CONGRESSIONAL BUDGET OFFICE
U.S. Congress
Washington, DC 20515

September 15, 2006

Honorable John Warner
Chairman
Committee on Armed Services
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

In the National Defense Authorization Act for Fiscal Year 2006, the Congress expressed concern about the contract approach that the Defense Information Systems Agency (DISA) is using to acquire network access to connect remote Department of Defense facilities to the Global Information Grid. A provision of that act directed the Congressional Budget Office (CBO) to review DISA's Analysis of Alternatives and underlying assumptions. CBO's review is attached.

If you would like further details about this analysis, we would be pleased to provide them. The review was prepared by R. Derek Trunkey, who can be reached at (202) 226-2916.

Sincerely,

Donald B. Marron
Acting Director

Attachment

cc: Honorable Carl Levin
Ranking Member

Alternatives for Connecting Remote Department of Defense Facilities to the Global Information Grid

September 15, 2006

The Congress of the United States ■ Congressional Budget Office

Notes

Unless otherwise indicated, all dollar amounts are in fiscal year 2006 dollars.

Numbers in the text and tables may not add up to totals because of rounding.

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Introduction and Summary

The Global Information Grid is the communications network that connects Department of Defense (DoD) facilities worldwide. Although it is in daily use, its content continues to evolve. The Defense Information Systems Agency (DISA) is implementing an initiative—called the Global Information Grid Bandwidth Expansion (GIG-BE)—to increase the bandwidth available to DoD users.[1] The initiative is also intended to move DoD from a network backbone owned by a contractor to one owned by the government (the GIG-BE).[2] In addition, the contract that had connected many remote DoD facilities—those not on the backbone—to the network expired in February, and DISA is in the process of replacing it and other, similar contracts with the Defense Information System Network Access Transport Services (or DATS) contract, which will connect remote defense installations in the continental United States to the GIG-BE.[3]

Under the DATS contract, DISA envisions using short-term leases (of three years, followed by seven one-year options) to obtain the circuits necessary to connect remote sites to the network. Alternatively, DISA could acquire those circuits by using indefeasible rights of use (IRUs). Leases require periodic payments for the right to use circuits that are provided by private companies. IRUs, by contrast, involve a one-time payment at the beginning of the term for unlimited use of a circuit. The most common term for IRUs is 20 years; because that is also the expected useful life of a circuit, IRUs are considered purchases.

Concerns About the DATS Contract

Members of Congress have expressed concern about DISA's approach to acquiring network access for remote DoD facilities through the DATS contract. The report accompanying the 2006 defense authorization act stated that:

- DISA is acquiring additional network access "without a complete analysis of the costs and capabilities" of possible alternative approaches;
- The agency "did not include cost as a factor" when deciding whether to lease or purchase fiber-optic connections; and

1. For more information about the grid and its expansion, see Defense Information Systems Agency, *Maturity and Effectiveness of the Global Information Grid Bandwidth Expansion* (April 25, 2005); and Congressional Budget Office, *Issues Associated with the Global Information Grid Bandwidth Expansion* (February 28, 2005).
2. The network's "backbone" is the approximately 80 highest-bandwidth circuits that connect large DoD facilities. (The exact location of the nodes where electronic devices receive and transmit data over the network is classified.) See Defense Information Systems Agency, *Maturity and Effectiveness of the Global Information Grid Bandwidth Expansion*, p. 5; and Bob Brewin, "A Leap in Connectivity for Global Grid," *Federal Computer Week* (June 20, 2005), p. 8.
3. See Defense Information Systems Agency, "DATS Request for Proposals" (June 16, 2005), available at www.ditco.disa.mil/dcop/public/asp/requirement.asp?req_no=HC1013-04-R-5020, and Defense Information Systems Agency, *Business Case for Acquiring Connectivity via Leasing vs. Indefeasible Rights of Use* (March 9, 2005), pp. 4-5.

- "DISA has not solicited sufficient input from industry."[4]

The Congress directed the Congressional Budget Office (CBO) to review DISA's analysis of alternatives and its underlying assumptions.

In responding to that request, CBO met with officials from DISA, who provided background information on the DATS contract, such as the projected number of required circuits, assumptions about the growth of bandwidth requirements in the future, and past lease prices. CBO also contacted 14 companies that perform work related to the Global Information Grid and the DATS contract. Six of the companies met with CBO staff and provided additional information, including rough price estimates for circuit leases and, to a lesser extent, for IRUs. (No company was willing to provide detailed pricing information for IRUs.)

Results of CBO's Analysis

Leases give DISA more flexibility than indefeasible rights of use do because they can be canceled after their initial three-year term. The agency must pay for that flexibility, however, since companies that provide circuits take the probability of cancellation into account when setting lease prices. If DISA does not need that flexibility for some circuits, obtaining them through IRUs would be less expensive. Even for circuits that might be canceled, DISA must balance the higher cost of leases against the likelihood that it will not need a circuit after it has paid for an IRU.

Indefeasible rights of use are also advantageous when the bandwidth requirement of a circuit is expected to grow. To upgrade the bandwidth of an IRU circuit, DISA must install new equipment, but it does not need a new circuit. With a leased circuit, however, a new lease would be necessary to accommodate an increase in bandwidth.

Examining each circuit on a case-by-case basis would determine the best option for that circuit, depending on how likely it is to be terminated in the future and whether the need for bandwidth is expected to grow. In addition, as DISA implements the DATS contract, it could take proposals or bids for IRUs covering some of the circuits. That would allow DISA to compare the actual DATS lease prices with actual bids for an IRU covering the same circuit. The agency could then project the expected life and bandwidth of that circuit and determine which option was best. Using that approach would give DISA the necessary information to determine which circuits would be less expensive overall with leases or indefeasible rights of use.

In the absence of that information, CBO used past lease prices and rules of thumb for pricing IRUs to make illustrative calculations of the relative costs of the two alternatives. Specifically, CBO used the historical lease prices provided by DISA and the IRU price examples provided by industry to project the cost of connecting remote DoD facilities to the GIG-BE under different procurement options over a 20-year period.

4. Senate Committee on Armed Services, *The National Defense Authorization Act for Fiscal Year 2006*, report to accompany S. 1042, Report 109-69 (May 17, 2005), p. 303.

CBO's analysis indicates that for most of the circuits about which DISA provided information, leases could be less expensive than IRUs given the circuits' current configurations. However, for 0.5 percent to 6 percent of those circuits (the large-capacity ones), using IRUs could be cheaper than leasing. Furthermore, if bandwidth requirements grew, IRUs could be more advantageous in the future relative to leases.

CBO's results are sensitive to assumptions about the rate at which remote facilities' need for bandwidth might increase in future years. A higher growth rate makes future bandwidth requirements bigger and makes IRUs less expensive compared with leases, because IRUs can be upgraded less expensively. However, the lack of specific pricing information about IRUs introduces substantial uncertainty into CBO's comparisons.

Circuits Covered by the DATS Contract

The DATS contract, under which DoD installations that are not on the network backbone will be connected to the new GIG-BE, replaces several previous contracts—most notably, the Defense Information System Network Transmission Services for Continental United States (DTS-C) contract. DISA originally estimated that DATS would cover about 5,000 circuits. The agency now plans to move as few as 2,500 circuits to new contracts, although that determination is not final.[5] Under the DATS contract, the continental United States is divided into four regions. In each region, one winning bidder will be selected to provide all of the circuits in that area.[6] The standard DATS contract with those providers will run for three years, with seven one-year options thereafter.[7]

DISA furnished CBO with information about 4,628 likely DATS circuits (the same set provided to bidders on the contract) as well as about 53 other circuits that DISA considers to be good candidates for indefeasible rights of use (those are high-capacity circuits not likely to be terminated). Because DISA has not yet determined which circuits to move to DATS, CBO analyzed all 4,681 of the circuits about which the agency provided information.

Those DATS circuits come in one of two types of capacity: digital signal (DS) or optical carrier (OC). They are designated by letter/number combinations—such as DS1 or OC48—that indicate the type of capacity as well as the capacity itself (that is, bandwidth), with higher numbers representing larger bandwidths. OC circuits have much greater capacity than DS circuits do (see Table 1).

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5. Brewin, "A Leap in Connectivity for Global Grid," p. 8; and data provided by the Defense Information Systems Agency to CBO in April 2006.

6. Two companies expressed concern that dividing the United States into four regions would prevent companies from achieving some cost savings by providing circuits to the whole country. Other companies stated that the four regions match the structure of the commercial market for telecommunications and may lead to predictable winners in each region.

7. For more details of the proposed contract, see Defense Information Systems Agency, "DATS Request for Proposals."

Table 1.

Characteristics of the DATS Circuits Analyzed by CBO

Type of Circuit	Bandwidth (Millions of bits per second)	Increase in Bandwidth over Next-Smaller Circuit	Number of Circuits in CBO's Sample
DS1	1.5	n.a.	3,854
DS3	44.7	29.0	274
OC3	155.5	3.5	329
OC12	622.1	4.0	161
OC48	2,488.3	4.0	38
Other[a]	n.a.	n.a.	25
Total	**n.a.**	**n.a.**	**4,681**

Source: Congressional Budget Office based on data from the Defense Information Systems Agency.

Note: DATS = Defense Information System Network Access Transport Services; DS = digital signal; n.a. = not applicable; OC = optical carrier.

a. Various circuits of nonstandard bandwidths. For the purpose of this analysis, CBO rounded those circuits to the next-higher standard capacity.

Most of the DATS circuits that CBO analyzed are low bandwidth: 82 percent are DS1, and only 4 percent are OC12 or larger. Twenty-five of the circuits in DISA's sample are not a standard bandwidth but rather a combination of other circuit capacities. For example, 15 of them consist of two OC3s each. For CBO's analysis, those circuits were rounded to the next-higher capacity (in this case, an OC12).

Historical Lease Prices

To help CBO project the costs of the DATS contract, DISA also provided two sets of data about the prices of past circuit leases. One set, called "Competitive Bids 2005," comes from the electronic bulletin board system where DISA posts the requirements for circuits and then preapproved vendors bid to provide them. The data furnished by DISA comprise actual monthly recurring charges for 2005 from the winning bidders of 289 contracts for circuits ranging from DS1s to OC12s.[8] There was no information on the distance covered by each circuit, whether the circuit was already available, the number of bidders, or characteristics of the area (such as population density or terrain) to be covered. Some of circuits in that set will be moved to the DATS contract.

The second set of data is from the 2005 price schedule for the DTS-C contract. Under that contract, AT&T provided circuits to connect DoD installations to the network backbone that preceded the Global Information Grid. The price schedule included nonrecurring costs and monthly recurring costs for 216 circuits ranging from OC3s to OC48s. DISA did not provide information about distance or area characteristics for the 216 circuits, many of which will be moved to the DATS contract.

8. Three of the circuits were discarded because of missing information.

DISA expects future lease prices to bear more resemblance to the competitive bids prices than to the DTS-C prices. The competitive bids are more recent, and the DTS-C prices were unusually good and are unlikely to be repeated.[9]

Modeling "Competitive Bids 2005" Lease Prices

To understand the variations in past lease prices, CBO matched the competitive bids data with information from the 2000 census on the characteristics of different areas. The competitive bids data contain the area code and prefix (the first three numbers of the seven-digit local phone number) for each circuit's starting and ending points. That information was cross-referenced with the postal zip codes contained in the census data. (Area codes and prefixes do not align exactly with zip codes, so the matching was approximate.) CBO then estimated the population density for each circuit's starting and ending points as well as the distance of each circuit, measured as the distance between the center of the starting and ending zip codes based on their latitude and longitude (included in the census data).[10] For the circuits in that data set, average population density was 1,721 people per square mile, and average distance covered was 115 miles.

CBO then modeled the monthly recurring cost of each circuit as a function of its bandwidth, distance, and population density. CBO tried several functional forms and chose the "semilog" form—that is, ln(monthly recurring cost) = f(distance, bandwidth, and population density)—as the best fit with the data. That analysis indicates that higher-bandwidth circuits cost more and that their cost increased with distance for OC3s and OC12s (see Figure 1). For low-bandwidth circuits such as DS1s and DS3s, however, prices did not rise with distance. In either case, the average cost per mile declined with distance for almost all of the circuit lengths in the sample.

Prices for the higher-bandwidth circuits were also more sensitive to population density. Those circuits were cheapest in areas with medium population densities (see Figure 2). The reason may be that locations with low population densities have few providers, and areas with high population densities (such as large cities) have capacity constraints and expensive construction costs.

Modeling DTS-C Lease Prices

Using the method described above, CBO also matched lease prices in the 2005 price schedule for the DTS-C contract with 2000 census data on area characteristics. That matching yielded nearly twice the population density found in the competitive bids data (3,404 people per square mile, on average) and a longer average distance (327 miles). Nonrecurring costs were fixed for each bandwidth.

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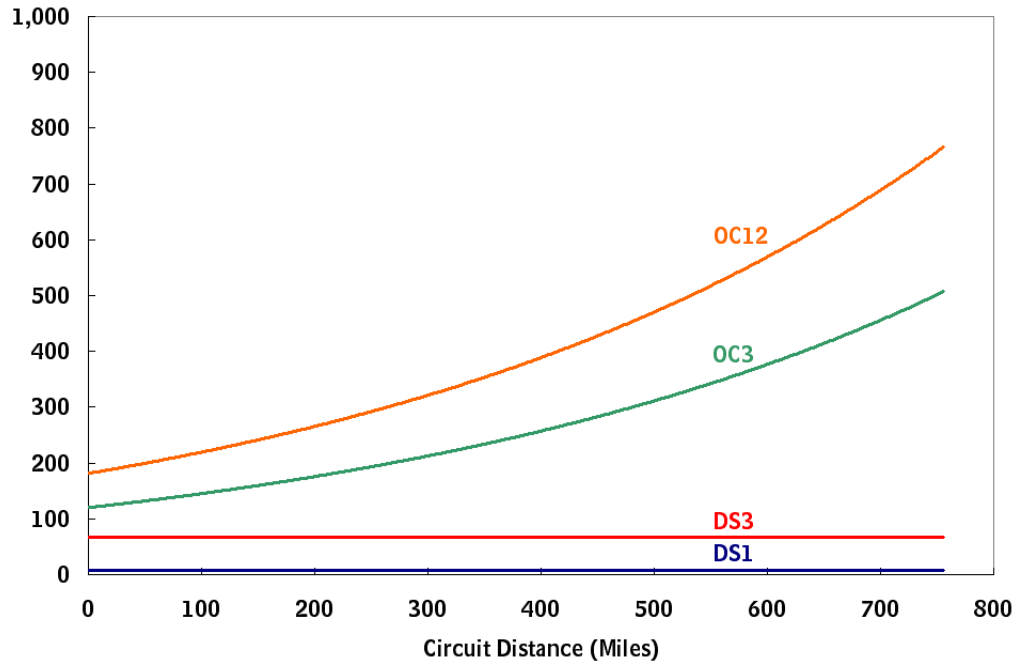
9. Although both the DTS-C prices and the competitive bids prices are from 2005, the DTS-C contract prices were fixed in 1996, the first year of the 10-year contract. Those prices were 40 percent of the government's cost estimates. See Defense Information Systems Agency, *Business Case for Acquiring Connectivity via Leasing vs. Indefeasible Rights of Use*, p. 5.

10. CBO also looked for possible correlations between circuit prices and square miles of area covered by water in the starting and ending zip codes. No relationship was found.

Figure 1.

Estimated Relationship Between Lease Cost and Circuit Distance for Various Types of Circuits in the "Competitive Bids 2005" Data

(Annual cost in thousands of 2006 dollars)



Source: Congressional Budget Office based on data from the Defense Information Systems Agency.

Note: The longest circuit in the "Competitive Bids 2005" data set was 756 miles.

CBO tried the same functional forms to model the DTS-C prices as the competitive bids prices, but a simpler model worked for the DTS-C data. In particular, prices were correlated only with distance (see Figure 3), not with population density.[11] Scheduled prices for OC3 and OC12 circuits under the DTS-C contract were 10 percent to 40 percent less than competitive bids for similar circuits, whereas prices for OC48s were about equal to competitive bids for four OC12s (the equivalent capacity). DTS-C was also cheaper for long routes and very low or very high population densities.

Pricing Examples and Rules of Thumb for IRUs

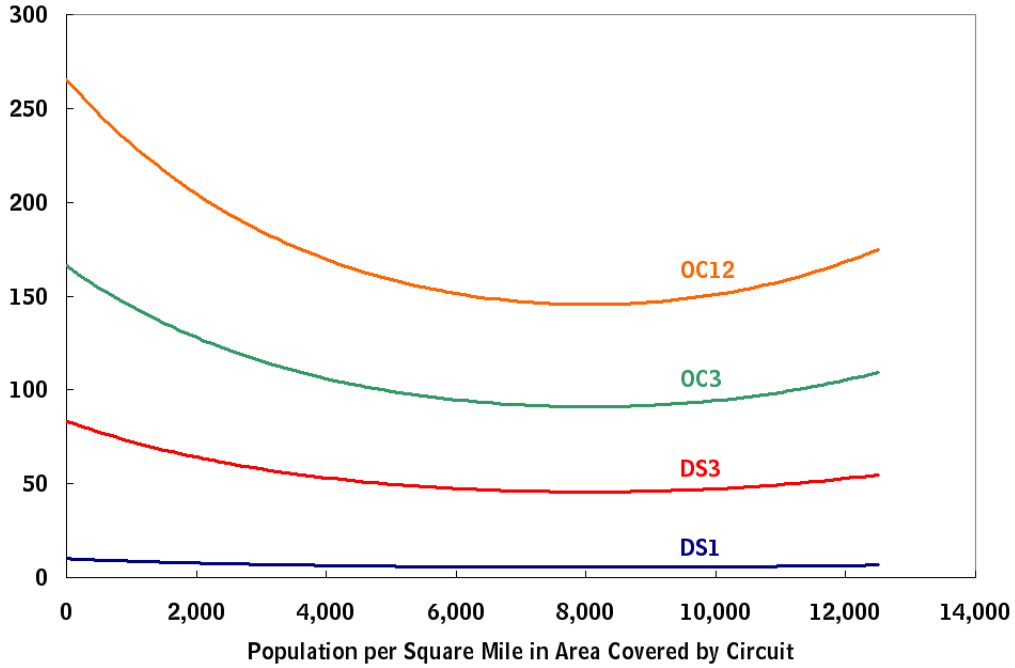
Purchasing circuits through indefeasible rights of use involves making a one-time payment at the beginning of the term for unlimited use of the circuit. The most common term for an IRU is 20 years (the maximum expected useful life of most circuits), although 10-year and 25-year terms also exist.

11. Figure 3 also shows the underlying data for the relationship between lease prices and circuit distance. Underlying data were not shown in Figures 1 and 2 because competitive bids prices depended on both distance and population density, which means that a three-dimensional graph would be necessary to plot the estimated relationship and the actual data on the same figure.

Figure 2.

Estimated Relationship Between Lease Cost and Population Density for Various Types of Circuits in the "Competitive Bids 2005" Data

(Annual cost in thousands of 2006 dollars)



Source: Congressional Budget Office based on data from the Defense Information Systems Agency.

Note:The highest population density for the circuits in the "Competitive Bids 2005" data set was 12,706 people per square mile.

Indefeasible rights of use can be for dark fiber (unlit fiber-optic cable) or for bandwidth. In a dark-fiber IRU, the only practical limit on the capacity of the circuit is the equipment that is installed to "light" the fiber-optic cable. Thus, once the fiber is purchased, it can be upgraded to carry as much traffic as necessary. An IRU for bandwidth comes with the equipment needed to carry a specific amount of network traffic already installed; as a result, capacity is limited by the terms of the contract.

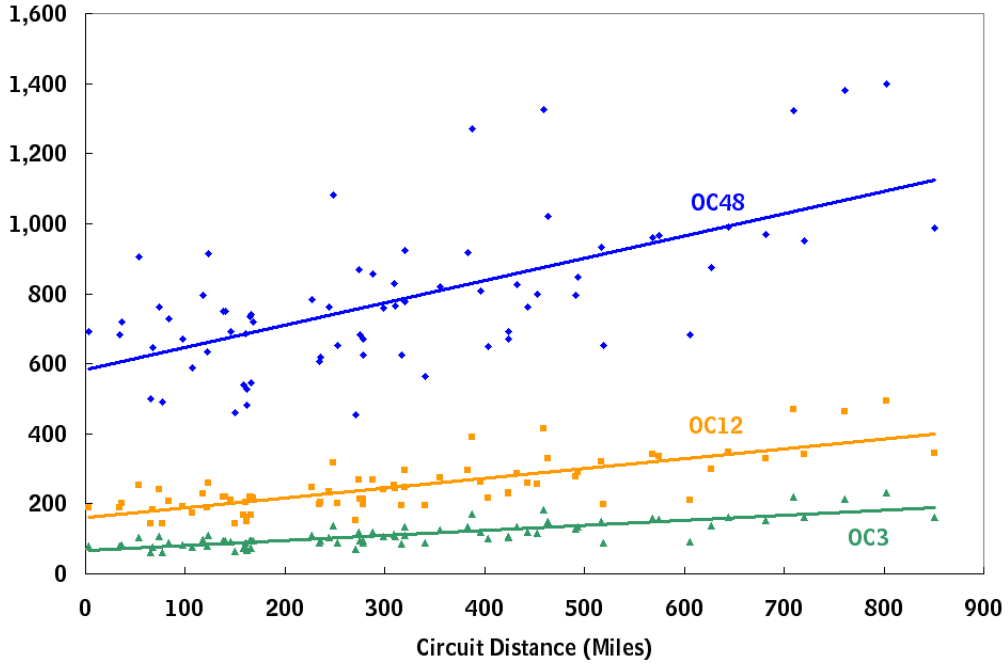
IRUs also require some maintenance fees for the fiber and the equipment. The companies that CBO met with provided a wide range of estimates of maintenance costs for IRUs: from 3 percent to 50 percent of the annualized purchase price. They noted that the age of a circuit, its location, and the type of equipment would all affect maintenance costs.

CBO was not able to obtain the same type of price information for IRUs as for the leased circuits discussed above. DISA could provide only a single example of an existing IRU: a 20-year IRU for bandwidth of an OC192 circuit that it purchased in 2005. The cost data for that IRU did not appear typical, however, so CBO did not

Figure 3.

Estimated Relationship Between Lease Cost and Circuit Distance for Various Types of Circuits in the DTS-C Price Schedule

(Annual cost in thousands of 2006 dollars)



Source: Congressional Budget Office based on data from the Defense Information Systems Agency.

Notes: DTS-C = Defense Information System Network Transmission Services for Continental United States (contract).

The longest circuit in the DTS-C price schedule was 851 miles.

use it in this analysis.[12] The companies that CBO met with were also unable or unwilling to provide information about IRU prices. One company said such information is not generally available for IRUs, as it is for leases.[13] The firms also said the market for circuits is in flux because of excess supply and several recent bankruptcies of major suppliers. Some companies stated that they do not sell IRUs because they consider them a company asset, not a product. Other companies said they have no preference between leases and IRUs and price them to make the same expected profit (accounting for the probability that a lease will not be renewed after it expires).[14]

12. In that one case, the IRU price was less than the price of the lease that it replaced as well as the projected price of a lease for the equivalent bandwidth under the DTS-C contract.

13. Gartner Group, *Assessment of IRU Versus Lease for DISA GIG-BE* (March 6, 2006), p. 7.

14. Even if a lease and an IRU have the same expected profit for a company, the effective price to the government can be different because the government faces a different cost of borrowing money, can pool risks among a broader number of circuits, and incurs upgrade, termination, and maintenance costs not necessarily reflected in the provider's profit calculation.

Leases commonly last three or five years, with options for renewal, although one-year leases are also used. That means that leases are typically more expensive than IRUs on an annual basis but provide more flexibility for changing circuit requirements.

Some companies also expressed a willingness to dig and install new fiber-optic cable for circuits. They did not provide firm cost estimates for such installation because the circumstances for individual circuits can vary greatly. Companies use $150,000 to $300,000 per mile as a planning factor for rural areas, although many unforeseen factors can increase the final cost. Installations in urban areas are much more expensive because of the need to obtain rights of way and accommodate existing infrastructure.

Alternatives Used to Compare Leases and IRUs

To compare leases and indefeasible rights of use, CBO estimated how much it would cost to acquire the 4,681 DATS and other IRU candidate circuits over the next 20 years through various methods:

- A three-year lease plus seven option years—followed after 10 years by another three-year lease with seven option years—under either competitive bids prices or DTS-C prices;
- Two successive 10-year IRUs for existing dark fiber;
- A 20-year IRU for existing dark fiber; or
- A 20-year IRU for newly constructed dark fiber.

CBO's analysis cannot take into account all aspects of the market for circuits, however, because of the complexities of that market and the lack of specific information, especially the limited data about IRU pricing.

How CBO Estimated the Costs of the Alternatives

Using the modeling methods described above, CBO first estimated lease prices for each circuit under competitive bids and DTS-C prices. Although CBO based most of its subsequent analysis on the competitive bids lease prices, it did perform some sensitivity analyses using the (generally lower) DTS-C lease prices. CBO then estimated how much the 10-year and 20-year IRUs would cost if they returned the same expected profit as a DTS-C lease (with three base years and seven option years) for a high-bandwidth (OC48) circuit.[15] That equal-profit assumption means that an IRU's price would be less than a lease's on an annualized basis, because the vendor would receive an up-front payment and not bear the risk of having the lease be canceled. The extent of that price difference would depend on how likely a lease was to be terminated at the end of the three-year period or each option year. Under the equal-profit assumption, if a company believed that a lease was very likely to be paid for the whole

15. CBO assumed that prices of both leases and IRUs would rise at the rate of inflation. Thus, the prices over the next 20 years are the same expressed in 2006 dollars.

20 years, the lease's annual price would be very close to that of an IRU. (CBO's methodology is explained in more detail in the appendix.)

DISA provided information about termination and initiation rates since 2000 for circuits similar to those in CBO's analysis. On average, for every 100 circuits that DISA starts with each year, about nine are terminated because they are no longer necessary, and 11 new ones are added. Those rates result in a net increase of about 2 percent annually in the number of circuits, meaning that the 4,681 in this analysis will grow to almost 6,800 circuits at the end of 20 years. However, many of the current circuits will no longer be in use at that time, and many new circuits will have been created.

To estimate the cost of a 20-year IRU for circuits that involve digging and installing new fiber-optic cable, CBO used the midpoint ($225,000 per mile) of the industry's range of planning factors ($150,000 to $300,000 per mile). CBO assumed that companies would recover all of their costs in installing the fiber. Maintenance costs were estimated using the range provided by the industry (3 percent to 50 percent of the annualized cost of the IRU).[16] CBO assumed that all IRUs would incur the equipment-installation cost specified in the DTS-C contract as a nonrecurring cost.[17]

Assumptions About Bandwidth Growth

In addition to changes in the number of circuits, the bandwidth requirements for each circuit can increase over time. DISA originally estimated that bandwidth requirements would grow by 60 percent per year, but it now expects that growth will average about 35 percent per year.[18] According to one company, bandwidth requirements in general (not specific to DoD) will grow by about 80 percent annually. However, another company said that those estimates of growth rates are not likely to continue and have resulted in the excess supply that now exists.

Currently, DISA's circuits use about 20 percent of their bandwidth capacity, on average. CBO assumed that all circuits would start at 20 percent capacity and that their bandwidth requirement would either not change at all or would increase by 35 percent or 60 percent. Under the latter two assumptions, all circuits would grow at uniform rates and be upgraded at the same time. (A circuit beginning at 20 percent capacity and growing by 35 percent annually would reach full capacity before the end of the sixth year). Either growth rate implies a network with much greater bandwidth capacity after 20 years: between 300 and 7,500 times more than the current capacity.

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16. For determining which of the existing circuits would be less expensive with an IRU, CBO used both the 3 percent and 50 percent estimates of maintenance costs. For determining how much cheaper it would be to obtain all of DISA's circuit requirements over the 20-year period of the analysis, CBO used the midpoint of that range (27 percent).

17. The nonrecurring cost in the DTS-C contract covers equipment installation and hookup for leased circuits. CBO assumed that IRU prices would include a one-time payment for the use of the circuit as well as the same equipment-installation cost as that of leased circuits. IRUs would also incur separate maintenance costs.

18. The first estimate was provided by DISA officials in May 2005 and the second in April 2006.

CBO's analysis assumes that circuits reach nearly their full capacity before being upgraded. That assumption probably understates bandwidth requirements, because DISA usually upgrades circuits before they get close to maximum capacity.[19] The two growth rates produce a wide range of estimated bandwidth requirements over the 20-year period, which is consistent with the uncertainty surrounding future bandwidth needs. If CBO had instead assumed that DISA would upgrade circuits well before they reached full capacity, the range of projected requirements would be even wider.

Under CBO's assumptions, leased circuits are upgraded by letting the current contract expire and initiating a new contract for the next-larger circuit, with an associated nonrecurring cost and a higher monthly recurring cost. Thus, upgrading leased circuits raises costs not only because of the expense of the upgrade but also because higher-capacity circuits are more expensive to operate.

IRUs are upgraded by installing new equipment. They incur only a one-time cost for that equipment, which is estimated as the full nonrecurring cost specified in the DTS-C contract. That specified cost may include some items associated with installing a new circuit that would not be incurred in an upgrade. Conversely, that cost may not include the total cost of equipment if some of that equipment is already in place.

For circuits that are already an OC48 (the highest capacity in this analysis), CBO assumed that DISA would obtain additional OC48s to accommodate the need for greater bandwidth.[20] That assumption increases the number of circuits as well as their total cost.

Results of CBO's Analysis

CBO's comparison of the cost of leases and indefeasible rights of use focused on two questions:

- How many circuits would be cheaper to obtain with an IRU than with a lease?
- How much money might be saved over 20 years if IRUs were used for those circuits?

To answer the first question, CBO calculated the costs for the next 20 years of each of the 4,681 DATS and other IRU candidate circuits that are now in existence.[21] It then

19. According to DISA officials, the agency begins planning upgrades when a circuit's traffic reaches 50 percent to 75 percent of capacity, although the upgrade may not occur until capacity utilization is higher.

20. DISA could instead purchase an OC192 or other, higher-capacity circuit, but no detailed pricing information was available to analyze that option.

21. Because of the high turnover of circuits, many of the existing circuits will no longer be needed in 20 years, and many other circuits will be created during that time to meet new needs and growing bandwidth requirements.

Table 2.

Twenty-Year Costs and Savings of Using Leases or IRUs for the DATS Contract

	Assumed Annual Rate of Growth in Required Bandwidth		
	No Growth	35 Percent Growth	60 Percent Growth
Estimated Lease Cost of the DATS Contract (Based on historical competitve bids prices)			
Present Value of Total 20-Year Costs (Billions of 2006 dollars)	4	30	135
Percentage Savings from Using IRUs Where Cheaper			
10-Year IRUs	0	-1	-3
20-Year IRUs	-2	-20	-25
20-Year New-Fiber IRUs	-2	-5	-5
All Types[a]	-4	-23	-33

Source: Congressional Budget Office.

Note: DATS = Defense Information System Network Access Transport Services; IRUs = indefeasible rights of use.

a. Savings from using the lowest-cost procurement option for each circuit in the analysis (among leases with competitive bids prices, 10- or 20-year IRUs for existing dark fiber-optic cable, or 20-year IRUs for newly constructed dark fiber).

compared the cost of providing each circuit under the lease and IRU options described above.

That comparison suggests that IRUs could be cheaper for 23 to 276 of the 4,681 existing circuits, depending on whether the high or low estimates of IRU maintenance costs and new-fiber building costs are used. All of the circuits in question are OC3 or higher-capacity circuits; none of the circuits smaller than an OC3 would be cheaper with an IRU.

To answer the second question, CBO took two additional factors into account: turnover in circuits and growth in bandwidth requirements. The turnover rates specified by DISA imply that about 11,700 new circuits will be required over the next 20 years and that about 9,600 circuits will cease to be needed at some point during that period. At the same time, existing circuits will most likely require additional capacity. CBO's assumed rates of bandwidth growth imply a significant change in future circuit makeup. Currently, just 4 percent of DATS circuits are OC12 or greater. A current capacity utilization of 20 percent and growth of 35 percent per year for all circuits implies that 57 percent of circuits will have to be OC12 or greater to accommodate demand in 15 years or less. A 60 percent annual growth rate for bandwidth means that 57 percent of circuits would have to be OC48 or larger in 15 years.

In general, high turnover of circuits makes leases more attractive than IRUs because of their flexibility: DISA can avoid paying up front for circuits that may be terminated

later. (Once an IRU has been purchased, only maintenance costs will be avoided if the circuit is terminated.) CBO assumed that termination would occur randomly among all DATS circuits. However, DISA might be able to target only stable circuits for IRUs, which would lower their cost relative to that of leases.

Substantial growth in bandwidth requirements, by contrast, generally makes IRUs more attractive than leases. As noted above, upgrading the capacity of an IRU circuit requires only a one-time fee for new equipment and installation rather than a new, more expensive lease.

Potential Savings

If DISA uses the DATS contract to continue making short-term leases, as in the past, under competitive bids prices, the costs of those leases will total $4 billion (in 2006 dollars) with no growth in bandwidth requirements, $30 billion with 35 percent growth in bandwidth, or $135 billion with 60 percent growth, CBO estimates (see Table 2). Those figures reflect 20 years of costs discounted to their present value.[22]

If, instead, DISA purchased circuits with IRUs in cases where that approach was projected to be less expensive than the competitive bids lease price, it could save as much as 33 percent over 20 years, depending on the type of IRU used and the assumptions about bandwidth growth. (That and the other savings estimates in Table 2 are based on the midpoint of the range of IRU maintenance costs and new-fiber installation costs.)

Specifically, if bandwidth requirements were assumed to remain static, having the option to use 10-year IRUs would produce negligible savings compared with competitive bids lease costs. Purchasing 20-year IRUs for either existing or new fiber would save about $0.1 billion (or 2 percent) over 20 years. Using the lowest-price procurement option (except DTS-C prices) for each individual circuit—the approach labeled "All Types" in Table 2—would save about $0.2 billion (or 4 percent) over 20 years.

If bandwidth requirements grew by 35 percent annually, most circuits would have to be upgraded to high-bandwidth capacity by the end of the 20-year period. That

22. Present value is a single number that expresses a flow of current and future payments in terms of an equivalent lump sum paid today. As such, it represents the current value of a future cash flow, discounted to account for the time value of money. A cost incurred sooner has a greater negative impact on present value than does a cost of the same size incurred later. Discounting captures the value of the interest payments on debt that the government can avoid by making a payment farther in the future. Because IRUs involve more expenses at the start of the contract than leases do, they have a greater negative present value relative to total 20-year payments. Comparing leases and IRUs is a form of cost-effectiveness analysis, since the benefits accruing to the government from the two methods are the same but the costs differ. In calculating present value, CBO used a real discount rate of 3 percent. See Charles Hitch and Roland McKean, *The Economics of Defense in the Nuclear Age* (Santa Monica, Calif.: RAND Corporation, March 1960), p. 207; and Office of Management and Budget, "Discount Rates for Cost-Effectiveness, Lease-Purchase, and Related Analyses," Appendix C in *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, Circular A-94 (January 18, 2006).

assumption makes IRUs cheaper compared with leases because the cost of upgrading them is lower. In that case, using some 20-year IRUs for existing fiber would save about $6 billion (or 20 percent) over 20 years, and using the lowest-cost option for each circuit would save about $7 billion (or 23 percent).

Bandwidth growth of 60 percent a year leads to even higher DATS costs and larger potential savings from using IRUs. In that scenario, if DISA employed the least expensive procurement approach for each circuit, savings would total about $45 billion (or 33 percent) over 20 years compared with competitive bids lease costs.

The range of savings estimates in CBO's analysis is large. In addition, the lack of specific pricing information for IRUs introduces potentially large but unquantifiable uncertainty into the comparison of leases and IRUs. Moreover, prices for circuits have generally come down over time.[23] Future price changes could alter the relative costs of the two procurement methods.

Sensitivity of the Estimates to Two Assumptions

To gauge the extent to which the savings estimates depend on factors other than the assumed rate of bandwidth growth and the type of IRU, CBO examined the effects of changing two other assumptions: the discount rate used to calculate present-value costs, and the type of lease whose expected profit the IRUs were assumed to match.

In its calculation of present-value costs, CBO used a real (inflation-adjusted) discount rate of 3 percent. Changing that discount rate to 6 percent reduces the savings in most scenarios by about 1 percentage point.

As noted above, CBO projected IRU prices so as to yield the same expected profit as a DTS-C lease of an OC48 circuit. Instead, IRU prices could have been pegged to the competitive bids lease price of four OC12 circuits (the equivalent bandwidth). The average prices of an OC48 in the DTS-C data and an OC12 in the competitive bids data are about the same per capacity, but the distribution of prices differs. Competitive bids prices are generally higher for long-distance circuits and for those in areas with very low or high population densities. Changing the basis of projected IRU costs to the competitive bids price of four OC12s generally reduced the estimated savings—by as much as 50 percent for the "All Types" approach with 35 percent bandwidth growth.

Other Considerations

Other factors that could play a role in the choice between leases and IRUs were beyond the scope of CBO's analysis or could not be included because of a lack of information:

23. Information provide to CBO by DISA in April 2006.

- To purchase an indefeasible right of use, DISA may be required to use funds budgeted for procurement rather than for operation and maintenance.[24] Operation and maintenance funding pays for routine operations, such as short-term leases, whereas procurement funding is used for capital expenses.

- The data that DISA provided about circuit capacity, terminations, new circuits, and bandwidth growth were not specific to particular bandwidths (that is, there were not separate growth rates for DS1s, DS3s, OC3s, and other circuits). If those factors varied with bandwidth, CBO's results could be biased in one direction or the other.

- According to both DISA and telecommunications companies, obtaining rights of way is a major disadvantage and source of cost risk associated with installing new fiber-optic cable. One large project to install such cable was eventually canceled after multiyear delays and cost increases. DISA could use the federal government's powers of eminent domain to obtain rights of way, but it has not done so recently.[25]

- Soliciting indefeasible rights of use could be more expensive for DISA than soliciting leases because the agency has little recent experience with IRUs. The Gartner Group estimated that purchasing an IRU would take about 1,880 hours (one work year) of employees' time at the GS-14 salary level, compared with just four hours for a circuit lease.[26] That difference arises because DISA views IRUs as less standard and more complex than leases. The time needed to purchase IRUs would be likely to decrease, however, as the agency gained more experience with them.

- Technological changes could alter the relative costs of IRUs and leases or even make both obsolete. According to one company, for both IRUs and leases, the "last mile" of a circuit—the connection to the end user—is often the most expensive part of the circuit. Many companies are switching to wireless technology to avoid building circuits in densely developed areas. Greater use of wireless technology by DoD or other technological changes could make it less attractive to commit to long-term IRUs.[27]

- The DATS contract and indefeasible rights of use are not mutually exclusive. DISA could implement DATS to replace expiring contracts and simultaneously take bids on IRUs for some circuits. The most likely candidates—expensive, high-

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24. Section 373(a) of the National Defense Authorization Act for Fiscal Year 2006; 10 U.S.C. 2245(a). An IRU might also necessitate more budget authority at the outset in order to fully fund the up-front costs; see Office of Management and Budget, *Preparation, Submission and Execution of the Budget*, Circular A-11 (2005), Appendix B.

25. According to the Fifth Amendment to the Constitution, private property may be taken for public use if just compensation is paid.

26. Gartner Group, *Assessment of IRU Versus Lease for DISA GIG-BE* (March 6, 2006), p. 8.

27. One concern that DoD has with wireless technology, however, is meeting security requirements.

bandwidth circuits that are currently leased—could be left on a transitional contract until an IRU price proposal was obtained or could be switched from DATS to an IRU after the first three-year lease expired.[28] That approach would give DISA a firm lease price to compare with any IRU bids.

28. A transitional contract called DTS-C Access Optimization is currently in place for circuits that were on the expired DTS-C contract. It will continue until the DATS contract is fully implemented.

Appendix: Methodology for Estimating IRU Prices

The Congressional Budget Office was unable to obtain pricing information for indefeasible rights of use that was similar to the data on lease prices provided by the Defense Information Systems Agency. To estimate the cost of obtaining various circuits through either 10-year or 20-year IRUs, CBO had to make several assumptions about how IRU prices relate to lease prices and about the rate at which to discount future cash flows to calculate their present value.

Relationship Between IRU and Lease Prices

Two companies that provide both IRUs and leases stated that they price the two options so as to earn the same expected profit. From the companies' perspective, the main difference between the two is that leases can be terminated and IRUs are paid for up front. Thus, with an IRU, a company is guaranteed a price to cover 10 or 20 years' worth of use of a circuit. With a lease, by contrast, the company is guaranteed only three years' worth of payments (the initial term under the DATS contract). After that, the lease can be canceled.

In the past, DISA has terminated circuits similar to those in CBO's analysis at an average rate of about 9 percent per year. In other words, at the end of three years, there is roughly a 27 percent chance that the government will no longer need a particular circuit and that the company will no longer receive federal revenue from leasing it. (There is also a 9 percent chance that the circuit will be terminated each year thereafter.)

For the company to receive the same expected revenue from a lease that could be canceled as from an IRU, it will charge more for the lease than for the IRU because it may receive revenue for only part of the common 10- or 20-year time frame of an IRU. In this analysis, CBO estimated how much 10- and 20-year IRUs would cost if they returned the same expected profit as a high-bandwidth lease (for a term of three base years plus seven option years) under DISA's recently expired contract.[1] In other words, CBO assumed that companies would charge DISA more for leases because of the agency's built-in flexibility to cancel them.

Discount Rate for Calculating Present Value

Companies value payments they receive today more than payments they get in the future because of the time value of money. Money is more valuable the earlier it is received since it can either earn interest or can be used to pay off debt. CBO discounted the expected cash flows that a lease would produce (accounting for the probability of cancellation) to obtain an equivalent present value for an IRU. In doing

1. CBO assumed that prices of both leases and IRUs would grow at the same rate over time and thus would be the same over the next 20 years expressed in 2006 dollars. In the comparison, CBO used prices for leasing an OC48 circuit—the highest-capacity circuits for which price information was available—under the expired DTS-C contract. IRUs do not have a capacity associated with them, so companies price them the same as high-capacity leases. Prices for OC48 circuits were added to the DTS-C contract about three years ago and thus are not as old as the other DTS-C prices, which date from 1996.

that, CBO used a real (inflation-adjusted) discount rate of 3 percent, in keeping with federal budgetary guidelines.[2]

Arguably, interest rates on corporate bonds may be a more appropriate discount rate because they better reflect the interest costs that a company avoids paying under an IRU, which accelerates its revenue stream relative to that of a leasing arrangement. Corporate bond rates exceed the Treasury interest rate that budgetary rules mandate for government cost-effectiveness analyses; the reason that they are higher is that people who invest in corporate bonds face the risk of default, whereas Treasury bonds are considered risk-free. Higher corporate bond rates can also be seen as reflecting the risk that a company faces in a leasing arrangement that is subject to termination by DISA. Using the corporate bond rate in CBO's analysis would result in lower projected IRU prices (because future lease payments would be worth less with a higher discount rate).

From DISA's perspective, a higher discount rate than the Treasury rate may also be appropriate for choosing between leases and IRUs over the 20-year period of this analysis. The leasing option is more flexible because leases can be canceled if they are no longer needed. That greater flexibility is explicitly modeled in the 9 percent of circuits that are terminated every year (including those acquired through IRUs, for which nonrecoverable costs would have already been paid). Moreover, the termination rate could exceed that historical average rate in the future—a risk that is not captured in CBO's model. Using a higher discount rate would reduce the present value of the stream of lease payments, making leases appear more attractive—as should be the case if their flexibility in mitigating risk is taken into account.

If higher discount rates were used in both a company's and DISA's calculations instead of the Treasury rate, the net effect would be minor. Companies would offer IRUs at lower prices, making that procurement method more appealing to DISA; but DISA would more heavily discount the stream of lease payments, making leasing more attractive. The net result of those two effects on DISA's decisionmaking could be quite small.

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2. See Office of Management and Budget, "Discount Rates for Cost-Effectiveness, Lease-Purchase, and Related Analyses," Appendix C in *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, Circular A-94 (January 18, 2006).