Recommendation T/S 52-01 (Copenhagen 1987)

CHECK-LIST FOR OPERATION AND MAINTENANCE ASPECTS IN SPECIFICATIONS AND TENDERS

Recommendation proposed by Working Group T/WG 11
"Signalling, Protocols and Switching" (SPS)

Text of the Recommendation adopted by the "Telecommunications" Commission:

"The European Conference of Postal and Telecommunication Administrations,

considering

— that systems once purchased and installed must be operated and maintained for their operational life,

— that the operational costs over this time tend to be equal to or greater than the initial acquisition costs,

— that these costs consist mainly of operation and maintenance costs,

— that it is therefore worthwhile to take these operation and maintenance costs into account when procuring new systems (which consideration can be at the specification stage as well as at the evaluation of tenders),

— that this subject remains the total responsibility of the Administration concerned, i.e. this Recommendation will not dictate what the Administration should or should not consider on this matter,

— that it is, however, recommendable to have a check-list of aspects which contribute to these operation and maintenance costs,

recommends

the following check-list of operation and maintenance headings which can be considered when formulating specifications and negotiating and evaluating tenders."

1. INTRODUCTION

Systems which have been purchased and installed must be operated and maintained for their total life. The cost of this support over the life-cycle is about the same and often even more than the initial acquisition cost.

An important part of these running costs are the costs for Operation and Maintenance.

Therefore it is worthwhile to take aspects into account with the procurement of new systems.

This can be done at two moments in the life-cycle:

a) when specifying the equipment in Specification, and/or
b) when asking for Tenders.

In choosing new systems it is advisable to take these aspects into account.

2. ASPECTS IN SPECIFICATIONS

In the specifications not only the required primary functions are laid down, but also the required management functions and the grade of performance of the equipment. These aspects, which contribute largely to the costs, can be specified beforehand. These functions are specified for stated conditions.

The following aspects can be taken into account when specifying operation or maintenance functions.

It has been recognized that in some cases there are overlappings and the aspects are valid for operational as well as for maintenance functions.

It is advisable, when specifying, to follow, where possible, the CCITT and/or CEPT Recommendations.

For extended definitions see T/S 10-13 "General maintenance concept and terms".

2.1. Operational aspects

The implementation of operational functions should be done in such a way that they can be carried out easily and no special trained operators are required.

Entering modified software in the system must preferably be possible without any effect on the operational mode of the system and of any subscriber. Any interruption must be of short duration only (e.g. not longer than 30 minutes) and must be stated as a maximum value.

2.2. Environmental conditions

As the reliability of an equipment depends on its environmental conditions, these should be clearly stated in the specification.

Reference to Recommendation T/TR 02-03 can be useful for this.

2.3. Availability performance

Normally the "unavailability" will be defined. However this parameter not only depends on aspects for which the manufacturer is responsible (reliability performance and maintainability performance) but also on aspects for which the Administration is responsible (maintenance support performance).

So, in defining the unavailability the Administration should state what assumptions have been made on their part (Maintenance Support Performance: e.g. logistic delay time, level of maintenance personnel).

The unavailability can be defined e.g. by defining "partial and/or total unavailability" or by introducing weighting factors and so define "cumulative unavailability".

The specification must state if the required value is relative to predicted or operational unavailability.

Also the number of "restarts" or "recoveries" is important.

2.4. **Reliability performance**

a) *Failure rate*

This parameter gives an idea about the expected maintenance effort for the Administration. For this the "Failure rate" and the MTBF (Mean Time Between Failures) can be specified.

The specification must state if the required value is relative to predicted or operational failure rate.

b) *Functional failure rate*

Protection from the loss of function of an item is often provided by the use of redundant equipment including its software. However the Administrations need to know the frequency with which the function of both normal and redundant equipment, including its software, will be lost simultaneously.

The specification must state if the required value is relative to predicted or operational functional failure rate.

2.5. **Maintainability performance**

Parameters like "Detection efficiency" or "Localization efficiency" can be specified.

The specification must state how these parameters will be tested (e.g. by failure simulation or in the field).

Various kinds of test-programs can be required and the ability to schedule various test-programs.

Furthermore operations with frequent occurrence must be easy to perform (like e.g. the replacement of fuses and lamps, and adjustments).

The specification must state the efficiency of fault detection at component level, attainable when adopting the repair-procedure recommended by the manufacturer.

2.6. **Requirements for construction and components to be used**

To assure the Administration that equipment will function well for a certain period of time, requirements on components to be used and on the methods of construction must be stated.

2.7. **Man-Machine Language (MML)**

The exchange of information on operational and maintenance matters between men and machines should be specified.

2.8. **Interfaces**

The interfaces to terminals (workstations) or other intelligent management systems should be specified.

2.9. **Standardized consumable articles**

Articles to be used with the system, like paper, ink-lint, magtapes, etc., must be standardized ones.

2.10. **System security/authorization**

In order to protect the system against unauthorized operations an authorization procedure must be required.

2.11. **Measurements for wrong replacements**

It must not be possible for interchangeable items to be put in wrong positions where they will be damaged; for this mechanical—or "paper"—keys can be used.

2.12. **Documentation**

A specification should state what documentation should be made available and when. Preferably the documentation should be in the native language.

Documentation must be structured in such a way that it is easy to read and easy to retrieve information.

2.13. **Programs**

Requirements should be stated for program-language, structure, modularity, software-documentation, change procedures, etc.

2.14. **Possibility of subsequent delivery**

The supply of parts and individual components must be guaranteed for a certain period (e.g. 10 years) after the last delivery. After that period substitute functions must be guaranteed.

2.15. **Guarantee on knowledge with the manufacturer**

The manufacturer must guarantee that he keeps the knowledge of a certain system for a period (e.g. 20 years) after the latest delivery, for both hardware and software.

At any time he must be willing to enable the Administration to obtain this knowledge.

2.16. **Safety requirements**

The safety of personnel and other people working with the system must be guaranteed.

2.17. **Energy consumption**

The allowable consumption of energy (power and air-conditioning) must be specified.

2.18. **Ergonomic requirements**

Ergonomic aspects in any area can be essential and can therefore be specified.

2.19. **Requirements for mobile equipment**

For equipment which has to be mobile, i.e. which has to be installed several times at different places after transportation, or which has to be stored temporarily several times during its life time, the costs for transportation and storing must be estimated. Therefore the transport- and storing-conditions must be known.

2.20. **Warranty period of equipment**

The specification must state what is the duration of the warranty, when the failure rate complies with its specification.

3. OPERATION AND MAINTENANCE ASPECTS IN TENDERS

The manufacturer, in answer to a request for tenders, has to show he complies with every parameter of the Administrations specification, e.g. in a "statement of compliance".

If predicted values of the specified parameters are announced by the manufacturer, the statement of compliance shall include all information necessary to verify the calculations made by the manufacturer.

If the manufacturer provides the Administration with figures, he has to guarantee these figures.

Furthermore, the following aspects are very important to deal with in tenders.

3.1. **Failure rate**

The failure rate, expressed in "Failure rate" or MTBF, the manufacturer expects in his equipment of the individual items building the system.

3.2. **Spare-part set**

What will be the recommended spare-part set, including consumables, for a given amount of equipment? What will be the price of this set? What are the assumptions for calculating the number of spares? What is the cost of each spare?

3.3. **Repair time**

The manufacturer should mention the average repair time he has used in his calculations for unavailability or functional failure rate.

The manufacturer should also describe any equipment that cannot be removed from the site of repair.

3.4. **Turn-around time**

What will be the average turn-around time the manufacturer can guarantee; when is he responsible for the repair?

3.5. **Prices of repairs**

What will be the average price of repair of a defective interchangeable item, after the warranty period with the specified failure rate?

3.6. **Guarantee on duration of repair facilities**

If the manufacturer is willing to agree upon a repair-contract, how long does he guarantee to perform this repair actions?

After this period the Administration has to repair the failed items itself. For this the manufacturer must enable the Administration to obtain the knowledge and the necessary tools. Arrangements for this must be made when dealing about the tender, including the cost of equipment, documents and software required to set up and operate a repair facility, covering all items of equipment supplied.

3.7. **Confidence in repair**

What confidence level will the supplier offer that equipment which has been repaired will function correctly when returned and inserted in a compatible system?

3.8. **Routines (Periodic maintenance)**

The manufacturer should state the type and frequency of routines (periodic maintenance) required for all equipment supplied.

3.9. **Documentation**

What will be the price of the documentation, either in the language the manufacturer prefers or in the native language:

a) for all documentation (technical descriptions, user-guides, documentation for maintenance, etc.),
b) only for user-guides?

3.10. **Training**

The manufacturer has to offer facilities for training, e.g. the
— operation and maintenance operators,
— maintenance, specialists (including repair staff), software maintenance people,
— to a high degree of proficiency, in operating, maintaining and programming the system.

Therefore the manufacturer has to state:

i) what training courses can be made available,
ii) the location, duration, cost and syllabus for each course,
iii) the standard of technical proficiency required of trainees attending the course,
iv) the degree of participation in the system program development that would be possible and the number of customer staff that would be able to participate,
v) the extent of on-site training available, both before and after the system has been accepted,
vi) for how long such training courses will be available for both the equipment and for the system configuration provided.

3.11. **Manufacturer maintenance support (Last resort)**

If the manufacturer has to perform support activities (Last resort), that is to say that the manufacturer comes to help if the maintenance people of the Administration are not able to solve the problem, a contract has to be agreed upon during the negotiations about the tender.

In this contract e.g. the following items must be laid down:
— procedure,
— price,
— response time,
— duration of the contract,
— how long the manufacturer is willing to continue the contract.

3.12. **Information about repairs**

To allow the Administration to set up failure statistics, the manufacturer must deliver information about repaired items.

3.13. **Software maintenance and modifications**

The costs of software maintenance and modification should be considered beforehand.

3.14. **Maintenance actions and repairs during the guarantee-period**

The administrative aspects of maintenance actions by the manufacturer and the repair of failed items during the guarantee-period must be considered.

3.15. **Maintenance contracts**

If the Administration wants to contract out all the maintenance actions, all aspects have to be laid down in a firm contract, dealing with e.g.:
— cost for provision of a 24 hour service or a limited service,
— cost for keeping stocks of spare parts,
— cost for preventive and corrective maintenance actions,
— hourly wages,
— procedure to follow, etc.

3.16. **Maintenance of auxiliary equipment**

Auxiliary equipment may be supplied by different manufacturers, either as separate items or as integral part of a system. Arrangements for the maintenance of these items should be agreed.

4. PENALTY CLAUSES

Although it is not common practice, the Administration can consider laying down in the contract a paragraph dealing with penalizing the manufacturer if he does not fulfil his commitments.

5. COMPLIANCE TESTING

For testing the compliance of an equipment with its availability, reliability and maintainability specifications, Recommendation T/S 56-01, "Testing the compliance of an equipment with its reliability, availability and maintainability" can be used.

6. CONCLUSION

In this document various aspects are given, which an Administration can take into account when calculating the running costs during life time of a system.

This document has not the intention to dictate to the Administrations which operation and maintenance aspects they have to deal with; it is only a check-list to help the Administrations to ensure that they did not forget any aspect in the calculation of the operation and maintenance costs; this document is meant to be a "Guidance".

The calculated running cost together with the investment cost give a good understanding of the total life cycle cost, which can be of help e.g. in choosing a new system from various offers.