage invoicing system.

4.4.3 External Service Providers (ESP)

IPPA PPUs had to access the data made available by other external service providers. The following table summarises them, together with the type of data exchanged :

External service provider	Data Exchanged
C-MAP Data Centre	Electronic charts update – CM93/3 format Meteorological forecast – GRIB file format
Norwegian Coast Directorate	NAVCO messages – XML formatted data Pilot mission administration data – XML formatted data
SetShip - Genoa Port Authority System	Ships on berth, incoming and outcoming traffic – java applet

Table 4 ESP data exchange

The common way to access these data from the PPU was directly via a GPRS Internet connection, without any intermediate computer.

4.4.4 Difficulties encountered and problems solved

The main difficulties encountered were related to message exchange, especially data formatting problems.

It was not always possible to solve them beforehand, due to lack of specifications or because dedicated equipment was installed only temporarily on demo purposes, thus they have been addressed on site, during testing phase just before the demonstrations.

A key factor to find required solutions was the availability on site of partners' developers, enabling the modifications of hardware or software 'on-the fly' when testing evidenced errors or problems.

4.4.5 Conclusions

Internet technologies and protocols (XML, TCP/IP, etc.) are the route to follow. In any case, close co-operation with external service provider is needed to better integrate available information into the PPU.

Integration with local VTS system is a key issue for IPPA PPU, therefore VTS targets exchange with PPU must be carefully designed and, if possible, standardized.

Maybe a more reliable communication link should be designed to connect PPU to shore (GPRS has obvious distance limitations), for example using a dedicated radio link. Of course this would require an IPPA Ground Station with a radio base station connected to it.

4.5 Interfacing

PPU internal and external hardware interfaces have been described in [IPPA D53]. In summary they are :

(1) WLAN – between PMU and PEU;

(2) GPRS – between PEU and Internet;

(3) AIS – between PEU and other AIS transponders;

(4) GPS – between PEU and GPS satellites;

(5) Serial RS232 or RS422 – between PEU controller and AIS unit, heading sensor, GPRS module;

(6) Parallel – between PEU controller and custom charger board.

The Siemens MC35 GPRS Terminal (MC35) has a serial interface (9 pin D-plug) where commands to the terminal are sent, and data received on the OTA (Over The Air) GSM interface. The MC35 has connectors for antenna and power supply, as well as an interface for a handset (not used).

The MC35 was connected to the PC-104 via a serial port. The MC35 was controlled via AT (Hayes) modem commands, and GPRS set-up commands used are described in the ETSI GSM 07.07 standard. To connect to the Internet, the IETF PPP (Point - to - Point Protocol) (IETF STD 55) was used.

Since the PMU is mobile, it will move in and out of coverage area of GSM (and GPRS). To detect if the connection is still active, ICMP ping messages were used. If the connection was dropped, the software disconnected the GPRS module, and tried to reconnect continuously. This went on until a successful connection had been achieved.

This supplied the PEU with an external IP address, and also works as a router for the PMU.

The 802.11b protocol was selected for the communication of the IPPA PMU with the PEU. For this purpose the CISCO Aironet 350 PCMCIA WLAN card was selected. More specifically, the CISCO AIR-PCM352 card with incorporated antenna was used in the PMU (laptop) and the CISCO AIR-LMC352 card (with external antenna) was used for the PEU (PC-104). The installation and configuration of the WLAN cards and the network were performed using the tools provided in the operating system of the units.

4.5.1 Interfacing to other systems

As part of the Rotterdam demonstration the Dutch pilot organisation enabled the following interfaces on behalf of EMPA. Four notional web services were created to form an interface between the IPPA application and the system of the Dutch pilot organisation. These services were capable of being activated via the website http://www.ippa.loodswezen.nl, allowing access to the following information :

⇒ A list of vessel journeys;

⇒ Detailed ship information;

⇒ Information with regard to the ETA / ETD of a ships journeys;

⇒ Information with regard to ship passage data.

In the light of experience gained in preparing for the demonstration, the following could have been improved :

⇒ A better structured plan would have resulted in greater help from the pilot organisation;

⇒ The preparation for the demonstration was ad-hoc.

Similarly, during the demonstration the web services were used inefficiently, which made the system unnecessarily slow and more difficult to handle; a specific instance was the difficulty experienced in integrating information from the system of the Dutch Pilot Organisation with the electronic sea chart.

These were all valuable lessons for the developers to learn.

4.5.2 External interfacing

Interfacing from PPU to the external world is based on two links :

⇒ VHF AIS data link, using AIS messages standard format;

⇒ GPRS and internet, using TCP/IP protocol and various messages and standards (i.e. XML and web services).

Here is a brief listing about external interfacing from PPU :

⇒ IGS and MFPS interfacing was developed as a custom solution, using Internet as a transport layer to exchange files with data formatted in proprietary way;

- ⇒ IGS and SPIL interfacing was developed as a custom solution, but relying on XML and web services standard to exchange data;
- ⇒ The Rotterdam AIS Base station used ftp protocol to interface radar track table. The Radar Track table was read from the Rotterdam Port System when the radar track file changed. This file was then decoded and the individual tracks obtained. It should be noted that as every VTS is different the radar track interface will be different for every site;
- ⇒ Genoa Base Station used a custom SW to interface local track table, but Internet and TCP/IP was adopted as transport layer. Data were encapsulated on TCP/IP message using a proprietary solution;
- ⇒ C-MAP data Centre is interfaced via internet using proprietary file format for charts update and standard GRIB file for weather forecast;
- ⇒ Norwegian Coast directorate is interfaced via internet using XML formatted messages (both Navco and pilot mission data);
- ⇒ The Genoa Port Authority system is interfaced via Internet to a proprietary Java application.

4.6 Demonstration

Although only two demonstrations (Tromsø and Rotterdam) were eventually specified in the project's statement of work, a third was held in Genoa, at the specific request of the Italian Coastguard. In addition, a trial of the IPPA concept was held in Hamburg.

In each case the intention was to expose the project's work to as wide an audience of potential users as possible. Although this was done with dissemination clearly in mind, the principle aim was to validate the work that had been done, based on the established User Requirement Specification.

The three individual demonstrations and trial were reported on in Deliverable D61 – Demonstration Report but the conclusions drawn from these four, well attended events were :

4.6.1 Results and Impacts

The demonstrations and trial conducted by project IPPA have undoubtedly made a great impact on those who attended them. This follows on from what developed as a high profile topic since the project began, not least because of the considerable international exposure that has been achieved. Working with demonstration equipment can be a fraught experience but the capability displayed was convincing and, in the end, it was the project team and not the audiences who felt most acutely when something didn't work quite as planned.

Given the initial poor reception of the concept of IPPA that was expressed by some influential port managements, it is surprising that the greatest impact has been on the way in which VTS authorities are now beginning to rethink their approach to Vessel Traffic Management. The perception that tactical control of ships can be largely left to IPPA equipped ships with the strategic (traffic organisation) role now being the focus of the VTS operator was not something that was predicted at the beginning of the project. This potential reduction in routine VTS operations happily coincides with the realisation that the increasing demands of port community systems and other forms of electronic data interchange and the expectation that the VTS operator may need to be a central figure in this type of activity.

Having been exposed to some very critical users, IPPA has proven worthy of the challenges set for it. The potential for a production equipment has been amply demonstrated and the 'high end user' (the pilot) would like it tomorrow. The demonstrations and trial have resulted in much helpful feedback about how the prototype equipment should be taken forward, once the project has ended.

Whilst individual ports can accept tailored solutions, especially to the challenge of interfacing to the various data sources required it is clear that for equipment used in two or more locations standardisation is absolutely essential. One way to ease this task has been identified as channelling all information through one source, for instance a VTS Centre. This would also have the benefit of enabling the relevance, accuracy, consistency and redundancy of information transmitted to be checked.

In Tromsø all the planned Use Cases were successfully demonstrated, including the message function from the AIS base station. The PPU concept has proved to be operational and was seen to have beneficial functionality. A question raised by the Norwegian pilots was : 'Why not make the system more modular? There is a basic unit to which you can add more functionality as needed, depending on the mission. As the need for a modular approach has been stressed throughout the project, and must be taken forward into production, this would indicate a dissemination failure, as far as the Norwegian pilots are concerned.

Although the project did not have control of the AIS base station used in Rotterdam, the severe limitations imposed on the transmission of radar tracks, as pseudo AIS targets, was noted by everyone and calls into question the suitability of AIS for this purpose. The use of GPRS in Genoa for the same task was much more effective and indicates that an alternative communications bearer is better suited to the task of transmitting radar track data.

Standardisation is seen as essential by most users and IPPA draws together a number of functions that would benefit from having standardised interfaces / protocols. The complexity of the issues faced is being addressed in D81 – Recommendations on Standardisation but the task should not be underestimated as the variety of systems involved, and therefore potentially requiring modification, is considerable. The perceived inadequacy of the AIS update rate, in certain situations, is just one issue that would not be easy to change.

4.6.2 Added Value of the IPPA Demonstrators and Trial

The Demonstrations and Trial proved the IPPA concept and thus endorsed the approach taken by the consortium in developing the prototype. This was a major dissemination achievement. The wholehearted support by such organisations as the Norwegian Coast Directorate and the Italian Coast Guard, together with the management of such major ports as Rotterdam and Hamburg, shows that IPPA is being taken seriously, because of the benefits it offers to Vessel Traffic Management.

The Demonstrations naturally revealed some areas of weakness and the knowledge of these areas will prove of value to those taking the concept forward. These include :

- ⇒ Problems with weight and size;
  - The size of the heading sensor;
  - The need for an IPPA AIS that is fully interoperable with IMO / ITU AIS;
  - Improved power supply and cabling;
- ⇒ Ease of installing and setting up the equipment;
- ⇒ Issues involving interference;
  - The suitability of the selected wireless LAN;
- ⇒ The robustness of antennae;
- ⇒ Error handling;
- ⇒ Further development of some applications.

Despite the challenges encountered by the developers, the demonstrations clearly proved that the required functionality can be provided and that it is possible to provide a suitable user interface.

The Demonstrations, because they exposed the project to critical but interested users, continued the process of learning. Whilst the demonstrated capability generally met and in some cases surpassed the initial user requirement specification, it became clear from the Demonstrations that because IPPA was capable of taking forward the processes of Vessel Traffic Management there was an emerging requirement for even more precise information for the 'high end' user.

The ability to compare the use of AIS and GPRS for the transmission of radar tracks was a considerable bonus fore the project. It confirmed the initial inclinations of many who had felt that AIS was not the right route to follow and supported those who felt that the AIS's primacy of safety information should not be put at risk.

In general, the Demonstrations, having shown what was already possible enabled those attending to start thinking about what else the equipment might be capable of allowing them to do.

4.7 Standards

The PPU prototype is based on the latest available technology. Today's technology will continue to develop and thus the basis for standardisation will be in flux. The technical solution is based on existing standards. Work Package 8 (WP8) has therefore not considered any recommendations for standardisation of hardware and software of possible future technology.

The main contribution of WP8 is standardisation of information models. The need for standardisation is primarily assessed in the light of the user requirements stated in D21.

IPPA has proposed a system architecture for the PPU, see D31 and D41. The prototype has been tested in different environments; in Tromsø, Rotterdam and Genoa. As long as not all aspects of the suggested architectures are fully tested, it is not possible to make a final recommendation of a reference architecture. However, the work package report (D81) covers a brief description of the suggested architecture and refers to relevant system architecture projects.

Communication through AIS and GPS is not covered since these areas are already satisfactorily covered by existing standards.

4.7.1 Conclusions and Recommendations

The following conclusions and recommendations are made in WP8 :

⇒ Hardware and software are satisfactorily covered by existing standards. Therefore, no recommendations for standardisation in this field are made;

⇒ Information models for messages should be developed according to international standards. The possible use of ISO 10303 AP239 and ISO 15926 should be considered. The possible incorporation of AP239 as Reference Data in ISO 15926 should be investigated;

⇒ The IPPA architecture should be aligned with other initiatives on development of standards for Intelligent Transport Systems (ITS) architecture e.g. the work of ISO TC204. The possible incorporation of the overall ITS architecture in ISO 15926 should be investigated;

⇒ User requirements from the European Maritime Pilot's Association (EMPA) are brought forward as Guidelines for the construction of PPU and the presentation of information for a "comprehensive" PPU. These Guidelines should be used as basis for developing the information models;

⇒ A European qualification scheme should be made for users of the IPPA solution.

4.7.2 Challenges and Solutions

Application of existing information models may be considered as oversized with respect to the need in this specific project. The models are often huge and adjusted to information exchange on broadband. To meet this challenge use of the Reference Data Library (RDL) in ISO 15926 is suggested. Messages defined by use of the RDL are computer sensible, i.e. misunderstandings related to the message content will be avoided.

The RDL will be available via the Internet. Since the PPU may occasionally operate in areas not covered by GSM or GPRS, it is recommended that a subset of the relevant part of the RDL in the PPU be established. Similarly a subset of the RDL may also be copied to the IPPA Ground Station (IGS). The IGS may easily communicate directly with the RDL via the Internet, so the chosen solution for each individual IGS may be evaluated, based on line capacities etc.

The data exchange between the PPU and the IGS may be performed as illustrated in the Figure below.

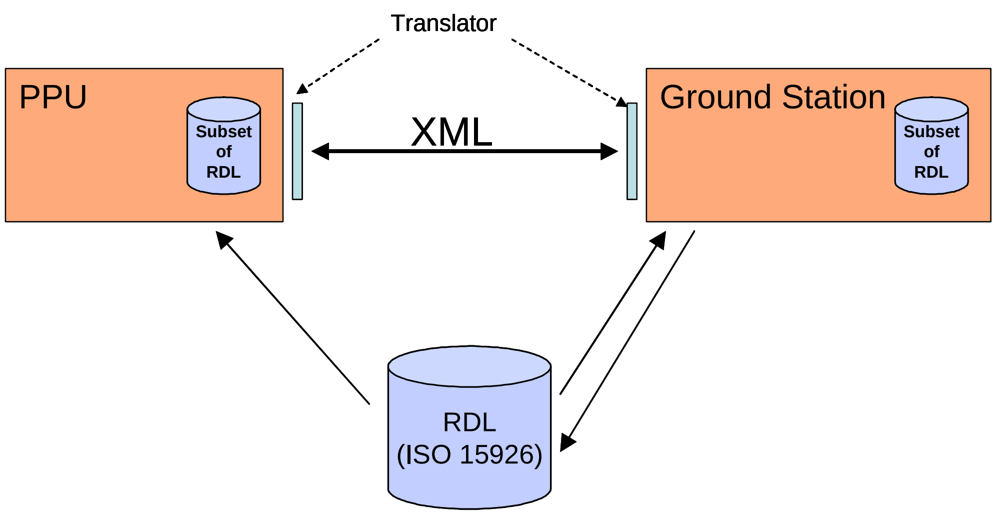

Figure 6 Data exchange between PPU and Ground Station

4.8 Validation of the IPPA concept

The Assessment Methodology used involved qualitative assessment, compliance assessment and global assessment. The qualitative assessment focused on the response of users to the equipment and its functionality as demonstrated at the IPPA demonstrations. The compliance assessment focused on how well the equipment worked compared to its specification, while the global assessment utilised results from the qualitative and compliance assessments to provide an overall evaluation of how well the IPPA goals are met.

The source data for the qualitative and compliance assessment were collected during the IPPA demonstrations (Tromsø and Rotterdam). However, as the demonstrations were held towards the end of the evaluation period, the actual development of the technology demonstrators were also evaluated. This required plans for a set of intermediate 'tests' in order to be able to provide evaluation feedback to the project management in a timely manner. These plans involved two milestones: Validation of development preparedness and Validation of demonstration preparedness. The validation of development preparedness was considered completed in November 2001, while validation of demonstration preparedness was considered sufficiently completed to distribute invitations to the Tromsø demonstration in August 2002. The verification tests were completed in September 2002.

During the demonstrations (see Section 4.6) the users were asked to fill out a questionnaire based on the use cases described in Deliverable D31 – System Specification. The users were asked to give scores on the criteria Usefulness, Ease of use, Information presentation, Accuracy, Response time, and Comparison to current situation. The scoring range was from 0 – 10, with 0 as very bad and 10 as very good. The average response from the users was very positive, with an average score of 7.4 in Tromsø, 7.3 in Rotterdam and 7.5 in Genoa.

The users were also asked to express how well they agreed with a set of statements formulated from the IPPA goals. Also here a scoring range from 0 – 10 was employed, with 0 as completely disagree and 10 as completely agree. The highest agreement at the demonstrations was obtained for the following statements :

⇒ The IPPA unit provides information enhancing safety and efficiency that is not available from onboard sensors;

⇒ The IPPA concept is useful and should be implemented;

⇒ The IPPA unit is useful for both SOLAS vessels and other vessels not covered by the carriage requirements of SOLAS.

The lowest agreement was obtained for the following statements :

⇒ The IPPA unit is suitable for regular operational use;

⇒ An estimated marked price of 10000 Euro for an IPPA unit is acceptable.

The global assessment focussed on how well the IPPA project achieved its goals and fulfilled its specific objectives. Although there have been problems on meeting the deadlines of some deliverables, the project consortium considers 26 of 28 specific objectives completed. The two remaining will not be completed for reasons beyond the control of the project partners. All the IPPA goals that could be achieved are therefore considered achieved.

4.9 Dissemination

During the project two brochures were produced; the first in the early stages of the project to raise awareness in the maritime community and the second to promote the demonstrations. In addition a poster was produced, in conjunction with the first brochure.

An active programme of papers / presentations / representation at potential technology transfer events was pursued and these are shown in the following table.

Date	***Type and Title/Scope***	***Number of persons attended + other information***
8/1/01	*Platform on Information and Communications systems*	*15 (Project Presentation)*
10/1/01	*Project Schelde ECDIS*	*20 (Project Presentation)*
24/1/01	*Rotterdam Port Authority*	*30 (Project Presentation)*
8/2/01	*1st User Workshop*	*20*
6-7/3/01	*Fargis Conference*	*80 (Project Presentation)*
15/3/01	*Inland ECDIS meeting*	*30 (Project Presentation)*
15/3/01	*IALA VTS*	*40 (Project Presentation)*
19/3/01	*SWAN seminar*	*30 (User briefing by Co-ordinator) & attended by DNV*
22/3/01	*Additional User Workshop*	*21*
23/3/01	*Project EMBARC*	*Discussions between co-ordinators*
28/3 – 3/4/01	*Waterman – IPPA Workshop / Seminar*	*30 (4 Project Presentations)*
6-8/8/01	*American pilots / USCG / PAWS project*	*45*
19/9/01	*EMPA (Policy Making Group)*	*10*
20-21/9/01	*SWAN – 2nd Technical Forum*	*Attended by QinetiQ*
25/9/01	*Waterman Seminar*	*40*
12/12/01	*MISTIC – 2nd MISTIC Day*	*Attended by Thetis. Provision of a PowerPoint presentation and session rapporteur*

Date	*Type and Title/Scope*	*Number of persons attended + other information*
11-15/3/02	*IALA Conference*	*200 delegates. Paper presented by QinetiQ.*
3/02	*Oceanology*	*Representation by Thetis*
12/4/02	*3rd Swan Forum*	*Attended by DNV*
15-20/4/02	*Euro-China*	*Attended by Thetis CEO and Commercial Manager – One stand as IPPA Project at EC projects' zone (Hall 1 Booth 27). IPPA poster exposed, IPPA power point presentation available, distributed brochures to visitors.*
2-5/4/02	*EMPA Conference*	*200 delegates.*
5/02	*IHMA Congress*	*150 delegates Project advertised on HITT stand.*
28/7-2/8/02	*IMPA Conference*	*300*
24-25/9/02	*4th SWAN Conference*	*Representation by ISSUS*
10/2002	*ISIS - Hamburg*	*50 Representation by ISSUS*
10/2002	*SMM 2002*	*210 Representation by ISSUS*
15-16/10/02	*Demonstration – Tromsø*	*30 non-IPPA attendees.*
30/10/02	*5th WATERMAN Management meeting - Genoa*	*30 delegates Presentations by QinetiQ and Thetis*
4-5/11/02	Demonstration – Rotterdam	71 non-IPPA attendees.
7/11/0-2	3rd MISTIC Day	Rotterdam. Participation by Thetis, SML and QinetiQ.
26/11/02	Trial – Hamburg	43 non-IPPA attendees.
29/11/02	EHMA – VTM Seminar	Rotterdam (40 delegates)
2-3/12/02	EMPA Continued proficiency training	100
10/12/02	Demonstration - Genoa	34 non-IPPA attendees.
10/1/03	Final Workshop	Rotterdam.
3-7/2/03	IALA Training Workshop	Rotterdam 100 delegates. Presentation by EMPA.
18/3/03	6th WATERMAN Management meeting - Marseilles	25 delegates Presentation by QinetiQ.
2/4/03	UKHMA	120+ delegates. Presentation by QinetiQ & SML.
1/7/03	*NAV 49*	*Presentation by QinetiQ & SML.*
12/2/04	*VTS2004*	*200 delegates. Paper requested from QinetiQ.*

Table 5 Dissemination events

Notes.

1. Copies of the presentations made at the Final Workshop have been posted on the project's website.
2. As it was realised that the term Final User Workshop would be restrictive, with regard to decision and policy makers that need to be encouraged to attend it, the title of the event was amended to 'Final Workshop'.

5 DELIVERABLES AND OTHER OUTPUTS

5.1 Deliverables

The Deliverables produced by the project were as shown below :

Deliverable no.	Deliverable name	Deliverable type	Security*	Delivery in (proj. month)
D11	Project Presentation	O	PUB	4
D12	Final Report	R	PUB	28
D21*	User Requirement Specification	R	REST[1]	5
D31*	IPPA System Specification	R	REST[1]	7
D41	IPPA System Design	R	REST[1]	11
D51	Verification Plan	O	REST[1]	21
D52	Verification Report	R	REST[1]	23
D53	Technology Demonstrator (physical)	P	REST[1]	23
D53	Technology Demonstrator (written)	R	REST[1]	28
D61	Demonstration Report	R	PUB	27
D71	Assessment Methodology	R	PUB	6
D72	Final Evaluation Report	R	PUB	26
D81	Recommendations on Standardisation	R	PUB	27
D91	Report of 1st User Workshop	R	PUB	5
D92	Dissemination and Use Plan	R	PUB	6
D93	Report of 2nd User Workshop	R	PUB	28
D94	Technology Implementation Plan	R	REST[1]	26

Table 6 IPPA Deliverables

Key :

O = Other PUB = Public

P = Prototype REST = Restricted

R = Report [1] = Commission and Consortium members only

* = Document revised and re-issued during the course of the project.

It should be noted that due to the timing of the 2nd Annual Review the reviewers felt that there was little new documentation for them to examine. This led to a request for a written report about the Technology Demonstrator, which the Consortium acceded to and Thetis agreed to produce.

5.2 Other Outputs

Other outputs produced by the project included :

⇒ The Project Synopsis;

⇒ The Project Fact Sheet;

⇒ A project Poster;

⇒ Two Project Brochures;

⇒ The Project Management Plan;

⇒ The Project Quality Manual;

⇒ Quarterly Management Reports;

⇒ Periodic Reports;

⇒ Reports (in CD form) for two Annual Reviews;

⇒ Three Cost Statements.

6 PROJECT MANAGEMENT AND CO-ORDINATION ASPECTS

6.1 General

Project Management and Co-ordination were undertaken by QinetiQ, which at the beginning of the project was called the Defence Evaluation and Research Agency (DERA). Overall co-ordination was exercised by Dr M Hadley and he was assisted in technical co-ordination by Mr P Knight and to a considerable extent by Mr M Mazzon of Thetis. With 12 partners, only one other of which was based in the UK, it was clear that the majority of business would have to be conducted by e-mail. The need for meetings was realised but it was agreed from the outset that these should be kept to a minimum and be combined with other events wherever possible.

Perhaps unsurprisingly, it was only after the project had begun that grey areas in the specification of tasks and responsibilities and the enlarged scope of some activities began to emerge. These were all handled in a mature fashion and with considerable understanding by the Project Officer. The helpfulness and co-operation displayed by the various partners in resolving the issues as they arose is worthy of note.

6.2 Finance

Financial management was controlled by QinetiQ, with all monies being received and paid from its Euro account. Some of the partners found that the need to invoice QinetiQ, for their various EU payments, was a novel experience but this was the only way in which the company's financial system could disburse money. From the time taken to respond to financial issues, it became clear that some partners had a looser connection with their finance / contract departments than others. In some instances considerable 'chasing' was required to achieve invoices for partner payment.

A consequence of the need to extend the project was that a number of partners found that their budgets were being stretched most uncomfortably. Despite this, the contract amendment was achieved with no increase in budget and this greatly redounds to the credit of those partners concerned. Due to the extension of the project and the consequent departure of its nominated point of contact, ISSUS participation in the final months was somewhat fragmented.

The high level of integration activities and the need to respond to requests for 'face to face' meetings by external authorities, whose input to the project was essential, put a severe strain on travel budgets. Two specific instances of the latter case were the need for a project team to brief the head of the Italian Coastguard and a similar team to resolve problems arising with the Technical Department of the Port of Rotterdam. This last requirement arose at short notice and caused the parties involved considerable, unexpected expense.

All Deliverables were made, following Peer Review, but some were not made in accordance with the project management plan. This was due to a combination of, in some instances, lack of application by or diversion to other tasks of the responsible partners but also the failure of the plan to recognise potential resource bottlenecks. The most significant instance was felt at Thetis and they deserve considerable credit for the way in which they tackled the challenges that the project posed for them. There was also some delay caused by the changed timetable for the Peer Reviewers and the fact that there was a flurry of activity right at the end of the project. Despite the time penalty incurred towards the end of the project it is considered that the use of a continuity Peer Reviewer (Mr R Lee) was extremely beneficial.

Three Cost Statements were submitted during the course of the project but the processing of the final Cost Statement was not helped by the fact that, at the time of its presentation, the result of the second was not known.

6.3 Project infrastructure

At the outset of the project, Management and Quality Plans were issued, which included a template for all written project Deliverables. A website, initially www.ippa.dera.gov.uk and latterly www.ippa.QinetiQ.com, was set up and maintained throughout the project. This had both public and consortium only sections.

There was a deliberate intent to keep meetings to a minimum and initially six Consortium Meetings were planned. However, when it became clear that development of the IPPA prototype would take longer than anticipated and the project needed to be extended by 4 months, this number was increased to seven. Nonetheless, in most cases, it was possible to link these meetings with other project or concertation events.

6.4 Contract amendment

The contract amendment made necessary by the extension to Work Package 5 was an unwieldy process that took over a year to complete. This was, in part, due to a change in the requirements of the Project Officer but in the main to the slow response of some partners to requests for administrative detail and then the slow internal processes of the Commission. This slowness was a general factor in the management of the project, which seemed to worsen as the project went on, and which meant that chasing after inputs to reports and signed original pages accounted for a growing proportion of the overall management task.

Although the principle focus of the contract amendment was the four month extension, the opportunity was taken to refine various partners' individual budget profiles, not least of which was the need to extend expenditure into a third financial year. One significant shift was the passing of some effort from ISSUS to SINTEF. This resulted from a reduced capability being available to ISSUS after the originally planned project end date and the need to complete Work Package 7 (Evaluation), in which ISSUS had a key role. The willingness of SINTEF to take on this additional task, for which they had to find compensating funding, was much appreciated by the consortium. Overall and with difficulty, these financial changes were achieved within the initial budget.

Although conducted outside the scope of the contract amendment, a similar transfer of effort was privately negotiated between INTRACOM and THETIS, so that the Verification Task (5.2) could be completed by THETIS.

7 OUTLOOK

7.1 General

The immediate outlook for IPPA is bright. The concept has been well received and there are signs that it is beginning to alter the thinking of both administrations and ports in their approach to Vessel Traffic Management. There is undoubtedly a requirement for an IPPA product and with its sound basis in a comprehensive user requirement capture and with experienced practitioners involved throughout the project IPPA is well placed to seize a share of the available market when it is produced commercially. The concept of modular construction should allow IPPA to meet the requirements and budgets of a wide variety of potential users.

The market for IPPA should continue into the foreseeable future for the 'high end' user (i.e. the specialist pilot) and for numerous categories of vessels not covered by the carriage requirements of SOLAS. However, it is envisaged that, eventually, the functionality of IPPA will be incorporated into integrated bridge equipment systems (IBS). Experience would indicate that this will not be a general case for SOLAS vessels for some years to come but in that context, IPPA could be seen as aiming at a niche in the SOLAS market.

However the future high-end IPPA product will be an integrated instrument of the VTS shore based infrastructure aimed at changing frontiers and generating totally new VTM concepts and architectures. The main objectives of these new concepts and architectures will not be to just increase the safety and efficiency of the vessel traffic. The increased accessibility of the port will result in a new fairway and port access policy. New terms will develop in the main ports of Europe, such as : controlling space, controlling ship, tactical, operational at the strategic level and allocation management resulting in pilot-VTS integration.

7.2 Applications

As indicated, the potential for IPPA is considerable and not necessarily bound by the requirements of the maritime world. However, within that sphere, the following have been identified as some of the possible exploitation routes for IPPA :

- ⇒ Passage Information Exchange;
- ⇒ Search & Rescue (SAR);
- ⇒ Pollution avoidance / control;
- ⇒ Small vessel safety;
- ⇒ Pilotage administration;
- ⇒ Coastal VTS;
- ⇒ Port State Control;
- ⇒ Port security;
- ⇒ Portable VTS.

7.3 Decision Support

With regard to the 'high end user', the major benefit of IPPA is its potential to provide state of the art decision support. Those areas where this has been identified as being applicable are :

- ⇒ Optimised Port Accessibility;
  - Enhanced Dynamic Under Keel Clearance Management;
  - Real Time & Predicted Squat Measurement;
  - Near real time display of hydrographic multibeam sonar sweep surveys;

- ⇒ Enhanced mathematical path prediction;
  - Position / ROT – 90-120 seconds;
  - SWE / Bank / Multilayer current effect;
- ⇒ Docking / Approach mode with real-time kinetic GPS accuracy;
- ⇒ Hyperlinks to shorebased infrastructure;
  - CCTV;
- ⇒ TTI of tugs;
  - Predicted pivot point (90 seconds);
  - Optimisation of the tug handling process;
  - Bollard pull data;
  - Tug specific data.

7.4 Resource Planning

IPPA can assist in administrative / logistical / planning tasks and via the Enterprise Resource Planning system used in the Port of Rotterdam, the following have been identified as suitable applications :

- ⇒ Pilots;
- ⇒ Tugs;
- ⇒ Line handlers;
- ⇒ Sludge / waste management;
- ⇒ Custom clearance;
- ⇒ Electronic billing.

7.5 Port Accessibility

IPPA has been seen to provide the opportunity for revised thinking in Vessel Traffic Management and, in particular, provides a new way forward for :

- ⇒ UKC management;
- ⇒ Dredging management;
- ⇒ Dynamic tidal window management;
- ⇒ Port Management Safety & Quality Systems;
- ⇒ Emergency response;
- ⇒ Dynamic Passage Planning / Master – Pilot Exchange (MPX);
- ⇒ Slot allocation;
- ⇒ AtoN infrastructure.

7.6 Pilot / VTS Interoperability

IPPA, when integrated in a Port Management / VTS structure allows for a realignment of responsibilities, as shown below :

- ⇒ Pilot – tactical / operational;
  - Control of vessel;

- ✔ Local safety;
- ✔ Local efficiency;

⇒ VTS – tactical / strategic;

- Control of space;
  - ✔ Local & regional safety;
  - ✔ Local & regional efficiency
- Independent intermediary for port operations (port community system);
  - ✔ Transport management.

8 CONCLUSIONS

8.1 Community added value and contribution to EU policies

The area of the community affected by IPPA includes estuaries, fairways, rivers, coast maritime, and inland waterways and restricted pilotage waters, thus potentially impacting on all aspects of maritime and inland waterway transport. The maritime community has a need to trade between states within Europe, and further a-field to the rest of the world. The inland waterway community has a need to transit within, between and across many European territories through canal and river networks, including the Danube Corridor. In addition, both have a common need to be inter-operable with each other when using the same waterways and ports, and from a safety point of view, both need to be interoperable for inter-modal freight and passenger transport infrastructures, systems and services.

An efficient, safe and environmentally friendly transport system is an essential prerequisite for the European Union's competitiveness. It requires a first class understanding of the transport operational environment and the provision of state of the art, user-friendly telematic tools and services. The IPPA project will enable a more efficient and safer use of waterway infrastructures, canals, rivers, ports, restricted pilotage waters and coastal waters. By providing real-time, accurate information, the pilot or inland waterway vessel master will have safer use of the seas and inland waterways, particularly in congested areas.

By providing information on Port and waterway infrastructure status, IPPA provides users and operators within the passenger, freight, port and transport community with information that enhances logistic and resource management. This will result in better inter-operability between different transport sectors and the waterborne community (passengers, freight forwarders, insurance, consignees, consignors, port, ship operators). This is intrinsic to the provision of better interfaces that are needed for successful passenger and freight transport inter-modality.

Inter-modal transport is information-exchange intensive and relies extensively on communications. This is especially true of waterborne transport, which places considerable demands on communications, particularly voice radio communications, between its constituent parts and with others where remote communications is often necessary. Here the information society's role is of crucial importance. User friendly state of the art decision and support tools and information services resulting from IPPA contribute to paving the way towards a more balanced and user-oriented intermodal transport market and the goal of reduced operator workload by reducing the need for voice radio communications.

Telecommunication as well as telematic applications are rapidly growing markets, where the development will also influence shipping significantly. In an era of increased global competition, the EU must have its shipping industry in a leading position of quality, technological innovation, and competitiveness. The benefits mainly centre on enhancing the competitive position of the shipping enterprises using the latest technologies. Economic growth will also be enhanced by better skilled crews, as well as increased safety for ships, crews, passengers, cargo and environment. Improving the skill levels of crews is beyond the project’s remit but IPPA certainly contributes to improved safety.

The project has supported the IST programme by developing a technological solution to a Europe-wide problem by providing Europe-wide standards to which inland waterway and sea-going vessels and infrastructures can intercommunicate, thus being inter-operable throughout the continent. It assists in making transport within the waterborne community more efficient and safer, thereby promoting its use for carriage of freight and making more efficient the process of inter-modal facilities.

IPPA assists in accelerating technological development within the waterborne sector, whilst ensuring the visualisation of traffic and other image needs of individuals and enterprises within the waterborne transport and infrastructure community are met, therefore meeting a strategic objective of the information society.

The project met all four specific interrelated objectives of the IST programme. The project met the need and expectation of high-quality affordable visualisation tools and pictorial information services provided for use by individuals within the waterborne community.

⇒ It provides the benchmark standards to stimulate innovation for Europe's enterprises, workers and consumers within the information service sector of the waterborne community;

⇒ It assists in promoting Europe on the international stage for multi-media services within the waterborne transport community;

⇒ As an enabling technology it fulfils the needs of pilots to obtain information critical for operational success and as such will enhance generic applications accelerating similar technological solutions within Europe. The project is also fully compliant with all three threads of the IST programme strategy;

⇒ The end product of the project, when taken to the production stage, will ensure competitiveness within the market place both within Europe and of equal importance, within the international trade of waterborne transport, around the world.

8.1.1 The European added value of the consortium

The consortium, being made up of organisations' from many member states met the requirement to collaborate across Europe. This ensured critical mass in terms of skills and provides the vehicle to establish the consensus necessary for standardisation and assists with interoperability issues.

8.1.2 The project's contribution to the implementation or the evolution of one or more EU policies

The project does contribute to a number of policy initiatives of the European Commission that have been adopted over the past few years. Additionally and perhaps of most importance is that it also contributes to a number of more recent initiatives. The project, by providing potential services and equipment to be used on board by watch keeping officers when navigating close to the coast, has demonstrated that it is able to share information with the local VTS or RIS (Regional Information Services). This enables alternative action to be sought, such as choosing a more environmentally acceptable passage plan during rough weather, thus enabling Vessel Traffic Management to have extended traffic control as proposed within the COM 2000 802 final of the ERIKA II proposal for "establishing a community monitoring, control and information system for maritime traffic".

Another area in which the product of IPPA could make a significant contribution is the concept of veritable motorways at sea as proposed within the Transport White Paper "European transport policy for 2010: time to decide". On a similar theme it will also contribute to COM (1999) 317 final "The Development of Short Sea Shipping in Europe". It will contribute to both of these by providing tools and information that will improve knowledge of traffic, infrastructure and weather as well as other factors that can influence the "efficiency" measured in the length of time of a proposed sea voyage or river transit both of own vessel and those for transhipment. It will also improve port accessibility, by maximising the weather and tidal windows usable by constrained vessels.

It contributes to policy resulting from COM (2000) 603 final "Report from the Commission for the BIARRITZ EUROPEAN COUNCIL on the Communities strategy for the safety at sea" by improving the information flow between ships and vessel traffic management organisations and competent authorities (HAZMAT).

It also contributes to directives resulting form COM 2000 142 final "Communication from the Commission to the European Parliament and Council on the Safety Of The Seaborne Oil Trade". The products and infrastructure required to service them will contribute to the possibility of improving surveillance of navigation, particularly in those areas where oil tanker traffic is most dense.

It also contributes to the e-Europe initiative "Communication on a Commission Initiative for the Special European Council of Lisbon "An Information Society For All" regarding the Intelligent

Transport part. Here the initiative seeks to prevent or at the very least reduce accidents by the use of digital technologies. The project contributes to the provision of trans-European networks with systems offering traffic incident/congestion information and management.

8.2 Contribution to Community social objectives

In order to achieve socio-economic and environmental sustainability, the efficient and balanced use of existing capacities throughout the European transport system has become a key challenge, particularly within the maritime and inland waterway community. Whenever information technologies have been introduced within transport and tourism sectors, they have resulted in significant changes to the sectors' structures and their management. Within the maritime, port and inland waterway community, particularly regarding inter-modality and interoperability, many elements remain isolated.

Telematics, within the maritime and inland waterway community, though a key requirement for a sustainable market, preservation of safe environment and the provision of a competitive industrial edge, is still in its infancy regarding the provision of tools and services. The IPPA products will enable the introduction of state of the art services and tools for the user. Thus contributing to the purpose of the Commission's Information Society Technologies Programme to realise the potential of advanced information technologies and promote a user-friendly information society.

The project's tools and services will assist in stimulating more competitive methods of working and doing business within the waterborne transport sector inducing higher-quality lower-cost information services. The products and services that will evolve from this project will assist in the better management of maritime infrastructure, roadsteads and capital resources. This in turn will enable the more efficient turn around of ships in port and transhipment to and from inland waterway vessels. Therefore it will contribute to the possibility of making more attractive the use of the sea as a means of transportation so relieving congestion on the road and rail networks. Contribution to improving employment prospects and the use and development of skills in Europe

Because the products of the project will result in the better provision of infrastructure, traffic and individual vessel status, they will contribute to making the processes of planning times of arrival for transhipment or loading / discharging freight more accurate. The results will be a more efficient use of vessels and terminals, in turn leading to the growth of the use of inland waterway vessels and ships. This in turn will lead to increased employment opportunities within the numerous maritime operations and processes. Though the impact on large trucks will be noticeable, making the use of many of them redundant, it will not necessarily have a negative impact on the employment of the drivers as there will be far more opportunities as smaller urban and short distance distribution vehicles.

Telematic services will, in certain cases, displace some citizens from some areas of work. The resulting impact from IPPA will be to provide new services thus increasing employment opportunities within the service sector. The on-board visualisation and communication tools will need manufacturing and information integration software will have to be distributed to enable the addition of new service images, thus having a positive impact for employment within the electronics and software industry.

Because the products are aimed at different market sectors, there will be opportunities :

- ⇒ within the "high-end" system market directed to ocean going ships, ports and service providers;
- ⇒ within the inland waterways communities serving inland waterways vessels, RIS and the supporting infrastructure;
- ⇒ within the maritime communities serving the leisure and fishing market;
- ⇒ by creating a more competitive environment.

The products will be the catalyst to new services and employment opportunities.

8.2.1 Contribution to preserving and/or enhancing the environment and the minimum use/conservation of natural resources

The project will have a direct impact on both preserving and enhancing the environment, because it enables the sharing of information between shore infrastructures, environmental and pollution response agencies and ships at sea. Being used as the provider of geographic co-ordinates of risks to and actual pollution and being used as the provider of pollution response GIS co-ordination information, the products of this project can have a positive impact. The product also could have an application as an enabling tool for distant vessel traffic management to re-route vessels, this is an issue addressed within the ERIKA II proposals.

8.3 Economic development and S&T prospects

8.3.1 Possible contribution to growth

Europe is a maritime continent and its maritime industry is the second largest worldwide. After the recent expansion, Europe provides the world with its largest trading partner and 90% of its external trade is carried by sea. Furthermore its inland waterways are vital transport arteries throughout Europe, connecting the sea to numerous cities, industrial centres and providing a gateway via the Danube corridor to the near east. The density of waterborne users is among the highest in the world. Therefore Europe, and indeed the rest of the world, relies on an efficient maritime sector and the competitiveness of its maritime industry. The project realises the importance of promoting its work not only within Europe but also worldwide.

Europe is a leader in this area of Vessel Traffic Management and in order to maintain this position it must continue to be innovative. The project provides an opportunity for European industry to extend its capability in the provision of safety related systems to the professional and leisure market places and will act as a springboard for the development of related maritime systems applications. The product also makes these processes much safer and more efficient. As a consequence of better efficiency and safety there is the real potential for growth for the communities served by the IPPA services and decision support processes.

Telecommunication as well as telematic applications are rapidly growing markets, where the development will also influence shipping significantly. In an era of increased global competition, the EU must have its shipping industry in a leading position of quality, technological innovation, and competitiveness. The benefits mainly centre on enhancing the competitive position of the shipping enterprises using the latest technologies. Economic growth will also be enhanced by better skilled crews, as well as increased safety for ships, crews, passengers, cargo and environment. Improving the skill levels of crews is beyond the project's remit but IPPA will certainly contribute to improved safety.

For the sector concerned, the operational and trading environment of a ship is heavily regulated through Member State, European and International requirements (IEC, WRC, Port State Control, GMDSS, SOLAS, MARPOL, HAZMAT, ISM, etc). Therefore, to improve competitiveness and create new market opportunities the project adopts a high level dissemination of equipment performance standards, communication protocols and system inter-operability requirements. These issues are important in the context for the provision of services, i.e. "Vessel Traffic Management and Information Services", and the receiving / visualisation equipment. Therefore they include promotion within international organisations (International Maritime Organisation, International Association of Marine Aids to Navigation and Lighthouse Authorities, International Electrical Commission, etc.).

To ensure an active interest from a major continental market outside Europe, the US Coastguard and the International Maritime Pilots Association were actively involved in the project. The products therefore will not only create market opportunities in Europe but through this strategy, the rest of the world. The project therefore does have real potential for improving competitiveness. It also by providing a totally new product series that has no immediate competition creates a new marketing opportunity.

Products of the project serve several maritime communities including recreational yacht users, and other vessels covered and not covered by the carriage requirements of SOLAS, Pilotage organisations and maritime infrastructure managers. It therefore has enormous potential in terms of increasing the efficiency and safety of a number of navigation and traffic management processes. It will also contribute to the setting up and realistic monitoring / management of the "veritable sea motorways" mentioned within the transport white paper that will transfer the transportation of goods from road and rail to shorts sea shipping and inland waterways. The products therefore will have an enabling role that will indirectly have a positive value to the EU economy.

8.3.2 The strategic impact of the project

The products arising out of this project will make operations more efficient, this will have an impact on the cost of operations which in turn could make the exportation of products to and from Europe more competitive than those for competing non-European communities. The products by contributing to the efficiency of waterborne transport will inevitably have a knock on effect to the efficiency and cost of transportation within the manufacturing supply chain, from the provision of raw materials to the exportation of finished products.

The products of the project will make the planning of vessel movements more efficient by providing real time information that will contribute to the decision-making processes involved for the management of vessel traffic and navigation. The improved information will result in more efficient use of resources and hence improve competitiveness of individual ports and maritime infrastructures. The decision support and information service tools emerging form the project will create new local and regional service opportunities within the vessel traffic management and information service community. These new opportunities will demand continual evolution of new, more precise information that, in turn, will act as a catalyst for a new marketing initiative.

The potential of the product just within Europe is considerable. There are, essentially, four main markets to be addressed :

- ⇒ Portable Pilotage Aid : Within Europe alone there are some 600 plus pilotage areas, each handling several ships at a time, serving ports, terminals, canals and rivers connected to the high seas;
- ⇒ Fixed On-board aid for International Trading ships : There are some 70,000 ships that either regularly, or have the capability to visit or transit European Waters;
- ⇒ Fixed On-board aid for domestic ships (not plying outside Europe): 100,000+;
- ⇒ Portable / fixed On board aid for inland waterway vessels, Work boats, leisure craft and fishing community: market estimated in millions.

The worldwide market potential is therefore very exciting. The consortium will apply a realistic view of their achievable market penetration and the costs associated with this. The consortium contains several participants (manufacturers, service providers and users) that represent a significant share of the market for their products and consequently a very good understanding of their customer requirements. This provides considerable knowledge of issues such as promotion, potential competition, market requirements, potential take up and international maritime equipment trade shows.

8.3.3 Contribution to European technological progress

The project fostered international co-operation, research interaction and exchange; which went well beyond purely European involvement. Particularly important was the interaction between the research organisations and industrial partners. The academic and research community benefits from the significant real-world have obtained valuable experiences for future tasks. The industrial partners of the consortium have benefited from such an interaction, in being exposed to advanced concepts, methods, and tools. Results of this project will open various new prospects for future developments.

The project addressed the needs for standardisation and interoperability through dissemination to member state maritime and inland waterway administrations throughout Europe, not least in concertation with other European Commission sponsored projects. It also, through member state administration and agency sponsors, raised relevant issues regarding the protocols and performance standards during national, European and international organisation workshops and conferences. This strategy was vital to start the process of worldwide interoperability.

The project will have a major impact on technological progress within the Vessel Traffic Management and Vessel Traffic Service markets. It will also have a significant impact for the development of decision support tools serving mariners and operators alike. It places a demand on other state of the art technologies and in some cases stimulates the evolution of lower cost components to create the future lightweight integrated portable pilot unit.

ANNEX A IPPA GROUND STATION (IGS) DATA IMPORT

A 1 IPPA GROUND STATION DATA IMPORT

A 1.1 Problem Description

In Rotterdam, MFPS exports database tables in the DBF format. This is not readable by MySQL. Therefore it was necessary to provide some conversion utilities. It was also necessary to automatically FTP data from the MFPS client to the database server.

A 1.2 Suggested solution

Microsoft Excel reads DBF files. Excel can also save tables as semicolon separated files in ASCII text format. It was therefore necessary to find some way to import the file in Excel, control Excel so that it saves the files in semicolon separated format and transfer the files using FTP.

It was then necessary to import the files into the MySQL database.

Perl is a suitable scripting tool for this. ActivePerl (www.activeperl.com) supports COM control of Excel etc, so it is suitable for Excel control. It also has a FTP script library. Therefore it was recommended to use ActivePerl as a scripting tool for data conversion and file transfer. After transfer, the files are deleted. The Perl script is run at suitable intervals, or the script can run continuously.

When files arrive at the MySQL server a Java program is started, and the files are imported into the database tables. After import, the data files are deleted. On the server, there is also a thread in the Java program deleting records older than a given limit.

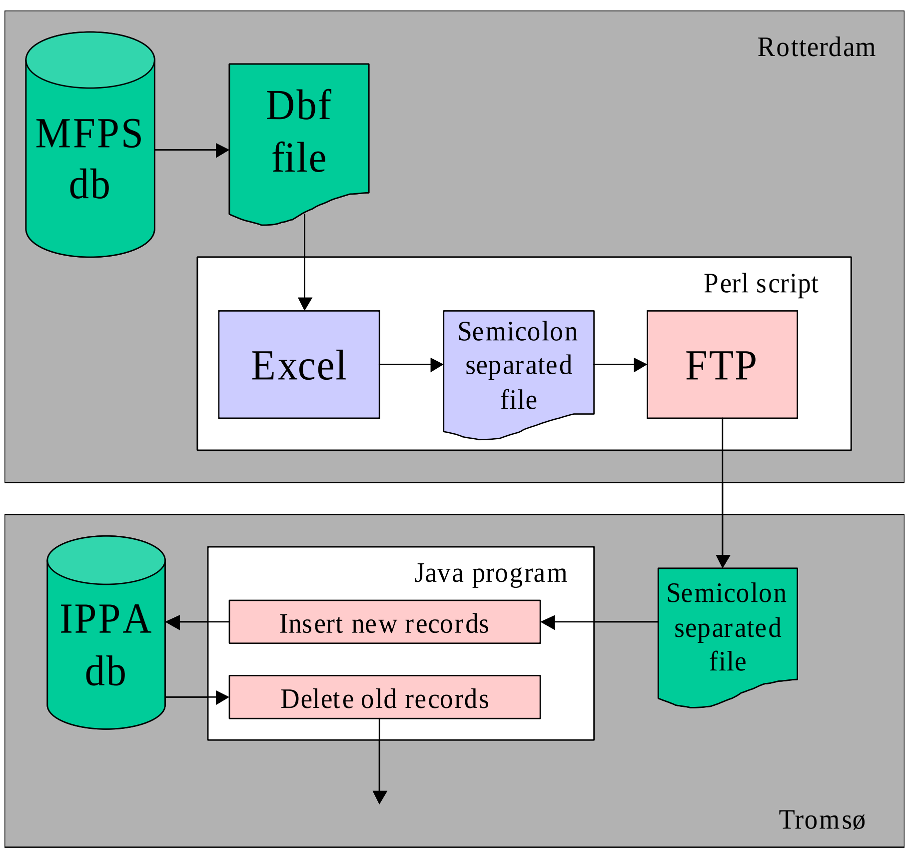

Figure A - 1 IGS data flows

Programs and scripts required to be written are outlined in white.

A 1.3 Tasks and responsibilities

- ⇒ **Telenor** wrote the Perl script and Java program;
- ⇒ **AVV** installed ActivePerl and MS Office (if needed) on the MFPS client machine;
- ⇒ **Telenor** configured the IPPA database with access for Intracom;
- ⇒ **AVV** decided which database tables to extract, and what columns, and sent the description to Intracom & Thetis.
- ⇒ **Telenor** imported the database tables blindly into the database.
- ⇒ **AVV** was responsible for naming the files. The name of the files were used as table names by the IPPA database. As the files are deleted when transferred, the same name was always used for the same table.