

OFFICE OF THE  
PARLIAMENTARY BUDGET OFFICER



BUREAU DU  
DIRECTEUR PARLEMENTAIRE DU BUDGET

## **Comparing PBO and DND Cost Estimates on Canada's Proposed Acquisition of the F-35 Joint Strike Fighter: Some Preliminary Questions and Answers on Key Issues**

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[www.parl.gc.ca/pbo-dpb](http://www.parl.gc.ca/pbo-dpb)

The *Parliament of Canada Act* mandates the Parliamentary Budget Officer (PBO) to provide independent analysis to the Senate and House of Commons on the state of the nation's finances, government estimates and trends in the national economy.

After the release of the PBO report "An Estimate of the Fiscal Impact of Canada's Proposed Acquisition of the F-35 Lightning II Joint Strike Fighter"<sup>1</sup>, the Department of National Defence (DND) provided a comparison of its figures with those of the PBO.<sup>2</sup>

On 3 March 2011, DND informed the PBO that it had not yet undertaken a 'detailed analysis of the entire project.'<sup>3</sup>

Directly prior to the PBO's report being released, DND provided its costs with respect to acquisition, initial logistics set-up, and operating and support, among others. However, DND did not provide details of its methodology, assumptions, uncertainties, or risks associated with these figures. Given this, the PBO is left to speculate as to the basis of the costs provided.

It appears that DND has relied upon the 2009 Selected Acquisition Report (SAR), published by the U.S. Department of Defense (DoD), as well as figures provided by the Joint Strike Fighter (JSF) Program Office. However, the reasonableness of relying on such figures might be questioned. The SAR was published in April of 2010. Since then, the JSF program has undergone two restructurings to address significant program delays and cost overruns, including a restructuring of the management of the JSF Program Office (see Nunn-McCurdy breach<sup>4</sup>).

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<sup>1</sup> Parliamentary Budget Officer (2011, March 10) *An Estimate of the Fiscal Impact of Canada's Proposed Acquisition of the F-35 Lightning II Joint Strike Fighter*. Retrieved from the PBO Web site: [http://www2.parl.gc.ca/sites/pbo-dpb/documents/F35\\_Cost\\_Estimate\\_EN.pdf](http://www2.parl.gc.ca/sites/pbo-dpb/documents/F35_Cost_Estimate_EN.pdf)

<sup>2</sup> Department of National Defence and the Canadian Forces. (2011, March 17) *Next Generation Fighter Capability Comparison of Costing*. Retrieved from the Department of National Defence and the Canadian Forces Web site: <http://www.forces.gc.ca/site/pri/2/pro-pro/ngfc-fs-ft/comparison-comparaison-eng.asp>

<sup>3</sup> Department of National Defence and the Canadian Forces. (2011, March 3) *Response to Parliamentary Budget Office, Answers and Questions*.

"The NGFC Project is presently in the Options Analysis Phase proceeding toward the Definition Phase within the DND Project Management Framework. Cost estimates at this stage are based on many broad assumptions that have allowed the Department to budget for the implementation of the project. It is during the upcoming Definition Phase that the detailed analysis of the entire project will be performed and will lead to substantive cost estimates based on actual planned implementation activities.

During the Definition Phase that is planned from Spring 2011 until Fall 2012, the NGFC Project Management Office, in consultation with stakeholders, will plan the implementation of the project in accordance with the stated operational requirements. Various options will be considered for aircraft delivery and operational implementation."

<sup>4</sup> Garamone, J. (2010, June 2) DoD certifies 6 programs under Nunn-McCurdy Law breaches. *American Forces Press Service*. Retrieved from <http://www.af.mil/news/story.asp?id=123207420>

The PBO, on the other hand, uses a Cost Estimating Relationship (CER) model that incorporates thirty years of actual jet-fighter program data, including but not limited to the data found in the 2009 SAR. Other reports, such as that of the U.S. Government Accountability Office (GAO) released on 15 March 2011, show average unit acquisition costs to be in the same order of magnitude as the PBO estimates.

The PBO continues to stand by its forecast.

While DND has briefly provided the bureaucratic process it may follow regarding the F-35 procurement, it has yet to provide the key details of its methodology, assumptions, uncertainties, or risks associated with its figures. Nonetheless, the PBO has attempted to provide a response to some of the issues raised by DND with respect to differences in estimates.

Parliament must have access to financial data and analysis to support it in fulfilling its constitutional mandate to manage the public purse. To support Parliament in satisfying its constitutional mandate, this short paper addresses some of the key concerns or issues raised by DND with respect to the PBO's forecast.

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## **Lifespan of the F-35A**

**DND** uses a time span of 20 years for its estimate.

**The PBO** uses a functional lifespan of 30 years for its estimate.

This is a distinction without a difference for two reasons:

First, the PBO grossed up DND's figures to offer a degree of comparability. Operating and support (O&S) cost was the only cost grossed up; DND's figure was increased on a pro-rata basis to reflect the additional 10 years that the PBO assumes that the F-35A will be in service.<sup>5</sup>

Second, the PBO is of the view that a 30-year functional life constitutes a reasonable assumption for three reasons:

- The U.S. Department of Defense's Selected Acquisition Report (SAR) forecasts a 30-year operational life.<sup>6</sup>
- By the time they begin to be replaced,<sup>7</sup> Canada's CF-18s will have been in operation for 34 years.<sup>8</sup> It is reasonable to assume that the F-35A will have a similar functional life as the plane that it replaces.
- In a program with such a large capital outlay, it would be unusual to amortize such a significant acquisition cost over a relatively short time horizon; the suggestion of a 20-year amortization horizon may pose a cause for concern.<sup>9</sup>

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<sup>5</sup> Parliamentary Budget Officer. (March 10, 2011). *An Estimate of the Fiscal Impact of Canada's Proposed Acquisition of the F-35 Lightning II Joint Strike Fighter*. Retrieved from the PBO's Web site: [www2.parl.gc.ca/sites/pbo-dpb/documents/F-35\\_Cost\\_Estimate\\_EN.pdf](http://www2.parl.gc.ca/sites/pbo-dpb/documents/F-35_Cost_Estimate_EN.pdf)

<sup>6</sup> U.S. Secretary of Defense. (2009) Selected Acquisition Report (SAR), 53. The SAR provides: "The total O&S Cost ... for all three U.S. variants based on an estimated 8,000 hour service life ...."

If the figure of 8,000 is divided by 240 flying hours per year (as confirmed by DND), that results in a functional life of 33.3 years. Given this, it is not clear why DND would chose to project a functional life for an aircraft considerably shorter than its capability.

<sup>7</sup> This assumes the delivery schedule provided by DND: 1, 9, 9, 13, 13, 13, 13 aircraft each year over 7 years beginning in 2016. Department of National Defence and the Canadian Forces. (2011, March 3) *Response to Parliamentary Budget Office, Answers and Questions*.

<sup>8</sup> Department of National Defence. (2007, March 26). *CF-188 Hornet: Technical Specifications*. Retrieved from the Department of National Defence's Web site: <http://www.airforce.forces.gc.ca/v2/equip/cf18/specs-eng.asp>

<sup>9</sup> If the Government intends to use the F-35 for 20 years rather than 30, the recapitalization and the capital asset replacement accounts would be compressed from a hypothetical 30-year timeframe to 20 years, implying an annual increase of between 33% to 50% in expenditures for the recapitalization and capital asset replacement accounts. Consequently, the 20-year scenario would result in a much more expensive program, since it would result in a relatively expensive plane when compared to its service life, and the additional budgetary pressures it would impose on account of the increased expenditures required on the capital accounts. Furthermore, it seems fair to assume that after 20 years, a new acquisition would have to be made. The cost associated with this could be significant.

### **Average Unit Acquisition Cost \$75 Million**

**DND** maintains that the average unit acquisition cost of the F-35A will be \$75 million—including upgrades and overhaul.

**The PBO** forecasts that the average unit acquisition cost of the F-35A will be approximately US\$128 million—excluding upgrades and overhaul.

As mentioned above, the PBO cannot comprehensively assess the robustness of DND's costing because DND has not provided the methodology, assumptions, uncertainties, or risks surrounding its figures. In the absence of such information, the PBO is left to speculate as to DND's methodology in arriving at an average unit acquisition cost of \$75 million. Perhaps coincidentally, this figure reflects statements made by Lockheed Martin in 2001.<sup>10</sup>

However, even in the absence of information on the methodology, assumptions, uncertainties, and risks surrounding this figure, the reasonableness of the amount may be questioned insofar as it is not in the same order of magnitude as comparable figures. The U.S. Government Accountability Office (GAO) estimates an average unit procurement cost of **US\$133 million** (dated 15 March 2011).<sup>11</sup> Importantly, this figure precedes any adjustment in cost associated with the most recent Nunn-McCurdy reassessment.<sup>12</sup> The U.S. Department of Defense's 2012 Budget Estimates puts fly-away unit cost at **US\$151 million** (dated 16 February 2011)<sup>13</sup> for a FY 2012 acquisition (i.e. in the Low-Rate Initial Production (LRIP) phase).

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<sup>10</sup> U.S. Government Accountability Office. (2011, March 15). *Joint Strike Fighter: Restructuring Should Improve Outcomes, but Progress Is Still Lagging Overall* (Publication No. GAO-11-450T), Appendix I. Retrieved from GAO Reports Main Page via GPO Access database: <http://www.gao.gov/new.items/d11450t.pdf>

<sup>11</sup> U.S. Government Accountability Office. (2011, March 15). *Joint Strike Fighter: Restructuring Should Improve Outcomes, but Progress Is Still Lagging Overall* (Publication No. GAO-11-450T), 16. Retrieved from GAO Reports Main Page via GPO Access database: <http://www.gao.gov/new.items/d11450t.pdf>

Note that the GAO figure reflects all three variants. However, separation of the costs associated with each individual variant may not be as material as might appear at first blush. There is very little cost difference between the F-35A and F-35B; the final cost of the F-35B is primarily driven by a higher engine cost (see reference below). Given this, and the fact that orders for the F-35C variant are relatively small by reference to the rest of the program, PBO is of the view that the comparison rendered above is helpful in understanding the magnitude of associated costs.

Pocock, C. (2011, March 18) F-35 Production Costs Still Unacceptable, Pentagon Officials Say. *AINonline*. Retrieved from: <http://www.ainonline.com/news/single-news-page/article/f-35-production-costs-still-unacceptable-pentagon-officials-say-29099/>

<sup>12</sup> The PBO confirmed this directly with GAO officials.

<sup>13</sup> U.S. Department of Defense (2011, February) *Fiscal Year (FY) 2012 Budget Estimates Air Force*, p 01-1. Retrieved from <http://www.saffm.hq.af.mil/shared/media/document/AFD-110211-038.pdf>

Furthermore, a figure of \$75 million does not match other data points in the public domain.

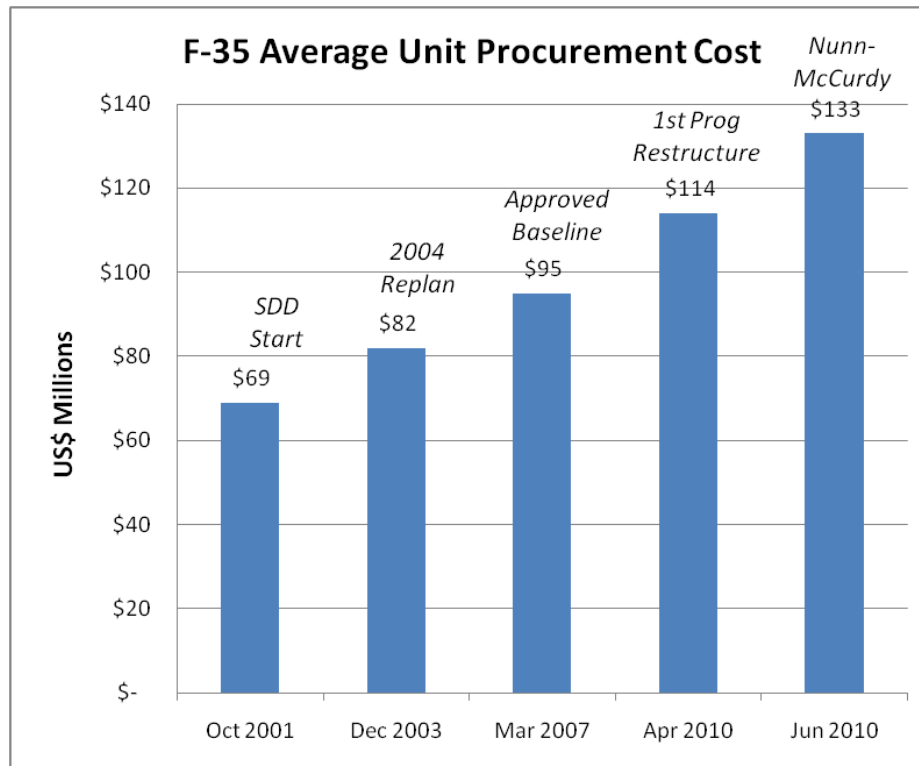
For example, the Joint Strike Fighter Program Office, in February 2010, put the cost at US\$122 million. See:

Butler, A. (2010, December 17) JSF LRIP IV Cost Targets Released. *Aviation Week*. Retrieved from [http://www.aviationweek.com/aw/generic/story\\_channel.jsp?channel=defense&id=news/awx/2010/12/16/awx\\_12\\_16\\_2010\\_p0-277980.xml](http://www.aviationweek.com/aw/generic/story_channel.jsp?channel=defense&id=news/awx/2010/12/16/awx_12_16_2010_p0-277980.xml)

On 16 December 2010, Tom Burbage, Lockheed Martin executive vice president and general manager for the F-35, stated that the Pentagon's official target per-unit cost for the CTOL version of \$111.6 million is about 3 to 4% higher than Lockheed Martin's. Adjusting the Pentagon's numbers to reflect this results in a Lockheed Martin figure of approximately US\$107 million. Mr. David M. Van Buren, Air Force Service Acquisition Executive—Office of the Assistant Secretary of the Air Force (Acquisition),

**Neither of these figures includes research, development, testing, and evaluation (RDT&E) or overhauls and upgrade.** U.S. GAO directly confirmed this with the PBO in writing, and the U.S. Department of Defense Fiscal Year (FY) 2012 Budget Estimates makes it clear that such costs are not included in its figures.

These increases reflect an escalating growth in the costs associated with the program as shown in the chart below.



Source: United States Government Accountability Office (2011, March 15).

**Important: does not reflect effects from additional restructuring announced after June 2010.**

and Vice Admiral David J. Venlet, Program Executive Officer for the F-35 Program, forecast the cost per engine to be US\$14.99 million. If US\$15 million is added to US\$107 million, the total cost per copy is US\$122 million for LRIP IV.

Van Buren, D. M. (U.S. Air Force Service Acquisition Executive, Office of the Assistant Secretary of the Air Force) & Venlet, D. J. (Program Executive Officer for the F-35 Program). (2011, March 15) *Air Force Tactical Aviations Program*. Presented to the House Armed Services Committee Subcommittee on Tactical Air and Land Forces of the U.S. House of Representatives. Retrieved from [http://armedservices.house.gov/index.cfm/files/serve?File\\_id=aaacd146-8781-40b6-addd-3324e2faa830](http://armedservices.house.gov/index.cfm/files/serve?File_id=aaacd146-8781-40b6-addd-3324e2faa830).

“A preliminary settlement agreement was reached between the Government and Pratt & Whitney in February 2011 for the above effort, including the procurement of 5 spares (3 CTOL and 2 STOVL). Contract award is expected by early April 2011. The per-variant price is \$14.99 million for CTOL/CV and \$32.07 million for STOVL.”

A recent Israeli acquisition cost of US\$2.75 billion for 20 aircraft for delivery in 2015 (averaging US\$137.5 million) provides an additional data point for consideration.

See: Pocock, C. (2011, 18 March) F-35 Production Costs Still Unacceptable, Pentagon Officials Say. *Military Aircraft*. Retrieved from <http://www.ainonline.com/news/single-news-page/article/f-35-production-costs-still-unacceptable-pentagon-officials-say-29099/>. Sources from the Congressional Research Service confirm the order size at 20 aircraft, not 19 as stated in the article.

Such cost growth is not unusual; other advanced fixed wing aircraft programs have demonstrated similar growth.

A 2009 report analysed the cost history of the F-22 program.<sup>14</sup> The average flyaway unit cost for 175 production F-22s being purchased by the USAF had grown to US\$158.8 million by May 2009 from a figure of US\$60 million estimated in 1988.<sup>15</sup> The increase of nearly US\$100 million can be attributed to the many changes to the program that occurred over the course of two decades including significant reductions to quantity procured. Under-estimation of the program costs at the inception is one of the principal reasons for the observed increases, and a similar picture might be said to be emerging for the F-35. A similar pattern has been observed in the context of the UK Typhoon, as reported in the UK National Audit Office's March 2011 report.<sup>16</sup>

In light of this and the figures provided above, it seems unlikely, but possible, that the cost of the F-35A would be as low as the figure provided by DND.

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<sup>14</sup> Watts, B. (2009, August). *The F-22 Program in Retrospect*. Retrieved from the Center for Strategic and Budgetary Assessments Web site: <http://www.csbaonline.org/wp-content/uploads/2011/02/2009.08.09-F-22-Program-in-Retrospect.pdf>

<sup>15</sup> Figures adjusted to 2009 dollars.

<sup>16</sup> UK Comptroller and Auditor General. (2011, March 2011). *Management of the Typhoon Project*. UK National Audit Office. Retrieved from UK National Audit Office Web site: <http://www.nao.org.uk/idoc.ashx?docId=84c8c0d3-4da4-4947-b4b1-bef52aef2172&version=-1>

Some highlights from the March 15, 2011 U.S. GAO report:

- The estimated **average unit procurement cost** for the JSF has about **doubled** since program start, and current forecasts indicate that **life-cycle costs will be substantially higher** than the legacy aircraft it replaces.<sup>17</sup>
- Rising costs erode buying power and may make it difficult for the U.S. and its allies to buy and sustain as many aircraft as planned, threatening volume, and driving average unit costs up.
- After more than 9 years in development and 4 years in production, the program has not fully demonstrated that the aircraft design is stable, manufacturing processes are mature, and the system is reliable.<sup>18</sup>
- Manufacturers are improving operations and have implemented 8 of 20 recommendations from an expert panel but have not yet demonstrated a capacity to efficiently produce at higher production rates.

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<sup>17</sup> In its 2009 report, the GAO confirmed the following:

“The total expected investment is now more than \$1 trillion—more than \$300 billion to acquire 2,456 aircraft and \$760 billion in life cycle operation and support costs, according to official program estimates.”

Thus, for every dollar spent on acquisition, the GAO expects \$2.5 to be spent on ongoing sustainment. The PBO’s forecasts are more conservative in this regard; the PBO forecasts that for every dollar spent on acquisition, \$1.4 will be spent on ongoing sustainment.

U.S. Government Accountability Office (GAO) (2009, March) *Joint Strike Fighter: Accelerating Procurement before Completing Development Increases the Government’s Financial Risk*. (Publication No. GAO-09-303), 1. Retrieved from GAO Reports Main Page via GPO database: <http://www.gao.gov/new.items/d09303.pdf>

<sup>18</sup> Shalal-Esa, A. (2011, March 12) Generator failure grounds F-35 fighter fleet. *Reuters*. Retrieved from: <http://www.reuters.com/article/2011/03/12/us-lockheed-fighter-idUSTRE72B2KB20110312?feedType=RSS&feedName=topNews>

Capaccio, T. (2011, March 15) F-35 is still behind schedule, report says. *Star-telegram*. Retrieved from: <http://www.star-telegram.com/2011/03/15/2924397/f-35-is-still-behind-schedule.html>

McGlaun, S. (2011, March 17) GAO is Concerned About Significant Delays in F-35 Software. *Daily Tech*. Retrieved from: <http://www.dailytech.com/GAO+is+Concerned+About+Significant+Delays+in+F35+Software/article21156.htm>

Trimble, S. (2011, March 17) Power failure investigation continues for F-35. *Flightglobal*. Retrieved from: <http://www.flightglobal.com/articles/2011/03/17/354485/power-failure-investigation-continues-for-f-35.html>



### Low-Rate Initial Production

**DND** has made statements to the effect that the price contained in the Low-Rate Initial Production (LRIP) contracts constitutes a ‘real cost’ of the F-35A.

The figures contained in the LRIP contracts<sup>19</sup> should not be seen as firm costs associated with the F-35A for a number of reasons:

- LRIPs are subject to cost overruns. In fact, the **LRIP contracts anticipate cost overruns** and provide for the allocation of such overruns between the Pentagon and Lockheed Martin.<sup>20</sup>
- LRIP contracts **do not include** engine cost.<sup>21</sup> This would add about US\$15 million to the cost.<sup>22</sup>
- LRIP contracts represent a price—not a cost. For further discussion, see next page.

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<sup>19</sup> Notwithstanding this, according to a U.S. Government source, the prices for LRIPs 1-3 are LRIP 1 - CTOL - \$221.2 million, LRIP 2 - CTOL - \$161.7 million; LRIP 3 - CTOL - \$128.2 million.

Butler A. & Warwick G (2010, 17 December) JSF LRIP IV Cost Targets Released. *Aviation Week*. Retrieved from [http://www.aviationweek.com/aw/generic/story\\_channel.jsp?channel=defense&id=news/awx/2010/12/16/awx\\_12\\_16\\_2010\\_p0-277980.xml](http://www.aviationweek.com/aw/generic/story_channel.jsp?channel=defense&id=news/awx/2010/12/16/awx_12_16_2010_p0-277980.xml)

<sup>20</sup> Van Buren, D. M. (U.S. Air Force Service Acquisition Executive, Office of the Assistant Secretary of the Air Force) & Venlet, D. J. (Program Executive Officer for the F-35 Program). (2011, March 15) *Air Force Tactical Aviations Program*. Presented to the House Armed Services Committee Subcommittee on Tactical Air and Land Forces of the U.S. House of Representatives. Retrieved from [http://armedservices.house.gov/index.cfm/files/serve?File\\_id=aaacd146-8781-40b6-addd-3324e2faa830](http://armedservices.house.gov/index.cfm/files/serve?File_id=aaacd146-8781-40b6-addd-3324e2faa830)

“Any overrun to the Target Cost will result in an equal sharing of overrun costs between the Contractor and the Government.”

<sup>21</sup> Pocock, C. (2011, March 18) F-35 Production Costs Still Unacceptable, Pentagon Officials Say. *AInonline*. Retrieved from: <http://www.ainonline.com/news/single-news-page/article/f-35-production-costs-still-unacceptable-pentagon-officials-say-29099/>

<sup>22</sup> See footnote 13.

## **Price versus Cost**

***The PBO*** estimated the cost associated with the F-35A—not the price.

The PBO and U.S. GAO estimates provide the average unit acquisition *cost*, *not the price* Canada may be able to negotiate at the time of purchase. However, the suggestion that Canada would be able to negotiate a price below the average unit acquisition cost should be treated with caution for, among others, four reasons:

- Canada intends to purchase at a relatively early stage. The unit acquisition cost at this time will be higher than that for the total program run.
- U.S. Federal law does not permit military equipment to be sold to international customers at a price less than that the U.S. pays.<sup>23</sup>
- International partners are unlikely to accept paying a higher price than Canada.
- Lockheed Martin, a publicly-traded for-profit corporation, would be unlikely to absorb the cost associated with pricing all aircraft below cost.

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<sup>23</sup> For further details of the restrictions imposed by U.S. law, see:

Parliamentary Budget Officer (2011, March 10) *An Estimate of the Fiscal Impact of Canada's Proposed Acquisition of the F-35 Lightning II Joint Strike Fighter*, p 47 fn 92. Retrieved from the PBO Web site: [http://www2.parl.gc.ca/sites/pbo-dpb/documents/F35\\_Cost\\_Estimate\\_EN.pdf](http://www2.parl.gc.ca/sites/pbo-dpb/documents/F35_Cost_Estimate_EN.pdf)

Procurement for cash sales, 22 U.S.C. § 2762 (2010). Retrieved from [http://www.law.cornell.edu/uscode/22/usc\\_sec\\_22\\_00002762----000-.html](http://www.law.cornell.edu/uscode/22/usc_sec_22_00002762----000-.html)

### **“(d) Competitive pricing**

(1) Procurement contracts made in implementation of sales under this section for defense articles and defense services wholly paid for from funds made available on a nonrepayable basis shall be priced on the same costing basis with regard to profit, overhead, independent research and development, bid and proposal, and other costing elements, as is applicable to procurements of like items purchased by the Department of Defense for its own use.”