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**New Purchasing & Supply Chain Strategies  
in the Maintenance, Repair and Overhaul Industry  
for Commercial Aircraft**

Jörg Rissiek und Joachim Kressel

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Institut für Volkswirtschaftslehre  
Helmholtzplatz  
Oeconomicum  
D-98684 Ilmenau  
Telefon 03677/69-4030/-4032  
Fax 03677/69-4203  
<http://www.wirtschaft.tu-ilmenau.de>

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## 1 Introduction – Industry Characteristics of the Maintenance, Repair and Overhaul of Commercial Aircraft

The global commercial aviation markets have seen a unprecedented dynamic in growth during the last twenty years after the deregulation and liberalisation activities starting in the United States in 1978 and in the European Union in 1988. Dynamic and liberal markets have lead to strong competition among the established carriers and numerous newcomers<sup>1</sup> – resulting in tremendous cost pressure for all airlines and consequently for the technical after-markets. These technical after-markets embrace the maintenance, repair and overhaul business (MRO) and provide the following services:

- ➔ scheduled checks of the airframe, engines, landing gears, components, cabin interiors ranging from a brief pre-flight check to a D-check, an overhaul lasting up to six weeks for the complete Aircraft,
- ➔ scheduled and unscheduled repair and modification programmes including engineering services,
- ➔ cabin completion and life cycle Aircraft services for the strongly growing highly customized VIP Aircraft market, and
- ➔ combinations of these different MRO services, which add up to total care packages like United Services' *Total Support*, SR Technics' *Total Care* or the Lufthansa Technik *Total Technical Service TTS*<sup>®</sup>.

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<sup>1</sup> For an overview of the airline industry see Doganis, R.: *The Airline Business in the Twenty-first Century*, London, New York 2001; for more details see Radnoti, G.: *Profit Strategies for Air Transportation*, Boston et al. 2002.

In the MRO industry, the market structure is highly competitive. Lufthansa Technik AG is the global market leader with a market share of approximately 10%.<sup>2</sup> Other strong players are Air France Industries, ST Aerospace, FLS Aerospace and for the high value engine overhaul market the manufacturers General Electric Engine Services, United Technologies/Pratt & Whitney and Rolls Royce.<sup>3</sup>

Two main factors determine all Aircraft services: *first*, the Aircraft fleet is by far the most important asset for an airline<sup>4</sup> and *second*, punctuality of flights is of highest importance for the customers.<sup>5</sup>

As a result the top priority in the MRO industry is to provide both safe and reliable Aircraft in order to fulfill the airlines' preconditions. Therefore all spare parts have to be available immediately or within very short lead times whenever and wherever needed to make the Aircraft fly. In the past, this has often lead to excessive safety stocks no matter what storage and transaction costs were implied.

High stock values are not only a result of limited cost awareness but also a consequence of a significant portion of non-routine work included within major MRO tasks - with only limited predictability of parts needed to be replaced during a specific event. In combination with partly excessive lead times for Aircraft-related parts up to one year MRO shops need to have a wide range of parts available, many of them being slow movers. For example, Lufthansa Technik AG keeps detailed information on 775.000 parts within its Enterprise Resource Planning (ERP) system.

In addition, for Aircraft safety reasons, each of these Aircraft-related parts needs to be certified by the Aviation Authorities<sup>6</sup> and requires full traceability back to birth.

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<sup>2</sup> For detailed company information see [www.lufthansa-technik.com](http://www.lufthansa-technik.com) for Lufthansa Technik AG and its affiliates, and [lufthansa-financials.com](http://lufthansa-financials.com) for the Lufthansa Group. For strategic purchasing and SCM information you can directly access [www.lufthansa-technik.com/purchasing](http://www.lufthansa-technik.com/purchasing).

<sup>3</sup> For a current engine MRO market overview see: Copping, P. (ed.): *The Engine Yearbook 2003*, London 2002.

<sup>4</sup> List prices for a standard body B737-600 may vary from 41.0 to 49.0 Mio US\$, for a long-range B777-300ER from 203.5 to 231.5 Mio US\$ in 2002; the difference between the high and low prices is a function of the configuration and special features options included in the Aircraft. Several options are available regarding performance capability, interiors, avionics, fuel, etc., which significantly affect Aircraft prices. Source: [www.boeing.com/commercial/prices/](http://www.boeing.com/commercial/prices/)

<sup>5</sup> Highest importance to the airlines' customers has safety of the flight operations, but next are on-time departure and the quality of the network, especially for business travellers.

These high standards for production and approval of parts as well as other quality regulations for suppliers in combination with high investment costs generate an overall highly oligopolistic - and for key parts even monopolistic - market structure for the supply of Aircraft parts and services.

Actually the aviation industry is suffering from an ongoing decline of the average yield per passenger for the airlines due to the economical downturn after September 11<sup>th</sup> 2001, a recession in the business cycle of the world economy<sup>7</sup> and increasing competition by new market entrants, such as no frills carriers Ryanair and easyjet in Europe. The combination of these factors has massively increased the economical pressure in the new millennium.<sup>8</sup>

On this background we present in part 2 a *four phase model* of current and future trends in purchasing with a broader approach to supply chain developments in the commercial Aircraft MRO business. The analysis shows perspectives to overcome cost pressure, to optimise processes and to find innovative ways to increase efficiency and therefore improve profitability of airlines under strong competition in the long term.

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<sup>6</sup> In the United States the Federal Aviation Authority (FAA), in the European Union the Joint Aviation Authority (JAA); see also [www.faa.gov](http://www.faa.gov) and [www.jaa.nl](http://www.jaa.nl).

<sup>7</sup> The current economical situation of the airlines is described in: The World Airline Report - Battered & Bruised, in: *Air Transport World*, July 2003, p. 29 - 113.

<sup>8</sup> For actual information on the MRO segment see: Maintenance Operations - Maintaining a Balance, in: *Airline Fleet & Asset Management*, July/August 2003, p. 38 – 45.

## 2 Developments in Purchasing and Supply Chain Management

### Phase 1: Cost Cutting Programmes

After market deregulation in the late 1980s and early 1990s, freshly privatised inefficient flag carriers were forced to significantly cut costs and reduce inefficiencies such as

- heavy overstaffing,
- excessive inventory levels, and
- bureaucratic processes

in order to survive as profit-driven private airlines.

In 1996, Deutsche Lufthansa AG set up the *Programm 15* to decrease its total cost base. This included massive negotiations on big supplier contracts for Aircraft and Aircraft-related parts and services. The name setting goal was to reach unit costs per seat kilometre offered (SKO) of 15 Deutsche Pfennige (approximately 7,7 Euro cent) by cutting all costs by a minimum of 4 % per year. This goal was successfully reached in 1999.

In the mid 1990s Lufthansa started in parallel its concept of an aviation group by separating its passenger transport airline and spinning off not only Lufthansa Technik AG as an independent company in 1994 to win new MRO markets outside Lufthansa, but also by founding other units in different fields of aviation such as global cargo services, leisure travel and specific IT solutions.<sup>9</sup>

### Phase 2: Cost-Benefit Approaches to Purchasing Processes

A second step was to increase overall efficiency and work on essential processes. This was based on a Net Present Value Analysis (NPV) for each project respectively process and a Total Cost of Ownership approach (TCO) for all long term investments

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<sup>9</sup> While most airlines concentrate on their core business, only three major companies worldwide have followed an aviation group concept; two of them, Singapore Airlines Group and Lufthansa Group, are successful market leaders. The third one, swiss SAirGroup, has gone bankrupt in 2001 and disappeared as an aviation group from the business.

such as contracting the parts supply and the customer support for new Aircraft over more than a decade. This cost-benefit approach broadened the view from simple cost cutting to a quality based, long-term assessment of business cases.<sup>10</sup>

During this phase major Original Equipment Manufacturers (OEM) started offering parts pools and on-site support services for the after sales market of engine parts, components, expendables and consumables in order to contribute to common cost-saving initiatives but also to secure their after-sales-markets.

In 2001, Lufthansa started programmes like *D-Check* for the whole Lufthansa Group and *Programm 150* within the Strategic Purchasing department of Lufthansa Technik AG. The strategic approach of *Programm 150* not only focuses on price reductions, but also systematically tackles inventory levels, purchasing processes, logistics and transaction costs.

Innovative new tools for purchasing enabled Lufthansa Technik AG to go into this direction, especially the invention of a state-of-the-art vendor monitoring/purchasing controlling system as well as the use of internet based platforms for reverse auctions such as the international aviation's electronic Marketplace Aeroxchange.<sup>11</sup> During the following years the activities evolved into close co-operations with innovative key suppliers and more sophisticated supply chain developments:

### **Phase 3: Developing the Supply Chain**

Consequently these new tools – together with ongoing economical pressure on airlines that could not be absorbed by the MRO providers themselves but needed the combined efforts of both the MRO providers and the suppliers – have lead to strategic projects that considered not only purchasing but included the supplier base as well as selected airline customers. This required a new level of frankness with key suppliers concerning bilateral information exchange and a general openness in mind,

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<sup>10</sup> See also the concept of KLM Engineering & Maintenance (ed.): A Strategic Approach to Purchasing, in: *engineering EDGE*, Vol. 8, 09/2002.

<sup>11</sup> The aviation eMarketplace Aeroxchange has been co-founded by 13 airlines to develop and implement next generation technologies that create value with their products and services for all trading partners in the aviation supply chain. The founding airlines are: Air Canada, Air New Zealand, All Nippon Airlines, America West, Austrian Airlines, Cathay Pacific, FedEx, JAL, KLM, Lufthansa, Northwest Airlines SAS Singapore Airlines; for details see [www.aeroxchange.com](http://www.aeroxchange.com).

resulted in long-term reciprocal agreements, improving predictability of demand and reduced bullwhip effects<sup>12</sup>.

During this stage Lufthansa Technik AG has begun to exchange forecasting information with selected key suppliers to allow a production planning according to the expected demand in the mid/long run and to order corresponding to the actual just-in-time demand from production. Consequently making use of on-line on-time availability of information has lowered stock levels drastically.

For example, the Customised Lead Times programme of Airbus Spares Support & Services in Hamburg allows airlines and their MRO providers to order Airbus proprietary parts without long catalogue lead times according to their actual demand. On the same level, the Lean Spares programme of General Electric Engine Services offers lead times for most high-usage parts of just one day. Currently Lufthansa Technik AG and Airbus are working on a joint project to connect their parts management systems in a way that for a wide range of parts the actual demand of Lufthansa Technik's overhaul shops directly leads to a supply by Airbus without manual interference or additional processes.

The SCM solutions vary strongly according to the volume and the turnover of parts: high value items, such as hot section high pressure turbine blades in an engine have to be treated differently compared to fast moving low value items for line maintenance, e.g. standard hardware like screws, washers, nuts & bolts. Relevant costs to determine the optimal solution for each group of parts are capital costs, storage costs, costs of a defined re-ordering and re-stocking concept, costs for transportation and other logistics, such as goods receiving and quality checks, plus administrative costs of purchasing and accounting.

These costs have to be judged in relation to the turnover rate of the respective material to decide whether a storage procedure or a demand-driven just-in-time solution makes more sense with the constraint of highest availability in order to prevent an Aircraft On Ground (AOG) caused by a missing part.

To support the ongoing supply chain initiatives Lufthansa Technik AG also promotes the extension of already existing and the invention of new electronic communication

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<sup>12</sup> For a discussion of the bullwhip effect see Simchi-Levi, D., Kaminsky, P., Simchi-Levi, E.: *Designing and Managing the Supply Chain*, Boston et al. 2000, p. 82 – 93.

and purchasing tools. Currently the supplier communication system via the Internet using the XML-SPEC2000 standard<sup>13</sup> is introduced in co-operation with Aerox-change. As a result more and especially smaller suppliers that have not run a SPEC2000 converter for costs reasons will be in a position to use electronic communication tools when dealing with Lufthansa Technik AG. All participating parties will save costs in ordering and accounting processes as well as coming to intelligent supply chain solutions like automatised just-in-time ordering/delivery.

#### **Phase 4: Integrated Supply Chain Solutions**

The next step in evolving purchasing and supply chain management will be a systematic, not only case-by-case, cross-functional collaboration:

- within the complete MRO organisation including all global affiliates and partners,
- cross-border to the supplier base including their sub-suppliers,
- and with the airline/alliance customers worldwide.

Lufthansa Technik AG therefore works on establishing a network with its more than 30 different affiliates but also with selected customers. Airlines and MRO providers are also looking for global co-operation e. g. within the STAR Alliance network<sup>14</sup> or by using co-operative eAuctions.

These purchasing networks inherently face growing complexity of different organisational structures, non-standardised IT systems and global production sites<sup>15</sup>. The necessity of a stringent supply chain co-ordination and standardisation is one of the most urgent challenges for the near future in the aviation industry. Therefore several dimensions of future MRO market strategies have to be considered.

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<sup>13</sup> SPEC2000 is an EDI standard using global communication networks. SPEC2000 has been invented by the Air Transport Association of America (ATA) in 1986, the forerunner SPEC200 was launched in 1950. The SPEC2000 XML-format is in the development phase to fully use Internet technology. For more information see [www.spec2000.com](http://www.spec2000.com).

<sup>14</sup> For the –until today partly disappointing- status of joint purchasing within the global airline alliances see also Baker, C., Field, D.: Where are they now?, in: *Airline Business*, July 2003, p. 42 – 46.

<sup>15</sup> Lufthansa Technik AG for example has to provide spare parts to its more than 170 line maintenance stations around the globe.



### 3 Perspectives for the Maintenance, Repair and Overhaul Industry

The MRO sector in the global aviation industry will keep changing due to numerous reasons that will effect the market structure and challenge purchasing and supply chain strategies:

- Product innovation in new Aircraft types like the long-range Aircraft Airbus A340-600, the new 560-seater Aircraft A380 and the planned highly efficient Boeing B7E7 will appear.
- The Aircraft manufacturers have responded to the need of the airlines by continuously improving the reliability of all Aircraft types and their systems to reduce ground time and extend the time between regular Aircraft checks significantly.
- Mergers and acquisitions in the first tier MRO supplier markets lead to further consolidation<sup>16</sup> often resulting in less market alternatives and a trend towards stronger monopolies.<sup>17</sup>
- The MRO market itself changes as powerful OEMs and some new airline spin-offs enter the market<sup>18</sup> while airlines reduce their MRO activities to concentrate on their core airline business.<sup>19</sup>
- In addition, more and more airlines lease their Aircraft instead of buying them – they consequently also retreat from the MRO market. The leasing companies are looking for reliable long-term partners who can provide

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<sup>16</sup> This market trend has been analysed by Pfähler, W., Lublinski, A. E.: Luftfahrt-Cluster Hamburg Norddeutschland, Frankfurt am Main 2003, p. 169 - 193.

<sup>17</sup> An exception is the failed merger of General Electric and Honeywell in 2001; the proposed merger has been declared incompatible with the common market by the European Commission (Case No COMP/M.2220 General Electric/Honeywell). For an analysis of this case see Giotakis, D., Petit, L., Garnier, G., de Luyck, P.: General Electric/Honeywell - An insight into the Commission's investigation and Decision, in: *Competition Policy Newsletter*, No. 3, October 2001, p. 5 – 13, and [http://europa.eu.int/comm/competition/mergers/cases/decisions/m2220\\_en.pdf](http://europa.eu.int/comm/competition/mergers/cases/decisions/m2220_en.pdf).

<sup>18</sup> For recent market trends concerning OEMs entering the MRO business see: Maintenance Operations - Aftermarket Dynamics, in: *Airline Fleet & Asset Management*, March/April 2003, p. 34 – 40.

<sup>19</sup> For the main reasons of outsourcing MRO see: Maintenance Operations - Outsourcing Management, in: *Airline Fleet & Asset Management*, May/June 2003, p. 44 – 49.

life cycle asset management and all MRO services for their heterogeneous fleets and airline lessees.

- Airline customers continuously face cost pressure and are looking for a further decrease of total technical costs and shorter down times.
- The differentiation between the needs of no frills airlines flying point-to-point and high quality network carriers relying on dynamic alliance networks with big hub structures will split the market.<sup>20</sup>

For MRO providers in the aviation business the key success factor will be to build up and orchestrate these supply chain networks between major OEM groups on the one hand and their heterogeneous global airline customer base on the other.

Finally, the future challenges to successfully survive changing conditions and install efficiently working supply chain networks is a matter of an active change management within the organisation. The lessons learnt from many previous purchasing and SCM projects is that a well trained, open minded purchasing staff is at least as important as strategies and tools .

The purchasing/SCM team is crucial for the success of an innovative customer oriented MRO organisation. Therefore, investment in purchasing-specific human capital is substantial for building up a world class Purchasing/SCM organisation.

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<sup>20</sup> A new mix of airline business models with major effects on the MRO industry is expected by AeroStrategy (ed.): *The Low Fare Carrier Phenomenom: Implications for Suppliers*, Great Misenenden, Ann Arbor 2003; for the US market see also Hoffer Gittell, J.: *The Southwest Airlines Way. Using the Power of Relationships to Achieve High Performance*, New York et al. 2003.

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