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December 20, 2011

**2010 CENSUS PLANNING MEMORANDA SERIES**

**No. 159**

MEMORANDUM FOR      The Distribution List

From:                      Arnold Jackson *[signed]*  
                                 Acting Chief, Decennial Management Division

Subject:                    2010 Census Logistics Assessment

Attached is the 2010 Census Logistics Assessment report. The Quality Process for the 2010 Census Test Evaluations, Experiments, and Assessments was applied to the methodology development and review process. The report is sound and appropriate for completeness and accuracy.

If you have questions about this report, please contact Karen Seebold at (301) 763-9340.

Attachment

# 2010 Census Logistics Assessment

U.S. Census Bureau standards and quality process procedures were applied throughout the creation of this report.

Final Report

Karen Seebold

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Decennial Management Division



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## Table of Contents

Executive Summary .....	vii
1. Introduction.....	1
1.1 Scope .....	1
1.2 Intended Audience.....	1
2. Background.....	1
2.1 Census 2000 Logistics.....	1
2.2 2010 Census Logistics Program.....	1
3. Methodology .....	2
3.1 Methods.....	2
3.2 Questions to be Answered.....	3
4. Limitations .....	4
5. Results.....	4
5.1 What were the costs for 2010 Census non-IT equipment and furniture?.....	4
5.2 What were the costs for printing the 2010 Census kits? Did the total printing cost stay within the budgeted amount? If no, what factors caused the budget overruns?.....	4
5.3 Was there enough funding to cover operational requirements?.....	5
5.4 Were funds allocated in the right fiscal year to start printing for the 2010 Census kits? .....	5
5.5 What was National Processing Center’s estimated labor cost for each 2010 Census kit?.....	5
5.6 Did the value of investing money in National Processing Center conveyor belt system for building the 2010 Census kits meet our expectations versus what was used in Census 2000?... ..	6
5.7 Were enough staff hired to handle the procurement of non-IT equipment, furniture, and printing of forms and training materials? .....	7
5.8 Did staff have the resources to meet the requirements of the logistics operation? .....	8
5.9 Were baseline dates met for delivering non-IT equipment and 2010 Census kits to regions?.....	8
5.10 How many 2010 Census kits were forecasted by Field Division to be delivered? .....	8
5.11 Did installed furniture meet the operational requirements for office spaces?.....	9
5.12 What percent of furniture needed to support the 2010 Census arrived on time?.....	9
5.13 How were office supplies ordered and handled? How was the re-ordering of supplies handled?.....	10
5.14 If supplies were not ordered in a timely fashion for kit assembly and production in the Local Census Offices what were the reasons and impacts? What percent of supplies needed to support the 2010 Census arrived on time?.....	10
5.15 What procedures were put into place for the 2010 Census Logistics Program?.....	11
5.16 What process did Logistics Planning and Operation Branch use to keep track of kit models?.....	11
5.17 What was General Services Administration Global Advantage’s role for logistics in the 2010 Census?.....	12
5.18 Was the Census Bureau’s contract with the Government Printing Office beneficial for logistics and National Processing Center in the 2010 Census? What changes are recommended for the 2020 Census? .....	12

5.19	What was the process for assembling 2010 Census kits in National Processing Center? Was it more cost and time efficient than what was used in Census 2000? .....	13
5.20	What were the operational branches' roles in the logistics process? .....	14
5.21	What role did National Processing Center perform in the quality assurance process?..	14
5.22	What were the major obstacles that 2010 Census Logistics Program encountered during the 2010 Census? .....	15
5.23	What were the major successes for 2010 Census Logistics Program during the 2010 Census? .....	15
6.	Cost .....	16
7.	Related Evaluations, Experiments, and/or Assessments.....	16
8.	Key Lessons Learned, Conclusions, and Recommendations.....	16
8.1	2010 Census Logistics Program Lessons Learned .....	16
8.2	2020 Logistics Program Recommendations .....	17
9.	Acknowledgements.....	18
10.	References.....	18
	Appendix A: 2010 Census Non-IT Equipment and Furniture Cost .....	19
	Appendix B: Total Cost for 2010 Census Logistics Program .....	20

## List of Tables

Table 1: 2010 Census Printing Costs .....	4
Table 2: 2010 Decennial Logistics Printing Program Budget .....	5
Table 3: Kit Assembly Method Comparison Data.....	7

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## **Executive Summary**

The 2010 Census Logistics Program provided logistics support for field materials, kits, and supplies, in addition to non-IT equipment and furniture for 12 Regional Census Centers, the Puerto Rico Area Office, the 151 Early Local Census Offices, and 343 Local Census Offices. The 2010 Census Logistics Program was comprised of two phases. Phase 1 was the outfitting of census offices with furniture and non- IT equipment. Phase 2 provided all 2010 Census field offices with instruction manuals, training materials (guides, work books, job aids, and videos), forms of all types, kits (training, production, and supply), and expendable supplies at all levels in the quantities needed.

Delivery of non-IT equipment and furniture to the Local Census Offices ran smoothly and was delivered and installed according to schedule. Each office received a pre-determined quantity of furniture based on size and layout of the office space. All furniture was delivered on time. The furniture could be moved about the space to accommodate various operational requirements. In addition, the non-IT equipment arrived after the furniture was installed and was delivered on schedule.

A new kit assembly system was utilized at the National Processing Center that reduced assembly operational cycle time for kits, and resulted in a reduction in the amount of direct labor hours per kit. The National Processing Center assembled a total of 7,432,247 production and supply kits for the 2010 Census field operations.

In addition, the Census Bureau established a contract with the Government Printing Office, which provided additional printing options for the Census Bureau that kept the kit assembly process at the NPC on schedule.

The total cost of the 2010 Decennial Logistics Program was \$325.4M which represents 99.6 percent of the budget allotted for the program over the three-year period from FY 2008 – FY 2010. The main reason the program completed under budget can be directly attributed to a reduction in the cost of kit preparation and assembly.



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# **1. Introduction**

## **1.1 Scope**

This report provides an assessment of the schedule, requirements, and costs associated with the implementation of the 2010 Census Logistics Program. The Logistics Program required the coordination and delivery of training materials, non-IT equipment, supplies, and furniture to the 12 Regional Census Centers (RCCs), the Puerto Rico Area Office (PRAO), and the 494 Local Census Offices (LCOs).

## **1.2 Intended Audience**

The intended audience for this assessment report is program managers responsible for assessing the 2010 Census programs and planning for the 2020 Census.

# **2. Background**

## **2.1 Census 2000 Logistics**

In 2000, the Census Bureau established a Logistical Operations Center that included developing and implementing a national logistical plan for opening and closing offices, installing furniture and equipment; and provisioning supplies for office and field staff; providing help desk support; and coordinating all aspects of opening and closing field offices. In addition, the Logistics Operations Center was responsible for collecting, evaluating, documenting, and disseminating logistics information, tracking materials and equipment resources, providing event planning assistance, and providing daily Executive Summaries on the status of the logistics operation throughout the census period.

From November 1999 through May 2000, the Census Bureau conducted 19 individual census operations with 295 types of field operational kits. Logistical support was required to ensure the operational readiness of 520 LCOs, 12 RCCs, and the PRAO. During this period, the Census Bureau prepared and shipped more than 5.5 million operational kits to the LCOs (Field Division, 2001).

## **2.2 2010 Census Logistics Program**

The 2010 Census Logistics Program required the coordination and delivery of training materials and kits, non-IT equipment, supplies, and furniture to 12 RCCS, 494 LCOs, and the PRAO. The 2010 Census Logistics Program was comprised of two phases: Phase 1 provided the offices with non-IT equipment, supplies, and furniture such as fax machines, mail meters, photocopiers, hand trucks, paper, and pens/pencils to establish a working office environment for the field office and management staffs. Phase 2 provided all census field offices with instruction manuals, training materials (guides, workbooks, job aids and videos), forms of all types, kits (training, production, and supply) and

expendable supplies at all levels. Each field operation required materials and kits for operational training sessions. Kits were assembled and shipped from the National Processing Center (NPC) in Jeffersonville, Indiana to each Early Local Census Office (ELCO)/LCO and RCC. NPC assembled 7,432,147 production and supply kits during the census.

To support the 2010 Census Logistics Program operations, the Census Bureau leased additional commercial warehouse space in Jeffersonville, Indiana. The Patrol Road facility was approximately 6.3 miles away from the main NPC campus. The facility was a leased building encompassing 335,000 square feet that housed the printing, kit assembly, shipping/receiving, and warehousing operations. An additional 115,000 square feet of warehouse space was also leased for a total of 450,000 square feet in the same facility.

### **3. Methodology**

#### **3.1 Methods**

We utilized quantitative analysis, fact finding methodologies, and debriefings to gather data used in this report.

### 3.2 Questions to be Answered

Question	Data Source
1. What were the costs for 2010 Census non-IT equipment and furniture?	Financial Management Report (FMR)
2. What were the costs for printing the 2010 Census kits? Did the total printing cost stay with the budgeted amount? If no, what factors caused the budget overruns?	Financial Management Report (FMR)
3. Was there enough funding to cover operational requirements?	Financial Management Report (FMR)
4. Were funds allocated in the right fiscal year to start printing for the 2010 Census kits?	Financial Management Report (FMR)
5. What was National Processing Center estimated labor cost for each 2010 Census kit?	NPC Kit Production Summary, Condensed Master File, March 2011
6. Did the value of investing money in the National Processing Center conveyor belt system for building the 2010 Census kits meet our expectations versus what was used in Census 2000?	NPC Kit Assembly Method Comparison/Cost/Budget Analysis
7. Were enough staff hired to handle the procurement of non-IT equipment, furniture, and printing of forms and training materials?	Financial Management Report (FMR) and Fiscal Years 2009, 2010, 2011 Allocations
8. Did staff have the resources to meet the requirements of the logistics operation?	Financial Management Report (FMR)
9. Were baseline dates met for delivering non-IT equipment and 2010 Census kits to regions?	Master Activity Schedule (MAS)
10. How many 2010 Census kits were forecasted by Field Division to be delivered?	2007 Kit Forecast for the Office of Management and Budget
11. Did installed furniture meet the operational requirements for office spaces?	Space and Logistics Debriefings
12. What percent of furniture needed to support the 2010 Census arrived on time?	Master Activity Schedule (MAS)
13. How were office supplies ordered and handled? How was the re-ordering of supplies handled?	Field Division (FLD) and NPC operational memorandum
14. If supplies were not ordered in a timely fashion for kit assembly and for production in the Local Census Offices what were the reasons and impacts? What percent of supplies needed to support the 2010 Census arrived on time?	FLD Debriefings Master Activity Schedule (MAS)
15. What procedures were put into place for the 2010 Census Logistics Program?	FLD operational memorandum
16. What process did Logistics Planning and Operation Branch use to keep track of kit models?	Numbered memorandum series and the kit model data base in FLD Logistics Planning and Operation Branch
17. What was General Services Administration Global Advantage's role for logistics in the 2010 Census?	Detailed Operations System Plan
18. Was the Census Bureau's contract with the Government Printing Office beneficial for logistics and the National Processing Center in the 2010 Census? What changes are recommended for the 2020 Census?	Government Printing Office (GPO) Contracts with ACSD
19. What was the process for assembling 2010 Census kits in the National Processing Center? Was it more cost and time efficient than what was used in Census 2000?	NPC Kit Assembly Method Comparison/Cost/Budget Analysis
20. What were the operational branches' roles in the logistics process?	Detailed Operations System Plan
21. What role did the National Processing Center perform in the quality assurance process?	Debriefings; NPC Assessment Report
22. What were the major obstacles that 2010 Census Logistics Program encountered during the 2010 Census?	Debriefings
23. What were the major successes for 2010 Census Logistics Program during the 2010 Census?	Debriefings

## 4. Limitations

There were no limitations related to the results found in this report.

## 5. Results

The following questions were previously approved via the 2010 Census Logistics Study Plan. The methods and source documents listed in Section 3 of this report were used to answer the questions and provide insight and analysis for each subject matter.

### 5.1 What were the costs for 2010 Census non-IT equipment and furniture?

The total costs for the 2010 Census non-IT equipment and furniture for Fiscal Years (FYs) 2008 through 2010 was \$47,465,565. Non-IT equipment includes black and white copiers, color copiers, pallet jacks, hand trucks, shredders, mail meters, and fax machines for the RCCs and LCOs. Furniture includes desks, chairs, file cabinets, high density file cabinets, and other furniture. Other equipment includes waste bins, flat carts, and paper carts. Appendix A shows a breakdown of the costs incurred for 2010 Census non-IT equipment and furniture.

### 5.2 What were the costs for printing the 2010 Census kits? Did the total printing cost stay within the budgeted amount? If no, what factors caused the budget overruns?

The total costs for printing the 2010 Census kits were \$46,248,373. The unit of measurement used by GPO was the total pages printed, which were 29,750,780,882 total pages printed for 2010 Census kits. NPC cost includes paper, supplies, ink, and printing. Table 1 below shows the costs for printing the 2010 Census kits.

**Table 1: 2010 Census Printing Costs**

<b>FY</b>	<b>Pages Printed GPO</b>	<b>GPO Cost</b>	<b>Pages Printed NPC</b>	<b>NPC Cost</b>
<b>2008</b>	238,814,097	\$1,793,814	None	None
<b>2009</b>	28,956,224,465	\$31,438,349	49,052,049	\$2,207,342
<b>2010</b>	359,458,475	\$4,183,438	147,231,796	\$6,625,430
<b>Sub Total</b>	29,554,497,037	\$37,415,601	196,283,845	\$8,832,772
<b>Total Pages Printed = 29,750,780,882</b>		<b>Total Cost = \$46,248,373</b>		

Source: NPC

FLD printing budget allocation was as follows:

**Table 2: 2010 Census Logistics Printing Program Budget**

<b>Fiscal Year</b>	<b>Allocated Budgets</b>	<b>Actual Cost</b>
<b>2008</b>	\$0	\$1,793,814
<b>2009</b>	\$26,853,235	\$33,645,691
<b>2010</b>	\$10,741,294	\$10,808,868
<b>TOTAL</b>	<b>\$37,594,529</b>	<b>\$46,248,373</b>

Source: FMR

The actual cost of printing was \$46,248,373, which exceeded the allocation by \$8.6M. In FY 2008, FLD requested funding to cover the printing of recruiting materials, administrative forms, and office supplies for the ELCOs. Due to competing funding priorities, most of the funding that was requested was provided in FY 2009. Additional costs were incurred as a result of operational training materials that were received late which required NPC to begin printing in order to meet kit preparation and assembly schedules. In addition, the decision to revert to a paper NRFU field operation also increased the number of kits, supplies, and training materials needed to support the operation.

### **5.3 Was there enough funding to cover operational requirements?**

There was not enough funding to cover the operational printing requirements. Printing was over the allocated budget by \$8.6 million. Increased printing costs were due to the printing of additional training materials and the printing of additional fingerprinting training materials that occurred with the implementation of the policy to fingerprint all temporary staff hired for the 2010 Census.

### **5.4 Were funds allocated in the right fiscal year to start printing for the 2010 Census kits?**

No, funding was not provided in the right FY to start printing for some 2010 Census kits.

In order to mitigate the risk of not meeting schedule deadlines due to funding shortages, the recruiting kits were delivered on a flow basis over several months, starting in September 2009 with the opening of the LCOs.

### **5.5 What was National Processing Center's estimated labor cost for each 2010 Census kit?**

Production was 7,432,247 kits as of February 2011, estimated labor cost was \$10,618,426, and the average labor cost per kit was \$1.45 (NPC, 2011b).

Estimated labor costs were generated through manually kept spreadsheets and a “dollars-per-labor-hour” amount supplied from NPC’s Fiscal Services Section. A spreadsheet file was established for each memorandum requiring production of kits. During production the number of staff assigned to each kit assembly line, the total labor hours for this staff for each day, and the daily kit production count were tracked for every kit number. Each kit number was tracked in a separate area of the spreadsheet and a summary section provided daily reporting and status of active kit assembly work against the hours recorded for assembly clerks and pre-counting clerk labor activity only.

A Production Summary spreadsheet was created to record all the final numbers for each memorandum and all the kits on that memorandum. In this spreadsheet, NPC calculated kits produced per labor hour, labor hours per kit, and labor dollars per kit. There were 126 memoranda with 127 revisions to those memoranda. Specified for production were 702 different kit numbers. These ranged from Administrative Forms kits to Bulk Supply kits and all encompassed the total kit work load for NPC during the 2010 Census.

#### **5.6 Did the value of investing money in National Processing Center conveyor belt system for building the 2010 Census kits meet our expectations versus what was used in Census 2000?**

Yes. The example below highlights the value of NPC investing money in the conveyor belt system for building 2010 Census kits and how it improved the kit building process for the 2010 Census.

The kit assembly operation consisted of 18 conveyor belt assembly lines with 10, 20, and 30 work stations and six manual assembly lines for a total of 24 assembly lines. The use of the assembly line methodology was new for the 2010 Census and allowed kit operations more flexibility and predictable output. A hydraulic lift system at the end of a line moved the pallet to the working height and gave operators the ability to rotate the pallet as needed to help alleviate the potential for injuries that can result from incorrectly lifting and reaching by employees.

On November 21, 2008 the effectiveness of the moving conveyor belt assembly method, as compared to the kit assembly method utilized during the Census 2000, was compared by using both methods to assemble the same kit. That kit was from Address Canvassing; kit #635A.

The data from the method comparison are as follows, where DIFFERENCE is “new method” compared to “old method”. Percent Difference is the “new method” minus “old method” divided by “old method” multiplied by 100.

**Table 3: Kit Assembly Method Comparison Data**

MEASURE	OLD METHOD	NEW METHOD	DIFFERENCE	Percent Difference
Total Labor Hours	214.55	30.00	-184.55	-86.01
Total Kits Assembled	537	333	-204	-37.99
Kits per Labor Hour	2.50	11.10	8.6	343.48
Labor Hours per Kit	0.39	0.09	-0.30	-77.45
Assembly Rate –kits per hour	87.6	222	134.4	152.96
Assembly Duration – hours	6.12	1.50	-4.62	-75.49
Number of Staff used	35	20	-15	-42.86

The old method was utilized during kit assembly for Census 2000 and for some Address Canvassing kits during the 2010 Census. The new method was utilized during kit assembly during the 2010 Census, except for some Address Canvassing kits. Average kit assembly time in hours required 0.40 labor-hours per kit for the old method (0.40 labor hours per kit = 23.97 minutes per kit). The new method averaged only 0.09 labor-hours per kit (0.09 labor hours per kit = 5.40 minutes per kit).

The difference in average time between the old and new methods, 0.31 labor-hours per kit (18.57 minutes per kit), demonstrate the superiority of the new method: 77.45 percent fewer labor-hours per kit.

The average rate of assembly for the old method was 87.6 kits per hour of assembly activity. The average rate of assembly for the new method was 222.0 kits per hour of assembly activity.

Productivity rate is a measure of output per unit of input. The productivity rate, expressed in the number of kits per labor-hour invested, was 2.5 kits per labor hour for the old method. The productivity rate for the new method was 11.10 kits per labor-hour. The difference between productivity rates favors the new method as it is 343 percent better. The productivity rate of the new method is 444 percent of the old method rate (11.10 divided by 2.50 times 100 percent = 444 percent).

**5.7 Were enough staff hired to handle the procurement of non-IT equipment, furniture, and printing of forms and training materials?**

Yes, the number of staff hired to handle the procurement of non-IT equipment, furniture, and printing of forms and training materials was sufficient. FLD, Logistics Planning and Operations Branch (LPOB) consisted of six full time equivalents (FTEs) and three contractors.



The NPC Decennial Logistics Branch reached a peak of 496 FTEs assigned to the Kit Preparation project in January 2010.

**5.8 Did staff have the resources to meet the requirements of the logistics operation?**

Yes, funding and resources were sufficient to ensure the logistics operation was implemented on time and according to schedule.

**5.9 Were baseline dates met for delivering non-IT equipment and 2010 Census kits to regions?**

According to the MAS, there was one schedule line that pertained to the delivery of non-IT equipment to the regions. This line to Ship 2010 LCO Non Automation Equipment, had a baseline start date of August 31, 2009 and baseline finish date of December 31, 2009. This activity met its baseline dates by beginning on August 8, 2009 and finishing on December 31, 2009.

In addition, there were 33 schedule lines that pertained to the delivery of 2010 Census kits to the regions. There were 15 schedule lines that met their baseline start and finish dates. There were eight schedule lines that did not meet their baseline dates due to longer than expected translation time for kits that were delivered to Puerto Rico. There were four schedule lines that did not meet their baseline start date. This was due to materials not being ready for shipment at NPC in time for the activity to begin on schedule.

There were five schedule lines that did not meet their baseline finish date. This was because the quantity of materials that needed to be shipped from NPC for these operations was much larger than NPC anticipated, which delayed meeting the baseline finish dates. To mitigate this risk, NPC started shipping materials on a flow basis for operations where they had not received all the materials. This led to the finish baseline dates not being met since all materials for an operation had to be shipped in time to meet the finish baseline date.

There was one schedule line that did not meet either the baseline start or baseline finish date. This activity (Update/Leave Operational and Supply Kits) was delayed because the training materials were redesigned, which led to baseline dates not being met and a Change Request was not submitted to document the change in training materials availability.

**5.10 How many 2010 Census kits were forecasted by Field Division to be delivered?**

Kit models were developed and used to determine the amount of supplies, materials, etc. that would be needed. The kit specifications used during Census 2000 were the starting point for determining the number of kits that would be needed for the 2010 Census field operations.

In June 2007, we estimated that 5,031,438 kits would be needed to support all data collection operations (FLD, 2007). However, in February 2008, a decision was made to complete the Nonresponse Followup (NRFU) operation using paper that increased the amounts of kits, supplies, and materials that would be needed.

The kits model used by FLD was a series of excel spread sheets developed by staff at the beginning of the 2004 Census Test. The staffing numbers that were used in the kit model were provided by Field Division. The kit model was refined for the 2006 Census Test and the abbreviated 2008 Dress Rehearsal. In addition, when the decision was made to revert to a paper NRFU data collection operation in 2010, the model was revised to allow for an increase in the number of kits and supplies needed by the field staff and an increase in the number of administrative forms that would be needed for appointing and paying additional field staff.

#### **5.11 Did installed furniture meet the operational requirements for office spaces?**

Yes, the furniture rented from CORT furniture met the operational requirements of the LCOs and RCCs. There was one task chair that was exchanged several times in the ELCOs that warranted CORT to change supply vendors for the LCOs. The replacement chair did not have any problems and there were no additional costs incurred as a result of the chair replacement/delivery.

As office spaces were accepted, Census Bureau's furniture supplier, CORT, delivered and installed the office furniture. The type and quantity of furniture necessary to support the office infrastructure was identified based on staffing and space design for each location. Immediately after offices were opened, non-automated equipment (copiers, mail meters, etc.) and supplies were delivered to prepare arriving staff for operational activities.

The Census Bureau instituted a recommendation by Jacobs, Inc, for a desk arrangement – “the boat concept”, which provided efficient space for staff including access to computers and workstations. The boat concept included 13 pieces of furniture in a 12’x32’ module, which provided flexibility and efficient use of the office space. There were 11 standardized desks that were 30”x48”, within the boat. There were also 2 layout tables, which were used for informal meetings with staff. In addition, there was space under the layout tables, which could be used for storage.

#### **5.12 What percent of furniture needed to support the 2010 Census arrived on time?**

The vendor delivered and installed 100 percent of the furniture according to the 2010 Census schedule.

**5.13 How were office supplies ordered and handled? How was the re-ordering of supplies handled?**

NPC assembled and shipped bulk supplies and recruitment kits to the RCCs to support initial recruiting and administrative operations. In 2009, the Census Bureau opened 151 ELCOs, and NPC shipped recruitment, bulk and operational kits to each ELCO to support field activities.

The RCCs were provided with a base list of supplies that were available at NPC. The basic list of supplies are items typically used in an office setting ( e.g. pens, pencils, paper clips, binders, and rubber bands). The RCCs were also provided with purchase (credit) cards that allowed the RCCs to order additional supplies through General Services Administration (GSA) Global Supply or local sources, if necessary.

The LCOs received bulk supplies in two separate shipments. All supplies were received well in advance of operations starting in the field. To order additional supplies, the LCO would notify the appropriate RCC to order any additional supplies that were needed. A Supply Order Request Form was completed by the RCCs for their respective LCOs to document the request for additional supplies. All orders were delivered by ground transportation or Federal Express depending on the urgency of the order(s).

**5.14 If supplies were not ordered in a timely fashion for kit assembly and production in the Local Census Offices what were the reasons and impacts? What percent of supplies needed to support the 2010 Census arrived on time?**

Training material arriving late at NPC was an issue. For example, Address Canvassing was delayed to the point the operation was in jeopardy of starting on time in the field. NPC had to work five weeks of overtime and prioritize the order of kits in order to print the required forms, assemble kits, and ship them to the ELCOs. Recruiting and administrative kits consumed many hours of overtime due to lack of materials being available to NPC. The Puerto Rico kits associated with almost all the operations had translation delays, which in turn meant assembly delays at NPC. The Excel spreadsheets provided at the weekly FLD meeting highlighted missing forms.

Due to the inadequate focus on materials planning within the structure of operational plans for executing the decennial census, there were situations where procurement staff had no insights into the requirements until a memorandum or specification file was issued along with a date needed. In many cases, the date needed was not provided with knowledge of the standard lead time or the existing inventory of materials (nation wide) among the several competing suppliers. Wherever possible, and whenever necessary, the procurement staff would split volumes to multiple vendors to find sufficient quantities to meet requirements. In other cases, regardless of procurement actions, the materials were not available in sufficient quantity because suppliers had limited inventory. Those same suppliers had to rely on responsiveness of manufacturers. Under these conditions a standard lead time to procure was not applicable and there was no preexisting

relationship with vendors that would allow them to stock materials in anticipation that the Census Bureau may need something.

New requirements or changes to the requirements during the conduct of census activities, with minimal forewarning, resulted in acquisition challenges, (for example, corn huskers lotion). The requirement to provide corn huskers lotion in each crew leader kit for the fingerprinting operation exceeded the total available inventory of the product from all existing sources. The same situation presented itself when a different messenger envelope was needed: insufficient inventory existed from all suppliers, and the manufacturers were required to produce more before our orders could be completed.

Nevertheless, one hundred percent of supplies needed to support the 2010 Census arrived on time.

#### **5.15 What procedures were put into place for the 2010 Census Logistics Program?**

Weekly meetings were held to discuss the status of materials. Kit assembly strategies were discussed with NPC if materials were going to be late. In addition, excel spreadsheets were used to track kit requirements that were distributed by memorandum.

The Oracle Order Entry/Inventory (OE/I) System was used to track kits. Its primary use was to record the delivery of materials into the warehouse, and to record the withdrawal of materials as they are used to create kits or as the items were used. The OE/I System was also used to generate a listing of materials required per kit. This list was used to order the materials needed for kit assembly.

Once kits were assembled, the OE/I System was updated and used as a method to track the number of kits shipped to each LCO/RCC.

#### **5.16 What process did Logistics Planning and Operation Branch use to keep track of kit models?**

Each kit model (spreadsheet) was associated with a memorandum and was given a unique number according to its memorandum category. Memoranda referencing forms included the census year identifier for forms (e.g., Decennial, Dress Rehearsal). Each memorandum also had a unique Field Implementation Number to track all memoranda regardless of category. Memoranda were stored on a computer in folders in numerical order on the shared drive and signed memoranda were also posted on the Census Bureau Intranet for Headquarters (HQ) reference and on the Field Data Collection Automation Portal for RCC and LCO reference.

The memoranda showed the kit numbers, description, list of materials, distribution list, and quantities needed.

**5.17 What was General Services Administration Global Advantage's role for logistics in the 2010 Census?**

Any item that the RCCs deemed necessary for LCOs that was not available through NPC was ordered from GSA's Global Advantage, such as alpha file dividers, date stamps, correction tape, letter openers, ink jet labels, and hole punches. The RCCs were responsible for managing the use of GSA's Global Advantage for their respective LCOs.

**5.18 Was the Census Bureau's contract with the Government Printing Office beneficial for logistics and National Processing Center in the 2010 Census? What changes are recommended for the 2020 Census?**

The Census Bureau partnered with the GPO to establish printing contracts with commercial vendors to support the printing requirements of the 2010 Census. The contracts were based on print quantities and delivery time. When the materials were received late, it did not allow for the GPO contractors to print the quantities needed in the timeframe that would allow NPC to start kit assembly according to schedule.

Printing requirements were determined by identifying those materials that were being developed and estimating the number of pages each of those items might contain. By combining this information with the quantity required in each kit and the number of kits required by the operational branch, the total pages to print were calculated. Under the Joint Committee on Printing (JCP) Regulation, the internal printing limits are 5,000 copies per page with a maximum of 25,000 copies per print order. In preparation for the 2010 Census, the Administrative and Customer Services Division (ACSD) and NPC, working with the GPO, established the GPO 951 Printing Program at NPC. This program allowed the Census Bureau to print on demand and not be in violation of the JCP regulations. This option also provided NPC with the flexibility to assemble kits in a more efficient and effective manner.

Adequate time to print refers to the time between availability of the print-ready file and the scheduled start of kit assembly. The measurement was the date on the calendar, the start date for kit assembly from the schedule, and the standard lead time available through individual GPO contracts for each print job. If the time between the availability of the print-ready file for the item and the start date for kit assembly permitted an off-site GPO vendor to respond and deliver, the order was placed through a new GPO print contract order. If the time was too short for the vendor to deliver (less than ten days), the NPC on-site GPO print vendor printed the amount of copies needed to begin kit assembly. The NPC on-site GPO print vendor would print only enough to sustain assembly until an off-site print contract could be awarded. During the peak of kit assembly for the 2010 Census, the decision on what printing options were used was a day to day management decision. No data were collected to track which option was used.

The Census Bureau on-site GPO vendor printed over 196 million pages for operational kits.

### **5.19 What was the process for assembling 2010 Census kits in National Processing Center? Was it more cost and time efficient than what was used in Census 2000?**

During the 2010 Census, NPC established an assembly line methodology to prepare operational kits and some supply kits, for distribution to the RCCs and LCOs to accomplish both training and various data capture operations.

There were a total of 18 assembly lines. There were three configurations of assembly lines with six of each configuration. The configuration was simply the number of fixed workstations on each line, as follows:

Configuration #1 = 10 workstations

Configuration #2 = 20 workstations

Configuration #3 = 30 workstations

The basic idea of an assembly line is that a kit is progressively assembled as it is transported past fixed workstations by a material handling device such as a conveyor belt. The work elements, that is the work performed at each workstation, was established through the division of labor principle so that each work station has nearly an equal amount of work to perform to complete the kit assembly. At each work station, the assembly clerk performs the work repeatedly on each kit as it passes their work station. The notion of progressive assembly and the division of labor to nearly equal amounts is to achieve a condition where one minimizes the total amount of idle time and the total number of work stations required for a given assembly line speed or pace.

The line speed, or pace, utilized for all 18 assembly lines was 15 feet per minute.

Specific material (any one of several different forms, manuals, etc.) was assigned to each work station to be utilized on each assembly line for each individual kit. Materials were presented to the assembly clerk on a section of roller conveyor (supply conveyors) which moved accumulated materials to the assembly clerk at the point of assembly near the moving conveyor belt. Material handlers and laborers moved material to these supply conveyors and loaded the materials onto the roller conveyors. The supply conveyors were set up to provide “gravity feed” movement to the point of assembly.

Conveyor belts moving at 15 feet per minute created a cycle time of eight seconds during which all work activity for all workstations had to be completed. Where the material assigned to a workstation required counting a large quantity, the material was “pre-counted” elsewhere and delivered to the assembly line in a “ready to assemble” condition. All of the 18 paced assembly lines were able to deliver 450 cycles per hour and if the assembly line crew kept the pace, their output would also be 450 kits per hour. Note: Pre-counting hours were tracked and included in the total hours used in all productivity calculations where it applied.

Each kit started at Work Station Number 1 where the first item was assembled into the kit container (poly bag, portfolio bag, or carton). As the kit progressed to and through each subsequent work station the assembly clerk at each work station assembled their respective material into the kit. At the conclusion of the assembly line the kit is completely assembled. Once the first kit exits the first workstation, another kit is placed there and the next cycle begins. As the first kit completes the entire assembly line, subsequent kits arrive, at a rate of up to 450 per hour of assembly line operation.

The total cost of conveyors, stools, mats, work benches, pallet handling equipment, and totes was \$873,211.81.

The Census 2010 kit assembly process was a high volume, high mix, low speed assemble-to-order fulfillment operation using assembly lines with automated conveyors, hydraulic pallet lifts, and an industrial carton maker for the first time. The kit assembly process that was used in Census 2010 was a major departure from what was used in Census 2000. In Census 2000, a piecework kit assembly model was established. In this model, an entire kit was individually built by one person, who then sent it down a manual conveyor belt, where a quality assurance check occurred and then the kit was palletized for shipment. In addition, in Census 2000 each carton that was used to fill materials for the field was individually made by hand. The kit assembly process used in Census 2010 was more cost and time efficient than the kit assembly process that was used in Census 2000.

## **5.20 What were the operational branches' roles in the logistics process?**

One year before the first training session for each operation, draft specifications were provided to the respective operational branch and the RCCs. Once these specifications were approved by the operational branch, and the date that the kits were required in the LCOs was established, a draft kit assembly memorandum was issued to NPC. A weekly conference call was established to discuss the status of training materials and their availability for printing. If materials were going to be late and would impact kit assembly an alternate printing plan was developed that would keep kit assembly on schedule. Eight months before the first training session for each operation, a final kit assembly memorandum was issued to NPC.

The operational branches provided training materials for printing and distribution to FLD, updates and feedback regarding material quantities and due dates to the RCCs and LCOs, and any special instruction for NPC for the assembly and shipping process.

## **5.21 What role did National Processing Center perform in the quality assurance process?**

One of the major "Lessons Learned" from Census 2000 was the need for a better Quality Assurance (QA) review of materials before they were printed and released to the field. Several major items were printed with errors during Census 2000, which caused

operational confusion in the field. In order to mitigate this risk, the NPC Statistical Methods and Quality Assurance Branch reviewed the 2010 Census materials. If errors were found in the QA process used to review field operational materials, they were returned to FLD for correction.

#### **5.22 What were the major obstacles that 2010 Census Logistics Program encountered during the 2010 Census?**

There were three major obstacles that the 2010 Census Logistics Program encountered:

- The length of time it took to procure some expendable items, including standard office supplies, such as pencils, pens, paper clips, rubber bands, folders, binders, labels, staplers, staples, and envelopes. The time needed to procure expendable items needs to begin earlier to ensure that they are available for kit assembly. Not having expendable items available delayed NPC's ability to build kits according to schedule. However, no kits were delivered late to the LCOs. To mitigate the risk of not meeting the delivery schedule, FLD and NPC purchased expendable items in waves, which allowed materials to be delivered in smaller increments. The procurement of expendables is a complex process. The kit models provided to NPC from FLD are the basis for which orders are placed with vendors. If the kit models provided are drafts and not final, the quantities needed will change as new data are provided. The decennial census is the largest non-military operation that the government conducts. The sheer numbers of items needed are beyond the normal inventory capacity of most vendors. Hence, the earlier that NPC can project to vendors what quantities will be needed and that funding is available dictates the timing of purchases. To deal with the kit assembly process and schedule, FLD and NPC held weekly conference calls to strategize which kits would have priority for kit assembly based on the availability of expendables. Expendables were purchased in waves (amounts needed to keep kit assembly on schedule). Without this approach, kits would have been delivered to the LCOs/RCCs late.
- The lack of an established quality assurance process in the operational branches to review training materials, manuals, forms, etc. before being sent to print.
- The inability to track materials at the time information is most needed for decision-making, particularly during the peak activity period between July 2009 and February 2010. The lack of an integrated logistical management and tracking system posed tremendous problems to management and operations. The problems included "uncertainty" about whether items were actually available or not, whether additional materials should be printed or ordered, when shipments could be made, and in some cases whether there were sufficient items shipped.

#### **5.23 What were the major successes for 2010 Census Logistics Program during the 2010 Census?**

There were four major successes for the 2010 Census Logistics Program:



- Most field operational kits were assembled and delivered on time which allowed field operations to start according to the schedule.
- A new kit assembly system was utilized at NPC which reduced labor cost and increased productivity.
- The GPO 951 Printing Program gave the Census Bureau the flexibility in printing that kept the kit assembly process moving.
- Improved communication between FLD and NPC. The weekly conference call between these two organizations significantly improved communications.

## **6. Cost**

The total cost of the 2010 Census Logistics Program was \$325.4M which represents 99.6 percent of the budget allotted for the program over the three-year period from FY 2008 – FY 2010. The main reason the program completed under budget can be directly attributed to a reduction in the cost of kit preparation and assembly. The budget for the 2010 Census Logistics Program consisted of funding for field operational kits; RCC, PRAO, and E/LCO furniture, supplies, fingerprinting training material, and supplies; and printing costs. Appendix B shows the total cost of the 2010 Census Logistics Program.

## **7. Related Evaluations, Experiments, and/or Assessments**

This section does not apply.

## **8. Key Lessons Learned, Conclusions, and Recommendations**

### **8.1 2010 Census Logistics Program Lessons Learned**

(a) The materials management issues surrounding the 2010 Census constitute a significant portion of the need for a logistics function within the Census Bureau, such as the need to automate:

- (1) kit assembly production reporting
- (2) material receipt transactions in the Integrated Logistics Management System,
- (3) procurement activities based on material demand, and
- (4) capture of “labor expended on kit assembly” tasks.

(b) The MAS did not attempt to list or schedule individual materials and their respective due dates. Neither common materials nor materials produced exclusively for use during 2010 Census were identified on the schedule or tracked to ensure delivery on a timely basis to conduct kit assembly operations. For example:

- (1) Durations of activities in the MAS did not reflect the 2010 Census assembly methods used at NPC and the MAS schedule logic for materials needed for assembly was not appropriate to the assembly task,
- (2) Due dates for material were the same as due dates for assembly. In other words, a required kit material could be delivered on the final day of kit assembly and be considered “on-time,” per the schedule, and
- (3) Most of the operational kit assembly operations experienced the delivery of approximately 60 percent of the materials required before the first kit could be scheduled and assembled, and this 60 percent was achieved well into the duration of kit assembly; 20 percent to 30 percent of the duration had already been consumed.
- (4) Allow additional time for translation of materials when developing the MAS for logistics.

## **8.2 2020 Logistics Program Recommendations**

- (1) Implement an Integrated Logistics Management System that includes:
  - a) A fully automated inventory system that connects FLD Logistics, NPC, Finance Division, RCCs and LCOs.
  - b) Use of barcode technology to capture receipt and distribution of inventory at NPC, RCCs, and LCOs.
  - c) Fully define the management role and provide training in the LCO for inventory control.
  - d) Explore printing alternatives for print on demand capability.
  - e) The timing of funding was not consistent with the MAS plan of activities. The time at which funding is provided should bear a much closer resemblance to the schedule detailed by the MAS to avoid circumstances that lead to costly responses in logistics functions. For example, if the task to deploy ELCOs is to occur during the 4th Quarter of FY2018, funds to procure required materials, warehouse space, and staffing to manage and execute these activities should be available before 4th Quarter of FY2018. If the task is to deploy all LCOs (not just 30 percent of them as ELCOs), then the level of

funding must also be increased to accommodate the increase in required spending to support the task.

## **9. Acknowledgements**

DMD would like to thank Field Division and the National Processing Center (NPC) staff for their assistance in documenting the 2010 Census Logistics Program activities.

## **10. References**

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Field Division (2007). "U.S. Census Bureau 2007 Kit Forecast for OMB." July 2007.

National Processing Center (2011a). 2010 U.S. Census Bureau, Decennial Assessment Report, "Printing, Kit Assembly, and Warehousing Operations." January 2011.

National Processing Center (2011b). "NPC Kit Production Summary, Condensed Master File." March 2011.

## Appendix A: 2010 Census Non-IT Equipment and Furniture Cost

### 2010 Regional Census Centers

<i>Black &amp; White Copiers</i>	\$ 826,300
<i>Color Copiers</i>	\$ 876,960
<i>Pallet Jacks</i>	\$ 3,756
<i>Hand Trucks</i>	\$ 9,750
<i>Shredder</i>	\$ 28,574
<i>Mail Meter</i>	\$ 127,478
<i>Fax Machine</i>	\$ 20,748
<i>Filing Cabinets</i>	\$ 428,603
<i>Furniture</i>	\$ 5,844,820
<i>Other Equipment</i>	\$ 33,178
<b>Total Cost</b>	<b>\$ 8,166,991</b>

### 2010 Local Census Offices

<i>Black &amp; White Copiers</i>	\$ 10,835,128
<i>Pallet Jacks</i>	\$ 102,415
<i>Hand Trucks</i>	\$ 133,590
<i>Shredder</i>	\$ 1,261,930
<i>Mail Meter</i>	\$ 248,320
<i>Fax Machine</i>	\$ 269,430
<i>Furniture</i>	\$ 26,447,761
<b>Total Cost</b>	<b>\$39,298,574</b>

Source: Financial Management Reports

**Appendix B: Total Cost for 2010 Census Logistics Program**

<b>Fiscal Year</b>	<b>Total Allocation</b>	<b>Actual Cost</b>
<b>FLD RCC Furniture/Supplies/Namecheck &amp; Fingerprint</b>		
2008	\$4,128,642	\$5,225,190
2009	\$6,892,640	\$9,094,996
2010	\$10,692,084	\$11,482,331
<b>FLD LCO Furniture/Supplies/Namecheck &amp; Fingerprint</b>		
2008	\$10,097,305	\$10,103,848
2009	\$14,467,551	\$15,688,936
2010	\$44,848,195	\$46,094,101
<b>Kit Preparation</b>		
2008	\$6,000,000	\$5,532,002
2009	\$94,886,947	\$91,370,975
2010	\$56,803,707	\$53,403,169
<b>NPC Fingerprinting (Associated Kit Costs)</b>		
2008	\$2,495,072	\$2,656,332
2009	\$36,602,825	\$27,154,435
2010	\$1,218,755	\$1,332,185
<b>Printing</b>		
2008	\$0	\$1,793,814
2009	\$26,853,235	\$33,645,691
2010	\$10,741,294	\$10,808,868
<b>TOTAL</b>	<b>\$326,728,252</b>	<b>\$325,386,873</b>

Source: Financial Management Report (FMR)