
THE ROLE OF DLR PRICES IN DECISIONS

When the Air Force first established DLR prices, the prices were expected to influence the day-to-day decisions that wing maintenance personnel make about repairing unserviceable DLRs that they are equipped to repair versus purchasing serviceable ones through the working capital fund (hereafter referred to as the “fund”). However, DLR prices also provide powerful financial incentives for customer commands and depot repair shops. As a result, these prices influence a broad spectrum of decisions affecting DLRs, including decisions made during the planning process.

In this chapter, we examine decisions affecting two classes of DLRs: line-replaceable units (LRUs) and shop-replaceable units (SRUs). LRUs are components that are removed and replaced at the flight line. SRUs are components that are removed and replaced at intermediate or depot level. Not all LRUs and SRUs are reparable, but our concern here is only with those that are.

WINGS

Wings make at least two types of decisions that affect DLRs. Wings choose between purchasing serviceable units through the fund and repairing them locally, whether or not they are authorized to do so.¹ If a wing decides to go through the fund, it must decide when to re-

¹A wing can recommend local repair of a DLR to its major command; however, the major command and the Air Force Materiel Command (AFMC) must approve the change in level of repair.

turn the unserviceable unit. Wings can also affect the state of repair of carcasses through consolidation of broken SRUs (cannibalization), extended or reduced use of units before removal from aircraft, or other action.

These decisions are depicted in Figure 2. Repairing a DLR locally or purchasing a serviceable one from the fund is a strategic decision. Local repair requires an allocation of repair resources to the wing (see the discussion of customer commands below). The decision of whether to cannibalize a DLR at the local level (or change the time between removals) depends on the nature of the DLR.

When making these decisions, wings are primarily concerned with achieving their flying program and readiness goals; however, wing commanders may also have secondary goals such as improving quality-of-life programs. Each wing must achieve its goals within the constraints of its assigned manpower, repair equipment, and operations and maintenance (O&M) budgets, all of which are provided by the command. The wing commander does not have the flexibility to trade among these three types of resources.

All else equal, wings have a preference for local organic repair because of the perception that it is more responsive than depot-level

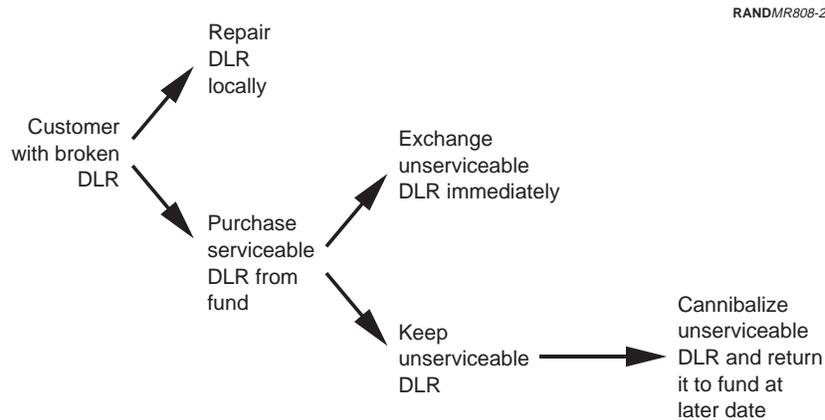


Figure 2—Wing Decision Tree

repair. Trained military repair personnel are highly motivated and can work overtime to achieve flying program and readiness goals, whereas wings believe that DLR budgets cannot accommodate higher-than-expected demands for serviceable units and cannot guarantee that there will be serviceable items in supply when needed. This means that if wing commanders are asked to give up their organic maintenance capabilities in exchange for DLR funds to purchase the items that previously were repaired locally, they will believe themselves worse off because they will no longer have the same flexibility to meet surges in demand.² Also, if a wing lacks confidence in the ability of the supply system to provide serviceable units when needed, it will prefer local organic repair even when it has DLR repair funds to meet unanticipated demand. Because local repair resources and DLR funds are not viewed as being perfect substitutes for one another, wing commanders will make decisions that favor local organic repair over depot-level repair to reduce the risk of not achieving their primary goals.

At wings, operational considerations generally dominate budgetary ones. Indeed, given that wings' budgets are tied to DLR prices and expected demands, it is not obvious why wings' actions should be influenced by these prices. However, there are several reasons why DLR prices play a role in wing decisions. First, at least one command, Air Combat Command (ACC), has received smaller budgets for DLRs than it requested and has had to draw funds from other areas to cover DLR expenditures. Wings are aware of this budgetary shortage and feel pressure to find ways to reduce DLR expenditures. More generally, commands set standards for cost per flying hour. All else equal, a wing commander does not wish to appear less fiscally responsible than other wing commanders.³ Second, with the introduction of prices and budgets, an unexpected increase in removals

²Apparently, for at least some units, it is not uncommon for organic maintenance personnel to work overtime to support the normal pace of operations. If this is true, surge capacity is eroded and the associated incentive to favor organic repair is reduced.

³The wing tracks its expenditures on consumables, fuel, and DLRs because these are the primary costs that it can influence. The Sustainment Executive Management Report (SEMR 97) constructed by AF/LGMY indicates that for the B-52 and the F-16, DLR expenditures between FY 1997 and FY 2002 are expected to exceed expenditures for fuel and consumables, and for the C-141, DLR expenditures are expected to be less than fuel but greater than consumables expenses.

for DLRs can prematurely deplete a wing's budget, leading to temporary shortages of serviceables. Third, if a reduction in DLR expenditures results in a surplus of O&M funds at the end of the fiscal year, organic maintenance organizations may receive some of the extra funds to upgrade their facilities.⁴

In the short run, when local repair resources are fixed, wings have incentives to substitute away from depot repair through cannibalization, prolonged use of DLRs, and unauthorized local repair in order to conserve funds for potential surges in demand for items that *must* be sent to the depot for repair. A wing can compare DLR prices and local variable repair costs to determine which types of items yield the greatest savings when it avoids exchanging them through the fund. The wing will then focus on finding ways to substitute away from depot repair for these items.

In the long run, wings can influence command decisions about what types of repair resources to provide (discussed below), wings may gather additional repair capacity at the local level, and resist the removal of repair capacity. When recommending a change in level of repair for a specific DLR to its major command, a wing may use DLR prices to justify the change, comparing the total outlays to the fund with the perceived cost of the organic repair capability.⁵

CUSTOMER COMMANDS

Major customer commands directly affect the level of repair. Jointly with AFMC, customer commands determine the initial levels of repair for new weapon system components, and commands participate in revisiting level-of-repair decisions for items already in the active inventory. In addition, customer commands *implicitly* affect the level of repair and state of repair of items currently in the inventory through their allocations of military manpower, repair equipment,

⁴We learned of one Air Education and Training Command (AETC) maintenance shop that late in the fiscal year develops a "buyout" list of things it would like to have. Thus, it is ready to request funds should any become available.

⁵Wings are not provided with a standard methodology to calculate the total cost of performing a repair locally. We have heard that these calculations often include only the cost of materials and labor and do not take into account the cost of equipment depreciation, inventory costs, and so forth.

and O&M funds to the wings each year. For example, the command may not provide sufficient repair manpower or equipment for selected repairs authorized at the local level, thereby increasing the number of these repairs performed at depot level. Alternatively, the command may provide wings with some types of repair equipment and repair manpower that can be used to repair items in addition to the intended ones or to alter the state of repair of items (e.g., screening capability for F-16 avionics provides opportunities for cannibalization).

The goals of a customer command are much like those of its wings. A command is primarily concerned with making sure that its wings achieve their flying programs and meet all readiness goals. However, it must also be concerned with a broader set of issues. For example, ACC must be concerned with the deployment footprints of its wings and squadrons—how much repair equipment and manpower it deploys—because of transportation capacity constraints. The command must also bear the additional costs associated with local repair that wings do not see, such as the opportunity cost of devoting manpower to repair and the cost of deploying extra people and equipment or transporting unserviceables to individual bases rather than centralized repair facilities during deployment.⁶ Thus, even though the command tends to reflect the views of its wings and, hence, also tends to prefer local organic repair to depot-level repair, its views of costs may drive it to choose repair outcomes that differ from those desired by its wings.

Unlike its wings, the command can make trade-offs between limited resources for local and depot-level repair (manpower, repair equipment, and O&M funds) for each of its wings during the planning and budgeting process each year. During the execution year, the command can move resources between wings, but the command's total O&M dollars and military manpower are fixed.

DLR prices can play a role in the command's trade-off decisions during the planning process, as do the responsiveness of depot-level repair and deployment considerations. The command sees DLR

⁶When FedEx or another commercial carrier can transport components back and forth between CONUS and the theater, transportation costs may not differ between installation repair and centralized repair.

prices as the cost of having depot-level repair; thus, DLR prices, weighed against what the command views as the full cost of local repair, indicate the items that yield the largest savings to the command from avoiding transactions with the fund.

In the long run, commands may reverse level-of-repair decisions, devoting scarce manpower resources for those repairs that yield the largest savings in terms of DLR prices and shifting other repairs to the depot level. For example, partly because of high prices for F-16 avionics, ACC has chosen to retain avionics test stands and the associated manpower at its wings for screening even though intermediate-level maintenance for these DLRs has been moved to the depot.⁷

In addition, commands have established new organizations within wings' logistics support squadrons (Gold Flag in ACC and GOLDWAY in AETC) to seek out sources of repair for consumable items and alternative (local) sources of repair for DLRs. Their focus is clearly on reducing costs to the wing (and thus the command).

DEPOT REPAIR SHOPS

In addition to supplying repair services to the fund, depot repair shops purchase SRUs, some of which are themselves DLRs, from the fund when SRUs are needed to repair LRUs.

Depot repair shops make decisions that affect the cost and speed of depot-level repair. See Figure 3. When repairing unserviceable LRUs, depot repair shops are supposed to exchange broken DLR SRUs (e.g., electronic cards in F-16 avionics boxes) for serviceable replacements through the fund. The fund then transacts with the appropriate shop for repair of the unserviceable SRUs. However, because the two shops are frequently located in the same facility, LRU repair shops can choose to route a job directly to the SRU repair shops, rather than transact with the fund. Bypassing the fund is called "job routing."

One goal of the depot repair shops is to increase the measured efficiency of the repair process, that is, reduce cost and repair time

⁷See Camm and Shulman (1993).

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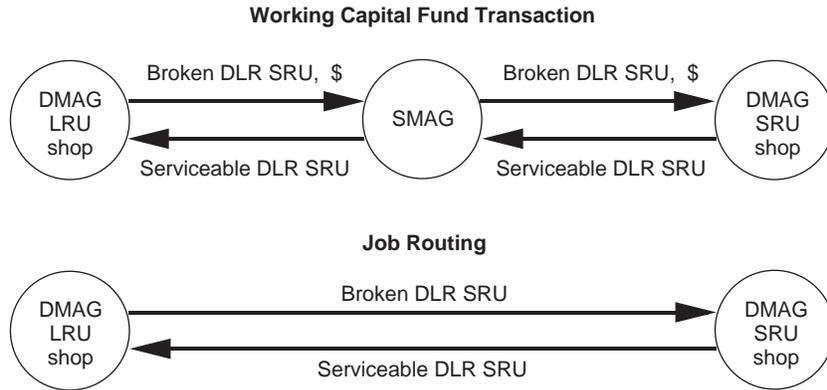


Figure 3—Depot Repair Shop Transactions

without reducing quality. Shops try to improve efficiency because customers will seek to move repair from the depot to the local level if there are cheaper sources of repair or if the supply system is unresponsive to their requests for serviceable items. Clearly, the strength of shop incentives to improve efficiency is positively related to the possibility of competition.

There are several reasons why LRU shops may job route rather than transact with the fund. Through job routing, the LRU repair shop reduces its risk of not being able to get serviceable SRUs in a timely manner. When the LRU shop returns an unserviceable SRU to supply, there is no guarantee that it will receive a serviceable one immediately. If there are no serviceable units in the inventory, supply hands out serviceable units returned from repair based on priority, so the SRU turned in by the shop may go to a different customer after it is repaired, causing the shop to have to wait for a serviceable item. However, when the LRU shop job routes the broken SRU directly to the appropriate repair shop, it is guaranteed to get that SRU back as soon as it is repaired.⁸

⁸However, if supply has the SRU in stock, job routing does not shorten the time that it takes the LRU shop to get a serviceable SRU. From the Air Force's perspective, the in-

If fund prices for SRUs are higher than the amounts the SRU shop charges for repairing them, LRU shops also have a financial incentive to job route. The total cost of repairing a type of LRU in a given year is calculated by adding the cost of the manpower and equipment in the LRU repair shop, the transfer prices paid to the fund for serviceable SRUs, and the portion of the cost of the SRU repair shop that can be attributed to job-routed items. As repair shops lower their operating costs, DLR prices become lower, and depot-level repair looks more favorable when compared with local repair. This improves the repair shop's chances of continuing to be authorized to perform the LRU repair.⁹

AIR STAFF

The Air Staff makes strategic decisions on the number and types of weapon systems to be supported in the active inventory. Limited budgets mean that estimated operating and support (O&S) costs of the weapon systems are inputs to these decisions, and DLR prices are components of these costs.

For some weapon systems, DLR expenditures are significant proportions of the cost estimates. Table 1 provides estimates from the Air

Table 1
DLR Costs as a Percentage of O&S Costs

Aircraft	FY 1996 DLR Costs as a Percentage of O&S Costs
B-1B	29
F-15C	24
C-141B	9
C-130H	5
F-16C	18
E-3B	14

ventory costs of the two transactions should be the same. SMAG's portion of the fund transaction does not add significantly to the flow time.

⁹A third reason to job route is to protect employment in the SRU repair shop. If demand is low for repairs at this shop and if supply has plenty of spare SRUs, transacting with the fund may not generate work for the SRU repair shop, whereas job routing does.

Force's SABLE model of the percentage of several weapon systems' O&S costs attributable to DLR expenditures.¹⁰

The differences among weapon systems can be attributed partially to the composition of DLRs needing repair and the demand rates of these DLRs. In particular, weapon systems with relatively larger and more sophisticated electronics will have higher percentages of O&S costs attributable to DLRs.

¹⁰These are the estimated expenditures by customer commands and do not account for the cost of DLRs used in the repair of non-stock-funded items, such as DLRs replaced during programmed depot maintenance (PDM). We are indebted to our colleague Gary Massey for providing these data.