

A spare part can take literally dozens of routes to go from vendor to buyer. Although some of these are inefficient and can make buying expensive, it still gives airlines the option of buying from surplus suppliers. Parts from these companies are cheaper if bought from the manufacturers; who are trying to force suppliers out of the market.

Solving the spares supply chain puzzle

The route to acquiring inventory for newly introduced aircraft types is straightforward. As each aircraft spends more years in operation, more and more entities enter the spares aftermarket supply chain until a point is reached where an operator literally has hundreds of entities from which to access inventory.

Trade between these entities results in a web of supply chains that are often convoluted and involve unnecessary transactions and entities. This inevitably makes some transactions more expensive than they need to be.

Many other transactions in the aftermarket are unavoidable because of an excess of stock as well as used aircraft being traded in or torn down. This adds further to the supply web, since more parties can involve themselves in the chain of transactions. The nature of the aftermarket, however, does not necessarily mean these transactions are pointless.

A need for parts

The supply chain only concerns high-value rotatable and repairable items with market values of \$500 plus.

Airlines are traditionally the largest end-consumer of parts. Independent airframe, component and engine overhaul shops also consume inventory.

There are several factors that drive a need for parts:

- Airframe checks, whereby parts are removed and either replaced, repaired or upgraded.
- A shortage of parts held by airlines and

repair shops. This can either be for an immediate requirement or to replenish stock to safety levels. High-value items that have low failure rates are often not held by many airlines because of the financial inefficiency in owning them. These insurance items will therefore be bought as and when required on an emergency basis.

- Airlines may introduce new and used fleets into service, requiring inventory.
- High-value material becomes beyond economical repair and certain rotatables and repairables are required for the repair and overhaul of other higher value rotatables.
- Airlines can suffer emergency and aircraft-on-ground situations, stimulating the need for high-value items.
- Parts fail to work or have to be upgraded to higher variant dash numbers and so require other parts for an upgrade.

Web evolution

A new fleet being introduced into service stimulates the need for parts. Inventory for aircraft and engines that are new in service can often only be accessed directly by the respective major manufacturers.

Although many parts for these aircraft and engines are manufactured by specialist original equipment manufacturers (OEMs), they have a contract with the major manufacturers. This prevents buyers going direct to the OEMs, averting the development of an aftermarket.

“Airlines traditionally bought new inventory according to manufacturers’ initial provisioning lists. In their attempt to ensure high dispatch reliability, manufacturers would generally encourage heavy positioning. This is the first step that leads to an excess of material,” says Josh Abelson, senior vice president at Aviation Sales Distribution Company.

Eventually some aircraft and engines are traded. This inevitably leads to their respective inventories becoming available. Airlines that have also bought excessive inventories under the major manufacturers’ recommendations find ways of getting rid of their excess stock to industry suppliers. “Many airlines are not set up to sell surplus stock,” explains Abelson. “One role industry suppliers have is to deal with surplus airline stock.” Stock can also be sold between airlines. These transactions are the first step in starting a supply chain.

As more and more of an aircraft type are traded, sub-leased, leased or retired, the volume of inventory for these aircraft and engines in the aftermarket grows and is held by more parties across the industry, leading to the growing web of supply chains.

Web entities

The parties in the supply chain start with the OEMs of the parts themselves. These are vendors to the major manufacturers. Major manufacturers include the large airframe producers Airbus and Boeing, engine manufacturers and also the makers of large components. These include auxiliary power units



(APUs), landing gear sets, avionics, wheels and brakes and other major items. Examples are BF Goodrich, Allied Signal, Honeywell, Bendix and Sunstrand.

“In many cases airlines cannot buy directly from the OEM,” explains Bill Brown, vice president of sales at American Aircarriers Support (AAS). “For example, all airframe manufacturers have many subcontracting suppliers that must supply finished products to them on an exclusive basis only. The airframe manufacturers then mark up the material and sell the product on a request-only basis to airlines, as well as using material to support their aircraft production line. Additional inventory of subcontracted material is then sold to the airlines and aftermarket suppliers at very large markups.”

Once opportunities arise for surplus or used stock to be bought from airlines, other parties and entities get involved. The category of parts providers known as surplus suppliers, or suppliers, includes companies such as AAS, The

Ages Group, AAR and Aviation Sales Distribution Company. Suppliers own their own inventory and buy parts with their own financial resources. They also manage parts, including repairing and upgrading their modification status and providing various levels of inventory management for airlines. “One example is the Total Inventory Management (TIM) Total Aircraft Management (TAM) service we offer,” explains Abelson. An example of TIM/TAM is our management, procurement and repair of all parts for major airlines during their maintenance checks at one of our repair facilities, such as TIMCO.

“Not only do we manage parts, but we also vertically integrate those parts into a maintenance programme,” says Abelson. “As part of Aviation Sales Company we provide nose-to-tail parts support, a/c and component maintenance and manufacturing.”

Brokers also exist in the supply chain. They do not own their own inventory

A spare part can take one of many routes to get to a buyer. While some airlines may find some acquisition paths over-complicated, the existence of a dynamic aftermarket is in their interests.

and rarely physically handle parts. They just buy and sell material.

One role they have is to acquire parts from the aftermarket for buyers in airline technical departments that are unable to access the parts they need themselves. Brokers often only buy parts when an airline has asked them for supply. Brokers have several sources of parts, including suppliers and overhaul shops. Suppliers therefore often compete with brokers to get a direct sale with the end buyer, although suppliers will have to sell to brokers if they cannot determine the identity of the end buyer.

Another entity in the supply chain is the airline with surplus stock. This becomes available on the aftermarket from airlines for various reasons. “Airlines may simply have too much, they retire old fleets, or several aircraft of a retired type are stripped down to satisfy the demand for other fleets,” explains Bill Brown.

The supply web also involves several sources of information providing data about which parts are available from which parties. This includes Aviall’s inventory locator system (ILS), AIRS, The Memphis Group’s B.COM system and the Internet.

“Airline and independent overhaul shops also sell a small volume of parts that are used, or need repairing or upgrading,” says Bill Brown. “They also need to source material for repairs. The surplus market is another source of inventory. In some cases parts can be paid for at retail prices from the manufacturers and OEMs or surplus material can be bought at wholesale prices.”

Basic supply chain

The basic supply chain involving the partners described above is illustrated by the chart (*see page 28*). The first route from the OEMs to the manufacturers is a one-way path that cannot be interfered with because contracts between the manufacturers and OEMs, prevent other entities from dealing direct with them.

The second step is then the simple supply of inventory from manufacturers direct to the airline. For a new type or one with just a few years in service these two stages are generally the only supply chains in existence.

After a few months or years of operation, aircraft and engines require maintenance work and this is when

independent repair shops become involved. Major manufacturers will still try to prevent an aftermarket developing by ensuring these shops either acquire their parts direct from the manufacturers or via the airline technical departments. Manufacturers have also been active in buying many independent repair shops. Maintenance facilities cannot be prevented from acquiring material from other shops, just as airlines can deal with other airlines. An aftermarket, therefore, starts to develop.

Once the first aircraft start to be traded parts become available on the aftermarket. This can still take several years, and often more than a decade, if the major manufacturers have managed to keep a tight rein on the supply of parts for their products.

One example is the A300. When aircraft were purchased by lessors such as C-S Aviation for freight conversion, a minority of Air France, Air Inter and other fleets were purchased for breakage and inventories by suppliers and brokers such as AAR, Ages, Aviation Systems International, Aviation Sales and the Memphis Group. It was not until this point that material became available on the aftermarket in any appreciable quantity. This process in the past two to three years has more than halved the market value of some A300B2/4 parts.

Stock also becomes available outside the manufacturer-airline supply chain when a carrier decides it has an excess of stock and contracts a supplier to buy it or manage it in some way to get further utilisation and financial returns from it. "Aviation Sales Distribution Company has been involved in programmes where an airline has 90-120 days of stock and has reduced it to a just-in-time level. Aviation Sales Distribution Company manages the surplus and this can involve buying it. We can either lease the inventory back to the carrier or consign it among several airlines," says Abelson. This is one way surplus stock finds its way to the aftermarket.

Once suppliers have entered the market for a particular airframe or engine type, they can then find many ways to gain a return on their investment.

First, they will sell, lease or consign it to several other carriers. This in itself can stimulate more transactions, since each supplier can gain a reputation for specialising in particular types of material.

Suppliers can then buy more material from maintenance shops as well as buying damaged, stored or scrapped aircraft for teardown. Suppliers will then deal directly with airlines, maintenance shops, brokers, manufacturers and even other suppliers to get a use out of their stock. It is the multitude of ways suppliers can find to

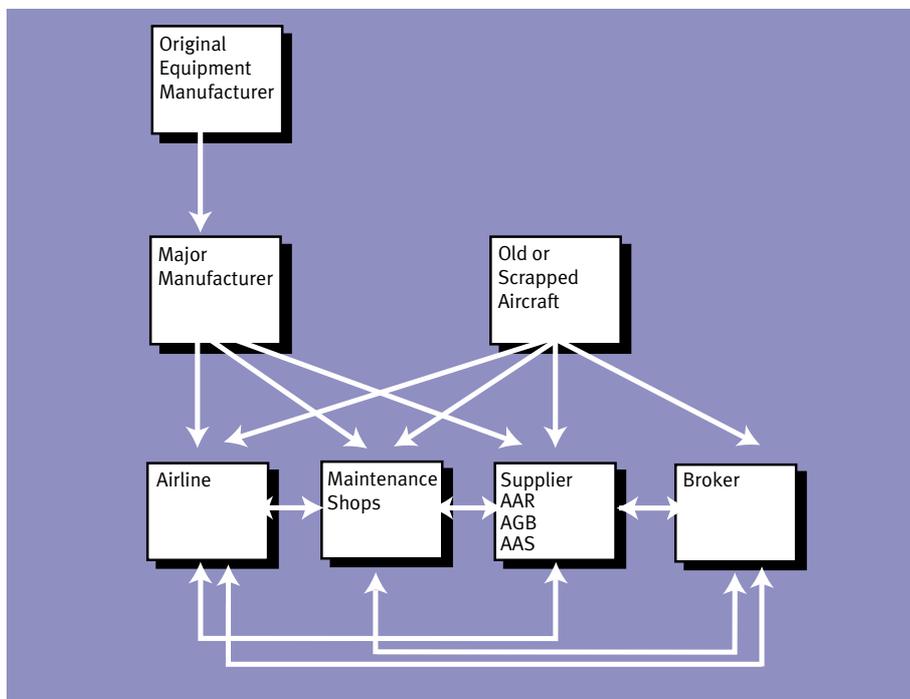
maximise use of their material that complicates the supply chain.

While most entities in the supply chain are affected proportionately by economic cycles, suppliers make use of downturns by buying material at reduced market values. Older or poorer examples of aircraft and engine types becoming more popular in the aftermarket provide just such opportunities.

Aircraft that become available for teardown are usually bought only by suppliers, although brokers and even airlines could theoretically tear down old aircraft for parts as well. Teardown of aircraft requires significant parts management since much of the material will have to be upgraded or repaired. Manpower and finance will also be required to trace all records of each part to prove airworthiness.

Tighter chain

Brokers get involved in the supply chain by getting themselves between the airline purchasing departments and any source of material they can identify. "There are many ways of finding inventory, such as subscribing to a private listing service which provides its own system as well as on the Internet," explains Karl Brown, chairman and chief executive officer at AAS. "Unfortunately



this includes brokers who can show themselves as having a part without actually owning it. The brokers use these services as a lure to get end users to call them, then they go out and use the same services to source the part themselves. The trick in reducing the supply chain is to see who really has the part.”

Basically, this means cutting brokers out of the supply chain. The main factor here is that the supply chain is less convoluted and has one entity’s profit margin omitted from the transaction. “We do not use brokers, but the real source of parts to get our material. This includes surplus airline stock and the teardown of old aircraft,” says Brown. “Pure brokers, however, deal directly through a relationship with an airline. Because they rarely have CASE and ASA 100 approval their scope for business is reduced. Airlines’ buying activities get overloaded and so they still deal with brokers sometimes.”

Abelson explains: “An example of reducing the supply chain is where American Airlines has a policy of not taking a part that has gone through more than one supplier within 90 days. In this way American can prove the authenticity of the part because each party in the supply chain has to have paperwork.”

Buying parts and avoiding brokers is not always easy or possible. “One problem a buyer faces is that it always gets 10 different people responding to a request for a part,” explains John Avery, head of supply chain services at The Memphis Group. “Many of these are brokers. The buyer then has to establish who legitimately has the part. An airline, such as British Airways, had a policy of not accepting brokered parts. This rule is actually difficult to implement fully, because the suppliers always have to get

some through brokers.”

Avery notes: “We supplied material to Emery for its DC-10s. We got 90% from our own sources, but the remaining 10% had to be acquired from others, including suppliers and brokers that met Emery’s quality standards.”

Different customers have different standards and requirements when buying inventory. All follow some standard for traceability and serviceability. Most need to be able to trace the part back to the OEM that originally manufactured it, the airline that last operated it, or the repair station that owned it. Mike Mayer, senior vice president at Avatar Alliance explains that the aviation industry has developed acceptable traceability standards. These standards are followed by most of the airline industry. Trace will normally be to one of the following regulated sources FAR 21, FAR 121, FAR 129 and FAR 145. Any of these traceability sources shows the part’s history to the airline, shop or OEM. It does not provide any record of repair, upgrade or serviceability.

There are also Federal Aviation Administration 8130-3 return to service tags, either for a FAR 145 repair station or FAR 121 airline. A part can therefore have at least two sets of paperwork. Airlines outside the US may also stipulate their local aviation authority equivalent for the FAR tags.

Aftermarket evolution

In the past 20 years the aftermarket has evolved to provide suppliers with large volumes of business.

“An example is where suppliers contract with the manufacturers to remarket material for old fleets that were being retired by an airline taking new aircraft,” explains Bill Cumberlidge,

executive vice president at The Ages Group. “Airlines often trade in old fleets for new with the manufacturers. Because the major manufacturers were not originally concerned with the material aftermarket and also do not want to be associated with the business, they ask companies like us to buy the material from them.”

This then starts several more supply chain possibilities (see chart, page 30), since suppliers will find ways to make a return. To ease the suppliers’ cash flow manufacturers may allow the material to be paid for over an extended period.

“What then typically develops is a network of paths where a supplier will sell material direct to other airlines, overhaul agencies and other suppliers,” says Cumberlidge. “Other suppliers will know something of their own markets that Ages might not be aware of and vice versa. Suppliers may also sell to other suppliers via brokers, since purchasing suppliers may have knowledge of a customer but not a source, hence the

formation of the ILS. This way three different suppliers can be involved. Suppliers can then buy and sell with overhaul agencies and airlines.”

Avery admits that traders and suppliers sell to each other. “The Memphis Group is the second largest trader in some parts in the world. Many of our customers are other suppliers,” says Avery. “There are two major sources of material. First, airlines have tended to have excess and second we part-out a lot of used aircraft.”

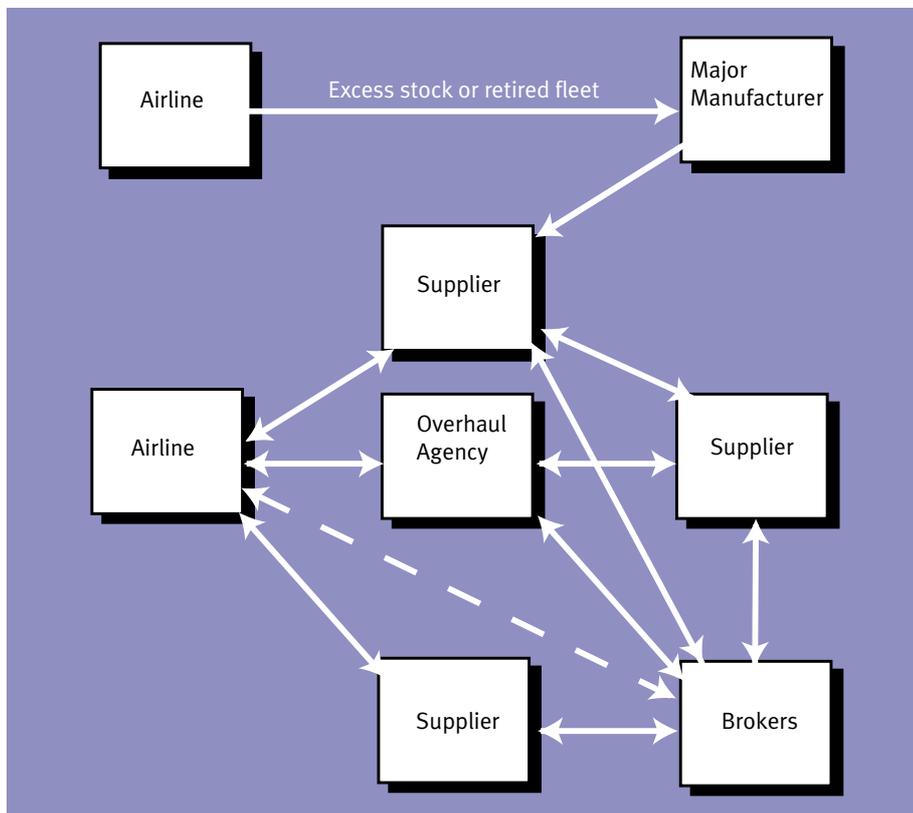
Airlines are now tending to deal with larger suppliers only in an attempt to reduce the number of sources for inventory. They are also avoiding dealing with brokers. This has forced brokers to deal between different suppliers. Suppliers are of course trying to avoid this in some respects, since they compete with each other and prefer to sell direct to the end source.

“Airlines are trying to avoid brokers and they need companies with the right amount of stock and expertise to source the remaining material,” says Mayer. All companies do brokering at some level, but airlines want suppliers with substantial amounts of stock. There is definitely a consolidation of suppliers and some brokers will get squeezed out.”

Challenged future

Cumberlidge explains that the major manufacturers are now finding ways to block the supply routes in the aftermarket. Once a material aftermarket has developed airlines are no longer dependent on a single source of material and the major manufacturers lose a potential for making large margins on parts.

“Manufacturers are holding on to or scrapping aftermarket material. This



prevents suppliers from getting the material to trade on the aftermarket, which protects the manufacturers' margins," says Cumberlandidge.

Avery agrees that manufacturers are trying to get into the aftermarket. "Boeing has tried several times, but has been unsuccessful. This is usually because manufacturers like to concentrate their efforts on developing and selling new aircraft. The traders and suppliers control about 5% of the material market and controlling it will have little additional benefit for the major manufacturers. Ultimately they are unlikely to focus their efforts on controlling this 5%."

Cumberlandidge points out: "One example where major manufacturers have been successful in the aftermarket is where airlines have contracted with engine manufacturers for a fixed power by the hour engine overhaul and support programme. If the airlines are satisfied with the contract they do not need to deal with the inventory, since parts are included in the fixed price per flight hour. These sort of deals close down the suppliers' access to the aftermarket."

Avery agrees that engine manufacturers have innovated a way of getting into the aftermarket business and adds: "The people that will suffer therefore are the short-term engine traders."

Cumberlandidge explains that other manufacturers are using techniques to get into the aftermarket by blocking suppliers when new fleets are acquired. "Material is held on to by the manufacturer, which will never sell parts even it has a surplus because selling stock will just introduce a

competitor and reduce market value," he notes. "Manufacturers are using several techniques to keep suppliers out of the market. When they deliver new aircraft to airlines the manufacturers use forms of credit to acquire old equipment. Techniques include trade-in deals made at new aircraft purchases, swapping old technology for new and providing airlines with credits for old equipment on new equipment sales."

Major manufacturers are even buying or keeping retired aircraft, rather than letting them get into the aftermarket, to prevent suppliers acquiring them for the material. Once manufacturers have got used material from airlines for old fleets they are keeping more of it than they used to."

One example of a manufacturer with a tight control in the aftermarket is Rolls-Royce. International Air Leases, for example, was one of the few companies to have spare RB211s for lease.

Cumberlandidge notes that: "Because manufacturers are preventing material getting onto the aftermarket, in 20 or 30 years' time there will be little material that suppliers will be able to do business with. The 727, 747, DC-9, DC-10 and A300 markets are now all saturated with material and this has pushed down values to a point where it is harder to make a return. Most of the younger types are supported directly by the manufacturers which leaves less for the suppliers. This will continue, squeezing the suppliers harder."

Also, manufacturers keeping a larger portion of an airline's inventory means airlines are only keeping material for

which they have a high demand.

Manufacturers are actually consigning a large portion of airlines' inventory. This means airlines no longer own their material and the manufacturers manage it, including the repairs. Manufacturers can extend their protection by getting into the repair and overhaul market like the large engine producers have."

He continues: "The techniques will lead to a material shortage in the market, forcing up their value and reducing margins for suppliers that try to get involved. This is already forcing suppliers to find other ways of doing business in the aftermarket. One example is where Ages has formed a partnership with Volvo Aero Engines, Bank of Tokyo Mitsubishi and ELF to form ALF, a long-term engine leasing company. Ages supplies engine parts to Volvo.

"Another example is the joint-venture AAR has with GE Engine Services, and also Airliance Material, which was set up in 1998 to supply and transfer excess stock from some of the partnership airlines in the Star Alliance, namely Lufthansa, Air Canada and United. All other suppliers can no longer deal with these carriers, but have to deal with Airliance Materials instead."

Despite these developments, Cumberlandidge points out that there will always be a surplus of material on the market with which suppliers can do business. Examples are airlines going into bankruptcy or changing fleets, which sees the release of material. Manufacturers holding a higher proportion of inventory for all operators will reduce the amount of material available over time. As Cumberlandidge notes, however, manufacturers often exchange older aircraft types built by their competitors with new ones. In the process they also take their competitor's material. Because they do not want to be seen to be dealing with this stock they sell it to the suppliers.

One way to combat manufacturers' attempts to close the parts supply routes is for the suppliers to become vertically integrated with them. As aircraft types get older and fleets disperse to secondary operators, manufacturers will have a reduced need to hold onto the inventory and will need specialists in the industry to market the material. "An example of a possibility is for a supplier to manage the material support for older types of aircraft no longer produced by one of the large manufacturers. The suppliers could provide their expertise in this role, since once fleets are retired from primary operators they fragment into smaller operations that have different inventory requirements from primary airlines.

Boeing and Ages have recently signed an agreement whereby Ages will market surplus inventory for Boeing aircraft that are no longer in production. 