

COST-EFFICIENT SELECTION AND PROCUREMENT OF GROUND-SUPPORT EQUIPMENT AND TOOLING

Before taking delivery of a new airplane model, an airline operator should select and procure the ground-support equipment and tooling required for airplane maintenance and operation. Procurement can be expensive, so it is very important that the operator select only the required tools. The procurement process should include bidding to obtain the lowest tool prices and allow adequate lead time for the manufacture and delivery of the tooling. The airline should begin tool selection and procurement 9 to 12 months before initial airplane delivery to ensure tools are available before the new airplane arrives.

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1 UNDERSTANDING WHO DESIGNS, MANUFACTURES, AND MARKETS GSE AND TOOLS

Before the selection and procurement processes can begin, an operator needs to understand who designs, manufactures, and markets the different types of GSE and tools (table 1).

In general, *GSE* is defined as the large pieces of equipment that connect to and service an airplane. This includes equipment for airplane towing, electrical power, heating and air conditioning, lavatory and water service, baggage and cargo loading, and engine starting.

Maintenance tools are usually smaller than GSE. They are used either for on-airplane maintenance or for maintenance on components already removed from the airplane. On-airplane maintenance tools are used for both scheduled and unscheduled maintenance tasks. These tasks are done during airplane servicing, airplane turnaround, line-station maintenance, hangar maintenance, and heavy maintenance. The tools also are used to remove and install airplane assemblies, engines, and other components such as landing gear, flight control surfaces, and auxiliary power units. Some tools are used to test various airplane systems, such as the electrical, avionics, oxygen, and fire-suppression systems. Still

other tools are used for employee safety and protection of the airplane or its systems during maintenance.

Component maintenance tools are used to perform maintenance on airplane components already removed from the airplane. The components typically undergo maintenance in one of the overhaul shops at the airline, such as the avionics shop, electrical shop, hydraulic shop, or wheel-tire-brake shop.

Airplane manufacturers.

The airplane manufacturer designs most of the tools that are used for on-airplane maintenance and many of the tools used for component maintenance. These tools are considered *specialized* because they are designed only by the airplane manufacturer for its particular airplane models.

It is important to know that the airplane manufacturer does not manufacture the specialized tools that it designs. Instead, it contracts the manufacturing to other companies, called *GSE licensees* (see the following section). An airline may purchase the specialized tools either from a GSE licensee or from the airplane manufacturer through the normal spares purchasing process.

1 DESIGNERS, MANUFACTURERS, AND MARKETERS OF GSE AND MAINTENANCE TOOLS			
Type of Business	Design	Manufacturing	Marketing
Airplane manufacturer	X		X ¹
GSE licensee ²		X	X
Commercial tool vendor	X	X	X
Specific component tool vendor	X	X	X
GSE manufacturer	X	X	X
Airline tool manufacturer	X	X	

¹ Airplane manufacturers sell tools through their normal spares purchasing process.
² GSE licensees also may be commercial tool vendors or GSE manufacturers.

For operators to maximize their fleets' in-service reliability and profitability, they must properly select and procure ground-support equipment (GSE) and tooling that are appropriate for their airplanes' maintenance and operation. The selection and procurement process is especially important when taking delivery of a new airplane model because large amounts of money may have to be invested in new GSE and tooling.

Proper GSE and tool selection involves many factors, including the type and level of maintenance to be performed, the number of line stations to be supported, the number of ramp operations, and the extent of component overhaul to be performed by the operator. All these factors must be compared to the level of work that is contracted by the airline to other GSE and maintenance support service providers, such as maintenance repair

organizations, other airlines, and local airport service providers for fueling, cleaning, baggage loading, and catering.

For example, at a line station, an airline often will contract its required maintenance to another airline. The other airline may be the predominant air carrier at the airport, and therefore already may have all the needed GSE and tools for performing airplane turnarounds and maintenance.

The process for acquiring GSE and tools involves these primary steps:

1. Understanding who designs, manufactures, and markets GSE and tools.
2. Selecting the required GSE and tools.
3. Procuring the selected equipment and tools.

GSE licensees.

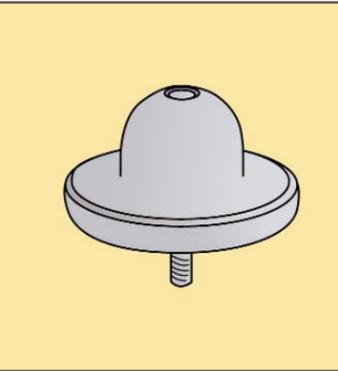
Rather than manufacture the specialized maintenance tools that they design, airplane manufacturers contract with other companies, which become GSE licensees. The GSE licensees are authorized to manufacture the tools according to the airplane manufacturer's tool drawings. The GSE licensees can manufacture and market the tools to airlines and other maintenance providers.

and tire changing, tire inflation and deflation, ground-to-flight-deck communication, and airplane chocking. Other examples of commercially available tools are the common hand tools used by mechanics, such as wrenches, screwdrivers, and drills.

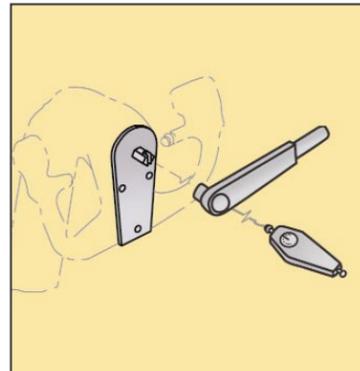
Commercial tool vendors also produce tools that are used for component maintenance in the airlines' backshops. Examples of these tools

airplane hangar maintenance. GSE is often large in size and usually located near the airplane. The equipment is used for many different tasks, such as airplane towing, providing electrical ground power, lavatory and potable water servicing, engine starting, baggage and cargo loading and unloading, galley servicing, air conditioning, and heating.

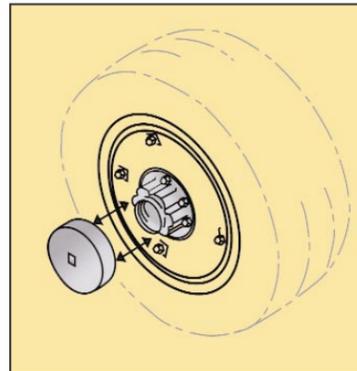
GSE is complex and can be expensive to purchase. In many instances,



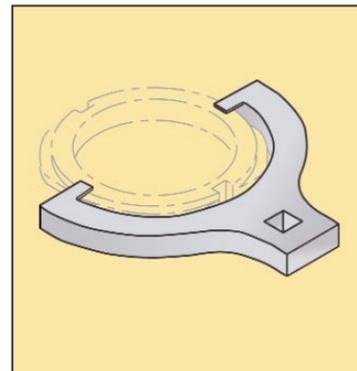
Wing jack fitting



Control wheel torque and force test adapter



Nose landing gear axle nut socket



Stabilizer trim retaining nut wrench

The licensees are required to build the tools according to the airplane manufacturer's standards and specifications. The GSE licensees are given real-time access to all the airplane manufacturer's tool drawings, ensuring that they have the most up-to-date information. The airplane manufacturer periodically reviews the manufacturing processes of the GSE licensees.

The GSE licensees are not limited to manufacturing and selling just the specialized tools designed by the airplane manufacturer. Many GSE licensees also design, manufacture, and market their own GSE and maintenance tools.

Commercial tool vendors.

Commercial tool vendors provide many of the general-purpose maintenance tools used for on-airplane and component maintenance. These *commercially available tools* are designed, built, and marketed by more than one company and perform the same maintenance task.

Commercially available tools can be used for on-airplane maintenance tasks such as airplane jacking, wheel

are multimeters, electrical testing equipment, and nondestructive test equipment. Some of the tools can be large and expensive, such as test benches used for test and repair of avionics, electrical, hydraulic, and pneumatic components.

Specific component tool vendors.

Some component maintenance tools are designed and built only by the designer of the airplane component or assembly. Some examples of component maintenance for which there may only be one tool vendor are the overhaul of valves, pumps, and line replaceable units.

GSE manufacturers.

GSE manufacturers design, manufacture, and market the large pieces of GSE used for servicing airplanes. GSE manufacturers are typically separate from the GSE licensees, although several GSE manufacturers are also GSE licensees.

GSE primarily is used to support airplane servicing, airplane ramp operations, airplane turnaround, and line maintenance operations. The equipment is used to a lesser degree to support

the equipment is offered with a variety of options that must be considered before actual purchase. These options may include different types of engines (e.g., gasoline, diesel, propane), equipment for cold weather operations, various power inputs and outputs, and arrangements for spare parts.

Airline tool manufacturers.

When an airline acquires a new airplane, it also receives all the tool drawings for that airplane. If the airline has the resources and capability, it can build the maintenance tools in-house. The tools must be built according to the airplane manufacturer's tool drawings. The airline also may opt to have the tools manufactured by another company, such as a machine shop located nearby.

2 SELECTING THE REQUIRED GSE AND TOOLS

An operator should begin the selection of GSE and tooling 9 to 12 months before delivery of its first new airplane. This selection process is a team



effort between the operator and airplane manufacturer, especially for the introduction of a new airplane model. The following factors should be considered during the selection process.

Commonality of GSE and tools with that of existing airplane models.

Commonality of new tooling with the operator's existing tooling can provide major financial benefits to the operator. For example, assume an airline decides to buy a new airplane model (e.g., 737-700) that has evolved from an earlier model (e.g., 737-300). If the airline already owns the earlier airplane model and is performing maintenance on it, the airline can use many of its existing tools on the new airplane. As a result, the airline will not have to buy as many new tools and

will save money. As much as possible for an airplane model, the airplane manufacturer designs the new derivative airplane to maximize the commonality of GSE and tools with earlier airplane designs. The commonality of GSE and tools between the new airplane model and the earlier airplane model reduces an operator's investment cost associated with the new airplane model. The airplane manufacturer knows which tools are common between old and new models and can help the operator select only those tools required for use on the new airplane.

Type of maintenance to be performed.

The type and level of on-airplane maintenance to be performed on the new airplane directly affects the type and quantity of tools selected. Higher

levels of maintenance require more tools. For example, an airline that performs only airplane turnarounds will require fewer tools than an airline that performs letter checks, such as C-checks, or heavy maintenance.

If an operator plans to have the capability to perform unscheduled maintenance (e.g., unscheduled change of engines, removal of damaged control surfaces, removal of landing gear), then additional equipment, such as maintenance work platforms, will be required to access all the different areas around the airplane.

If an operator desires to perform component maintenance overhaul, even more tools will be required. The number and types of tools depend on the extent of the overhaul work and how many overhaul shops the airline operates or intends to operate. Some airlines do not perform any overhaul maintenance, while other airlines perform partial or even full maintenance overhaul. If an operator performs full component maintenance overhaul of avionics equipment, the operator may be required to purchase automatic test equipment, which adds significant expense.

Contracting maintenance to outside companies.

Small airlines, tour operators, and even large airlines contract some or all of their maintenance to other maintenance providers. As a result, the airline saves money by not having to purchase new GSE and tooling. The amount of contracting depends on a business analysis that studies the cost and benefits of contracting airplane maintenance.

Ramp operations requirements.

The GSE required for ramp operations is typically large and expensive. One piece of GSE, however, can often be used for more than one airplane model. For example, a tow tractor that is used for a larger airplane can also be used for a smaller model. However, if an airline buys a new airplane model that is larger than any of its existing models, then the airline may need to acquire a substantial amount of new GSE.



Line-station requirements.

The amount of line-station maintenance performed by an operator at any given location usually depends on the number of airline flights to the location. Operators often contract their line-station maintenance work because the amount of work at a given line station does not justify the investment in equipment and personnel. However, if an airline plans to provide its own maintenance at a line-station location, it will need to select the appropriate type and quantity of GSE and tooling.

Facility requirements.

When an airline introduces a new airplane model into its fleet, the airplane manufacturer can work with the airline to determine whether the airline's maintenance facilities are adequate to handle the increased maintenance activity. For example, the airline's component maintenance shops may not be large enough to handle the larger pieces of equipment and increased flow of items through the shop. The airplane manufacturer can consult with the airline and

recommend improvements to an existing shop or plan a new shop layout. The airplane manufacturer can then help select the proper tools and equipment for the shop.

The airplane manufacturer can also work with the airline to determine whether or not the airline's airplane hangar can physically accommodate the dimensions of the new airplane model. If needed, the airplane manufacturer can provide recommendations for modifying the existing hangar or developing a new hangar.

3 PROCURING THE SELECTED EQUIPMENT AND TOOLS

After selecting the required GSE and tooling, the operator needs to determine the best method of procurement. GSE and tooling can be procured from a variety of sources: the airplane manufacturer, GSE licensees, commercial tool vendors, specific component tool vendors, or GSE manufacturers.

Operator experience over the years has shown the following guidelines to be prudent and effective in acquiring GSE and tooling in an economical way. After selection of the required GSE and tooling, the operator should request price quotes for each piece of GSE and tooling that it intends to purchase. Requests for quotes should be sent to a minimum of three companies that market GSE and tools. This method will result in a variety of price quotes and will allow the operator to choose the company that best meets its needs.

Past experience indicates that prices can fluctuate greatly among GSE and tool manufacturers. The amount of price fluctuation depends on several factors, such as demand for the tool, whether or not the tool is currently in stock, the quantity of tools ordered, and the requested lead time. The airline may receive a price reduction if it plans to purchase all or most of its GSE and tools from one company.

Lead time includes not only the time needed to manufacture the tool but also the time needed for shipment, travel through customs, delivery, and inspection. The airline should allow for as much lead time as possible. Longer

lead times typically result in lower prices, while shorter lead times tend to increase tool prices. Larger quantities of the same tool also can result in a lower unit price.

As an option, the airline can purchase GSE and tools from the airplane manufacturer by sending a purchase order directly to the manufacturer. The airplane manufacturer will review the order to check that the correct GSE and tools have been selected. The airplane manufacturer will then purchase the requested tools from different GSE and tool manufacturers. When the tools are delivered to the airplane manufacturer, they will undergo a quality control

inspection. The inspection ensures that the airline will receive the correct tools and that they will be completely functional. After inspection, the tools will be shipped from the airplane manufacturer to the airline.

SUMMARY

Before the introduction of a new airplane model into its fleet, an operator needs to work with the airplane manufacturer to understand the different types of GSE and tools that will be required for airplane maintenance and operation. Based on the airline's particular maintenance needs and operation, the operator should be able to properly select the GSE and tools that will be needed. The selection process should begin 9 to 12 months before initial airplane delivery. To procure the GSE and tooling in as cost-efficient and timely manner as possible, the operator should request a bid from three or more companies for each piece of equipment the operator intends to buy. Prices will vary depending on the demand for the tool, whether the tool is in stock, the order quantity, and the production lead time. By following these steps, the operator should be able to properly select the required GSE and tools, procure them at the lowest price, and have them available at the time of airplane delivery.

For assistance with GSE and maintenance tool selection and procurement, contact the Maintenance and Ground Operations System (MGOS) group in Commercial Aviation Services.

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