# ATIS '93 (Air Transport Information Systems)
# Sheraton, Frankfurt Airport, Germany

# TIM

**Overhead Slides Presentation**

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**ABSTRACT**

**KEYWORDS**

**IA Corporation** - CONFIDENTIAL

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# Strategic Foundations

## Background

Modern customers want timely, secure, efficient and cost-effective service. To meet this demand, and to compete effectively, commercial enterprises are constantly seeking new ways of lowering product and service costs, improving product and service quality, reducing inventory and shortening lead times… they are constantly looking for new and more efficient ways of responding more quickly to customers and market demands on a global basis. This, in a complex and challenging environment of shortened product life-cycles, increased domestic and international competition, rising labor and raw material costs, frequent technological innovations, and internal organizational changes.

In the turmoil of the forthcoming deregulation, airlines and air carriers are putting such strategic criteria under detail scrutiny. They strive to provide safe and reliable airplanes at the gate for on-time departure at the least total cost; supporting this primary objective through the continuous improvement of operating procedures, support equipment, and people. The goal being to maximize asset productivity of the aircraft. The challenge being optimal operational effectiveness.

## Information: An Evil Asset

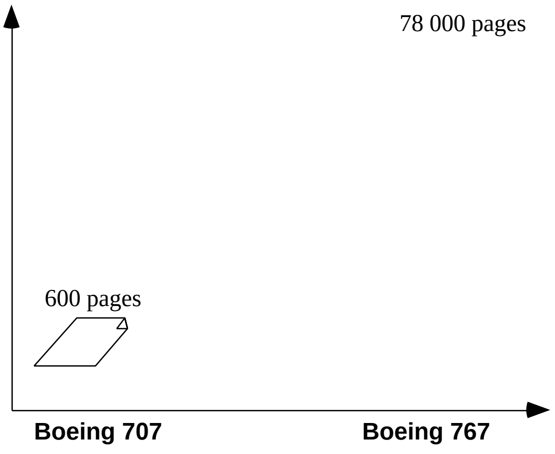
It is commonly agreed upon today that major disfunctionments, delays and defects in an organization are rarely the consequence of incompetent or bad-willed staff. The poor quality, or lack, of equipment can rarely be blamed too. The major responsable of such dysfunctionments is information, or more precisely, the lack, unavailability or inaccurancy of technical information - be it engineering data, drawings, or technical documentation and manuals. Technical information has been colourfully described as “a necessary evil that constantly adds to overall costs at a rate which exceeds all other growth, frequently providing the end-user volumes of unusable data well past the date of its initial use”

In the current business environments, composed of islands of automation and complex business networks, it is extremely difficult, perhaps impossible, to keep the technical information manipulated for a given product or service, consistent with the changing reality, to consolidate continuous feedback, and to integrate rapidly requested changes in the design.

Technical Information Management (TIM) is a prime concern of all major industrial enterprises, as reflects this quote, taken from an RFI: “Time and money are being lost and overhead rates are being driven up because of (1) the variety of forms and formats used to prepare and store these documents; (2) inadequate search and retrieval methods; and (3) and inability to maintain effective version control”. This quote, taken from an RFI, reflects common concerns and perceived opportunities for the management of engineering data and technical information.

This phenomena is particularly critical in the aerospace industry where the volumes of technical information are critically high. Boeing for instance, maintains 18 564 000 pages of maintenance manuals providing airlines with 14 km of paper and 7 km of microfilm cassettes. The shear weight of the B1’s 1.4 million pages documentation is heavier than the bomber itself, and its elaboration has costs the US Air Force $6 billion.

*Increasing volumes of documentation*




Two particularly significant key figures have been selected to illustrate here the strategic impact of technical information:

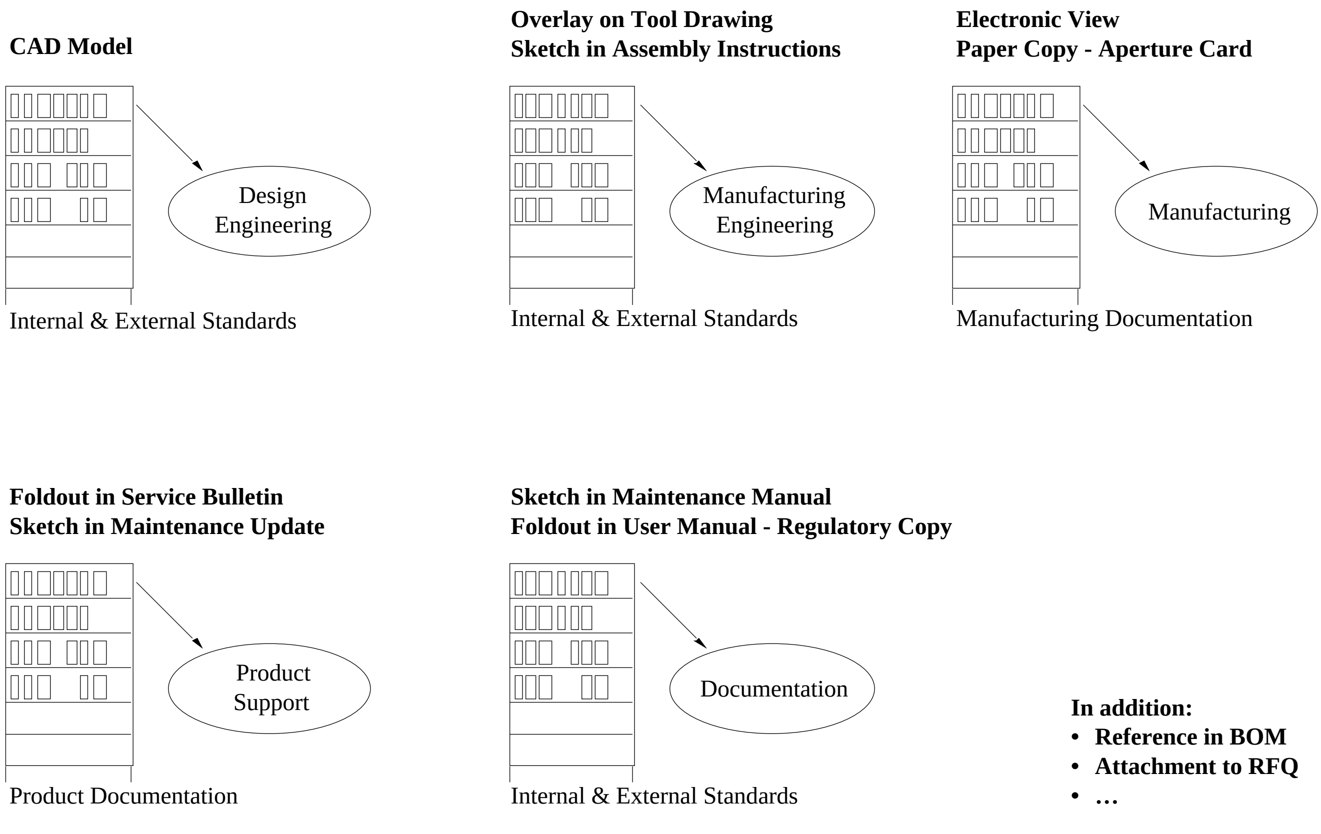
- Engineering change can consume 45% of product design time and more than half its cost;

- 30% of the military equipment used by the Allied Forces during the recent Gulf War was unoperational due to outdated technical manuals.

## Islands of Automation

The traditional solution to the challenges presented earlier has been automation. Automation, as implemented so far, is a day-to-day operations approach that enforces frontiers betwen the functional groups of the entity, hence creating islands of automation. These latter are also referred to as islands of data in the CIM terminology since, as a result of automation, individual data bases and documentation vaults are created for each group. The consequences are massive dupplication, non optimal communication among the diverse functional groups, labor and time intensive data management practices, both in creation and retrieval of data, and diverse, heteregeneous, and non-standard hardware platforms which do not lend themselves to off-the-shelf interconnection

*Islands of automation*

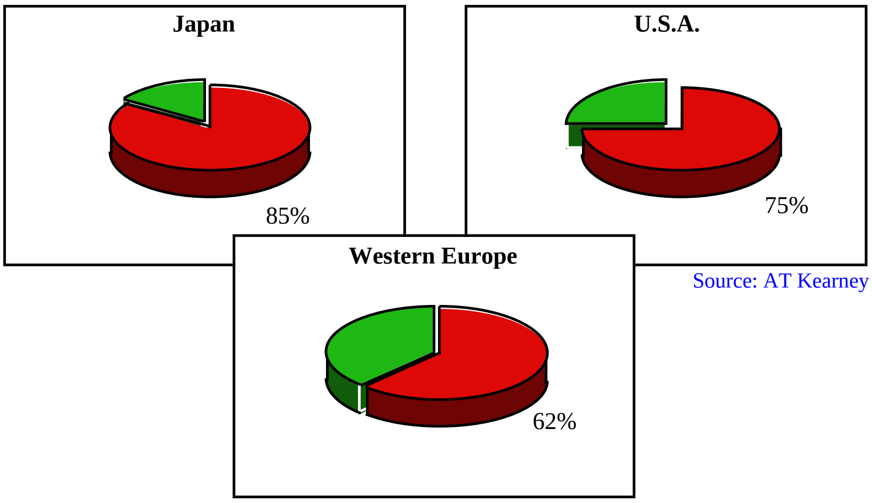


## Business Networks

A general trend today is for companies to concentrate on their prime job, and to contract out the various aspects of the products they manufacture, or the services they deliver, that are not directly related to the technologies they master or to the company's know-how.

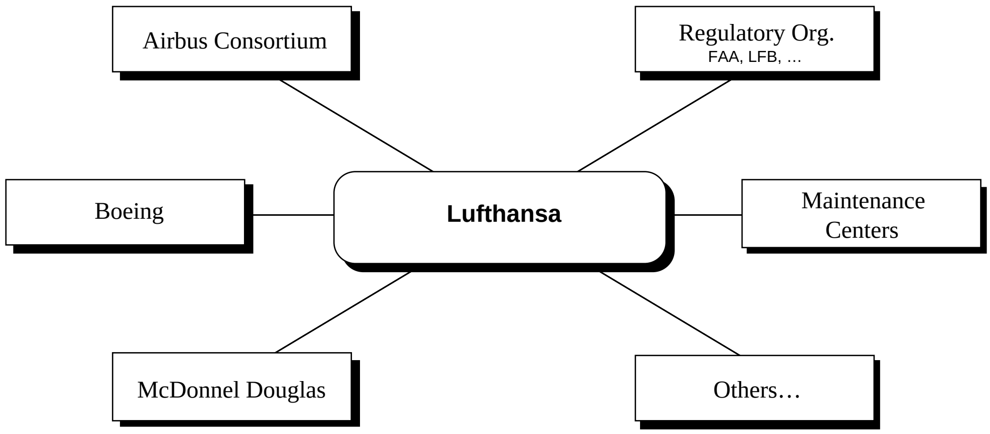
Sub-contracting, or co-contracting, can represent over three quarters of the overall production costs. A recent study by AT Kearney shows that this phenomena is particularly important in Japan (85%) and North America (75%); Western European companies, with 62% are rapidly catching up.

*The Importance of Subcontracting in Modern Economies*



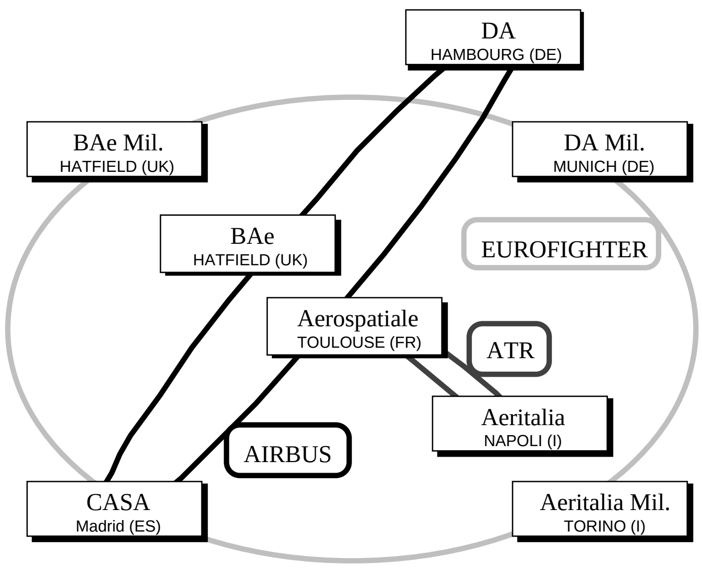

Sub-contracting and co-contracting increasingly cover major functional components, no just parts; the contracted partners are specialists that deliver complete sub-systems and functions based on the requirements and specifications of the contractor.

*Lufthansa's Business Network*



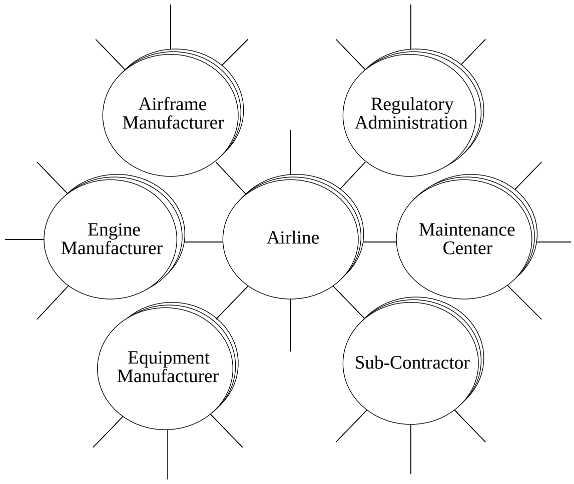

In the European AIRBUS program, for instance, the main parts of an AIRBUS plane are split among the various partners of the consortium: Aerospatiale is responsible for the cockpit, British Aerospace for the wings, Casa for the rear wings, DA for the fuselage. Further breakdown shows that the various equipments of each part are equally sub-contracted.

*Major European aerospace manufacturing connections*




Modern business networks consist of many actors, all of which may have different languages, cultures, know-hows, practices, methods, etc. This further complexifies the environment. Hence, a major industrial challenge is to monitor and control these business networks.

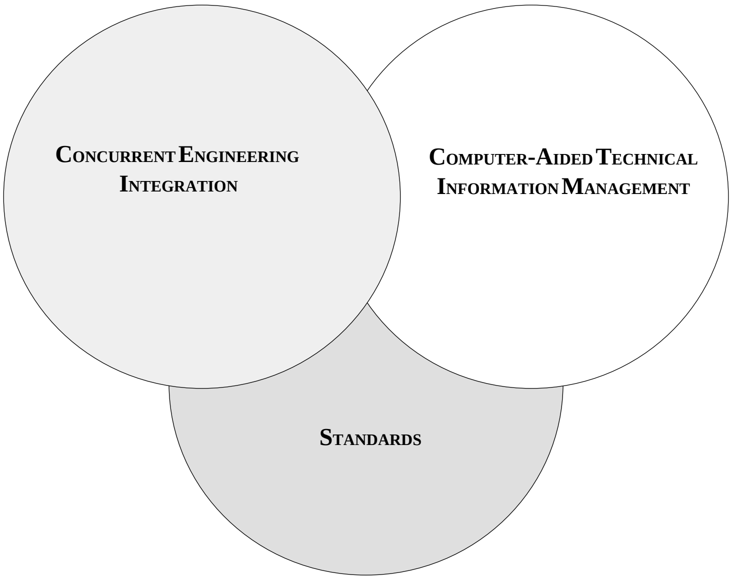
*Typical Airline Industrial Network*



## Keys to Operational Effectiveness

Today, enterprises are discovering the need for integrated, business-driven, and concurrent operations, where all operators, whether human or automated, access all the information and ressources they require to perform their work under optimum time and space conditions. Where the strategic leitmotiv is "*the right information, in the right form, at the right place and at the right time*", and though it may involve wrenching organisational change, Concurrent Engineering (CE) combined with computer-aided TIM applied in a standardized environment are proving the answer.

*Keys to Operational Effectiveness*




### Concurrent Engineering

In use by Japanese manufacturers for over three decades, CE is the simultaneous design of product and the process required to produce it. CE is "*a systematic approach to the integration of design, production, and related process which considers all aspects of a product life-cycle*". More colourfully, some describe CE as "*the last frontier of competitive advantage in manufacturing*", meaning that the resulting benefit of *time to market* is a critical attribute.

CE is the antithesis of our rigid, long-entrenched serial methods that “*compare to a relay race*”. The walled-in design engineers hand off to manufacturing engineers, and they to production, and they to marketing, and so on. With CE people from all the involved disciplines, including suppliers and even users, are assembled at design inception. Decisions here can influence 70% to 80% of the cost of the product. Pre-CE, these were arbitrary; downstream managers could do little to affect cost, serviceability, quality, or even delivery.

The method of CE is to optimize, as rapidly as possible, high quality design for lowest possible production cost. With all voices heard at the outset, downstream problems are anticipated and eliminated. There is assurance that the design will be compatible with the company’s manufacturing practices and the capabilities of its suppliers, and that the entire cycle will remain customer-focused.

Shortening cycle time does not come from dropping essential steps, nor from speeding up work. What is dropped is the circuit of arbitrary, talentless, or just bad decision-making, and the need they create for endless corrections downstream. Gone are the sacred departmental walls, the impediments of middle management, and the monumental indefference on the part of personnel to the operation of the whole. Gone are the adversarial energies that bristle between groups of different technical expertise, languages, and cultures. Gone are the sempiternal costly and unplanned upstream interrupts. Thus CE is about parallel processing and about teamed and personnaly invested people; hence the domain of CE is not restricted to the manufacturing field.

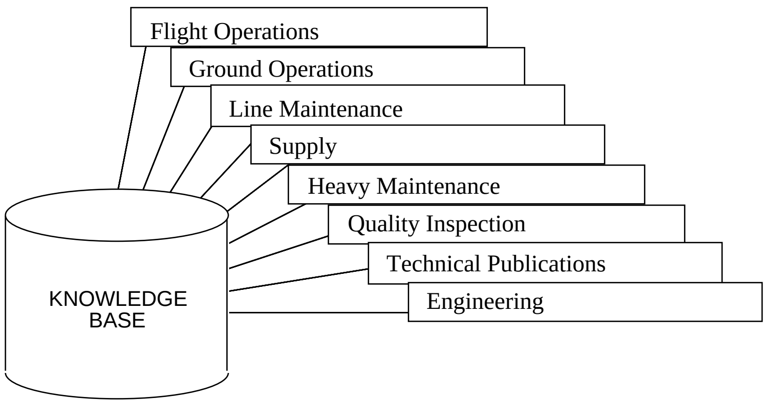
However CE is not a trivial move. It is a walls-come-tumbling-down change in the way a company develops and sustains products and services. A radically new freedom of interchange among related professionals takes place. Their individual *empowerment* adds responsability, sharpens effectiveness and increases personal involvment. None of this jibes with the pyramidal hierarchy that dominates business today. Where CE fails, it is a failure of teamwork or irreconcilable differences involving key management.

## Technical Information Management

TIM, in contrast to CE is not a discipline. It is a suite of modern computer science technologies such as, but not restricted to, electronic imaging, distributed and concurrent processing, and storage and distribution of multiple data types. TIM serves the engineering documentation and data management environment. It provides the ability to quickly communicate engineering data/drawings in raster (digital) more or the full range of *native* formats - including CAE, CAD, MRP2, video visualization, annotations both voice and writtent, and technical publications. It permits full control over the engineering change process with instant updating.

CAD/CAM/CAE and TIM are not competitive, but complementary. CAD, for instance, has tremendous value for the designers and engineers. However, it is the wrong medium for full range communication with most of the downstream people and people at remote sites. The non-engineering use of drawings can exceed 95%. Most do not need an intelligent document beyond some annotations and redline levels. TIM is the necessary complement to the CE initiative. The traditionals paths for verifications, approvals, remote site inputs, and even distribution take several weeks; through electronic imaging and communication enablers, TIM enables the same distributions and work flows to occur in a matter of hours.

*TIM: Multiple and concurrent views of the same information.*




## Standards

TIM is the enabler, the set of tools, that enable optimum CE activities by integrating into the system functions that automate the control of information access, its distribution, and its simultaneity. Their are two prerequisites to the implementation of a TIM system.

The first reprequisite, for evident reasons, is that the management of an organization's information can only occur once all entities of that organization communicate; the retention or disordered dissemination of information must be tackled first. Enhancing communication between those entities comes after.

The second prerequisite requires that the information exchanges between entities be standardized, irrespectively of the procedures and behaviors of these entities. Standardization is therefore of strategic importance. In fact, standardization and integration are so intimately interconnected, that it follows all the trends and evolutions of the latter. Consequently standardization efforts are closer to R&D than to existing commercial products. Worldwide recognition of the vital importance of standards has led to many standardisation efforts: the CCITT and ISO recommendations have almost totally modelled the mechanics of modern communications; for more than twenty years now, the world's airlines have conformed to the internationally agreed ATA 100 specifications for all airline manuals, whatever their format. No de facto or internationally agreed standards have yet emerged for the automated interchange of technical information and data; even though drafts and preliminary versions are becoming available (e.g., STEP for the product data, or the draft standards for manuals on CD-ROM produced by the ATA 100 Advanced Retrieval Technology workgroup).

Nevertheless, key standards are available and sufficient for the first phase implementations of TIM systems. The fantastic impulse of the CALS program of the US DoD, recently followed by the NIPDE initiative of the US DoC, have forced the step of standardization and should lead to the availability between now and 1995 of a complete set of standards for the integration and interchange of engineering and technical information. The thrust is such that it will impact all organizations, and not only those that operate in the military field.

## *Standards for Portability*

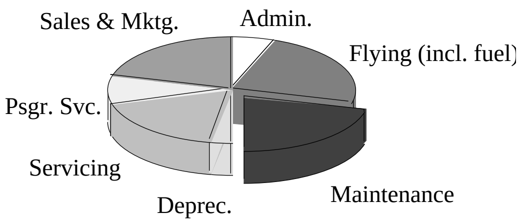
| *Function* | *Component* | *Interface Specification* |
|---|---|---|
| Operating System | Extended POSIX | FIPS 151 (IEEE Std. 1003.1 -1988)<br>Shell & Tools (P1003.2, draft 8)<br>System Admin. (IEEE P1003.7) |
| Database Management | SQL<br>IRDS | FIPS 127<br>FIPS 156 (X3.138 1988) |
| Data Interchange | | |
| • Graphics | CGM | FIPS 128 |
| • Products Data | IGES, PDES | NBSIR 88-3813 |
| • Document Processing | SGML<br>ODA/ODIF | FIPS 152<br>ISO 8613 |
| Network Services | | |
| • Data Communications | OSI | FIPS 146 (GOSIP) |
| • File Management | TFA | IEEE P1003,8/X |
| User Interface | XWindow System | Version 11, Release 3 |
| Programming Services | C<br>COBOL<br>FORTRAN<br>ADA<br>PASCAL | X3J11, draft X3.159<br>FIPS 021-2<br>FIPS 069-1<br>FIPS 119<br>FIPS 109 |

Source: "The Standards Test for Portability", by Roger Martin, Datamation May 15, 1989

# An Airline Maintenance Bonanza

## The Opportunity

Airline economics depend on achieving optimum use of fleets of very costly aircrafts; maintenance holds a vital part in this equation.




Aircraft maintenance schedules are, for obvious reasons, very stringent. Airline staff are certainly the most highly trained, probably the most highly paid, in the maintenance sector. In the 1970s, these factors served to justify the industry shift from printed to microfilm-based drawings and technical documentation.

*Cost of maintenance per airborn hour*

| | | |
|---|---|---|
| Concorde | 65 900 F | $13 180 |
| Airbus A300 | 14 600 F | $2 920 |
| Boeing 747 | 11 300 F | $2 260 |
| Boeing 727 | 8 700 F | $1 740 |
| Airbus A310 | 8 500 F | $1 700 |
| Airbus A320 | 6 100 F | $1 220 |
| Boeing 737 | 4 150 F | $830 |

Source: Air France

Today, the current and emerging standards, the available and announced price-performance of data processing equipments - particularly workstations, and the maturity of distributed data and processing techniques, make the initiation of TIM projects, in this area, timely.

TIM is not new to the aerospace industry; many manufacturers initiated projects in the mid-1980s. These projects served technology and feasability testing. Today, a majority of these projects have grown into full and highly strategic technical information systems. (Incidently! IA Corporation is proud to be the leading supplier of TIMSs to this industry). These pioneers of TIM applied to the aerospace industry, make such maintenance projects highly practical through lowered risks and immediate availability of the manufacturer provided technical information.

## The Challenge

The objectives of aircraft maintenance are to provide optimum security and highest possible availability of aircrafts, in order to ensure maximum profitability. This can be achieved through the deployment of dynamic maintenance strategies that limit redundant maintenance operations and operational costs, while optimizing the use of equipments and the work of human ressources. Dependant, on the corporate strategies, this can also encompass increased sales of marketing services. Hence, a responsive maintenance program is the corner stone of airframe maintenance.

## The Model

Aircraft maintenance consists of many highly regulated and timed, preventive and curative, maintenance operations. All of which are systematically documented. Documentation is required prior to, during, and after the operation.

Prior to a maintenance operation, the technical information required indicates what operations need to be carried out; where, when, and under what circumstances they must be performed. This documentation originates from both the manufacturer of the inspected component and the airline; the first gives recommendations and guidelines, that are adapted by the latter to accomodate corporate methods and procedures.

Each maintenance operation is carried out according to job cards which are specific to a given aircraft and a given situation. Complete documentation is available for the identification and correction of failures and break-downs, which may be noticed while airborn or at maintenance stops.

Documentation is equally required after maintenance operations to ensure their logging and to provide the necessary information for reliability analysis.

*Examples of maintenance documentation.*

| | |
|---|---|
| AMM | Aircraft Maintenance Manual |
| CMM | Component Maintenance Manual |
| EMM | Engine Maintenance Manual |
| FIM | Fault Isolation Manual |
| IPC | Illustreted Parts Catalog |
| ITEM | Illustrated Tool and Equipment Manual |
| MPD | Maintenance Planning Document |
| PMDB | Production Management Data Base |
| SRM | Structural Repair Manual |
| WDM | Wiring Diagrams Manual |
| OEB | Operations Engineering Bulletin |
| SB | Service Bulletin |
| SL | Service Letter |

## Ground Rules and Issues

Paperless maintenance operations is not the goal: as mentionned earlier, changing the medium will not improve the process. Further, if current working procedures are inefficient, automating them will result in automated inefficiency.

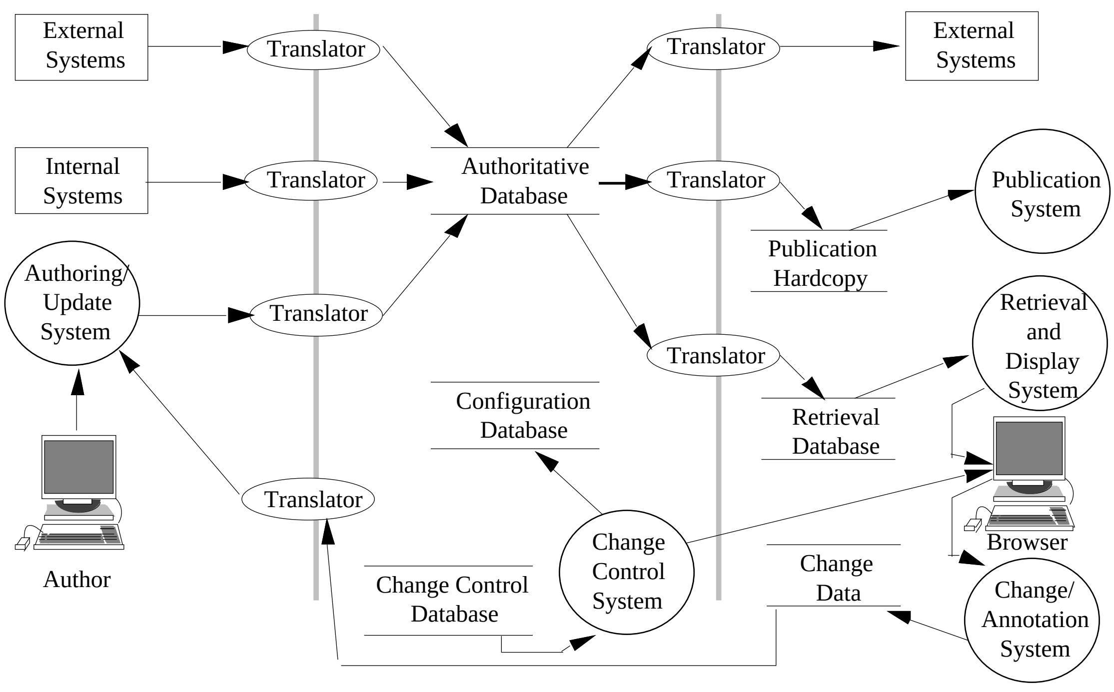
Instead, applying TIM must result in the availability of a knowledge base providing uniform and efficient management of corporate data, which, today, includes at least three data types, with more to come. The paraigm to which these systems must be designed includes presenting data where needed, when needed, and *in the form needed*. This last statement is particularly important: while the electronic storage and retrieval of technical manuals, can improve change control and simplify production, the presentation of a manual on a workstation screen represents a step backwards: it is hard to *flip through* !

Hence, the issue is intelligent access to the corporate knowledge base. Electronic documentation may improve configuration control and speed up delivery of electronic manuals, and CALS will facilitate the exchange of data. Both of these results imply benefits to the organization. A substantial additional benefit, however, will accrue from changing the storage and presentation of the data, that is, making the data available in the form needed for a particular purpose and by a particular person or work group, linking the data so that modifications to a datum will be automatically reflected where this datum is used, and by storing the data in the units best suited to the total projected use.

## The Corporate Knowledge Base

The Corporate Knowledge Base includes, in abstract, all data of relevance to the running of the corporation. In practice, the data divides logically into loosely coupled sets and, at least for the purposes of initial implementation and for presentation here, it is convenient to reduce the scope, which for this discussion will be maintenance data. It is nonetheless important that the design for an automated knowledge base take all data into account when defining repositories and access paths. The figure below shows a conceptual architecture of the knowledge base.

*Company Knowledge Base: Conceptual Model*




The components are:

- Authors, who create or update data
- Browsers, who display, change or annotate, data
- External systems which deliver and receive data, and internal systems which deliver data

- The Authoritative Database, which contains all data in a suitable form. This database is the knowledge base and contains the authorized, "canonical" version of the data in the knowledge base. Note that it is not a requirement that his database be centralized; whether it is centralized or distributed is an implementation issue
- Translators which convert data to/from the form stored in the Authoritative Database
- Publication systems which create static views of data for publication and/or presentation
- The Change Control system which manages the supported configurations of data, using
- The Configuration Database and
- The Change Control Database
- Retrieval Database(s), which are views created mainly for reasons of throughput and response

The components of this architecture will be further discussed below.

## Presenting the Information

The data retrieved from the Knowledge Base must be presented in the form needed. This will vary from application to application and from individual to individual, but some general issues can be identified:

- Careful indexing, using controlled vocabularies, improves the retrieval hit frequency
- Expert system help in retrieving will improve the hit frequency
- Links - hyper- or other - facilitate the retrieval, but the linking must be controlled to prevent an excessive and confusing number
- The presentation must be adapted to the resolution and window size of the platform(s)

## Getting There

The automation of a company knowledge base presents design and implementation issues which are different from conventional EDP automation in size and diversity, if not in concept. The diversity of the users of the knowledge base exceeds the user base of most EDP systems and requires a wider range of interfaces, and the set of datatypes is larger. The major steps to implementation are a data inventory, a function inventory, and an extension to a general design. The description here is by necessity brief, the actual effort is anything but.

**The Data Inventory**

The data inventory includes an inventory of the totality of the data within the corporation, a determination of the relevance of the data, an analysis of the interrelationships of the data, and a decomposition of the existing data into the logical units.

**The Function Inventory**

The function inventory includes a dataflow model of the current and/or planned operations, a decomposition into logical units, and the elimination of equivalent data.

**Planning the Knowledge Manager**

The combined result of the data and function inventories is a model of the organization showing the current operations. This model is then used as the requirements for the knowledge manager with relevant modifications, creating the model for the future operations. The modifications to support a varied set of users is particularly important as is the determination of the relevant presentation methods.

**The Components of a Solution**

This section presents some candidates for knowledge base automation. The actual selection of components for a particular implementation will depend on the particular circumstances, thus the components mentioned are candidates only. It is important to note that although a system can be implemented with a controlled amount of risk, all components are not available off-the-shelf. This is particularly true in the case of translators.

**Authoring**

The requirements for an authoring system are:

- Support for comprehensive data manipulation capabilities
- Support for indexing
- Support for import and export of a wide variety of data formats
- Support for export of data in component form with suitable attributes, or tagging.

Example are electronic publishing packages, such as Interleaf.

**Databases**

The main requirement for the database system for the Authoritative Database is support for the datatypes at the logical unit level identified. Candidates fall in two classes, relational database systems, and object-oriented database systems. Current relational database systems -- Oracle, Ingres, et cetera -- are candidates, as are the object oriented database systems.

**Retrieval**

For the retrieval and display system two different approaches must be considered: conventional retrieval packages, and hypertext based packages. An example of a conventional package is the retrieval engine by Knowledgeset, and Intermedia and KMS are hypertext examples.

**Configuration Control**

The configuration control package must support automatic notification following an approved change, as well as manage the change process itself. The package from STRC is an example.

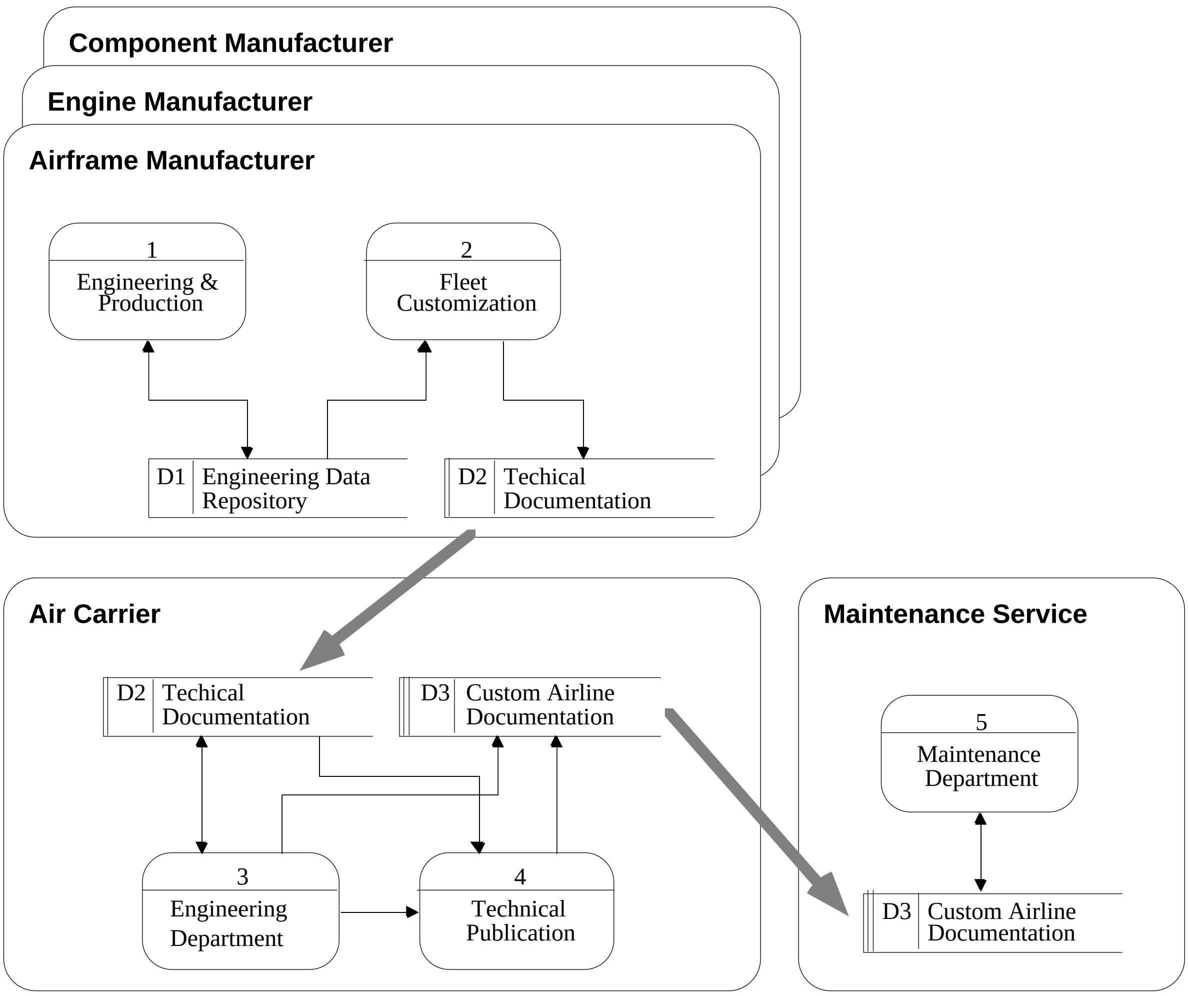
The intent of this section has been to present the case for automating the knowledge base. Automating the knowledge base is possible today with controlled risk, and is a genuine strategic opportunity.

## Phased Implementation of the Knowledge Base

The diagram below is a schematic depiction of the flow of maintenance data and documentation. It emphasizes the critical areas which should be automated first when planning the corporate knowledge base. These are :

- the automated interchange of technical documentation with the manufacturers;
- the automated assembly of maintenance documentation according to corporate standards and procedures;
- the automated submission of job cards along with the relevant documentation, and
- the ground counterpart of airborn Electronic Library Systems (ELSs).

*Engineering Documentation Flow*



## Automated Technical Information Interchange

Adopting automated technical information interchange with manufacturers is more an organizational issue than a technological one. Technologies are available to enable links to the manufacturer's electronic vault; these may be direct, through communication lines and remote retrieval workstations, through mail or fax distribution, or through the downloading of 8 or 4 mm tapes, WORM or CD-ROM discs, etc. Interchange services, depending on the agreed convention, can be available on demand, through regular updates, or as a combination of both.

A critical issue however is the standards for information interchange. This topic, previously discussed, has been partially formalized through ATA specifications which lay down the standards to be used for graphic images (i.e., TIFF format with CCITT T6 Group IV compression for raster graphics and CGM format for vector graphics). A key standard, which may be of paramount importance for the automated assembly of corporate documents, is the incorporation of SGML (Standard Generalized Mark-up Language) techniques which are widely used today in the preparation of all types of documentation in machine readable form - SGML has been incorporated into the ATA 100 CD-ROM standards with one fundamental change: the physical page concept has been replaced by AMTOSS and GEMTOSS task-based arrangements.

## Document Creation

The purpose of automation here is to dramatically reduce the labor and time consuming operations undertaken by airlines to adapt the manufacturers maintenance recommendations and guidelines to the airline's standards and working procedures. This topic has already been covered in the overall presentation of the knowledge base, the issue is incorporating technical publication applications such as Interleaf or FrameMaker. Automating document creation, in a first phase, can consist in providing *cut & paste* functional support for the incorporation of content portions from the Knowledge Base; these may be entire manual pages or individually tagged pieces of information if the use SGML has been adopted. Automation can also be used to automated the assembly of technical manuals, as service bulletins and letters indicate changes or errors.

## Electronic Library System

Electronic Library Systems (ELSs) are another step towards achieving operational effectiveness, with electronic control of information. ELS systems are designed to provide airline personnel with all significant aircraft flight operations, maintenance, cargo and cabin management data in easily accessible accessible format *on board* the aircraft. Complete maintenance and operational manuals for the aircraft abd subsystems can be displayed, as well as comprehensive worldwide navigational data, instructional texts and other reference material.

## Summing Up the Benefits

These include improved timeliness, reduced costs and improved quality of aircraft-based services and their supporting technical data. Thoughful implementation of TIM combined with a CE organizational approach will lead to increased operational readiness and commercial competitiveness. Some examples include :

- Reduced lead time ;
- Reduced cost ;
- Improved quality.

### Reduced Lead Time

- Improve industry responsivenness will result from the development of integrated data, automation of plant and airport facilities, and industrial networking.

- Shortened aircraft and airframe maintenance times will be possible through the creation of a shared data environment, both grounded and airborn, designed to generate and transfer required data to appropriate functions, and provide on-line access to documents and real-time updates.

- Reduced *out-of-service* times for repair, due to the availability of up-to-date documentation, will increase air transportation capabilities. This will be obtained from integrated planning, automated tool design and setup, and more rapid parts support.

### Reduced Cost

- The labor-intensive development of duplicate data used for seperate processes in design, manufacturing and support will be eliminated. The middlemen manhours required for document preparation, handling and access, between originators and users will be dramatically reduced.

- The use of paper will equally be dramatically reduced and replaced by accurate, timely, and cost-effective digital technical information for acquisition, logistics and field operations.

- Data will be shared by multiple systems, and commin system applications wil help achieve interoperability.

## Improved Quality

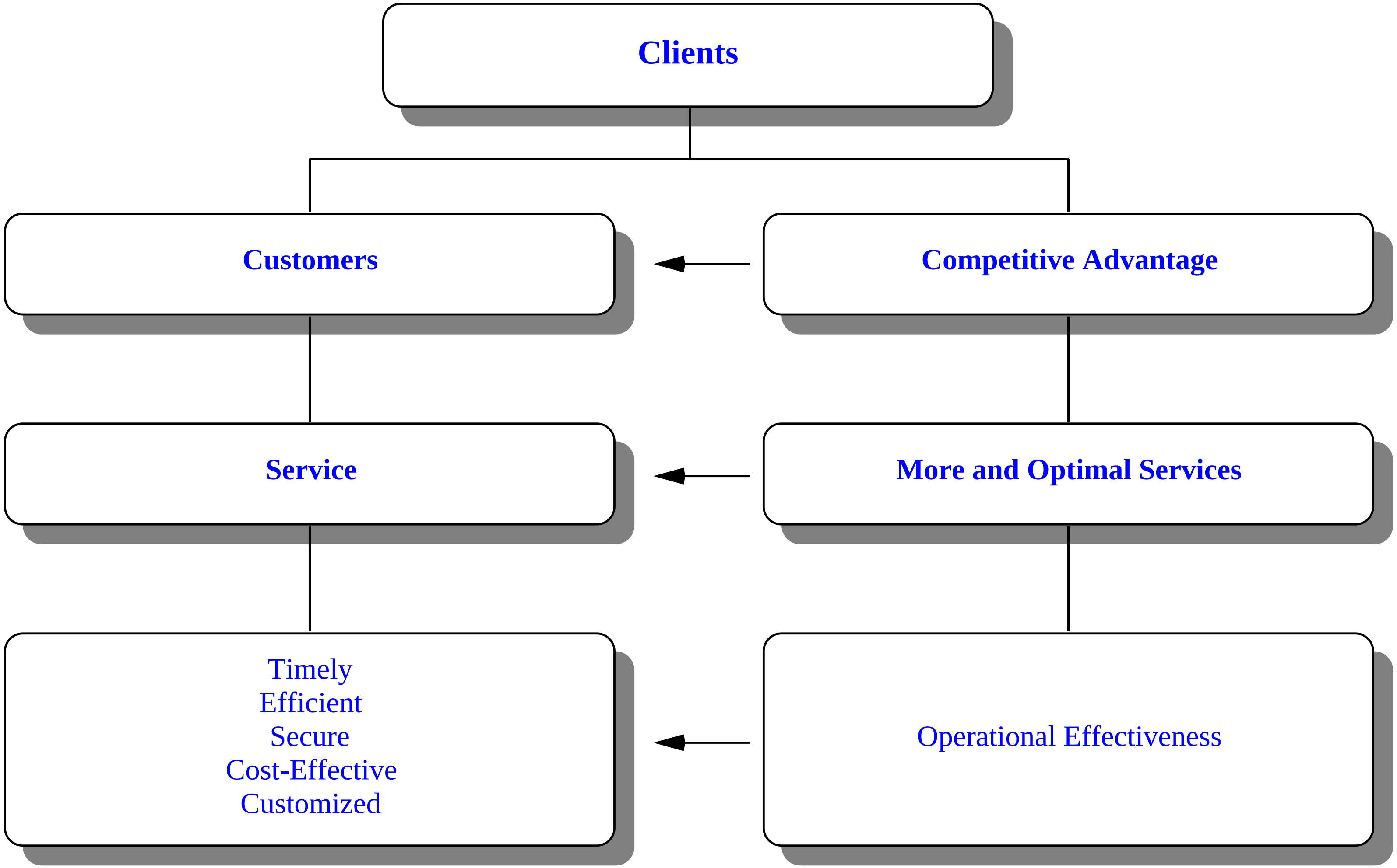
- Fewer errors in aircraft system design and manufacturing will result through the integration of key databases which can support these functions in a near to real-time environment. Producibility, reliability, and maintainability considerations will be integrated with computer aided engineering and design tools.
- Data consistency will be significantly enhanced as databases are linked together, enhancing document accuracies by reducing discrepancies among documents.
- An important sideeffect will be highly improved presentation of the information that will be modelled according to the company's document publishing charter, defining layout rules and guidelines.
- Another important consequence will be the greatly lowered *document learning curve* for new hires thus helping airlines face the declining rate of seniority experience.

# Introduction

- **Strategic Approach**
  - **Background**
  - **Business Context Analysis**
  - **Avenues to Operational Effectiveness**
- **Getting There**
  - **Automated Interchange of Technical Information**
  - **Aircraft Maintenance and TIM**
  - **Electronic Library Systems (ELSs)**
  - **Building the Knowledge-Base**
- **IA Corporation**

# Background

## What to Clients and their Customers want ?



**Applied to the Aerospace Industry, and more specifically to Air Carriers**

- **Business Objectives**
- **Business Environment**
- **???**

# Business Objectives

- **Provide safe and reliable airplanes at the gate for on-time departure at the least total cost.**

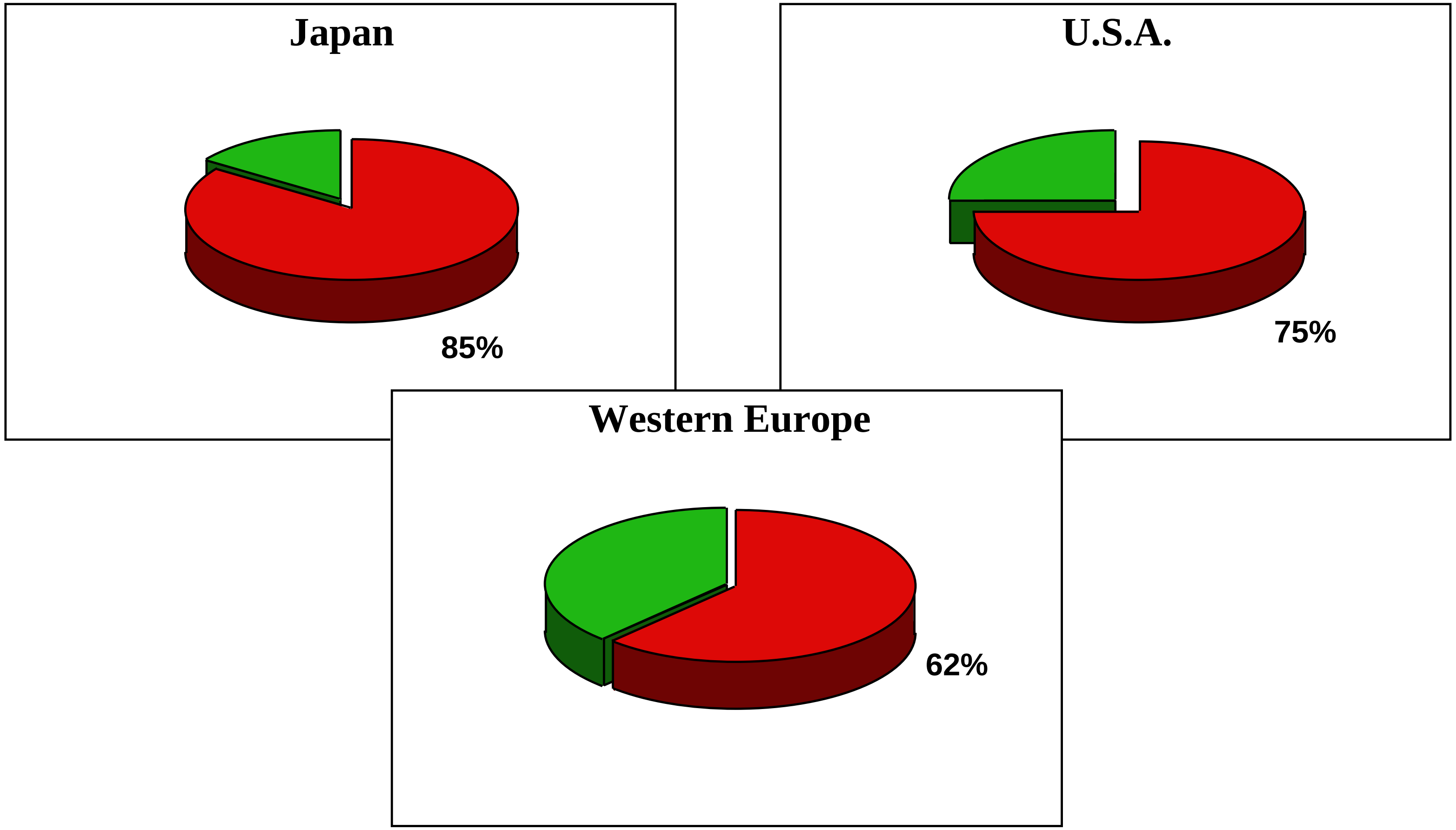
- **Support this primary objective through the continuous improvement of operating procedures, support equipment, and people.**

- **Maximize asset productivity of the aircraft.**

# Business Environment

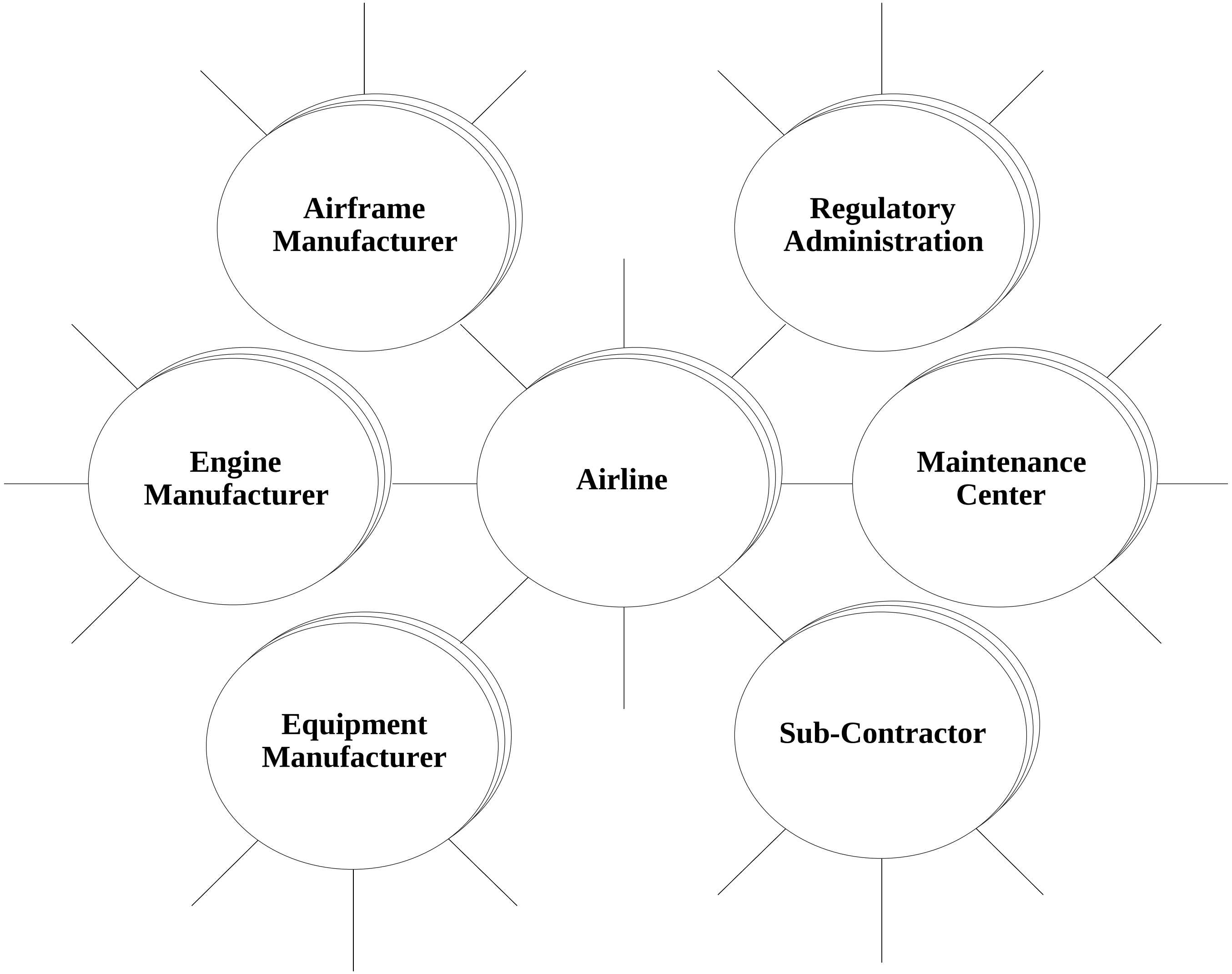
- **Islands of Automation**
- **Business Networks**

## The Importance of Subcontracting in Modern Economies

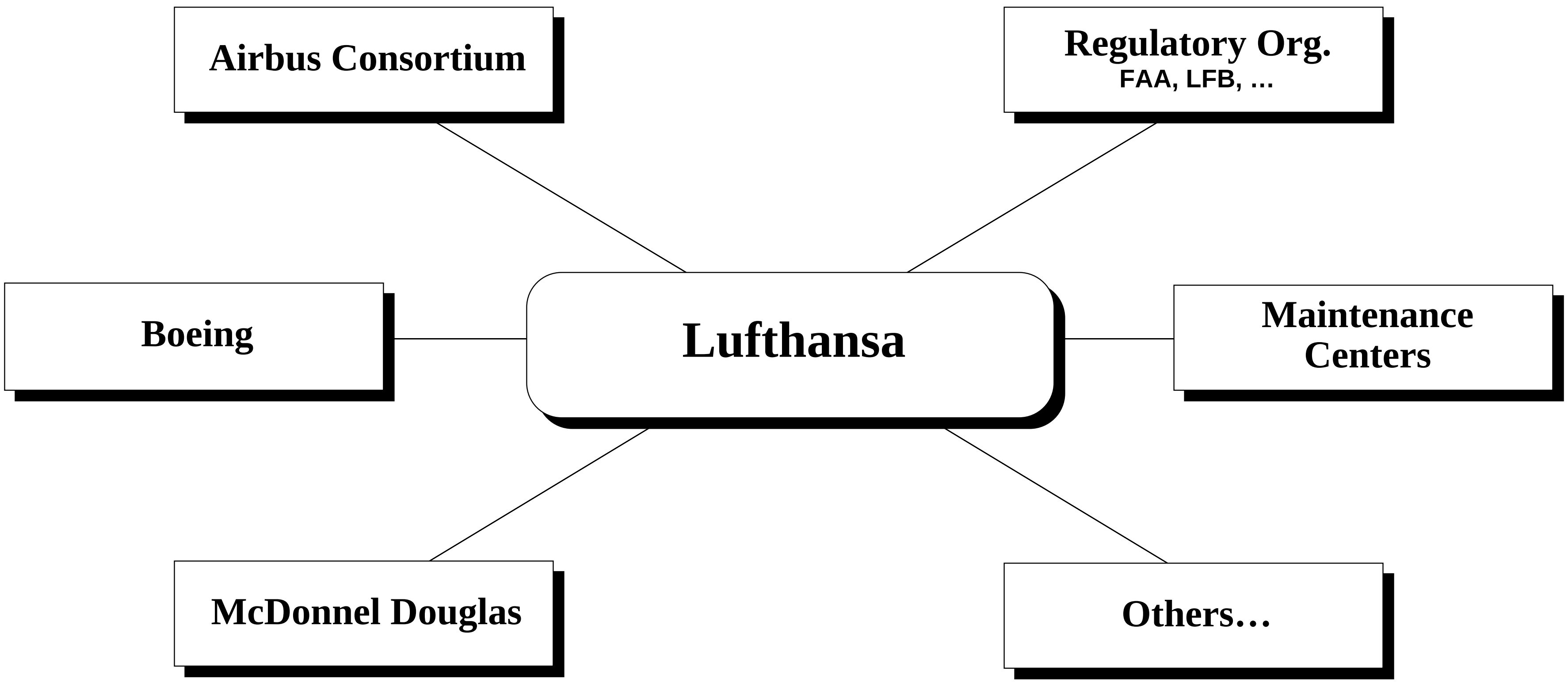



Source: AT Kearney

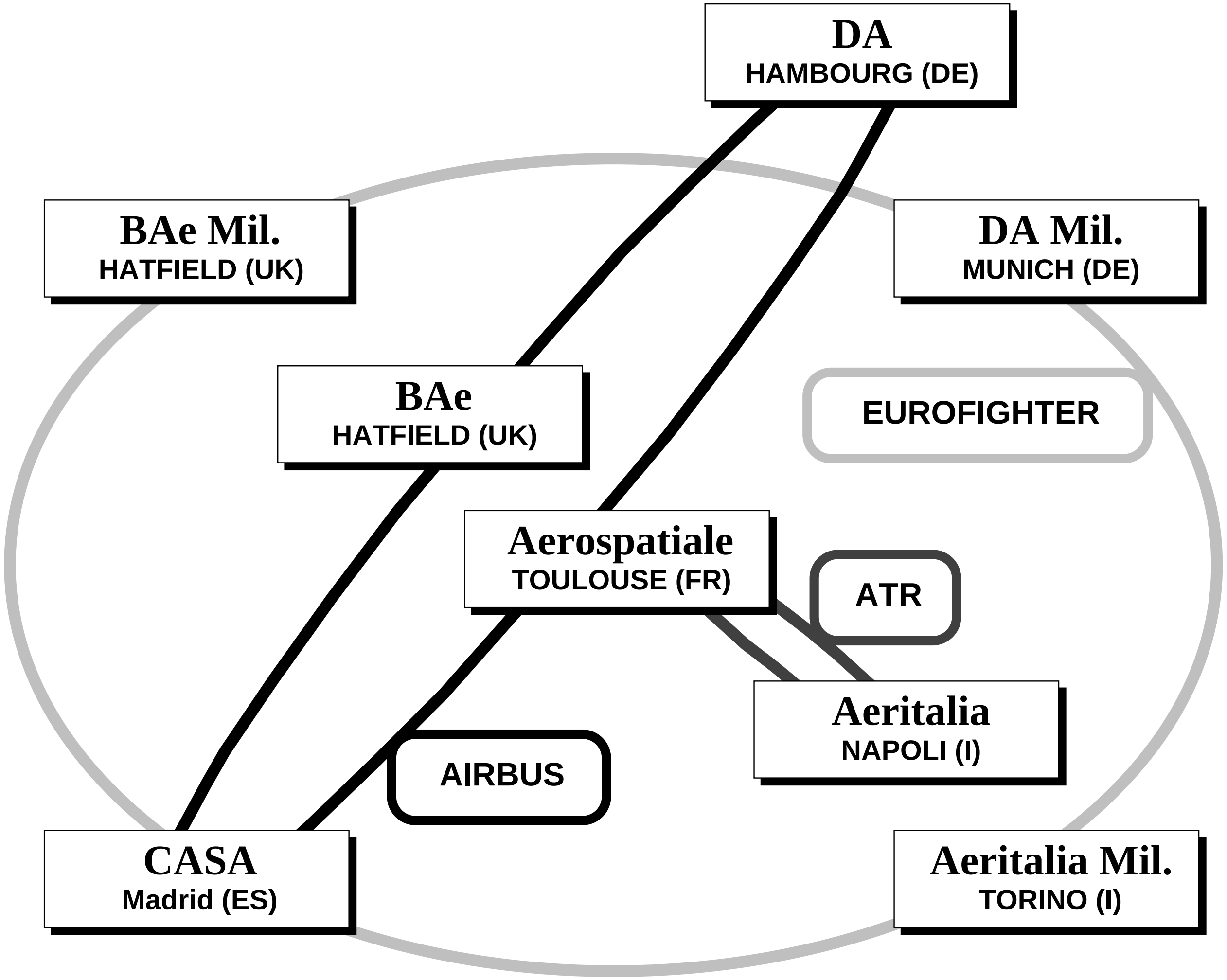
# Typical Airline Business Network



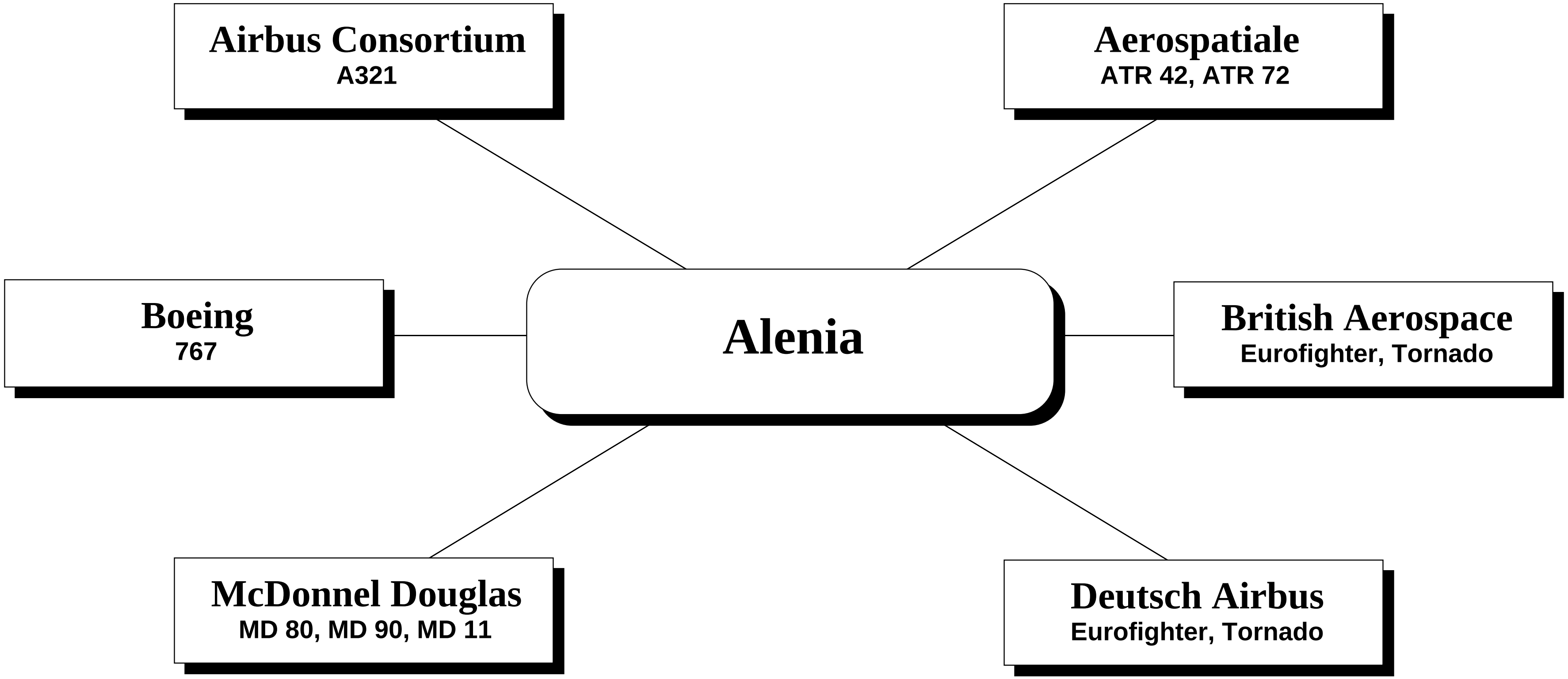
# Lufthansa's Business Network

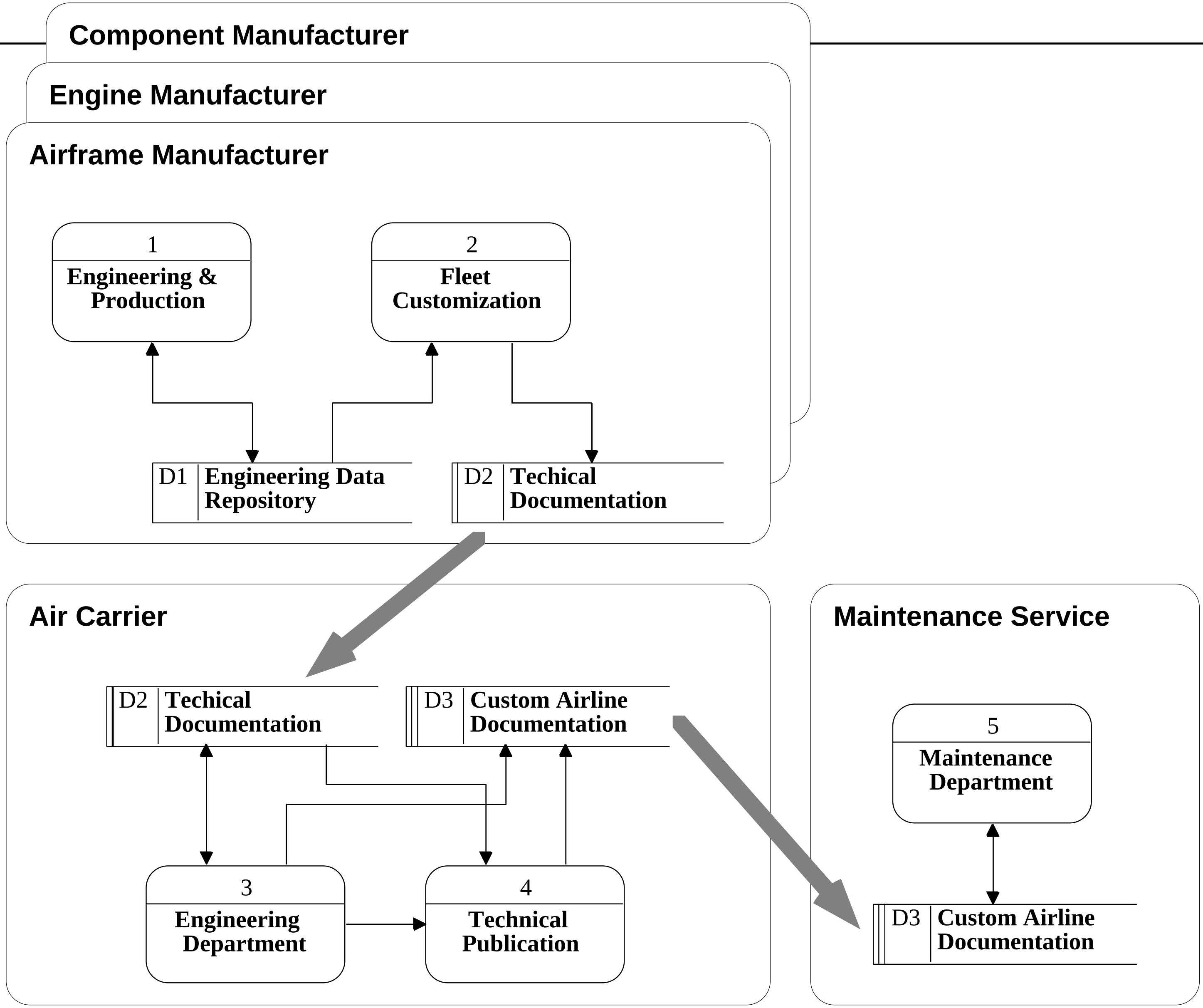


# Major European Aerospace Programs

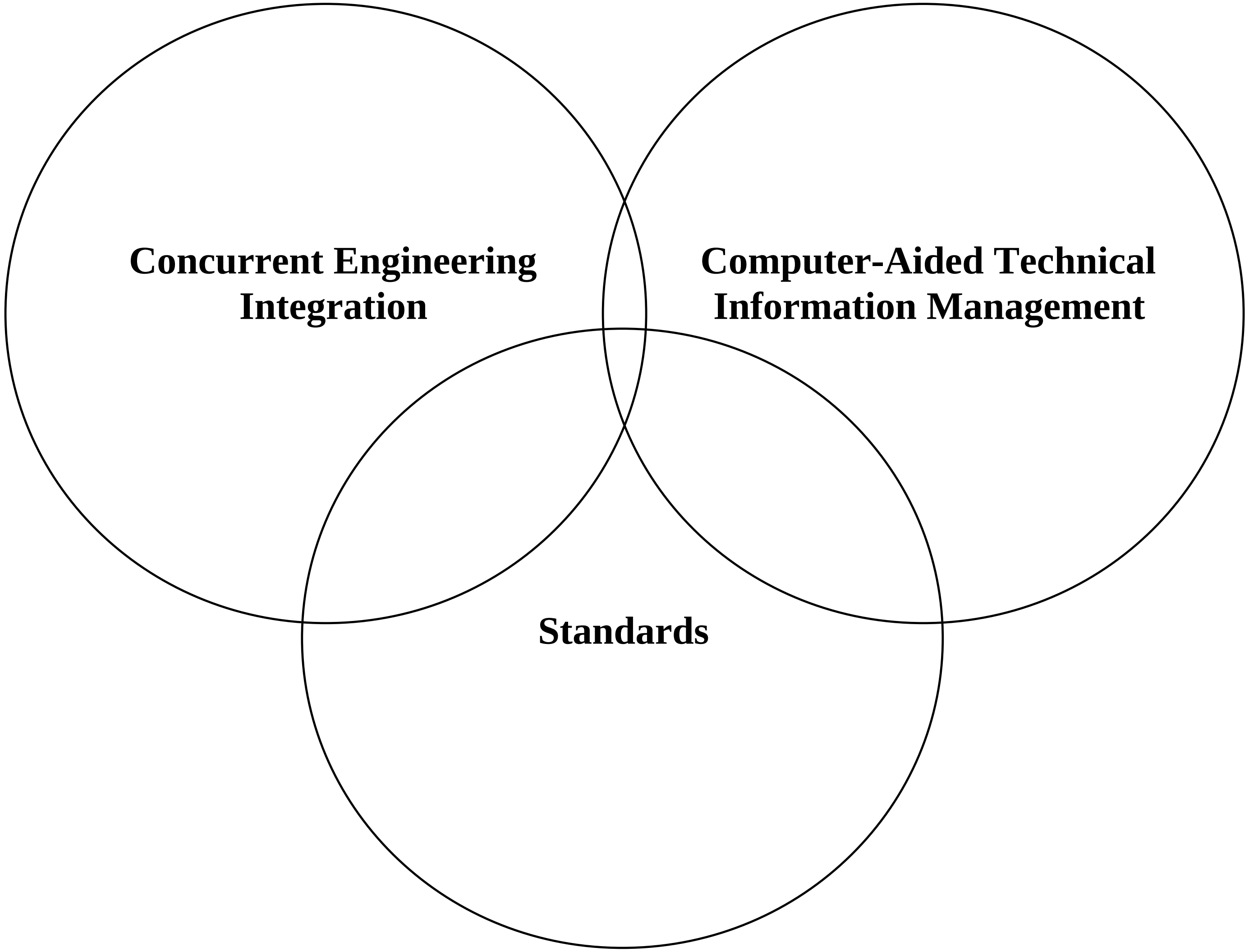


# Alenia's Business Network



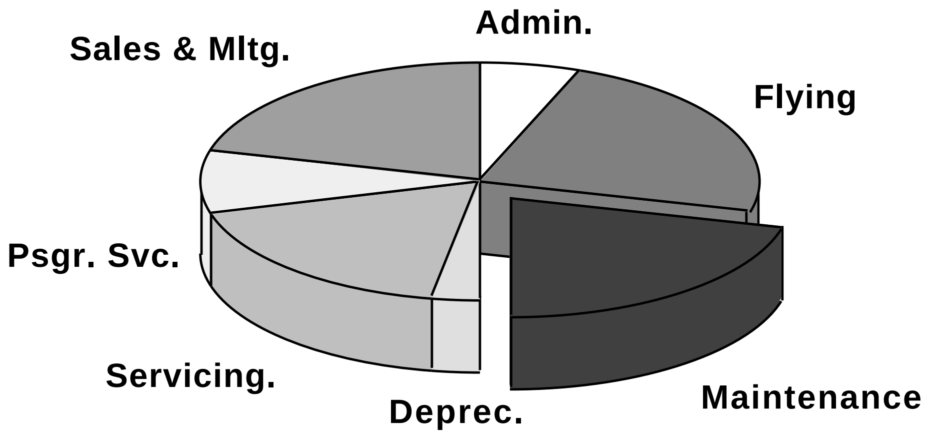

Component Manufacturer
Engine Manufacturer
Airframe Manufacturer
1
Engineering & Production
2
Fleet Customization
D1 Engineering Data Repository
D2 Techical Documentation
Air Carrier
D2 Techical Documentation
D3 Custom Airline Documentation
3
Engineering Department
4
Technical Publication
Maintenance Service
5
Maintenance Department
D3 Custom Airline Documentation

# Avenues to Operational Effectiveness



- Maintenance
- Objectives of Aircraft Maintenance
- Prerequisites for Aircraft Maintenance
- Maitenance Documentation

# Maintenance




- **1989 Expenses: $20.1b**
  - **Engines**
  - **Component Shops**
  - **Periodic Services & Inspections**
  - **Line Maintenance**

# Objectives of Aircraft Maintenance

- **Provide:**
  - **Optimum security**
  - **Highest possible availability of aircrafts**
  - **Maximum profitability**
- **To do so, airlines must:**
  - **Deploy dynamic maintenance strategies**
  - **Limit redundant maintenance operations**
  - **Optimize the work of human ressources**
  - **Optimize the use of equipment**
  - **Limit operational costs**
  - **Increase the sales of maintenance services**

# Prerequisites for Aircraft Maintenance

- **Maintenance is both preventive and curative**
- **All aircraft maintenance operations are systematically documented**
  - **Prior to operation**
    - **By the manufacturer indicating what operations should be carried out, when and how; and this indenpendantly of the airline's specific methods and procedures**
    - **By the airline, based on the manufacturer's recommendations and on the airline's specific methods and procedures, what operations should be carried out, when and where they should be applied**
  - **During operation**
    - **maintenance operations are carried out according to job cards specific to a given aircraft and a given situation**
    - **Complete documentation is available for the identification and correction of failures and break-downs notified either while airborn, or at maintenance stops.**
  - **After operation**
    - **To ensure the logging of all maintenance operations**
    - **To provide the necessary documentation support for reliability analysis.**

# Introduction

- Engineering Data Management
- Mission
- Knowledge Base
- TIM

## Why is this an issue ?

- **"Time and money are being lost and overhead rates are being driven up because of (1) the variety of forms and formats used to prepare these documents; (2) inadequate search and retrieval methods; and (3) an inability to maintain effective version control…"**

# Mission

- **“To provide access to the Knowledge Base in the form needed, where it is needed, and where it is needed.”**

## Definition

- **The Knowledge Base of an entity - corporation, agency, administration, etc., - is the totality of data, in any form, required for the continued function of the entity.**

## Definition

- **The cost-effective management of an entity's information assets, using applicable manual and automated procedures, to support the primary revenue generation of the entity.**

# Conclusions

- ‘Image Systems’ have come a long way
- Systems analysis and data analysis are musts
- The strategic system must work across organizational boundaries and aid in the overall knowledge-base automation
- Components are available off the shelf, systems are not
- The implementation of entity-wide automation, which is a must, requires a high level of commitment

# Rationale

- **Looking at data across the entity will allow the determination of the optimal form for their storage and the required operations on the data**
- **Looking at benefits across the entity will provide the justification for knowledge-base automation**

# Caveats

- A document is not necessarily the optimal entity for storage.
- A document is not the atomic element for the data contained in it.
- The documents existing in an organization are a function of the established work processes and organizational structures, and may not serve underlying information needs effectively.
- Automating the distribution of current documents along current workflows will result in missing a material part of the opportunity for managing the data better.
- Indexing and linking of data elements must be controlled to avoid “Hyper-Spaghetti”.
- A controlled vocabulary and authority are important.

# Goals & Rules

- **Typical Environment**
  - **Hundreds of Workstations**
  - **Hundreds of Printers**
  - **Multi-Million Object Databases**
  - **Multiple Document, Application and Object Classes**
  - **High Request Rates**
    **(ie. Results in 40+Mb/s backbone rates)**
- **Design Rules**
  - **Standards, standards, standards, …**
  - **Make the System Scalable**
  - **Reduce or Eliminate Central Control**
  - **Design for the Application**
    **(ie. Make the system fit the task)**
  - **Encapsulate Data**
  - **Analyze, analyze, analyze, …**

# Steps to Implementation

- **Look at the issues across functional groups**
- **Enterprise wide data analysis**
  - **What is the atomic form of a data element ?**
  - **Where is it used ?**
  - **In what form is it used ?**
  - **What operations are performed on the data element ?**
  - **What links should exist among data ?**
- **Develop a mechanisms for setting priorities**

# Environment

- **Heterogeneous, Multiple Different Systems**
- **Multiple Existing Applications**
- **Dynamic Business Environment**

# Objectives

- Integrate Entire Engineering Knowledge Base
- Integrate Existing Applications and Equipment
- Single Workstation on the Desk
- Open Architecture
- High Performance
- High System Availability
- Scalability
  - Within Single Site
  - Multi-Site