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MAINTENANCE QUESTIONNAIRE AND LIST OF RESPONDENTS.(U)
NOV 76 B P LIENTZ, E B SWANSON, G E TOMPKINS N00014-75-C-0266

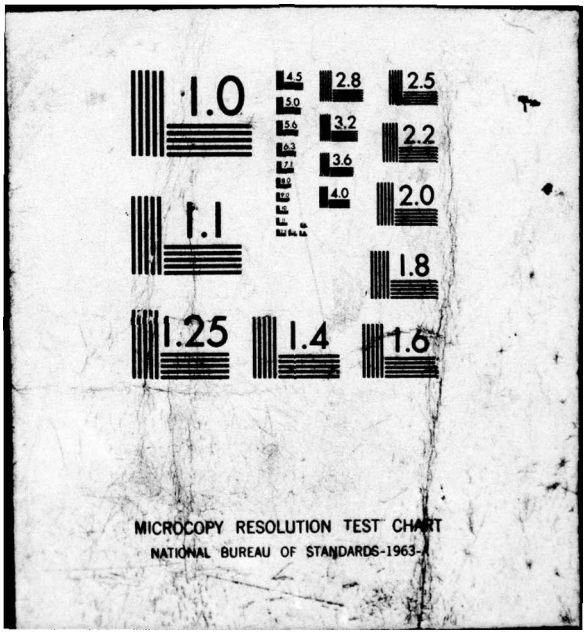
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Maintenance Questionnaire and List of Respondents*

See 1473

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Abstract

This paper contains the maintenance questionnaire and list of respondent organizations for a maintenance survey conducted in 1976.

Nov. 1976

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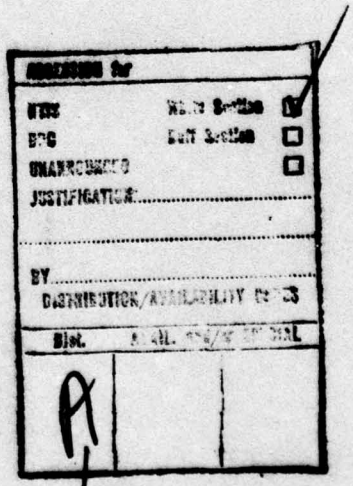
1. Introduction and Summary

There has been an increasing concern with the operational phase of the life cycle of software systems. This phase is concerned with the maintenance and enhancement of computer based information systems. Maintenance is the process of having the system meet the requirements specified in development. Enhancements are changes made to the system to meet new requirements.

To analyze these processes a questionnaire was constructed, field tested, and finalized. A copy appears in section 2. The questionnaire is divided into two parts: one dealing with the systems data processing and programming department and the other with a specific application system being maintained and enhanced. The questionnaire includes items of both technical and managerial interest.

The questionnaire was distributed to 120 organizations. Responses were collected for 69 applications. The organizations responding are listed in section 3.

The analysis of results and existing literature will appear in separate papers.



2. Questionnaire on Application Software Maintenance

The actual questionnaire begins on the next page.

A QUESTICNNAIRE ON APPLICATICN SOFTWARE MAINTENANCE

INTRODUCTION

The purpose of the questionnaire is to assess some characteristics of application software maintenance, as it is performed by Systems & Programming departments of various types and sizes. The term maintenance includes **enhancements**.

The questionnaire consists of two parts. The first contains questions on the Systems & Programming department. The second, questions on a particular application system maintained by the department.

The questionnaire should be completed by the manager of the Systems & Programming department, with the assistance of his or her staff.

Some of the questions call for facts which may not be readily determined within the Systems & Programming department. These questions are followed by a set of three queries requesting the basis of the answer given, vis-a-vis:

Check the applicable statement:
The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___

Space for "remarks" is also frequently included. Where you feel that your answer can be usefully clarified, please enter your remarks accordingly. It is imperative that every question be answered.

Your assistance and cooperation is greatly appreciated.

A QUESTIONNAIRE

ON

APPLICATION SOFTWARE MAINTENANCE

PART I

Questions on the Systems & Programming Department

July 1976

1. To what industry does the organization served by your department belong? (Check the one which most closely applies.)

Manufacturing industries:

a. Data Processing Equipment |___|
b. Instruments/Electrical |___|
c. Chemical/Allied Products |___|
d. Printing/Publishing |___|
e. Food/Tobacco |___|
f. Primary/Fabricated Metal |___|
g. Transportation Equipment |___|
h. Petroleum/Coal/Rubber |___|
i. Paper/Paper Products |___|
j. Textiles/Apparel |___|
k. Other (Please indicate) _____

Non-manufacturing industries:

a. Insurance |___|
b. Banking/Credit Agency |___|
c. EDP Services |___|
d. Education |___|
e. Government |___|
f. Public Utility |___|
g. Investment |___|
h. Mining/Construction |___|
i. Transportation |___|
j. Consultants |___|
k. Other (Please indicate) _____

2. What is the annual budget of your company for data processing equipment rental, maintenance, and amortization expense? (Check the category which applies.)

a.	$2,000,000 or more	|___|
b.	Less than $2,000,000, but $1,500,000 or more	|___|
c.	Less than $1,500,000, but $1,000,000 or more	|___|
d.	Less than $1,000,000, but $500,000 or more	|___|
e.	Less than $500,000, but $250,000 or more	|___|
f.	Less than $250,000, but $125,000 or more	|___|
g.	Less than $125,000	|___|

3. What is the total number of personnel in your Systems & Programming department?

_____

4. Of the total number of personnel, how many are employed as systems analysts and/or programmers?

_____

Remarks:

5. Of the total number of systems analysts and programmers, how many work in each of the following categories:

	Programming but not systems analysis	Systems analysis, but not programming	Both programming and systems analysis
New application system development, but not application system maintenance			
Application system maintenance but not new application system development			
Both new application system development and application system maintenance			
Neither new application system development nor application system maintenance (e. g. systems programming)			

Remarks:

6. Within your department, are formal lines of authority and responsibility drawn so as to separate the management of programming from the management of other activities?

Yes: |___| No: |___|

Remarks:

7. Within your Systems & Programming department, are formal lines of authority and responsibility drawn so as to separate the management of application system maintenance from the management of other activities?

Yes: |___| No: |___|

Remarks:

8. In terms of the total person-hours worked annually by your programming and systems analysis personnel, what percentage is spent in each of the following activities:

Application system maintenance:	____%
New application system development:	____%
Other:	____%
TOTAL:	100%

Remarks:

9. In your judgment, how important are the problems which arise in application system maintenance when compared to those of new application system development? (Check one of the following.)

a. Maintenance problems by far the more important |___|

b. Maintenance problems somewhat more important |___|

c. Maintenance and new system development problems of equal importance |___|

d. New system development problems somewhat more important |___|

e. New system development problems by far the more important |___|

Remarks:

10. Suppose that the programming and systems analysis capacity of your department could be increased by 10% (in terms of the number of equivalent persons available). Assuming that needed skills are reflected in the increase, how would you allocate this additional capacity?

Application system maintenance: ____%

New application system development: ____%

Other Activities: ____%

TOTAL: 10%

Suppose instead that the capacity could be increased by 25%. How would you allocate this larger percentage increase?

Application system maintenance: ____%

New application system development: ____%

Other Activities: ____%

TOTAL: 25%

11. Suppose that the programming and systems analysis capacity of your department was to be decreased by 10% (in terms of the number of equivalent persons available). Assuming that you could determine where the cut-back was to be made, how would you allocate the reduction?

Application system maintenance: ____%

New application system development: ____%

Other Activities: ____%

TOTAL: 10%

Suppose instead that the capacity was to be decreased by 25%. How would you allocate this larger percentage reduction?

Application system maintenance: ____%

New application system development: ____%

Other Activities: ____%

TOTAL: 25%

12. Relative to the tasks at hand, how would you evaluate your current level of programming and systems analysis staffing, on the whole? (Check one of the following.)

a. Substantially understaffed: |___|

b. Somewhat understaffed: |___|

c. Neither understaffed nor overstaffed: |___|

d. Somewhat overstaffed: |___|

e. Substantially overstaffed: |___|

Remarks:

A QUESTIONNAIRE

ON

APPLICATION SOFTWARE MAINTENANCE

PART II

The following questions are addressed to the maintenance of a particular application system by your department

July 1976

1. Please identify an application system maintained by your department which: (i) has been operational one year or longer; (ii) represents a significant investment of time and effort by your department; and (iii) is considered by management to be of fundamental importance to the organization.

Name of application system: _____

Basic function (Describe briefly):

2. What organizational units are the primary users of the application system? (A "primary user" is defined here as a unit which receives outputs from, or provides inputs to the application system.)

3. What is the total number of personnel in the primary user units, taken together?

_____

Check the applicable statement:
The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___

4. Of the total number of personnel in the primary user units, what percentage is actively engaged in receiving the outputs or providing the inputs?

____%

Check the applicable statement:
The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___

5. On what date (month and year) did the application system become operational?

Year _____

Month _____

Remarks:

6. What is the total number of programs in the application system maintained? (The term "program" is associated here with a block of source language statements compiled or assembled as a unit.)

_____

Check the applicable statement:
The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___

7. What is the total number of source language statements (excluding comments) included in the application system maintained?

_____

Check the applicable statement:
The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___

8. Of the total number of source language statements maintained, what percentage is written in each of the following languages?

COBOL	____%
FORTRAN	____%
Assembler	____%
PL/1	____%
RPG	____%
Others (Please indicate):	
----------	____%
----------	____%
----------	____%
TOTAL	100%

Check the applicable statement:

The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___

9. Of the total number of source language statements maintained, what percentage originated in each of the following time periods?

1975 - 76	____%
1973 - 74	____%
1971 - 72	____%
1969 - 70	____%
1967 - 68	____%
1966 or earlier	____%
TOTAL	100%

Check the applicable statement:
The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___

10. Of the total number of source language statements maintained, what percentage is associated with programs which carry out online processing?

____%

Check the applicable statement:
The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___

11. What is the total number of machine language instructions (object lines of code) of the application system maintained?

_____

Check the applicable statement:
The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___

12. How many computer systems - hardware - are employed in the operational processing of the application system maintained?

_____

If more than one, please specify their operational processing function in terms of the application system maintained:

13. Please identify the following characteristics of each computer system - hardware and software - employed in the operational processing of the application system:

Manufacturer(s) _____

Model(s) _____

Month/year when model(s) became operational _____ _____

Operating System Software _____

14. Is distributed processing employed in the processing of the application system? (The term "distributed processing" implies segmenting data bases and distributing application software processing among computers at different locations.)

Yes: |___| No: |___|

15. Is a data base management system employed in the processing of the application system?

Yes: |___| No: |___|

If so, which? _____

16. How many individual data files make up the data base associated with the application system? (The term "data base" is defined here simply as the set of master files associated with a system.)

Remarks:

17. What is the average size of the data base, measured in total number of bytes (or the equivalent)?

Check the applicable statement:
The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___

18. Of the total number of bytes contained in the data base, what percentage is the result of an update made during each of the following time periods, on the average?

The most recent day:	____%
Not the most recent day, but the most recent week:	____%
Not the most recent week, but the most recent month:	____%
Not the most recent month, but the most recent quarter:	____%
Not the most recent quarter, but the most recent year:	____%
Not the most recent year:	____%
TOTAL	100%

Check the applicable statement:

The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___

19. How many pre-defined user reports are associated with the application system maintained?

_____

Check the applicable statement:
The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___

Remarks:

20. Of the pre-defined user reports, how many are issued in each of the follcwing forms:

Visual display cr printed, on demand	_____
Visual display cr printed, daily	_____
Visual display cr printed, weekly	_____
Visual display cr printed, monthly	_____
Visual display cr printed, quarterly	_____
Visual display cr printed, semi-annually	_____
Visual display cr printed, annually	_____
Others (Please indicate):	
----------	_____
----------	_____
----------	_____

Check the applicable statement:

The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___

Remarks:

21. Which of the following tools and techniques were employed in the development of the application system? (Check those which apply.)

a.	Decision tables	|___|
b.	Data base dictionary	|___|
c.	Test data generators	|___|
d.	Structured programming	|___|
e.	ISDOS (Information System Design and Optimization System)	|___|
f.	Chief Programmer Team	|___|
g.	On-line Programming	|___|
h.	Automated flowcharting	|___|
i.	HIPO (Hierarchy plus Process-Output) Design Aid Technique	|___|
j.	Structured Walk-thru	|___|
	Others (Please indicate):	
k.	_____	|___|
l.	_____	|___|
m.	_____	|___|

22. What is the total number of person-hours now expended annually on maintenance of the application system?

_____

Check the applicable statement:	
The above answer is:	
Reasonably accurate, based on good data	___
A rough estimate, based on minimal data	___
An estimate, not based on any data	___

23. Of the total number of person-hours now expended annually on maintenance of the application system, what percentage is expended in each of the following problem areas:

a.	Emergency program fixes	____%
b.	Routine debugging	____%
c.	Accommodation of changes to data inputs and files	____%
d.	Accommodation of changes to hardware and system software	____%
e.	Enhancements for users	____%
f.	Improvement of program documentation	____%
g.	Recoding for efficiency in computation	____%
	Others (Please indicate):	
h.	_____	____%
i.	_____	____%
j.	_____	____%
	TOTAL	100%

Check the applicable statement:

The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___

24. Of the total number of person-hours now expended annually on maintenance of the application system, what percentage is spent on maintenance of programs which perform online processing?

____%

Check the applicable statement:
The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___

25. Of the total number of person-hours now expended annually on maintenance of the application system, what percentage is spent in communication with the user?

____%

Check the applicable statement:
The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___

26. What is the total number of individuals currently assigned (in whole or in part) to maintenance of the application system?

_____

27. Of the total number of individuals currently assigned to the maintenance of the application system, how many began their assignment in each of the following time periods?

1975 - 76	_____
1973 - 74	_____
1971 - 72	_____
1969 - 70	_____
1967 - 68	_____
1966 or earlier	_____

Remarks:

28. Of the total number of individuals currently assigned to the maintenance of the application system, how many are assigned to each of the following tasks?

a. Programming exclusively:	_____
b. Systems analysis exclusively:	_____
c. Both programming and systems analysis:	_____
d. Neither programming nor systems analysis (e.g. librarian):	_____

Remarks:

29. Of the total number of individuals currently assigned to the maintenance of the application system, how many have each of the following levels of on-the-job programming experience?

a. Five years or more: _____

b. Less than five years, but three or more: _____

c. Less than three years, but one or more: _____

d. Less than one year, but some: _____

e. None of the above: _____

Remarks:

30. Are all changes made to the application system programs logged and documented according to an established organizational procedure?

Yes: |___| No: |___|

How many changes were recorded during the past twelve months?

_____

31. Are all user requests for changes to the application system logged and documented according to an established organizational procedure?

Yes: |___| No: |___|

How many requests were recorded during the past twelve months?

____

Of the requests recorded during the past twelve months, how many have now been satisfied by changes made to the application system?

____

Remarks:

32. Are all troubles encountered in the operational processing of the application system programs logged and documented according to an established organizational procedure?

Yes: |___| No: |___|

How many trouble reports were recorded during the past twelve months?

____

33. Is a formal audit of the application system made periodically, according to an established organizational procedure?

Yes: |___| No: |___|

If so, how frequently, on the average?

_____

34. Is the documentation associated with the application system programs maintained by a program or system librarian?

Yes: |___| No: |___|

Remarks:

35. Is an accounting procedure employed to accumulate the personnel costs in your department associated with operating and maintaining the application system?

Yes: |___| No: |___|

If so, what was the total personnel cost (in dollars) accumulated during the past twelve months?

_____

Remarks:

36. Is an accounting procedure employed to accumulate the equipment costs in your department associated with operating and maintaining the application system?

Yes: |___| No: |___|

If so, what was the total equipment cost (in dollars) accumulated during the past twelve months?

_____

Remarks:

37. Are the personnel and equipment costs associated with operating and maintaining the application system charged back (in whole or in part) to the user?

Yes: |___| No: |___|

If so, on what basis is the charge made? (Check one.)

a. Equipment utilization exclusively: |___|

b. Personnel utilization exclusively: |___|

c. Both equipment and personnel utilization: |___|

d. Neither equipment nor personnel utilization: |___|

If costs are charged back to the user, what was the amount charged during the past twelve months?

_____

Remarks:

38. In your judgment, to what extent have the following been (or are) problems in maintaining the application system you have described?

	Major Problem	Somewhat Major Problem	Minor Problem	Somewhat Minor	None At All
	5	4	3	2	1
a. Turnover of maintenance personnel					
b. Quality of application system documentation					
c. Changes made to system hardware and software					
d. User demand for enhancements and extensions to application system					
e. Skills of maintenance programming personnel					
f. Quality of original programming of application system					
g. Number of maintenance programming personnel available					
h. Competing demands for maintenance programming personnel time					
i. Lack of user interest in application system					
j. Application system run failures					
k. Lack of user understanding of application system					

		Major Problem	Somewhat Major	Minor Problem	Somewhat Minor	None At All
		5	4	3	2	1
l.	Storage requirements of application system programs					
m.	Processing time requirements of application system programs					
n.	Motivation of maintenance programming personnel					
o.	Forecasting of maintenance programming personnel requirements					
p.	Maintenance programming productivity					
q.	System hardware & software reliability					
r.	Data integrity in application system					
s.	Unrealistic user expectations					
t.	Adherence to programming standards in maintenance					
u.	Management support of application system					
v.	Adequacy of application system design specifications					
w.	Budgetary pressures					
X.	Meeting scheduled commitments					

	Major Problem	Somewhat Major	Minor Problem	Somewhat Minor	None At All
	5	4	3	2	1

Others (Please indicate):

y. _____						
z. _____						

3. Responding Organizations

Below is a list of the organizations that responded to the questionnaire.

1. American Automobile Association
2. Architects Limited
3. Atlantic Richfield Company
4. Avco Financial Services
5. Bankamericard Systems
6. Bank of America
7. Baskins and Robbins
8. Bell Industries
9. B.F. Goodrich Company
10. *Brazilian Systems, Inc.*
11. Burroughs--Management Services
12. Burroughs Corporation--Western Application Development Center
13. Byron Jackson Pump Division
14. City of Los Angeles
15. Coast Community College District
16. Firestone Tire and Rubber Company
17. Ford Motor Company
18. Franklin Computer Services
19. General Motors Corporation
20. Getty Oil Corporation
21. Gibraltar Savings and Loan Association
22. Glendale Federal Savings and Loan Association

23. Great Western Savings
24. Hawaiian Telephone
25. H.C. and D., Limited
26. Honeywell Information Systems
27. Hughes Aircraft
28. Hughes Airwest
29. Hughes Markets, Incorporated
30. Island Insurance
31. Knape and Vogt Manufacturing Company
32. Knudsen Corporation
33. Lever Brothers
34. Litton Industries
35. Lloyd's Bank of California
36. Los Angeles City Schools
37. Los Angeles County
38. Los Angeles Department of Water and Power
39. Los Angeles Times
40. Market Basket
41. May Company
42. NCR
43. Northrop Corporation
44. Occidental Life Insurance
45. Pennsylvania Life Insurance
46. Pertec
47. Petrobas
48. Price Waterhouse and Company

49. Revell Incorporated
50. San Fernando Board of Realtors
51. Security Pacific National Bank
52. Sistema and Computacao
53. Southern California Edison
54. Southern California Gas Company
55. State of California Department of Motor Vehicles
56. Sunkist Growers
57. Thrifty Stores
58. Tobias Kotzin
59. Transamerica
60. UCLA Administrative Center
61. UCLA Medical School
62. Union Oil Company
63. University of California
64. United California Bank
65. Van de Kamps
66. Veterans Administration
67. Walt Disney Productions
68. Western Airlines
69. Xerox Computer Services

4. Acknowledgement

The authors wish to express their appreciation to the responding organizations and in particular to the Atlantic Richfield Company for data processing support.

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER Technical Report	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
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		6. PERFORMING ORG. REPORT NUMBER
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9. PERFORMING ORGANIZATION NAME AND ADDRESS Graduate School of Management University of California, Los Angeles		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS NR 049-345
11. CONTROLLING OFFICE NAME AND ADDRESS Information Systems Program Office of Naval Research, Arlington, Va.		12. REPORT DATE 11/76 (11) Nov 76 13. NUMBER OF PAGES 41
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) —		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) maintenance, survey, enhancements		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This paper contains the maintenance questionnaire and list of respondent organizations for a maintenance survey conducted in 1976.		

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