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Appraisal of Federal Government Cobol Standards and Software Management: Survey Results

Donald R. Deutsch

Systems and Software Division
Institute for Computer Sciences and Technology
National Bureau of Standards
Washington, D. C. 20234

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Final Report

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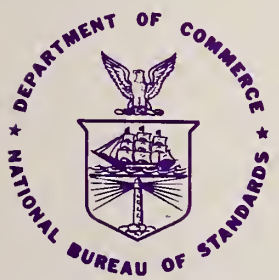

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

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U.S. DEPARTMENT OF COMMERCE, Elliot L. Richardson, *Secretary*

Edward O. Vetter, *Under Secretary*

Dr. Betsy Ancker-Johnson, *Assistant Secretary for Science and Technology*

NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Acting Director*

PREFACE

The author gratefully acknowledges the contributions of the following staff members of the Systems and Software Division, Institute for Computer Sciences and Technology.

-- DENNIS W. FIFE and MABEL V. VICKERS conceived and directed the entire project. Their support and encouragement were essential to the successful completion of this document.

-- ERICA JEN encoded, recorded in machine readable form and validated the response data. She also produced many of the statistical results included in this document using two generalized statistical packages, SPSS and OMITAB. Finally, she assisted in preparing aggregate presentations and reviewed textual and tabular entries for correctness.

-- JOSEPH C. COLLICA established a data base using the System 2000 generalized data base management software on the Infonet time-sharing network. Many of the results were derived using the query capability of this generalized data management tool.

Of course, any errors or omissions are solely the responsibility of the author.

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APPRAISAL OF FEDERAL GOVERNMENT COBOL STANDARDS AND SOFTWARE MANAGEMENT: SURVEY RESULTS

Donald R. Deutsch

This report summarizes the results of a survey of selected Federal Government Automatic Data Processing (ADP) installations. Undertaken primarily as an evaluation of National Bureau of Standards (NBS) activities in support of the standardization of the COBOL programming language, the study also dealt with software management tools and practices.

The survey sample was selected from a subset of all known Federal Government ADP units; specifically, only domestic installations with at least one general purpose hardware system capable of supporting a modern COBOL compiler were included. Responses were received from over 70 percent of the 190 installations included in the sample.

The major portion of this document is made up of tabular summarizations of all responses for each survey question. Gross statistics and frequency distributions are presented on a question by question basis. No interquestion relationships are analyzed. The appendices include a comprehensive discussion of the sampling methodology and survey mechanics and a reproduction of the survey instrument with cross references to response tabulations appearing in the report.

KEY WORDS: ADP; COBOL; Federal ADP installations; Federal Standard COBOL; Impact evaluation; Sample; Software management; Survey.

1. INTRODUCTION

1.1 Background

The National Bureau of Standards recently completed an evaluation of impact of its activities in support of the standardization of the COBOL programming language. As part of this study, a survey of selected Federal Government ADP installations was undertaken. The survey instrument, Appraisal of Federal Government COBOL Standards and Software Management, requested information about: installation and computer usage characteristics, software management tools and techniques, and COBOL usage and standardization. The

responses, in addition to being useful for COBOL impact analysis purposes, are also of general interest; the comprehensive nature of the questions and the broad coverage of the sample provided results representative of a large segment of the Federal ADP community.

1.2 Report Purpose and Organization

The purpose of this document is to present the results obtained from the survey in a form which will facilitate their use by most interested parties. To achieve this objective, the remainder of the report is divided into two sections and two appendices. The next section describes the survey, its methodology, the response rates and the applicability of results. Section 3, which comprises the bulk of this document, includes tabulations of aggregate responses for all survey questions. It is expected that most information requirements will be satisfied by Sections 2 and 3. It is important that, as with any statistical sample, the results of this study be viewed only within the context of the sampling plan and those actually responding. Appendix A includes a detailed description of the sampling methodology and survey mechanics.

Finally, Appendix B contains a copy of the survey instrument with cross-references to tabulations included in the report superimposed over each question. Readers can also go from the aggregates in Section 3 to specific questions in Appendix B by using references in table headings.

1.3 Availability of Detail Response Data

Details for all coded responses will be available in hard copy form to those wanting to analyze the data further. Inquiries about the availability of the source data used for generating the aggregates appearing in section 3 should be directed to:

National Bureau of Standards
Institute for Computer Sciences
and Technology
TECH A367 640.02
Washington, D. C. 20234
Telephone (301) 921-3491

2. SURVEY DESCRIPTION

2.1 Methodology Overview

A subset of all known Federal Government ADP units was taken as the population for the survey. Specifically included were domestic installations with at least one general purpose hardware system capable of supporting a modern COBOL compiler. From this limited population, a sample of 190 ADP units was selected using strict random selection procedures.

Questionnaire packets were sent directly to installation managers. Control and follow-up were based on questionnaire receipt cards; the survey instrument, which promised confidentiality, was not signed or coded to identify respondents.

Responses were encoded and recorded in machine readable form to facilitate processing. Generalized software packages were utilized for validation, data analysis and data retrieval.

Appendix A describes the survey methodology in detail. Included are discussions of the population, sample selection, data gathering and data analysis procedures.

2.2 Response Rates

Of the 190 ADP units surveyed, 142 responded. Five of these respondents indicated that the questionnaire was not pertinent to their operation. The remaining 137 answered some or all of the questions.

Because respondents were promised anonymity, returned questionnaires could not be identified as coming from specific ADP units or department/agency categories. Follow-up was done, therefore, using questionnaire receipt cards. The 137 cards returned represented 72% of all installations sampled. Because we have no mechanism for matching questionnaire receipt cards to returned survey instruments, no statement can be made about the degree of overlap between those returning cards and those returning questionnaires.

2.3 Applicability of Results

The terms STATISTIC and PARAMETER refer to the results of calculations using sample data and all data points in a population, respectively. Using these terms, the essence of the sampling process is the use of statistics as estimators of corresponding population parameters. The "goodness" of a statistical estimate is dependent on several factors. One

is the size and representativeness of the sample. Random sampling techniques such as those employed in this study are designed to assure that the sample truly represents the population. Indeed, with 100% response, results from a random sample of sufficient size should closely approximate those of the population. However, when response rates fall much below 100%, there is reason to question the characteristics of those not responding and thus the representativeness of the responses received.

One rule of thumb often applied to survey results states that at least 80% to 85% of all instruments must be returned before results can be correctly extrapolated to the population. According to this rule, the response numbers reported in the previous section are not sufficient to support the conclusion that the results are representative of the entire population.

Even when the response rate is large enough to allow the use of survey results for estimating population characteristics, statistical extrapolations must be made in light of the population sampled. The population for this study included only those ADP units listed in the 1974 GSA inventory having at least one hardware system classified as general purpose located in this country that could support a modern COBOL compiler (see Appendix A).

These caveats do not preclude the enlightened use of the survey data, however. Questionnaire and receipt card response rates that exceed 70% indicate that the survey results reflect the practices of a substantial portion of Federal ADP installations. While we cannot claim statistical significance, there is no evidence that the results are biased. Because the responses comprise a relatively large compendium of Federal COBOL usage and software management, many individuals in both the public and private sectors have expressed interest in obtaining the survey results. This document was written to satisfy those requests.

3. AGGREGATE RESPONSES

3.1 Guide to Tables

This section of the report is made up of tabular presentations of aggregate responses for all questions in the Appraisal of Federal Government COBOL Standards and Software Management questionnaire. The table of contents at the front of this document includes the general subject areas addressed. To make accessing the information easier, figure 3.1 lists all tables by general and specific subject area along with page numbers and questionnaire references. Tables and corresponding explanatory narrative paragraphs have matching numbers and titles. Another way to access the tables that make up this section is to use the cross-references superimposed on the survey instrument in Appendix B.

Responses are displayed in a manner designed to impart a maximum amount of information while still allowing the brevity of presentation associated with reporting aggregates. In addition to gross statistics such as totals and averages, wherever possible numbers of similar responses are presented. Numbers and percentages for question respondents and nonrespondents appear in the tables or their supporting text; the number of installations that answered all or part of the questionnaire, 137, was used as the denominator when calculating these ratios. All results are reported on a question-by-question basis; analyses of interquestion relationships are not included.

GUIDE TO AGGREGATE RESPONSE TABLES

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Figure 3.1

3.2 Characteristics of Responding Installations

3.2.1 Budget Data. Two survey questions were concerned with respondents' budgets for automatic data processing hardware, software, personnel and services. The first asked for a gross indication of total annual ADP cost. The second requested estimates for the percentages of total annual ADP expenditures allocated to various budget categories. Summaries of responses to these questions follow.

3.2.1.1 Total Annual ADP Cost. The numbers and percentages of respondents reporting total annual costs for automatic data processing hardware, software, and personnel in each of six budget categories are summarized in this table. A conservative estimate of the average annual budget for all question respondents, derived by using midpoints for the lower five classes and $5.5 million to represent the largest budget class, is $2.0 million.

ANNUAL ADP BUDGET AMOUNTS

Summary of Question I-A Responses

Annual Budget Amount Categories	Respondents	
	Number	Percent
ADP Budget < $1 Million	62	46.6
$1 Million ≤ ADP Budget < $2 Million	28	21.0
$2 Million ≤ ADP Budget < $3 Million	9	6.8
$3 Million ≤ ADP Budget < $4 Million	7	5.3
$4 Million ≤ ADP Budget < $5 Million	5	3.8
$5 Million < ADP Budget	22	16.5
Respondents	133	97.1
Nonrespondents	4	2.9

Table 3.2.1.1

3.2.1.2 ADP Budget Allocations. The numbers of respondents reporting percentages of total ADP budgets applied to budget allocation categories are presented for five percentage point intervals. Average allocation percents for all respondents also appear. The 129 installations answering this question represent 94.2% of all respondents; eight installations (5.8%) did not answer.

PERCENTAGE OF TOTAL ADP COST APPLIED TO BUDGET CATEGORIES

Summary of Question I-B Responses

Budget Allocation Categories	Percent of ADP Budget Applied																					Total Respondents	Average Pct.
	0	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-100		
Hardware and maintenance	1	4	17	10	18	22	18	8	14	3	5	1	2	2	1		1		1	1		129	26.8
Proprietary software	93	30	4	1	1																	129	1.0
Contract personnel and consultants	86	24	5	4	3	4	1	1		1												129	3.1
In-house personnel (except management)	4	1	1	3	3	4	9	1	13	16	22	12	20	8	5	6	1					129	46.0
Management	12	51	39	12	9	3		1		1						1						129	8.0
Computing supplies (cards, tapes, etc.)	1	55	45	12	13	1		1	1													129	8.2
Overhead (excluding items 5 and 6 above)	60	35	14	7	6	2	3		2													129	4.7
Other	87	32	4	3	2														1			129	2.2
	Number of Respondents																						

Table 3.2.1.2

3.2.2 Hardware. Respondents were asked to list computer systems by manufacturer and model number, to estimate approximate system value based on CPU purchase price, and to indicate how each system was acquired. A total of 520 computer systems were specified by the 137 installations responding to this question. Thus, the average respondent had 3.8 computer systems. Results are summarized in the five tables in this section.

3.2.2.1 Computer System Manufacturers. Numbers and percentages for computer systems and respondents having computer systems are tabulated by hardware manufacturer. For example, the first line of the table indicates that 23 responding installations have 73 Burroughs computer systems; these counts represent 16.8% of all respondents and 14.0% of all computer systems respectively. Because many respondents listed computer systems from more than one manufacturer, the manufacturer categories are not mutually exclusive; response tabulations and percentages therefore do not sum to 100%.

COMPUTER SYSTEM MANUFACTURERS

Partial Summary of Question I-C Responses

Computer System Manufacturer	Computer Systems		Responses	
	Number	Percent	Number	Percent
Burroughs	73	14.0	23	16.8
Control Data	39	7.5	22	16.1
Digital Equipment	17	3.3	8	5.8
Data General	5	1.0	4	2.9
Honeywell/GE	57	11.0	33	24.1
IBM	202	38.8	81	59.1
Univac/RCA	99	19.0	28	20.4
Other	27	5.2	12	8.7
Not Specified	1	.2	1	.7
Totals	520	100.0	212	
Respondents			137	100.0
Nonrespondents			0	0

Table 3.2.2.1

3.2.2.2 Computer System Acquisition. Numbers and percentages for computer systems and respondents having computer systems are tabulated for three hardware acquisition methods: leased, owned, and mixed (both leased and owned). For example, the first line of the table indicates that 57 responding installations lease 130 computer systems; these counts represent 41.6% of all respondents and 25.0% of all computer systems, respectively. Because many respondents acquired computer systems in more than one way, acquisition method categories are not mutually exclusive; response tabulations and percentages therefore do not sum to 100%.

COMPUTER SYSTEM ACQUISITION METHODS

Partial Summary of Question I-C Responses

Computer System Acquisition Method	Computer System		Responses	
	Number	Percent	Number	Percent
Leased	130	25.0	57	41.6
Owned	350	67.3	98	71.5
Mixed (both leased and owned)	36	6.9	15	10.9
Not specified	4	.8	3	2.2
Totals	520	100.0	173	
Respondents			137	100.0
Nonrespondents			0	0

Table 3.2.2.2

3.2.2.3 Computer System Value. Numbers and percentages for computer systems and respondents having computer systems are tabulated for estimated ranges of system value. For example, the first line of the table indicates that 48 responding installations have 144 computer systems with approximate value less than $50,000; these counts represent 35.0% of all respondents and 27.7% of all computer systems, respectively. Because many respondents listed computer systems with different values, approximate system value categories are not mutually exclusive; response tabulations and percentages therefore do not sum to 100%.

COMPUTER SYSTEM VALUES

Partial Summary of Question I-C Responses

Approximate Computer System Value Based on CPU Purchase Price	Computer Systems		Responses	
	Number	Percent	Number	Percent
Less than $50,000	144	27.7	48	35.0
$50,001 to $200,000	132	25.4	53	38.7
$200,001 to $500,000	99	19.0	40	29.2
$500,001 to $1,500,000	69	13.3	45	32.8
More than $1,500,000	67	12.9	34	24.8
Not Specified	9	1.7	4	2.9
Totals	520	100.0	224	
Respondents			137	100.0
Nonrespondents			0	0

Table 3.2.2.3

3.2.2.4 Cross-Tabulation of Acquisition Methods By Manufacturer. Computer systems are tabulated according to hardware manufacturer and acquisition method. Each non-zero cell contains four entries pertaining to a specific manufacturer (row) and acquisition method (column). From top to bottom these entries are:

- X_{ij} — the number of reported computer systems that were produced by the row manufacturer and acquired in the column manner.
- $\frac{X_{ij}}{\sum_j X_{ij}}$ — the percentage of all reported computer systems produced by the row manufacturers that were acquired in the column manner.
- $\frac{X_{ij}}{\sum_i X_{ij}}$ — the percentage of all reported computer systems acquired in the column manner that were produced by the row manufacturer.
- $\frac{X_{ij}}{\sum_i \sum_j X_{ij}}$ — the percentage of all reported computer systems (all manufacturers and all acquisition methods) that were produced by the row manufacturer and acquired in the column manner.

where: i is a row index = 1, ..., 9

j is a column index = 1, ..., 4

X_{ij} = number of computer systems acquired from the i/th manufacturer in the j/th manner.

CROSS-TABULATION OF COMPUTER SYSTEM ACQUISITION METHOD BY MANUFACTURER

Partial Summary of Question I-C Responses

Table Entries: Number / Row Percent / Column Percent / Total Percent		Computer System Acquisition Method			
		Leased	Owned	Mixed	Not Specified
Computer System Manufacturer	Burroughs	36 49.3 27.7 6.0	21 28.8 6.0 4.0	15 20.5 41.7 2.9	1 1.4 25.0 .2
	Control Data	11 28.2 8.5 2.1	25 64.1 7.1 4.8	1 2.6 2.8 .2	2 5.1 50.0 .4
	Digital Equipment	0	17 100.0 4.9 3.3	0	0
	Data General	0	5 100.0 1.4 1.0	0	0
	Honeywell/GE	24 42.1 18.5 4.6	30 52.6 8.6 5.8	3 5.3 8.3 .6	0
	IBM	33 16.3 25.4 6.3	157 77.7 44.9 30.2	12 5.9 33.3 2.3	0
	Univac/RCA	13 13.1 10.0 2.5	81 81.8 23.1 15.6	5 5.1 13.9 1.0	0
	Other	13 48.1 10.0 2.5	14 51.9 4.0 2.7	0	0
	Not Specified	0	0	0	1 100.0 25.0 .2

Table 3.2.2.4

3.2.2.5 Cross-Tabulation of Value by Manufacturer. Computer systems are tabulated according to hardware manufacturer and estimated system value. Each non-zero cell contains four entries pertaining to a specific manufacturer (row) and acquisition method (column). From top to bottom these entries are:

- X_{ij} — the number of reported computer systems that were acquired from the row manufacturer and have the column value.
- $\frac{X_{ij}}{\sum_j X_{ij}}$ — the percentage of all reported computer systems produced by the row manufacturer that have the column value.
- $\frac{X_{ij}}{\sum_i X_{ij}}$ — the percentage of all reported computer systems with the column value that were produced by the row manufacturer.
- $\frac{X_{ij}}{\sum_i \sum_j X_{ij}}$ — the percentage of all reported computer systems (all manufacturers and all values) that were produced by the row manufacturer and have the column value.

where: i is a row index = 1, ..., 9

j is a column index = 1, ..., 6

X_{ij} = number of computer systems acquired from the i/th manufacturer with the j/th value.

CROSS-TABULATION OF COMPUTER SYSTEM VALUE BY MANUFACTURER

Partial Summary of Question I-C Responses

Table Entries: Number / Row Percent / Column Percent / Total Percent		Approximate Computer System Value Based on CPU Purchase Price					
		<50K	>50K ≤200K	>200K ≤500K	>500K ≤1500K	>1500K	Not Specified
Computer System Manufacturers	Burroughs	19 26.0 13.2 3.7	21 28.8 15.9 4.0	17 23.3 17.2 3.3	12 16.4 17.4 2.3	4 5.5 6.0 .8	0
	Control Data	5 12.8 3.5 1.0	3 7.7 2.3 .6	9 23.1 9.1 1.7	10 25.6 14.5 1.9	11 28.2 16.4 2.1	1 2.6 11.1 .2
	Digital Equipment	11 64.7 7.6 2.1	1 5.9 .8 .2	3 17.6 3.0 .6	2 11.8 2.9 .4	0	0
	Data General	2 40.0 1.4 .4	3 60.0 2.3 .6	0	0	0	0
	Honeywell/GE	5 8.8 3.5 1.0	14 24.6 10.6 2.7	9 15.8 9.1 1.7	8 14.0 11.6 1.5	21 36.8 31.3 4.0	0
	IBM	70 34.7 48.6 13.5	43 21.3 32.6 8.3	30 14.9 30.3 5.8	29 14.4 42.0 5.6	24 11.9 35.8 4.6	6 3.0 66.7 1.2
	Univac/RCA	25 25.3 17.4 4.8	39 39.4 29.5 7.5	25 25.3 25.3 4.8	3 3.0 4.3 .6	7 7.1 10.4 1.3	0
	Other	7 25.9 4.9 1.3	8 29.6 6.1 1.5	6 22.2 6.1 1.2	5 18.5 7.2 1.0	0	1 3.7 11.1 .2
	Not Specified	0	0	0	0	0	1 100.0 11.1 .2

Table 3.2.2.5

3.2.3 Job Mix. Two survey questions were concerned with the nature of respondents' computing job mixes. One requested approximate percentages of all jobs processed that fall in descriptive categories. The other asked for the percentage of total job mix that requires emulation of other hardware configurations. Responses to these questions are summarized in this section.

3.2.3.1 Job Categories. The numbers of respondents reporting percentages of all jobs processed within job categories appear for five percentage point intervals. Average percents of job mix for all respondents are also presented. The 133 installations answering this question represent 97.1% of all survey respondents; four installations (2.9%) did not answer.

PERCENTAGE OF COMPUTING JOB MIX FALLING IN JOB CATEGORIES

Summary of Question I-D Responses

Job Categories	Percent of All Jobs Processed																					Total Respondents	Average Pct.
	0	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-100		
Data processing/ accounting	14	19	8	6	4	1	5	6	5	5	8	2	1	3	2	6	8	7	7	8	8	133	43.8
Scientific/engineering/research	76	15	8	5	2	4	2	1	2	1	3	0	3	2	2	1	0	1	1	2	2	133	13.3
Command and control/ resource management	80	18	9	6	3	3	4	1	0	0	3	1	0	0	2	0	1					133	7.2
Laboratory data collection/ process control	117	7	2	2	0	1	1	1							1				1			133	2.3
Information retrieval	51	23	19	6	7	5	4	3	3	2	2	1	1	1	0	1	2	0	1	1		133	12.8
Software development and maintenance	25	38	27	13	10	5	7	2	1	1	1	1	0	0	0	1	0	0	0	1		133	11.6
Other	104	6	4	1	1	3	0	0	2	0	1	0	1	0	0	1	0	1	1	1	6	133	9.7
	Number of Respondents																						

Table 3.2.3.1

3.2.3.2 Emulation. The numbers and percentages of respondents reporting levels of emulation (simulation, liberation, etc.) of other hardware configurations are presented for ten percentage point intervals of the total job mix. Average levels of emulation were 2.6% of job mix for all respondents and 11.1% for those who do some emulation.

EMULATION OF OTHER HARDWARE CONFIGURATIONS

Summary of Question I-E Responses

Percentage of Job Mix Requiring Emulation	Respondents	
	Number	Percent
0 %	88	80.7
1-10 %	14	12.9
11-20 %	3	2.8
21-30 %	2	1.8
31-40 %	1	0.9
41-50 %		
51-60 %		
61-70 %		
71-80 %	1	0.9
81-90 %		
91-100%		
Respondents	109	79.6
Nonrespondents	28	20.4

Table 3.2.3.2

3.2.4 Personnel. Respondents were asked to indicate the number of fulltime equivalent in-house and contract personnel applied to specific functions. Reported personnel counts varied widely, from 0 to 4124 for in-house personnel and from 0 to 210 for contract personnel. Because aggregate counts were severely biased by the few installations with very large numbers of personnel, average percentages of total installation personnel applied to various job functions are presented. While 135 installations reported non-zero in-house personnel counts, only 35 indicated that contract personnel were used; these counts represent 98.5% and 25.5% of all survey respondents, respectively. The tabulations do not include installations not reporting or those reporting zero personnel.

INSTALLATION PERSONNEL APPLIED TO JOB FUNCTIONS

Summary of Question I-F Responses

Job Function	Average Percent of FTE Personnel Applied to Job Functions	
	In-House	Contract
Data Entry or Preparation	19.7	29.7
Clerical operations and support	32.5	19.6
Software Development and Maintenance	31.6	48.2
ADP Management	10.4	1.3
Other	5.8	1.2

Table 3.2.4

3.3 Software Management, Personnel and Tools

3.3.1 Programming Languages and Software Development Tools. The numbers of respondents indicating whether specified programming languages and software development tools were available on their computer systems, whether the tools were ever used, and usage levels in terms of both percentages of all programs and percentages of total software development and maintenance personnel time are tabulated. Usage levels are presented for 25 percentage point intervals. In addition, average usage levels appear for both program percentages and percentages of total software development and maintenance personnel time; class midpoints were used for deriving these figures (e.g., 37.5 was used for 26-50%). The 51 responses in the "other" category appeared on 35 questionnaires. Languages and tools specified are not mutually exclusive; that is, use of one does not preclude use of others.

Installations selectively answered this question. Consequently, the numbers of respondents indicating availability of the various programming languages and software development tools do not agree with reported usage levels. For example, from the first line of the table we see that of the 117 (127-10) respondents indicating that symbolic assembly language was available and was used at their installation, only 114 (85+9+1+19) and 106 (82+9+1+14) reported usage levels in terms of percentages of all programs and software maintenance and development personnel time respectively. response rates varied from a high of 97.8% of all survey respondents for the 134 installations reporting the availability of symbolic assembly language to a low of 37.2% for the 51 installations reporting the availability of other tools; the numbers of nonrespondents for these questions were 3 (2.2%) and 86 (62.8%), respectively.

AVAILABILITY AND USAGE OF PROGRAMMING LANGUAGES AND SOFTWARE DEVELOPMENT TOOLS

Summary of Question II-A Responses

Programming Languages and Software Development Tools	Availability		Usage Levels										
			Never Used	Percent of All Programs					Percent of Software Development and Maintenance Personnel Time				
				1-25	26-50	51-75	76-100	Average Pct.	1-25	26-50	51-75	76-100	Average Pct.
	Yes	No											
Symbolic Assembly Language	127	7	10	85	9	1	13	27.4	82	9	1	14	25.0
FORTRAN	108	19	18	54	15	3	10	28.1	49	10	7	9	29.5
BASIC	43	70	9	31	--	-	--	12.5	27	--	-	-	12.5
COBOL	114	18	6	19	8	20	58	65.4	18	12	16	53	63.8
PL 1	34	81	13	15	4	1	--	20.0	14	2	--	1	13.9
Generalized Data Base Management Packages	58	55	11	36	5	2	1	19.3	38	3	--	1	16.1
RPG or Report Generators	82	37	27	44	2	1	1	16.1	41	1	--	1	14.8
Compiler Pre-processors (e.g. decision table translators)	28	78	10	12	-	1	1	21.4	11	-	1	1	22.1
Autoflowchart Generators	59	52	15	37	2	-	1	15.6	39	-	-	1	14.4
Debugging & Testing Packages (e.g. tracing, test control)	81	36	5	57	6	2	2	18.5	60	3	-	3	17.1
Other (specify)	49	2	3	35	4	1	5	24.2	37	2	-	3	19.1
	Number of Respondents								Number of Respondents				

Table 3.3.1

3.3.2 Personnel Software Development and Maintenance Activities. The numbers of respondents reporting percentages of total available software development and maintenance personnel time applied to specific activities are presented for intervals of five percentage points. Average percents for all respondents also appear. The 132 installations answering this question represent 96.4% of all survey respondents; five installations (3.6%) did not answer.

PERCENT OF TOTAL AVAILABLE SOFTWARE DEVELOPMENT AND MAINTENANCE PERSONNEL TIME APPLIED TO ACTIVITIES

Summary of Question II-B Responses

Software Development and Maintenance Activities	Percent of Total Software Development Effort																				Total Respondents	Average Pct.
	0	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-100	
Application analysis and system design																						
General system analysis and design	16	30	34	19	16	8	4	2	2								1					132	11.9
Detail system and procedure specification	17	22	23	25	23	9	4	5	2		1	1										132	13.7
Application programming																						
Program coding	6	10	26	23	26	15	9	2	9	2	4											132	18.7
Program debugging and testing	7	14	41	23	25	9	9		2		1				1							132	14.7
Program conversion or transfer	49	62	18		2						1											132	3.6
Program maintenance and modification	4	18	27	17	20	14	14	4	4		7	1					1		1			132	19.7
Documentation	7	62	42	10	10		1															132	7.7
System programming (compilers, o.s. and support software	51	31	23	14	6	1	1		1	1	2								1			132	7.0
Other	114	8	4	2			1		1						1		1					132	2.3
	Number of Respondents																						

Table 3.3.2

3.3.3 Benefits from Technological Advancements. The numbers of respondents reporting rankings of relative benefits that would be derived from technological advances are presented for specified functional areas. Average ranks for all respondents are also reported.

Installations selectively answered this question. Six functional areas for technological advancement were ranked by 133 respondents; two areas were ranked by 132 respondents; and two areas were ranked by only 131 respondents. Response rates are 97.1%, 96.4% and 95.6% of all survey respondents, respectively; the corresponding nonrespondents were: 4 (2.9%), 5 (3.6%) and 6 (4.4%).

RELATIVE BENEFITS THAT WOULD BE DERIVED FROM TECHNOLOGICAL ADVANCEMENTS

Summary of Question II-C Responses

Functional Areas For Technological Advancements	Rankings of Potential Benefits (1 most important, 10 least important)										Total Respondents	Average Rank
	1	2	3	4	5	6	7	8	9	10		
General system analysis & design	16	13	13	13	18	17	13	5	9	16	133	5.2
Detail system specification	11	13	13	8	11	18	16	18	15	10	133	5.7
Program coding & production	11	12	19	18	14	16	11	10	7	15	133	5.3
Program testing & reliability	23	25	17	15	21	11	10	6	1	4	133	3.9
System conversion or upgrade	18	11	4	7	12	4	15	18	14	29	132	6.3
Program maintenance & modification	14	17	20	14	13	12	12	16	7	8	133	4.9
Documentation	16	10	16	21	9	13	12	12	14	10	133	5.2
Standards & transferability	14	10	10	11	8	10	6	20	23	20	132	6.2
System programming	12	10	10	12	17	10	14	9	18	19	131	5.9
Software development tools, methods, & processes	30	16	16	11	10	8	7	8	10	15	131	4.6
	Number of Respondents											

Table 3.3.3

3.3.4 Methods for Acquiring Programming Aids. The numbers and percentages of respondents indicating that programming aids have been acquired in specified ways are tabulated. The four acquisition methods tabulated are not mutually exclusive; that is, use of one does not preclude use of others. On the average, 2.2 acquisition methods were reported by each respondent.

ACQUISITION OF PROGRAMMING AIDS

Summary of Question II-D Responses

How Have Programming Aids Been Acquired?	Positive Responses	
	Number	Percent
Delivered in integrated procurement with hardware	103	76.9
Primarily developed in-house	76	56.7
Acquired as separate procurements	50	37.4
Acquired through non-commercial sources such as user's groups and software exchange libraries	57	50.0
Totals	296	
Respondents	134	97.8
Nonrespondents	3	2.2

Table 3.3.4

3.3.5 Management of Computer Programming. The numbers and percentages of respondents indicating that the management of computer programming in their organizations can be described in specified ways are tabulated. The five descriptions of computer programming management are not mutually exclusive. On the average, 2.3 of the five descriptions were chosen by each respondent.

MANAGEMENT OF COMPUTER PROGRAMMING

Summary of Question II-E Responses

Descriptions of Management of Computer Programming	Positive Responses	
	Number	Percent
All programming is done by a central development group	51	37.8
A centralized programming group is available for assistance	62	45.9
Programming is primarily done by individuals or separate project teams	90	66.6
Programming standards and tests are established by one authoritative group	51	37.7
Programmer training and daily assistance is primarily a duty of computer installation management	50	37.0
Totals	304	
Respondents	135	98.5
Nonrespondents	2	1.5

Table 3.3.5

3.4 COBOL Usage and Standardization

3.4.1 COBOL Compilers. Respondents were asked to idenfity all COBOL compilers used by hardware manufacturer and CPU model, and to specify how each compiler was acquired. A total of 164 compilers were enumerated by the 105 installations responding to this question. Of those installations answering the question, 39 (37.1%) listed two or more compilers; 66 (62.9%) listed only one compiler Responses are summarized in the three tables in this section.

3.4.1.1 COBOL Compilers for Hardware Systems. Numbers and percentages for COBOL compilers and respondents having COBOL compilers are tabulated by hardware system manufacturer. For example, the first line of the table indicates that 23 responding installations have 25 Burroughs COBOL compilers; these counts represent 21.9% of all respondents and 15.2% of all COBOL compilers, respectively. Because a total of 20 installations (19.0% of all responding installations and 51.3% of those listing two or more compilers) listed compilers from more than one manufactuer, manufacturer categories are not mutually exclusive; response tabulations and percentages therefore do not sum to 100%.

COBOL COMPILER MANUFACTURERS

Partial Summary of Question III-A-2 Responses

Hardware Manufacturer	COBOL Compilers		Responses	
	Number	Percent	Number	Percent
Burroughs	25	15.2	23	21.9
Control Data	15	9.1	14	13.3
Digital Equipment	1	.6	1	.9
Honeywell/GE	31	18.9	27	25.7
IBM	78	47.6	56	53.3
Univac/RCA	12	7.4	9	8.6
Other	2	1.2	2	1.9
Totals	164	100	132	
Respondents			105	76.7
Nonrespondents			32	23.3

Table 3.4.1.1

3.4.1.2 COBOL Compiler Acquisition. The numbers and percentages for COBOL compilers and respondents having COBOL compilers are tabulated by three compiler acquisition methods: separately priced acquisitions from hardware system vendors, bundled acquisitions from hardware system vendors, and acquisitions from independent vendors. For example, the first line of the table indicates that 23 responding installations have 26 COBOL compilers that were separately priced acquisitions from hardware system vendors; these counts represent 21.9% of all respondents and 15.9% of all COBOL compilers, respectively. Because many respondents acquired COBOL compilers in more than one way, acquisition method categories are not mutually exclusive; response tabulations and percentages therefore do not sum to 100%.

COBOL COMPILER ACQUISITION METHOD

Partial Summary of Question III-A-2 Responses

Compiler Acquisition Method	COBOL Compilers		Responses	
	Number	Percent	Number	Percent
Separately Priced	26	15.9	23	21.9
Bundled	119	72.6	80	76.2
Independent Vendor	2	1.2	1	.9
Not Specified	17	10.3	11	10.5
Totals	164	100	115	
Respondents			105	76.7
Nonrespondents			32	23.3

Table 3.4.1.2

3.4.1.3 Cross-Tabulation of Compiler Acquisition Method by Hardware System Manufacturer. COBOL compilers are tabulated according to hardware system manufacturer and compiler acquisition method. Each non-zero cell contains four entries pertaining to a specific hardware manufacturer (row) and compiler acquistion method (column). From top to bottom these entries are:

- X_{ij} — the number of reported COBOL compilers that are used on hardware from the row manufacturer and were acquired in the column manner.
- $\frac{X_{ij}}{\sum_j X_{ij}}$ — the percentage of all reported COBOL compilers used on hardware from the row manufacturer that were acquired in the column manner.
- $\frac{X_{ij}}{\sum_i X_{ij}}$ — the percentage of all reported COBOL compilers acquired in the column manner that are used on hardware from the row manufacturer
- $\frac{X_{ij}}{\sum_i \sum_j X_{ij}}$ — the percentage of all reported COBOL compilers (all hardware manufacturers and all acquisition methods) that are used on hardware from the row manufacturer and were acquired in the column manner.

where: i is a row index = 1, ..., 7

j is a column index = 1, ..., 4

X_{ij} = number of COBOL compilers used on hardware from the i/th manufacturer acquired in the j/th manner.

CROSS-TABULATION OF COMPILER ACQUISITION METHOD BY HARDWARE MANUFACTURER

Partial Summary of Question III-A-2 Responses

Table Entries: Number / Row Percent / Column Percent / Total Percent		Compiler Acquisition Method			
		Separately Priced	Bundled	Indepen-dent Vendor	Not Specified
Hardware System Manufacturer	Burroughs	0	22 88.0 18.5 13.4	0	3 12.0 17.6 1.8
	Control Data	5 33.3 19.2 3.0	7 46.7 5.9 4.3	0	3 20.0 17.6 1.8
	Digital Equipment	0	1 100.0 .8 .6	0	0
	Honeywell/GE	1 3.2 3.8 .6	28 90.3 23.5 17.1	0	2 6.5 11.8 1.2
	IBM	20 25.6 76.9 12.2	48 61.5 40.3 29.3	2 2.6 100.0 1.2	8 10.3 47.1 4.9
	Univac/RCA	0	11 91.7 9.2 6.7	0	1 8.3 5.9 .6
	Other	0	2 100.0 1.7 1.2	0	0

Table 3.4.1.3

3.4.2 Measures of COBOL Usage. Five survey questions were concerned with various measures of COBOL usage. Three gross indicators of language usage were elicited: the percentage of all installation programs written in COBOL, the number of COBOL source programs, and the total number of source lines in all installation COBOL programs. In addition, respondents were asked to estimate the percentages of all COBOL programs falling in specified ranges for number of source lines. Finally, the percentage of installation programs using only standard COBOL was requested. Responses to these questions are summarized in this section.

3.4.2.1 Percentage of Programs. The numbers of respondents reporting percentages of all computer programs written in COBOL are presented for ten percentage point intervals. A substantial difference between mean and median values indicates that the response distribution is skewed; that is, the mean (average) is affected by a relatively few extreme values. Consequently, while the average percentage of all computer programs written in COBOL was 50% for all respondents and 70% for responding installations using the language, the median values of 75% and 85% respectively are better indicators of central tendency.

Question II-A (see table 3.3.1) asked respondents to indicate usage levels for various programming languages and software development tools including COBOL. The average usage level for COBOL was 65.4% of all installation programs. The slight difference between this value and question III-B responses summarized here are explained by:

- Question II-A had fewer respondents (105) than question III-B (124).
- Question II-A elicited usage levels in 25 percentage point classes; question III-B asked for a specific percentage value.
- Average percentages for question II-A were calculated using class midpoints (e.g, 37.5 was used for all responses in the 26-50% class); means and medians for question III-B are more precise.

In general, because of the larger number of respondents and the more precise recording and summarizing of responses, results for question III-B appear to be more indicative of COBOL usage at sampled installations.

PERCENT OF ALL COMPUTER PROGRAMS WRITTEN IN COBOL

Summary of Question III-B Responses

Percent of Computer Programs Written in COBOL	Respondents	
	Number	Percent
0 %	21	16.9
1-10 %	10	8.1
11-20 %	4	3.2
21-30 %	3	2.4
31-40 %	4	3.2
41-50 %	4	3.2
51-60 %	3	2.4
61-70 %	6	4.9
71-80 %	15	12.1
81-90 %	15	12.1
91-100%	39	31.5
Respondents	124	90.5
Nonrespondents	13	9.5

Table 3.4.2.1

3.4.2.2 Number of Source Programs. The numbers of COBOL source programs are reported in 500 program intervals for each compiler by COBOL compiler manufacturer and for all installation compilers together. The 106 installations answering this question represent 77.4% of all survey respondents; 31 (22.6%) did not respond. Responding installations had an average of 468 source programs for each COBOL compiler. The average number of total source programs for all compilers for each respondent was 803. This value was affected by a few extremely large responses; the median value of 500 source programs for all compilers per installation is, therefore, a better indicator of central tendency.

NUMBER OF SOURCE PROGRAMS

Summary of Question III-C Responses

COBOL Compiler Categories		Number of Source Programs							Total Responses (Compilers)
		0	1-500	501-1000	1001-1500	1501-2000	2001 & Above	Not Specified	
COBOL Compiler Manufacturer	Burroughs		15	6	4				25
	Control Data	1	9	3	1			1	15
	Digital Equipment		1						1
	Honeywell/GE		19	6	1	2	1	2	31
	IBM	5	44	12	9	2	1	5	78
	Univac/RCA	1	5	4	1		1		12
	Other		2						2
All Installation COBOL Compilers		4	49	20	17	3	8	5	106
		Number of Respondents							

Table 3.4.2.2

3.4.2.3 Lines of Source Code. The numbers and percentages of respondents reporting the total number of source lines in all installation COBOL programs are presented for intervals of 250,000 lines. Because mean and standard deviation values are biased by a few extremely large values, the median value of 278,236 lines is the most representative figure for the "average" respondent.

TOTAL LINES OF COBOL SOURCE CODE

Summary of Question III-D Responses

Total Lines of Source Code in All Installation COBOL Programs	Respondents	
	Number	Percent
Up to 250,000	44	46.8
250,001 to 500,000	12	12.8
500,001 to 750,000	15	15.9
750,001 to 1,000,000	7	7.4
1,000,001 to 1,250,000	2	2.1
1,250,001 to 1,500,000	4	4.3
1,500,001 to 1,750,000	3	3.2
1,750,001 to 2,000,000	4	4.3
2,000,001 and above	3	3.2
Respondents	94	68.6
Nonrespondents	43	31.4

Table 3.4.2.3

3.4.2.4 Source Program Size. The numbers of respondents reporting percentages of all COBOL source programs falling in specified size categories based on the number of source lines per program are listed in intervals of five percentage points. Average percentages are also presented for each size class. The 97 installations answering this question represent 70.8% of all survey respondents; 40 (29.2%) did not answer.

SIZE OF COBOL SOURCE PROGRAMS

Summary of Question III-E Responses

Number of Lines of Source Code Per Program	Percent of All COBOL Programs																					Total Re-spon-dents	Aver-age Pct.
	0	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-100		
Up to 500	6	9	14	2	6	5	4	6	5	0	7	6	2	2	3	2	7	1	3	3	4	97	39.4
501 - 1000	7	6	3	8	12	11	11	4	8	5	6	2	7	1	0	1	2	1	1	0	1	97	31.5
1001 - 2000	14	15	8	12	13	8	8	5	3	2	3	1	3	0	1	1	0	0	0	0	0	97	19.3
2001 - above	30	35	15	3	5	1	1	1	0	0	2	0	1	1	1	1	0	0	0	0	0	97	8.7
	Number of Respondents																						

Table 3.4.2.4

3.4.2.5 Use of Standard COBOL. The numbers and percentages of respondents reporting portions of all COBOL programs using only standard COBOL are presented for ten percentage point intervals. The mean and median percentages for COBOL programs using only standard COBOL were both approximately 55%.

LEVEL OF USAGE FOR STANDARD COBOL

Summary of Question III-G Responses

Percent of COBOL Programs That Use Only Standard COBOL	Respondents	
	Number	Percent
0 %	25	25.3
1-10 %	11	11.1
11-20 %	2	2.0
21-30 %	3	3.0
31-40 %	1	1.0
41-50 %	2	2.0
51-60 %	3	3.0
61-70 %	1	1.0
71-80 %	5	5.1
81-90 %	4	4.1
91-100%	42	42.4
Respondents	99	72.3
Nonrespondents	38	27.7

Table 3.4.2.5

3.4.3 COBOL Portability. Two survey questions were concerned with the portability of COBOL programs. The first asked respondents to indicate numbers of COBOL programs transferred to and from other installations over the past year. The other requested brief explanations of the major types of program changes that were required to achieve program transfers. Responses to these questions are summarized in this section.

3.4.3.1 COBOL Programs Transferred. The numbers and percentages of installations reporting COBOL program transfers to and from other installations are tabulated for intervals of 50 programs. Installations that did transfer COBOL programs during the previous year reported averages of 53.3 programs sent to and 259.6 programs received from other installations.

NUMBER OF COBOL PROGRAMS TRANSFERRED

Summary of Question III-H Responses

Number of COBOL Programs Transferred	Respondents Reporting COBOL Program Transfers			
	To Other Installations		From Other Installations	
	Number	Percent	Number	Percent
0	60	59.4	43	42.2
1 - 50	29	28.7	28	27.4
51 - 100	6	5.9	6	5.9
101 - 150	2	2.0	6	5.9
151 - 200	3	3.0	1	1.0
201 - 250	1	1.0		
251 - 300			3	2.9
301 - 350				
351 - 400			4	3.9
401 - 450			1	1.0
451 - 500			2	2.0
501 and above			8	7.8
Respondents	101	73.7	102	74.4
Nonrespondents	36	26.3	35	25.6

Table 3.4.3.1

3.4.3.2 Cross-Tabulation of Installations Transferring COBOL Programs. Respondents transporting COBOL programs are tabulated according to the numbers of programs transferred to and from other installations. Each non-zero cell contains four entries pertaining to the numbers of COBOL programs sent to other installations (row) and the numbers of COBOL programs received from other installations (columns). From top to bottom these entries are:

- X_{ij} — the number of responding installations that sent the row number of COBOL programs to other installations and received the column number of COBOL programs from other installations.

- $\frac{X_{ij}}{\sum_j X_{ij}}$ — the percentage of all responding installations sending the row numbers of COBOL programs to other installations that received the column number of COBOL programs from other installations.

- $\frac{X_{ij}}{\sum_i X_{ij}}$ — the percentage of all responding installations receiving the column number of COBOL programs from other installations that sent the row number of COBOL programs to other installations.

- $\frac{X_{ij}}{\sum_i \sum_j X_{ij}}$ — the percentage of all responding installations (all numbers of programs sent and received) that sent the row number of programs to other installations and received the column of programs from other installations.

where: i is a row index = 1, ..., 7

j is a column index = 1, ..., 11

X_{ij} the number of responding installations that sent the i/th number of COBOL programs to other installations and received the j/th number of COBOL programs from other installations.

For brevity of presentation, null columns were omitted from the table; specifically, because no installations reported receiving 201 to 250 or 301 to 350 COBOL programs from other installations, no columns appear for these values.

CROSS TABULATION OF INSTALLATIONS TRANSFERRING COBOL PROGRAMS

Summary of Question III-H Responses

Numbers of COBOL Programs Sent to Other Installations	Table Entries: Number / Row Percent / Column Pct. / Total Pct.	Numbers of COBOL Programs Received From Other Installations										
		0	1 to 50	51 to 100	101 to 150	151 to 200	251 to 300	351 to 400	401 to 450	450 to 500	501 & Up	No Resp.
	0	39 65.0 90.7 28.5	11 18.3 39.3 8.0	3 5.0 50.0 2.2	2 3.3 33.3 1.5	0	0	2 3.3 50.0 1.5	0	0	3 5.0 37.5 2.2	0
	1 to 50	2 6.9 4.7 1.5	12 41.4 42.9 8.8	2 6.9 33.3 1.5	3 10.3 50.0 2.2	1 3.4 100.0 .7	3 10.3 100.0 2.2	2 6.9 50.0 1.5	1 3.4 100.0 .7	2 6.9 100.0 1.5	1 3.4 12.5 .7	0
	51 to 100	2 33.3 4.7 1.5	1 16.7 3.6 .7	1 16.7 16.7 .7	0	0	0	0	0	0	2 33.3 25.0 1.5	0
	101 to 150	0	1 50.0 3.6 .7	0	0	0	0	0	0	0	1 50.0 12.5 .7	0
	151 to 200	0	1 33.3 3.6 .7	0	1 33.3 16.7 .7	0	0	0	0	0	1 33.3 12.5 .7	0
	201 to 250	0	1 100.0 3.6 .7	0	0	0	0	0	0	0	0	0
	No Response	0	1 2.8 3.6 .7	0	0	0	0	0	0	0	0	35 97.2 100.0 25.5

Table 3.4.3.2

3.4.3.3. Required COBOL Program Changes. Installations that had transferred COBOL programs during the previous year were asked to enumerate the types of COBOL program changes required. Narrative responses were received and subjectively grouped into categories of similar answers. Numbers and percentages of respondents indicating that changes were required are tabulated for these 15 COBOL program change classifications. The change classifications are not mutually exclusive; that is, the selection of one does not preclude the selection of others. On the average, 1.5 change types were selected by each respondent. It should be noted that more respondents reported changes required for COBOL program transfers than reported COBOL program transfers.

CHANGES REQUIRED FOR COBOL PROGRAM TRANSFERS

Summary of Question III-I Responses

Changes Required For COBOL Program Transfers	Responses	
	Number	Percent
Nonstandard Features	13	18.3
Environment Division Entries	11	15.5
Character Code	9	12.7
Data Division Entries	7	9.9
Compiler's Lacking Standard Features	3	4.2
Interface With System Software	3	4.2
Printer Carriage Control	2	2.8
Collating Sequence	2	2.8
IF Statements	2	2.8
Reserved Words	2	2.8
Identification Division Entries	1	1.4
Procedural Statements	1	1.4
Program Initialization	1	1.4
(Installation) Standard		1.4
Naming Conventions	1	1.4
Major Rewrite	1	1.4
Other Reasons	7	9.9
No Changes Required	42	59.2
Totals	108	
Respondents	71	51.8
Nonrespondents	66	48.2

Table 3.4.3.3

3.4.4 Vendor Extensions to COBOL. Three survey questions were concerned with vendor extensions to standard COBOL. The first asked respondents to select one best description of their use of extensions to standard COBOL. the others presented lists of tools and techniques for identifying standard versus non-standard COBOL capabilities. Respondents checked all means currently used in one question, and tools that they would like to have available in the second. Responses to these questions are summarized in this section.

3.4.4.1 Installation Policy. The numbers and percentages of respondents selecting each of five mutually exclusive alternative answers to the question "Do you have an installation policy regarding the use of vendor extension to standard COBOL? (check one)" are tabulated.

INSTALLATION POLICIES REGARDING VENDOR EXTENSIONS TO STANDARD COBOL

Summary of Question III-F Responses

Do You Have A Policy Regarding The Use Of Vendor Extensions to Standard COBOL?	Respondents	
	Number	Percent
No	34	32.4
Yes, freely permit their use	16	15.2
Yes, permit their limited use	32	30.5
Yes, forbid their use	15	14.3
Other	8	7.6
Respondents	105	76.6
Nonrespondents	32	23.4

Table 3.4.4.1

3.4.4.2 Means Used for Identifying. The numbers and percentages of respondents indicating use of specified means for identifying standard vs. non-standard COBOL features are tabulated. The ten alternative methods are not mutually exclusive; that is, the use of one does not preclude the use of others. On the average, 2.2 methods were selected by each respondent.

IDENTIFICATION OF STANDARD VS. NONSTANDARD COBOL

Summary of Question III-0 Responses

How COBOL Programmers Identify Standard Versus Nonstandard COBOL Features	Positive Responses	
	Number	Percent
Implementor provided annotated manuals	50	49.0
Installation produced annotated manuals	12	11.8
Use of ANSI standard publications	38	37.3
Automatic flagging of source program listings	12	11.8
Guidelines (supplement to manuals)	23	22.5
Validation summary report for the compiler	3	2.9
Newsletters	21	20.6
Informal (verbal) communication	35	34.3
Not required	21	20.6
Other	14	13.7
Totals	229	
Respondents	102	74.5
Nonrespondents	35	25.5

Table 3.4.4.2

3.4.4.3 Desired Tools for Identifying. The numbers and percentages of respondents indicating that they would like to have available specific tools for differentiating among standard and non-standard COBOL compiler capabilities are tabulated. The seven alternatives provided were not mutually exclusive; that is, wanting one type of tool does not preclude a desire to have other tools available. On the average, 2.4 tools were selected by each question respondent.

TOOLS FOR DIFFERENTIATING STANDARD VS. NONSTANDARD COBOL

Summary of Question III-P Responses

Tools which would like to have available for differentiating standard and non-standard COBOL compiler capabilities	Positive Responses	
	Number	Percent
Manuals	60	57.1
Guidelines	39	37.1
Automated tools (e.g. syntax checkers)	38	36.2
Compiler flagging on source listing	71	67.6
Compiler validation results	27	25.7
None	14	13.3
Other	2	1.9
Totals	251	
Respondents	105	76.6
Nonrespondents	32	23.4

Table 3.4.4.3

3.5 COBOL Evaluations

Respondents were asked to indicate their evaluations of the COBOL language in five separate but related questions. One question requested rankings of specified reasons for using the language. The others sought narrative responses. The results of all five questions are summarized in this section.

3.5.1 Reasons for Using COBOL. The numbers of respondents reporting rankings of the importance of nine specified reasons for using COBOL are tabulated. Average ranks are also reported. A total of 40 respondents ranked the requirement that they conform with the Federal standard as a reason for using the language; 39 ranked it first (most important) and one ranked it sixth in importance. Because "conformance with the Federal standard" was not specifically identified as a reason on the survey instrument, these 40 answers appear in the "other" category along with 21 miscellaneous responses that could not be categorized further.

Installations selectively answered this question. The eight specified reasons for using COBOL were ranked as follows: two reasons were ranked by 93 respondents, three reasons were ranked by 94 respondents, two reasons were ranked by 95 respondents, and one reason was ranked by 96 respondents. The "other" category was ranked by 61 respondents. Response rates were 67.9%, 68.6%, 69.3%, 70.1% and 44.5%, respectively; corresponding non-respondents were 44(32.1%), 43(31.4%), 42(30.7%), 41(29.9%) and 76 (55.5%).

IMPORTANCE OF REASONS FOR USING COBOL

Summary of Question III-J Responses

Reasons For Using COBOL For Those Programs Coded in COBOL	Rankings (1 most important, 9 least important)									Total Respondents	Average Rank
	1	2	3	4	5	6	7	8	9		
Self documenting	8	15	15	12	10	13	9	8	3	93	4.4
Easy to learn and use	16	28	17	9	9	8	2	5	0	94	3.2
Easy to maintain programs	1	75	14	17	20	10	6	1	0	94	3.9
Reduces programming cost	11	5	10	13	16	12	16	7	5	95	4.9
Reduces conversion cost	2	8	14	8	10	11	14	19	8	94	5.6
Machine independent	10	13	9	7	3	10	8	24	12	96	5.4
Facilitates debugging	0	2	12	18	12	18	15	10	6	93	5.6
Flexible I/O capabilities	8	4	6	18	11	8	16	11	13	95	5.5
Other	48	0	1	0	1	1	1	0	9	61	2.5
	Number of Respondents										

Table 3.5.1

3.5.2 Narrative Evaluations of COBOL. Four narrative questions asked respondents to evaluate Federal Standard COBOL. The first was concerned with deficiencies of the COBOL language or compilers that led to use of other languages. Two others dealt with features: those that should be incorporated in Federal Standard COBOL, and those that are unnecessary. Finally, the fourth elicited recommendations for change. It is evident from reviewing their comments that many respondents did not perceive these questions as being significantly different. Consequently, responses for all four are summarized together in the table. A total of 106 installations representing 77% of all survey respondents answered one or more of these questions; 31 (23%) did not respond to any of the four.

Overall, 444 responses were received for all four questions. This represents an average of 4.2 features and/or recommendations for each respondent answering one or more of the four questions. Individual questions were answered as follows:

QUESTION	QUESTION RESPONDENTS		NON-RESPONDENTS	
	NUMBER	PERCENT*	NUMBER	PERCENT*
III-K	96	70	41	30
III-L	68	50	69	50
III-M	57	42	80	58
III-N	66	48	71	52

*Percent of all 137 survey respondents.

Care must be taken when using these response counts, however, because of the erratic manner in which the questions were answered. For instance, while some installations listed features they would like removed from the standard solely in response to the question, "What features of Federal Standard COBOL do you consider unnecessary?," others also noted them in response to the question "What changes in Federal Standard COBOL would you recommend?." Thus, one idea could appear as a response in only one or in as many as four different questions.

The narrative responses were reviewed and subjectively grouped into 61 categories of similar answers. These categories were then combined further to produce the nine major and twelve subordinate response classes used in the table. The numbers of respondents reporting feature analyses and recommendations are summarized for these response classes; tabulations appear for each question and in total for all four questions. The types of comments

included in the nine major response classes are described below:

Operating System Interface:

Includes responses concerned with COBOL capabilities for accessing operating system information and interfacing with system software. Typical comments in this category include statements about the lack of a standard COBOL interface to system clock information and the desire for a WAIT and INTERROGATE capability.

Compiler Design:

Includes responses concerned with compiler (as opposed to language) features and characteristics. Examples include suggestions for improving debugging and compilation aids, and requests for a time-sharing COBOL compiler.

Language:

Includes responses concerned with features and capabilities of the COBOL language. The four subordinate categories include comments pertaining to:

- Environment Description -- various machine specific declarations that appear in the ENVIRONMENT DIVISION of a COBOL program.

- I/O and Data Definition -- DATA DIVISION entries and I/O capabilities. Character code problems, and the desire for enhanced immediate access I/O capabilities exemplify comments included in this sub- category.

- Source Statement Preparation -- programming conventions and format. For example, requests for a free form reference (coding) format and standard naming conventions are included in this subcategory.

- Procedural Capabilities -- Features and capabilities that are or would be included in the PROCEDURE DIVISION of a COBOL program. Examples include comments pertaining to specific COBOL verbs (e.g., ALTER, IF, EXAMINE), major COBOL modules, (e.g., REPORT WRITER, table handling), and generic capabilities (e.g., string, boolean manipulation, structured programming).

Efficiency:

Includes responses concerned with the efficiency of COBOL. The four subordinate categories include comments pertaining to:

- Speed--Time required for the compilation and execution of COBOL programs.
- Memory--The amount of main memory required by COBOL compilers and programs.
- Coding--The time and effort required to produce COBOL source code.
- General--The overall efficiency of the programming, compilation and execution of COBOL programs.

Applicability:

Includes responses concerned with the applicability of COBOL to specific types of tasks. The four subordinate categories include comments pertaining to:

- Scientific/Math/Engineering--The use of COBOL for scientific, mathematical and/or engineering problems.
- Data Management--The use of COBOL for storing and retrieving data and for interfacing with generalized data management software.
- Systems Programming--The use of COBOL for developing and maintaining operating systems and support software.
- Communications--The use of COBOL for developing and maintaining communications software.

Compiler Lacks Standard Features:

Includes responses indicating that features included in Standard COBOL are not implemented on respondents' compilers.

Standardize Non-Standard Features:

Includes responses indicating that respondents would like to standardize features that were not included in the 1968 COBOL Standard.

Other Features and Characteristics:

Includes all comments that could not be grouped in any of the other categories.

No Deficiencies or Unnecessary Features/
Recommend No Additions or Changes:

Includes all statements specifically indicating that COBOL has no deficiencies, requires no additional features, has no unnecessary features, and/or requires no changes.

NARRATIVE EVALUATIONS OF FEDERAL STANDARD COBOL

Summary of Responses for Questions III-K, III-L, III-M, and III-N

Federal Standard COBOL Features and Characteristics	Feature Analysis & Recommendations				Total
	III-K Deficiencies	III-L Features to Add	III-M Unnecessary Features	III-N Recommended Changes	
Operating System Interface	6	8		12	26
Compiler Design	5	6		7	18
Language					
Environment Description		1	2	1	4
I/O and Data Definition	21	16	1	16	54
Source Statement Prep.	1	5		9	15
Procedural Capabilities	17	13	11	23	64
Efficiency					
Speed	10				10
Memory	14				14
Coding	14				14
General	4	3		1	8
Applicability					
Scientific/Math/Engr.	29				29
Data Management	3	5			8
Systems Programming	5				5
Communications	3				3
Compiler Lacks Standard Features	4	4		5	13
Standardize Nonstandard Features	2	10		7	19
Other Features and Characteristics	11	5	2	4	22
No Deficiencies or Unnecessary Features/Recommended No Additions or Changes	16	31	41	30	118
Total	165	107	57	115	444

Table 3.5.2

APPENDIX A: SAMPLING METHODOLOGY AND SURVEY MECHANICS

APPENDIX A

SAMPLING METHODOLOGY AND SURVEY MECHANICS

This appendix includes a detailed discussion of all aspects of the methodology employed with the Appraisal of Federal Government COBOL Standards and Software Management Survey. The population, the sample, data gathering and analysis techniques are discussed in turn below.

1. POPULATION

The General Services Administration's Inventory of Automatic Data Processing Equipment in the United States Government,* referred to throughout this document, as the GSA Inventory, was used as the primary source for selecting survey respondents. Because of imperfections in data gathering and reporting mechanisms, this document is not a comprehensive listing of all ADP units within the Federal Government. It is, nevertheless, the best available listing and was used for defining the survey population.

The GSA inventory detail listing of computer systems in department/agency sequence was taken as representing all known ADP installations in the Federal Government. Three classes of ADP units appearing in this gross population were eliminated from consideration for the survey. Specifically, the following types of installations were determined to be beyond the scope of the study:

- ADP units that have only "special management classification" systems. This includes systems in the control, classified and mobile categories described as follows:

  Control Systems: Computer hardware that is an integral part of a total facility or larger complex of equipment, and has the primary purpose of controlling, monitoring, analyzing or measuring a process or other equipment.

  Classified Systems: Computer hardware that has a classified physical location.

  Mobile Systems: Computer hardware located on ships, planes or vans.

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*Inventory of Automatic Data Processing Equipment in the United States Government for Fiscal Year 1974, GSA Automated Data and Telecommunications Service, U. S. Government Printing Office Stock No.22 01-00062, September 1974.

- Units that are overseas.

- Units that DO NOT have any systems capable of supporting an available "modern" COBOL compiler.

Thus, the population used for the survey included only those ADP units appearing in the 1974 GSA Inventory of Automatic Data Processing Equipment that were domestic and had at least one "general classification" system capable of supporting a modern COBOL compiler. A total of 859 (47.5%) of the 1807 ADP units listed in the GSA inventory met these criteria.

2. SAMPLE SELECTION

The determination of sample size is a complex, multifaceted decision. A commonly applied rule-of-thumb states that a sample must include at least 5% of the population. This rule indicates that for the limited survey population of 859 ADP units, a sample of only 43 installations would be required. Because it was desired to complete the survey in a short period of time, there was concern that the volume of response from such a small sample would not be sufficient. Therefore, a larger sample was proposed. A sample size of around 200 was seen as being large enough to ensure a reasonable number of returned questionnaires within a short period of time.

Using these two values as lower and upper bounds on a range from which the actual sample size could be chosen, an analysis of the precision of various sample sizes was undertaken. Mean value of system cost was chosen as the population parameter for evaluating the precision (confidence interval) of sample estimates because it was both known and had a large variance. The resulting confidence intervals were:

Ranges of Sample Sizes	Range of Confidence Intervals
50 - 200	$\pm$ \$45,000 to $\pm$ \$4,200

That is, the largest amount by which an estimate of mean system value derived from a sample of size 50 would vary from the actual mean is $\pm$ \$45,000 and the largest estimation error indicated for a sample of size 200 is $\pm$ \$4,200. Because of the generally large magnitude of the paramter (the actual mean system value), all confidence intervals in the range were deemed acceptable for the purposes of the study. In order to assure a sufficient volume of response, a sample of size 200 was used.

The random selection procedure involved three steps: enumeration of the population, generation of a random number sequence, and identification of sample installations. First, all ADP units meeting the criteria for inclusion in the survey population were identified and assigned a unique number. Then a sequence of 200 integers ranging between one and 859 was selected from a table of random numbers.* The random numbers were generated "without replacement"; that is, 200 unique numbers were selected. Finally, the selected random numbers were used to identify the ADP units included in the large and small samples.

While gathering names and addresses of installation managers in the manner described below, we found that sampling at the installation level was inadequate for one agency because of the agency's centralization of software development. In this apparently isolated instance, the assumption that data could be gathered at the ADP unit level was incorrect. A revised (smaller) set of software development units was used to represent this agency and the sample was adjusted accordingly.

Figure A.1 is an analysis of the number of ADP units by department/agency included in the GSA Inventory, the survey population and the sample group. The 190 ADP units included in the sample represent 22.1% of the 859 installations in the survey population.

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*RAND Corporation Tables reprinted in Dixon, Wilfind J., and Frank J. Massey, Jr., Introduction to Statistical Analysis, McGraw-Hill Book Co., NJ, 1969.

ANALYSIS OF ADP UNITS BY DEPARTMENT/AGENCY

Source: Inventory of Automatic Data Processing Equipment in the United States Government for Fiscal Year 1974

Department/ Agency***	Number of ADP Units		
	GSA	Population	Sample
AGRI	33	19	5
COMM	50	30	9
CSC	2	2	1
DCG	8	7	4
DOD			
AF	227	142	20*
Army	508	237	71
DCA	9	9	4
DCPA	1	1	1
DNA	6	3	2
DSA	28	27	5
Navy	311	161	28
DOT	134	24	6
EPA	7	7	1
ERDA/NRC	203	43	8
FDIC	1	1	1
FRS	1	1	1
GAO	1	1	1
GSA	16	8	1
HEW	32	17	2
INT	26	14	2
JUS	6	6	2
LABOR	1	1	1
NASA	64	21	3
NSF	13	7	2
RRB	1	1	1
SBA	1	1	1
STATE	6	4	1
TREAS	34	32	5
TVA	7	4	1
33 Other Dept/Agen.**	70	28	--
TOTALS	1807	859	190

Figure A.1

* Sample reduced to this level because of centralized software development.

** Of these department/agencies, 9 had no ADP units listed in the GSA inventory.

*** Department/Agency abbreviations taken from Appendix II of GSA inventory.

3. DATA GATHERING

The GSA inventory did not include, nor did GSA maintain, any information about the names of ADP unit managers or the specific addresses required for mailing. We were able, however, to obtain a list of ADP/MIS liaison officers--individuals (one per agency) who provide GSA with the inventory data. These liaison officers were contacted and asked to provide us with the name of the installation manager and the mailing address for each ADP unit to be included in the sample. ADP/MIS liaison officers for agencies having only a few ADP units in our sample were contacted by telephone; others received a personalized letter request.

From the names and addresses received from liaison officers, mailing labels were produced and questionnaire packets were sent directly to the installation managers of the selected (sample) ADP units. The packets included:

- cover letter
- questionnaire
- questionnaire receipt card
- return envelope.

Appendix B includes a replica of the questionnaire along with cross references to tabulations appearing in Section 3.

The questionnaire receipt card was included in order to provide an early indication of response rate, to solicit a commitment from the individual receiving the packet, and to offer a reward in the form of survey results. Because confidentiality was promised on the questionnaires, the questionnaire receipt card was the primary controlling mechanism.

Returned questionnaire receipt cards were noted on a control list of all sampled ADP units. Units not responding within two to three weeks from the time the survey was mailed were sent a follow-up letter. A second follow-up letter was sent to those not responding in another three to four weeks.

4. DATA ANALYSIS

Returned questionnaires were numbered and their responses encoded, recorded in machine readable form, and validated using an on-line text editor. The validated data was used to populate a data base created using the System 2000 generalized data base management software package on the Infonet timesharing network. Many of the tabulations and statistics appearing in Section 3 were generated using the data base system's query capability. Other results reported in this document were derived from data analyses performed using the Statistical Package for the Social Sciences (SPSS) and OMNITAB.

APPENDIX B: SURVEY INSTRUMENT

APPENDIX B

SURVEY INSTRUMENT

This appendix contains a replica of the survey instrument. Questionnaire packets were addressed to the installation managers of the ADP units included in the sample. Cross references to the tabulations of Section 3 for each question or a portion thereof appear as overlays on the survey questionnaire, figure B.1.

NBS-1010
(12-74)

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

APPRAISAL OF FEDERAL GOVERNMENT COBOL STANDARDS AND SOFTWARE MANAGEMENT

RETURN TO:

Institute for Computer Sciences and Technology
National Bureau of Standards
Technology – A265
Washington, D. C. 20234

DIRECT INQUIRIES TO:

Computer Science Section
Telephone (301) 921-3491

Instructions:

The purposes of this questionnaire are twofold: to determine the impact of Federal government efforts to standardize the COBOL language, and to identify aspects of software development, maintenance and management which would benefit from technological advancements. Because of the general nature and breadth of the questions, managers of Federal government ADP installations are asked to respond.

Responses should be entered in the spaces provided. Where exact magnitudes are not known, best estimates are acceptable. Clarifying entries and additional information may be entered at the end of each section or may be submitted on supplemental sheets.

DO NOT write your name or the name of your agency on this questionnaire. Only aggregate results from all respondents will be used for publication. This report has been cleared in accordance with FPMR 101-11.11 and assigned Interagency Report Control No. 0051-DOC-OT.

PART I GENERAL INFORMATION ON COMPUTER USAGE

A. What is your total annual budget (cost) for automatic data processing (ADP) hardware, software, personnel and services?

- [ ] ADP Budget < $1 million
- [ ] $1 million ≤ ADP Budget < $2 million
- [ ] $2 million ≤ ADP Budget < $3 million
- [ ] $3 million ≤ ADP Budget < $4 million
- [ ] $4 million ≤ ADP Budget < $5 million
- [ ] $5 million ≤ ADP Budget

3.2.1.1

B. Indicate the approximate percentage of your total annual ADP budget which is applied to each of the following categories.

Budget Allocation Categories	% of ADP Budget
1. Hardware and Maintenance	%
2. Proprietary Software	%
3. Contract Personnel and Consultants	
4. In-house Personnel (except management)	3.2.1.2
5. Management	
6. Computing Supplies (cards, tapes, etc.)	%
7. Overhead (excluding items 5 and 6 above)	%
8. Other *(Specify)* _____	____
Total Annual ADP Cost	100%

C. Enter all of your computer systems by manufacturer and model number. Also, indicate with checks in the appropriate columns the approximate value based on CPU purchase price and whether each system is leased or owned.

SYSTEM DESCRIPTION				APPROXIMATE VALUES (Check one for each system)			
ACQUIRED FROM							
LEASED	OWNED	MANUFACTURER	CPU MODEL NO.	≤50K	>50K ≤200K	>200K ≤500K	>500K ≤1500K	>1500K

3.2.2.5

3.2.2.1

3.2.2.2

3.2.2.3

3.2.2.4

Figure B.1

D. Indicate your computing job mix by approximating the percentage of all jobs processed which fall in each of the categories listed below:

JOB CATEGORY	% OF TOTAL JOB MIX
1. Data Processing/Accounting	_____ %
2. Scientific/Engineering Research	_____ %
3 Command and Control Resource Management	3.2.3.1
4 Laboratory Data Collection/Process Control	
5. Information Retrieval	
6. Software Development and Maintenance	_____ %
7. Other *(Specify)*	_____ %
TOTAL FOR ALL JOBS	100 %

E. What percentage of your job mix requires emulation (simulation, liberation, etc.) of other hardware configurations?

_____ % 3.2.3.2

F. Indicate the number of full-time equivalent (FTE)* in-house and contract personnel applied to each of the functions listed below:

JOB FUNCTION	FTE IN-HOUSE PERSONNEL*	FTE CONTRACT PERSONNEL*
1. Data entry or preparation		
2. Clerical, operations and support		
3. Software Development and Maintenance (include systems & application software)	3.2.4	
4. ADP Management		
5. Other *(specify)*		
TOTALS		

*e.g. – 2 employees who each spend 1/2 of their time on a particular function = 1 FTE employee for that function.

Comments Part I:

Figure B.1

PART II. SOFTWARE MANAGEMENT

A. Indicate whether the programming languages and software development tools listed below are available on your computers and also the usage levels in terms of both the percentage of the total number of programs for all your computer systems and the percentage of the total software development and maintenance personnel time reported in I-F-3 above. *(Include both in-house and contract personnel, but exclude management.)*

Programming Languages and Software Development Tools	Availability		USAGE LEVEL								
			Never Used	% of All Programs				% of Total Personnel Time			
	Yes	No		1-25	26-50	51-75	76-100	1-25	26-50	51-75	76-100
1. Symbolic (Assembly) Language											
2. FORTRAN											
3. BASIC											
4. COBOL											
5. PL 1											
6. Generalized Data Base Management Packages											
7. RPG or Report Generators											
8. Compiler Pre-processors (e.g. decision table translators)											
9. Auto-flowchart Generators											
10. Debugging and Testing Packages (e.g. tracing, test control)											
11. Other *(specify)*											

3.3.1

B. What percentage of the total available software development and maintenance personnel time reported (in I-F-3) above is applied to each of the following activities? *(Include both in-house and contract personnel, but exclude management.)*

Software Development and Maintenance Activities	% of Total Software Development Effort
1. Application analysis and system design	
a. General system analysis and design	a _____ %
b. Detail system and procedures specification	b _____ %
2. Application programming	
a. Program coding	a _____ %
b. Program debugging and testing	b _____ %
c. Program conversion or transfer	c _____ %
d. Program maintenance and modification	d _____ %
e. Documentation	e _____ %
3. System programming (Compilers, O. S. & support software)	%
4. Other *(specify)*	%
TOTAL SOFTWARE DEVELOPMENT PERSONNEL EFFORT	100 %

3.3.2

Figure B.1

C. Indicate by ranking from 1 (highest) to 10 (lowest) your evaluation of the relative benefits which your operation would derive from technological advancements in each of the following functional areas:

Ranking of Relative Benefits	(Number from 1 to 10, with 1 as highest benefit; 10 as lowest)
a. General system analysis & design	
b. Detail system specification	
c. Program coding and production	
d. Program testing and reliability	
e. System conversion or upgrade	
f. Program maintenance and modification	
g. Documentation	
h. Standards and transferability	
i. System programming	
j. Software development tools, methods, and processes	

3.3.3

D. How have programming aids been acquired by your installation? *(Check all pertinent responses)*

- [ ] 1. Delivered in integrated procurement with hardware.
- [ ] 2. Primarily developed in-house.
- [ ] 3. Acquired as separate procurements.
- [ ] 4. Acquired through non-commercial sources such as user's groups or software exchange libraries.

3.3.4

E. Check all statements below which accurately describe the management of computer programming in your organization.

- [ ] 1. All programming is done by a central development group.
- [ ] 2. A centralized programming group is available for assistance.
- [ ] 3. Programming is primarily done by individuals or separate project teams.
- [ ] 4. Programming standards and tests are established by one authoritative group.
- [ ] 5. Programmer training and daily assistance is a primary duty of the computer installation management.

3.3.5

Comments Part II:

Figure B.1

PART III. COBOL USAGE AND STANDARDIZATION

A. (1) If COBOL is not available on some of your computers, identify those listed in I-C above for which you would like to have a COBOL compiler.

3.4.1.3

(2) Identify below each COBOL compiler now used.

	Manufacturer & CPU Model	Operating System Identification	Compiler Identification Number	Compiler Acquired From: System Vendor (Check one) — Separately Priced	Compiler Acquired From: System Vendor (Check one) — Bundled	Compiler Acquired From: Independent Vendor (Give name)
(a)						
(b)	3.4.1.1			3.4.1.2		
(c)						
(d)						

B. What percentage of all computer programs are written in COBOL? _____ %

3.4.2.1

C. How many COBOL source programs do you now have for each compiler identified in question A above?

(a) _____ (c) _____

(b) _____ (d) _____

3.4.2.2

D. Estimate the total number of lines of COBOL source code contained in all installation COBOL programs.

3.4.2.3

E. Estimate the percentage of all COBOL programs falling in each of the following ranges of source lines per program.

Number of Lines	Percent of Programs
Up to 500	
501 – 1000	3.4.2.4
1001 – 2000	
2001 – Above	

F. Do you have an installation policy regarding the use of vendor extensions to Standard COBOL? *(check one)*

- ☐ 1. No
- ☐ 2. Yes, freely permit their use
- ☐ 3. Yes, permit their limited use
- ☐ 4. Yes, forbid their use
- ☐ 5. Other *(specify)*

3.4.4.1

G. What percentage of your COBOL programs use only Standard COBOL *(COBOL specified in FIPS Pub. 21 and X3.23-1968)*?

_____ %

3.4.2.5

H. Indicate the occurrence of the following types of COBOL program transfer, in terms of number of programs over the past year.

3.4.3.1

No. of Programs Transferred

TO other installations _____

FROM other installations _____

3.4.3.2

Figure B.1

I. What types of COBOL program changes have been required to achieve the program transfers indicated in H above? Provide a brief explanation of the major types of changes.

3.4.3.3

J. For those programs coded in COBOL, rank your reasons for using COBOL *(Number from 1 to 9, 1 is most important, 9 least important.)*

1. Self-documenting _____
2. Easy to learn and use _____
3. Easy to maintain programs _____
4. Reduces programming costs _____
5. Reduces conversion costs _____
6. Machine independent _____
7. Facilitates debugging _____
8. Flexible I/O capabilities _____
9. Add any other *(specify)* and rank _____

3.5.1

K. What are the deficiencies of the COBOL language or compilers which have led to your use of other languages?

3.5.2

L. What features should be incorporated in Federal Standard COBOL that are important to your continued use of COBOL?

3.5.2

Figure B.1

M. What features of Federal Standard COBOL do you consider unnecessary?

3.5.2

N. What changes in Federal Standard COBOL would you recommend?

3.5.2

O. How do your COBOL programmers identify standard versus non-standard COBOL features? *(Check all appropriate means below.)*

- ☐ 1. Implementor provided annotated manuals
- ☐ 2. Installation produced annotated manuals
- ☐ 3. Use of ANSI standard publication
- ☐ 4. Automatic flagging of source program listings
- ☐ 5. Guidelines *(supplement to manuals)*
- ☐ 6. Validation Summary Report for the compiler
- ☐ 7. Newsletters
- ☐ 8. Informal *(verbal)* communication
- ☐ 9. Not required
- ☐ 10. Other *(specify)*

3.4.4.2

P. Which of the following tools for assisting users in differentiating standard and non-standard COBOL compiler capabilities would you like to have available? *(Check all appropriate.)*

- ☐ 1. Manuals
- ☐ 2. Guidelines
- ☐ 3. Automated tools *(e.g. syntax checkers)*
- ☐ 4. Compiler flagging on source listing
- ☐ 5. Compiler validation results
- ☐ 6. None
- ☐ 7. Other *(specify)*

3.4.4.3

Additional Comments May Be Submitted on Reverse →

USCOMM-NBS-DC

Figure B.1

NBS-114A (REV. 7-73)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET	1. PUBLICATION OR REPORT NO. NBSIR 76-1100	2. Gov't Accession No.	3. Recipient's Accession No.

4. TITLE AND SUBTITLE

Appraisal of Federal Government COBOL Standards and Software Management: Survey Results

5. Publication Date: August 1976

6. Performing Organization Code: 640.02

7. AUTHOR(S): *Donald R. Deutsch*

8. Performing Organ. Report No.

9. PERFORMING ORGANIZATION NAME AND ADDRESS

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16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

This report summarizes the results of a survey of selected Federal Government Automatic Data Processing (ADP) installations. Undertaken primarily as an evaluation of National Bureau of Standards (NBS) activities in support of the standardization of the COBOL programming language, the study also dealt with software management tools and practices.

The survey sample was selected from a subset of all known Federal Government ADP units; specifically, only domestic installations with at least one general purpose hardware system capable of supporting a modern COBOL compiler were included. Responses were received from over 70 percent of the 190 installations included in the sample.

The major portion of this document is made up of tabular summarizations of all responses for each survey question. Gross statistics and frequency distributions are presented on a question-by-question basis. No interquestion relationships are analyzed. The appendices include a comprehensive discussion of the sampling methodology and survey mechanics and a reproduction of the survey instrument with cross references to response tabulations appearing in the report.

17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)*

ADP; COBOL; Federal ADP installations; Federal Standard COBOL; Impact evaluation; Sample; Software management; Survey.

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