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NEW OPERATION & MAINTENANCE CONTRACT FOR ELECTRICAL NETWORK

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Abstract

The Electrical Exploitation is one of the few remaining operation services at CERN which nearly entirely relies on the CERN staff. Last year CERN policy, in connection with the LHC project needs, have led to the formulation of the strategy of out-sourcing of the Electrical Exploitation activities, market survey and subsequent Invitation to Tender. The following paper presents the approach used in the preparation of the Invitation to Tender and in solving of the out-sourcing issues applied to the operation and maintenance of the CERN electrical network. In particular the problems of the results oriented contract, quality assurance and performance as well requirement of the constantly increasing productivity of the Contractors team are treated. The paper gives also the particularities of the application of the out-sourcing to the electrical operation service as well as techniques used for the estimation of the work load of the activities being outsourced.

1 INTRODUCTION

The process of outsourcing of non-core activities is difficult in any organization. The experience of others is very useful but there is no single, ideal way to succeed. This paper describes the method chosen for the outsourcing of the electrical exploitation activities, which although are considered as non-core, have a big impact on the operation of the particle accelerators.

2 ELECTRICAL EXPLOITATION

2.1 Electrical exploitation activities

Until recently the electrical exploitation section had a wide scope of activities. They could be essentially divided into two fields:

- Electrical exploitation, comprising operation and maintenance activities.
- Project linked activities, such as installation work organization and follow up, minor works and commissioning.

2.2 CERN policy impact

The CERN policy clearly limits the possibility to employ the staff in lower (less than V) career path. In the 1987 the last person was employed in the career path IV for the electrical exploitation. Since then, many re-organizations took place in order to assure the correct service with constantly decreasing human resources. In order to replace the missing CERN staff an increasing number of support personnel was requested from the external firm. Recently the proportion of this support personnel exceeded 50% of the total resources of the section. This fact created two problems:

- Unclear line of responsibility, especially concerning electrical safety
- Legal problems related to the fact that the support personnel became permanently employed for positions of electrical operators.

3 OUTSOURCING PROCESS

3.1 Turning point – choice of strategy

The construction of the LHC became a turning point for the electrical exploitation. The LHC electrical works require an important number of personnel for the works organization and supervision as well as for the commissioning of the installations. It became clear that the present CERN staff would not be able to cover all activities. It was decided that the CERN staff would take the responsibility for works while the operation and maintenance activities will be assured by a new contract.

3.2 Market survey

The market survey conducted in the year 2000 resulted in 12 companies pre-qualified for the invitation to tender. Three types of potential bidders could be identified:

- utility companies
- maintenance departments of big industrial manufacturers
- 'multi-service' companies associated with small firms specialized in the maintenance.

3.3 Activity analysis

The starting point for the preparation of the technical specification was an in-depth analysis of the activities of the exploitation section. This analysis, which took several weeks, was based on the Rapier CMMS database extracts, survey with the section personnel and discussions with persons in charge of the various activities in the ST/EL group. The analysis showed that the operation and maintenance activities comprise approximately 11'000 hours, which include 4'920 hours for operation, 3'500 hours for corrective maintenance and 2'620 hours for other work. The amount of work corresponds roughly to the manpower of 2 technicians and 5 operators. See table 1 for details.

In addition to the activity of the operation and corrective maintenance the exploitation section manages the preventive maintenance executed by the external firm. The average cost of this activity is approximately 400 kCHF per year.

3.4 Type of the contract

The general trend in outsourcing of non-core activities is to build result-oriented contracts (as opposed to the contracts, which define the size of resources). In the case of the electrical exploitation the average lifetime of the equipment is thirty to forty years. For some equipment preventive maintenance interventions are performed every six years. This fact linked to the contract duration (maximum five years) lead to the concept of the hybrid contract, which would be partially result oriented and partially with imposed activity.

3.5 Technical specification

3.5.1 Nature of the works to be subject of outsourcing

The work to be executed by the future contractor has been divided into three lots, depending on the nature of activity and the method of payment:

- Operation and corrective maintenance of the CERN network. These activities shall be realized by so called base team, which shall be permanently present on the CERN premises during the normal working hours.
- Preventive maintenance of electrical equipment according to the maintenance plan. This activity shall be executed by the supplementary personnel and the base team in its idle time.
- Inspection and follow-up of electrical installation work done by other contractors. This work shall be executed by additional, specialized personnel.

3.5.2 Productivity gain

It is expected that the Contractor will increase the productivity both of the base operation team and of the maintenance team. The increase of the productivity of the operation team shall result in the decrease of the number of personnel. The increase of the productivity of the maintenance team can be done through the use of the operation team personnel in its idle time, which in turn will decrease cost of the supplementary maintenance personnel.

The profit resulting from the productivity gains shall be shared equally between CERN and the Contractor.

3.5.3 Performance indicators

The aim of the performance indicators is to maintain quality of work especially regarding the efforts to increase productivity. They will have an impact on the payment, see appendix 1.

The performance indicators taken into consideration from the beginning of the Contract are listed below:

- number of breakdowns due to the human error,
- average duration of repair intervention,
- average response time to a call from the TCR,
- personnel turnover,
- safety and respect of procedures.

Other performance indicators (number not exceeding 8 in total) will be introduced within one year from the beginning of the contract.

Instead of using relative performance indicators, i.e. evolution of chosen variables, it was decided to use the present values as a reference.

3.5.4 Contract evolution

In co-operation with the electrical exploitation the contractor will have the responsibility to workout new ranges/routines for the repetitive activities of the exploitation. The aim of this is to increase the activities paid according to the operation and maintenance price list and decrease the activities paid according to the service and fixed fees price list

3.5.5 Payment formula

Taking into account the above considerations, the payment for the work executed by the contractor shall be reached by the following formula:

$$R = F + E - PP + R_{PER}$$

Yearly lump sum Estimated activity Productivity gain return Payment resulting from application of performance indicators

See appendix 1 for details and explanations.

3.5.6 Personnel qualifications

An important stress has been put on personnel qualifications. They are clearly defined for all categories of personnel. Relevant experience is required (8 years for the contract engineer, 4 years for technicians and 3 years for operators). These references will be carefully checked before the beginning of the contract.

3.6 Human factor

In the process of outsourcing the exploitation personnel was informed constantly on the strategy and status of the process. Early discussions with every member of the team allowed to understand their anxiety as well as working preferences. On the basis of this information people were assigned to their new activities. The difficulties appeared in one case. All personnel was informed about the new responsibilities, possible developments in the career as well as availability of the training.

4 CONCLUSIONS

The outsourcing of the electrical exploitation is one of the most important challenges for the ST/EL group. Correct preparation of the process, especially the activity analysis, was essential. Next stage of the process will be putting the contract to work. It is expected that the phase-in will last up to 6 months. Within one year from the beginning of the contract first evaluation will allow to measure the success.

Table 1 – Summary of maintenance and operation work

ACTIVITY	Number/year	Hours/year	REMARKS	Average time per intervention
OPERATION		4920		
Network manoeuvres	30	540	6 operators necessary	3h
Safety locking-out, de-energisation	400	1200	2 operators, including travel, work and CAMMS report	1,5h
Measurements	20	320	Installation of the equipment, read-out, report	16h
Exploitation of event recorders: reports, archiving		840	1 operator, 10h per month	
Safety inspections	30 days	240	1 operator, rounds with TIS safety inspection	1 day
Safety conformity assurance	40 days	320	1 operator, 8 weeks	1 day
Reading/change of settings	20	60	2 operators, including travel, work and CAMMS report	1.5h
Assistants to clients (interlocks, emergency stop etc.)	30	90		3h
Commissioning of LV installations	30	100	1 operator, including travel, work and CAMMS report	3h
Temporary installations (LV switchboards, links, etc.)	20	160	2 operators, including travel, work and CAMMS report	4h
CAMMS database input, update, reporting		330	7 operators, 4 hour per month	
Tests of equipment in the workshop		300		
Documentation, labels, etc.		420	7 operators, 5 hours per month	
CORRECTIVE MAINTENANCE		4250		
Break-down repair during the normal working hours	600	3000	2 operators, including travel, work and CAMMS report	2.5h
Equipment repair in the workshop		500	3 operators, 1 month	
SPARES STOCK MANAGEMENT		600		
Spares stock management		400	1 operator, 4 days per month	
Workshop management, material expedition and reception		200	1 operator 2 days per month	
TEST/MEASUREMENT INSTRUMENT MANAGEMENT		200		
Measurement and test instrument management		200	1 operator 2 days per month	
TESTS		300		
Different test for clients GSS, TIS, etc.	50	300	2 operators	3h
OTHER		1520		
Training		420	7 operators, 60 hours each	
Procedures/instructions preparation		500	2 technicians, 20 hours per month	
Transport, cleaning, work supervision		600	5 operators, 10 hours per month	
TOTAL HOURS FOR OPERATION AND CORRECTIVE MAINTENANCE		11040		

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APPENDIX 1 – PAYMENT FORMULA

The payment (R) for the activities described in this specification will be reached by the following formula:

$$R = F + E - PP + R_{PER}$$

Yearly lump sum Estimated activity Productivity gain return Payment resulting from application of performance indicators

Lump sum payment (F)

The lump sum payment will comprise:

- Fixed overhead costs local and general (F1)
- Contract Engineer, including mobile phone and car or other personnel equipment if needed (F2)
- Permanent stand-by service (excluding interventions) (F3)

$$F = F1 + F2 + F3$$

Theoretical estimated activity – Target (E)

The theoretical activity (E), expressed in CHF, will be calculated yearly and will be the sum of the three estimates:

$$E = E1 + E2 + E3$$

E1 = The target activity of the base operation team

It will be calculated by multiplication of the unit price per hour for each category of personnel and number of hours estimated by CERN for three years. (10'500 for category of technicians and 22'500 for category of operators.

E2 = The real activity of preventive maintenance

It will be calculated by multiplication of the quantity of maintenance and their prices.

E3 = The real activity of the inspection team

It will be calculated on the basis of the daily rate and days worked.

Productivity gain

It is expected that the Contractor will increase the productivity both of the base operation team and of the maintenance team. The increase of the productivity of the operation team shall result in the decrease of the number of personnel and related cost C1.

The increase of the productivity of the maintenance team can be done through the use of the operation team personnel in its idle time, which in turn will decrease cost of maintenance personnel C2.

The profit resulting from the productivity gains shall be shared between CERN and the Contractor according to the following formula.

$$PP = \frac{(E1-C1)*0.5 + (E2-C2)*0.5}{2}$$

P1 - Base team productivity gain factor
P2 - Maintenance team productivity gain factor

The CERN will not assume the losses due to the unit price level offered by the Bidder for the preventive maintenance.

None of the values P1 and P2 can be negative. For $(E_n - C_n) \leq 0$ the $P_n = 0$ (n=1,2).

Cost (C)

The cost expressed in CHF designates the real work of the personnel in activities of operation team (C1) and maintenance team (C2)

It will be calculated on the basis of the hourly rate per category and hours worked according to the weekly hour-sheets for operation and maintenance teams.

Payment resulting from performance indicators (RPER)

The payment (negative or positive) resulting from the application of performance indicators will be calculated according to a formula established during the first year of the contract. The influence of the payment on the total payment (R) will be limited to +5% - 5%.