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현대로템의 K2 전차에 대한 비용관리

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현대로템의 K2 전차 비용관리

Abstract

현대의 전장상황은 네트워크전, 정보전, 로봇전, 우주전 등과 같이 고도로 정밀하고 복잡해짐과 동시에 장비 개발을 위해서 요구되는 비용은 기하급수적으로 급증하고 있는 추세이다. 그러므로 한정된 예산하에서 사업을 성공적으로 수행하기 위해서는 개발 초기부터 목표비용 설정 및 관리와 비용 절감 활동이 필수적으로 요구되고 있다.

따라서 본 연구에서는 국방분야에서 추진하고 있는 비용관리 정책을 소개하고 K2 전차를 개발하면서 현대로템에서 적용한 목표비용 개념, 비용관리 절차 및 방법론을 제시하고 대표적인 비용절감 사례를 소개하고자 한다.

<Key Words> 목표비용(Target Cost) 비용절감(Cost Reduction)

1. Introduction

We confronted the situation where the operation and support cost of equipment including the development and acquisition of weapon system increases by geometric progression because the weapon system will be able to accomplish the multi-task precisely and multi-functionally as a result that battlefield situation is developed in composition form of precision, network, information, robot and aerospace war[3]. Therefore the reasonable estimating about life cycle cost and the visibility of the cost information is demanded from early stage of development. For meeting the needs, it is tendency that military related organizations and companies prefer the method by CAPE(Computer Aided Parametric Estimation) to by ECE(Engineering Cost Estimation) as usual [2,4,5]

Advanced countries have already estimated the suggested cost using the method of parametric estimating and analyzing to reduce the preparatory period, negotiation cost and cycle time. They has apply the concept of CAIV(Cost As an Independent Variables) [1] to reducing life cycle cost as part of acquisition reform as well.

National military forces have organized "Analysis and Estimating team" in the Ministry of National Defense and "Cost Analysis center" in the KIDA (Korea Institute of Defense Analysis), and has stipulated in the regulations about acquisition process of weapon system that parametric cost estimating process and CAIV concept must be used from January, 1999. The Defense Acquisition Program Administration, DAPA, is opened also in 1996 for guaranteeing the clarity, increasing the efficiency, securing the professionalism and strengthening the competitiveness of acquisition of weapon system.

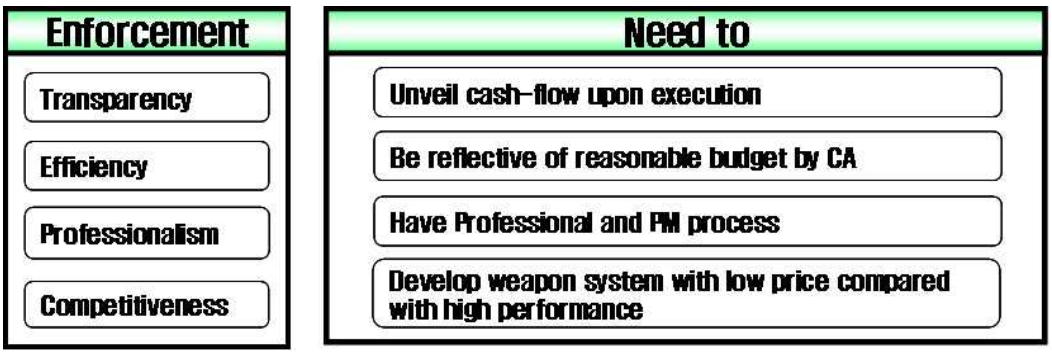
In this research, I will introduce the of cost management of Korean Government and the means of Hyundai Rotem to perform it efficiently. And I

will show you likewise the cost estimating result to the mass production unit cost of K2 main battle tank (hereinafter K2) using PRICE s/w and the cases of process, form and examples of applied cost reduction method for accomplishing the target cost of Hyundai Rotem Company.

1.1 The Policy of Government

Defense Acquisition Program Administration(DAPA) of Korea was opened on 1st of January, 2006 to improve defense capabilities through effective management of Armed Force Enhancement Program and Plans, timely delivery of military supplies and better support and promotion of the defense industries.

DAPA is enforced to the principles of transparency, efficiency, and professionalism to secure competitiveness[1]. Especially the government tries to promote the technique of the cost analysis and management as you can see in figure 1.



<Figure 1> Cost Analysis & Cost Management (Government)

First, it is being changed into a cost analysis using Parametric Cost estimating instead of Engineering Cost Estimating and Analogy Estimating.

Second, it is under examination to contract all weapon system with the

1) http://www.dapa.go.kr/

Fixed Price or Firm Price Incentive Fee (FPIF) type but the Incentive Form Price (IFP) type.

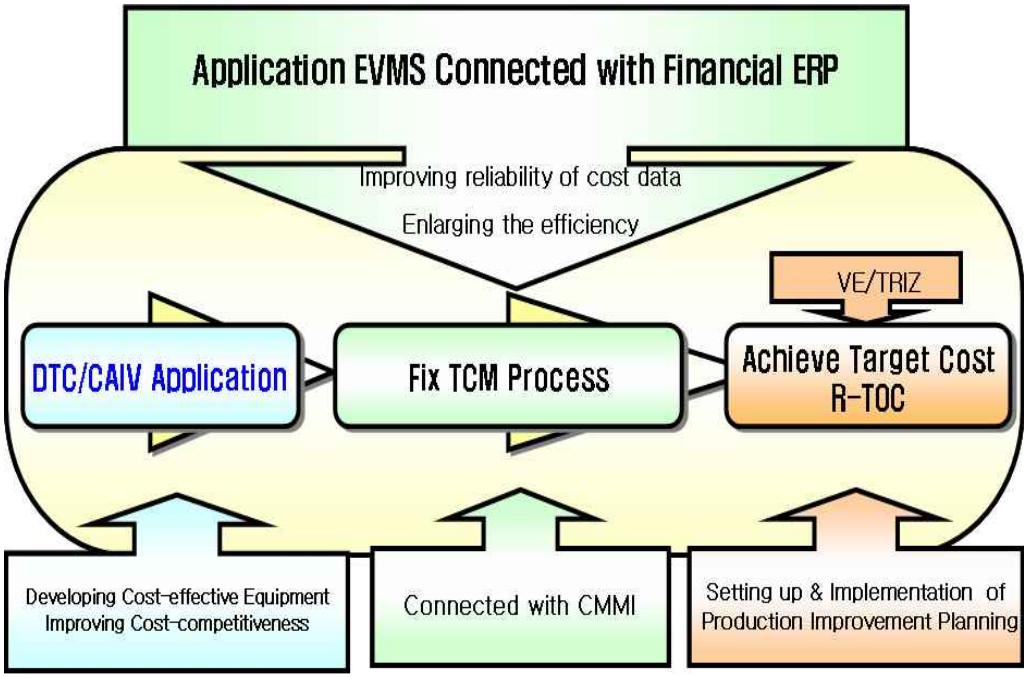
Third, the viewpoint of the acquisition is being changed from considering only an acquisition cost to considering the total life cycle cost including O&S cost.

Fourth, the management of acquisition is also being changed from the considering performance mainly to considering Cost.

And the government emphasizes CAIV methodology to all weapon system.

1.2 The Policy of Hyundai Rotem

The cost analysis & management of Hyundai Rotem was on the basis of the Korean Government's as introducing at section 1.1 and established management way to perform it in the concrete and practically. First, the project should be carried out with philosophy of DTC (Design to Cost) & CAIV(Cost As an Independent Variables) from early stage. Second, the process of cost estimation and management linked CMMI(Capability Maturity Model Integration) & ERP(Enterprise Resources Planning) system should be fixed for TCM(Target Cost Management)[6] when project is going on. Last, I will do my best so that cut down the mass production unit cost and operation and support cost. Specially, I will deduce the ideas to accomplish target cost and reduce life cycle cost using VE(Value Engineering) technique, the creative technique for cost reduction, and TRIZ(The Russian acronym for the theory of inventive problem solving) technique, the technique for solving contradiction originated by Genrich Altshuller.



<Figure 2> Cost Analysis & Cost Management (Hyundai Rotem)

2. Cost Estimation of the K2

2.1 Introduction of K2

The program status for developing K2 is as follows. From 1995 to 1997 we have done the concept exploration study. We're currently in the preparing the production program. The development concepts of K2 are the reduction of cost, weight and size.

K2 designed to lead the future combat environment is the original Korean model that has world class mobility, fire power and survivability. It has truly incorporated the latest technology and excellent functions such as the digital battle management system connected with the C4I system.

The K2 also will be supported by its family vehicle which shares the

same hull configuration and components, and provides great savings in logistic support costs and increase the ease of tactical operation.

2.2 General Description of K2

The K2 shown in the table 1 will have latest performance in mobility, fire power, and survivability.

The K2, fitted with a 1,500 hp diesel engine and in-arm hydro-pneumatic suspension unit, can produce world class speed on both paved road and the field. Through superior acceleration, quick pivoting and the ability to overcome obstacles, the K2 is excellent in rapid attack on the move and in avoiding enemy fire.

The in-arm hydopneumatic suspension unit (ISU) in the K2 enables excellent mobility on both soft soil and obstacles. Through attitude control, the K2 can improve its survivability by lowering the silhouette to avoid enemy detection and hits.

The K2 doesn't require any preparations for shallow water fording and it can perform underwater fording by just attaching a snorkel.

The main gun of the K2 is the 55 caliber, 120mm smoothbore gun whose effective firing range and penetration can be maximized through advanced kinetic energy ammunition.

The K2's autoloader enables fast and steady loading and firing under high speed maneuver on rough terrain.

The K2 has not only special armor package (SAP) and explosive reacting armor (ERA), but also Active defense system against rockets and anti-tank missiles to maximize the survivability. The crew compartment and ammunition stowage have been isolated; hence the crew members are protected from flame and toxic fumes that arise from blasting.

<Table 1> Main Characteristics of K2

Main Characteristics	K2	Remark
Crew	3	
Combat Weight(t)	55	
Dimension (LxWxH)(m)	10.8x3.6x2.4	
Engine(hp/type)	1,500/Diesel	
Suspension	All ISU	
Attitude Control	Yes	
Navigation System	INS/GPS	
Driver's Thermal Vision	Yes	
Max. Road Speed(km/h)	70	
Fording(m)	4.1	
Main Gun	120mm/L55	
Ammunition(rounds)	40	
Ammo Loading	Auto loading	
Gun and Turret Driving System	Electric	
Target Auto Tracking	Yes	
Commander's Sight	2-axis stab, Optic/thermal, LRF	
Muzzle Reference System	Dynamic MRS	
NBC Protection	Yes	
Armor Protection	SAP/ERA	
Active Defense System	Soft Kill	
IFF System	Yes	
Laser Warning System	Yes	
Battlefield Management	Yes	
Embedded Training/Manual	Yes	
Crew Display	Commander, Gunner, Driver	

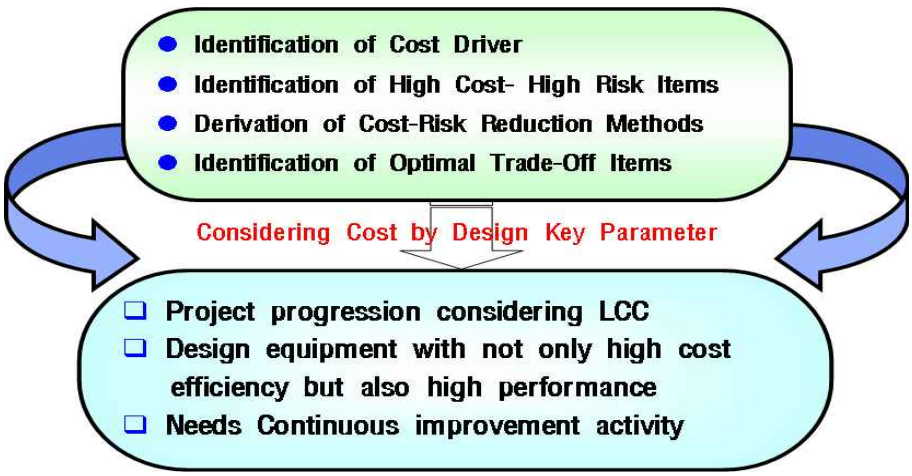
2.3 Cost Estimation Result

The cost analysis of K2 is performed by gathering up the cost analysis result of each company semiannually and Hyundai Rotem, system integrating company, supports the analysis operation of ADD (Agency for Department Defense). The K2 is going to contract of mass production this year and I am groping for scheme of reducing cost to achieve mass production unit cost suggested by DAPA. The final estimating result of mass production unit cost and operation and support cost will be decided after comparing the result of engineering analysis with those of computed model analysis. I omitted quantitative analysis result from this paper owing to our security .

3. Cost Reduction Program of Hyundai Rotem

In this chapter, I will introduce our way to reduce cost for attaining our goal about mass production unit cost.

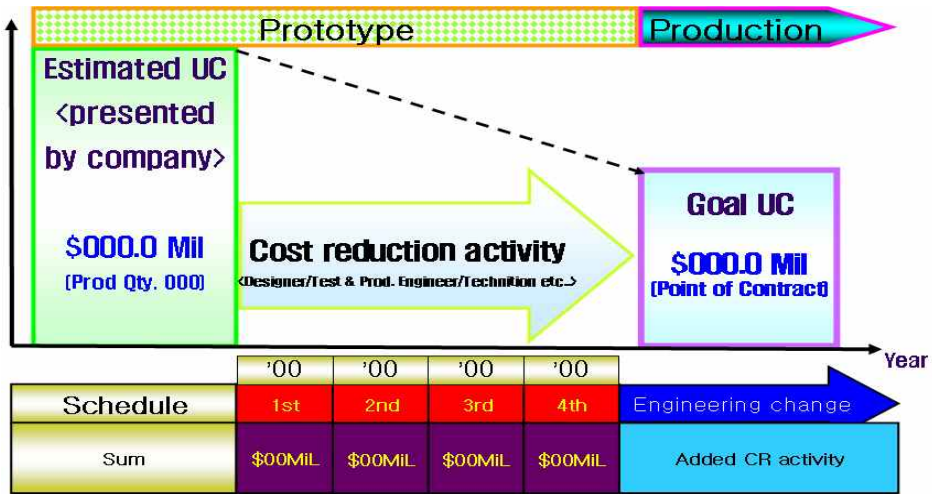
3.1 Basic Concept & Scheme of Fulfilling



<Figure 3> Basic Concept

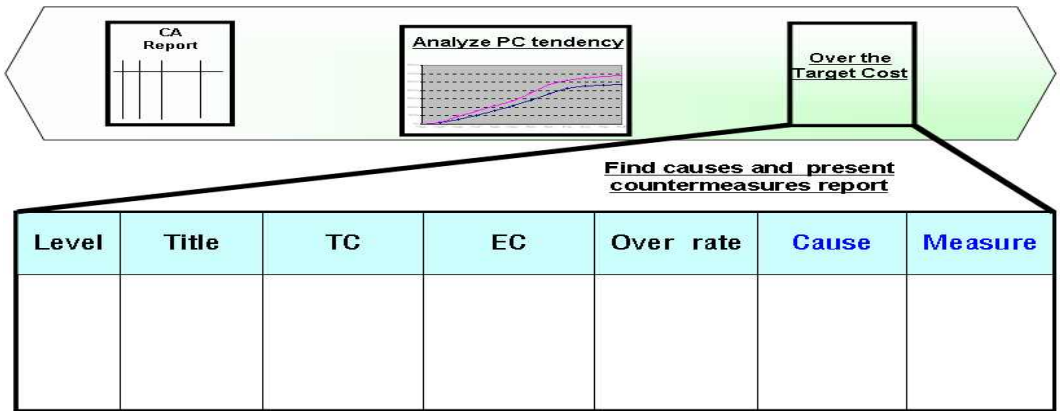
I should grasp cost diver for attaining target cost of K2 as you can see in figure 3. After distinguishing high-risk, high-cost items, I grope the way to reduce cost and risk, after which I develop the cost-efficient K2 by recognizing the optimal trade off target.

For reducing cost, First, All related companies should submit cost management plans to ADD at starting stage and should manage cost item by item on the basis of target cost of ADD. They should submit semiannual cost analysis report on the basis of cost management plan and should hold a conference about whether achieving target cost or not and how achieving target cost if not. The one shown at figure 4 is schematic diagram on schedule of cost reduction. The goal of cost reduction was assigned being classified into equipment or every year and considered only direct cost which could be managed, except overhead for practical management. The manager belongs to R&D center should control and manage the direct cost & the material cost, the manager belongs to factory should manage the labor cost in connection with manufacturing testing product.



<Figure 4> Cost Reduction Goal & Schedule

Second, you can show in figure 5, they should consider and confirm the every semiannual cost analysis report and should check the target cost by period for trying to find the cause and to take a measure when the cost is over. Specially, the constructing system which is composed of control signal system and over cost factor tracing system proceeds all over for managing the cost effectively.



<Figure 5> Cost Analysis Report & Cause Examination & Measure Report

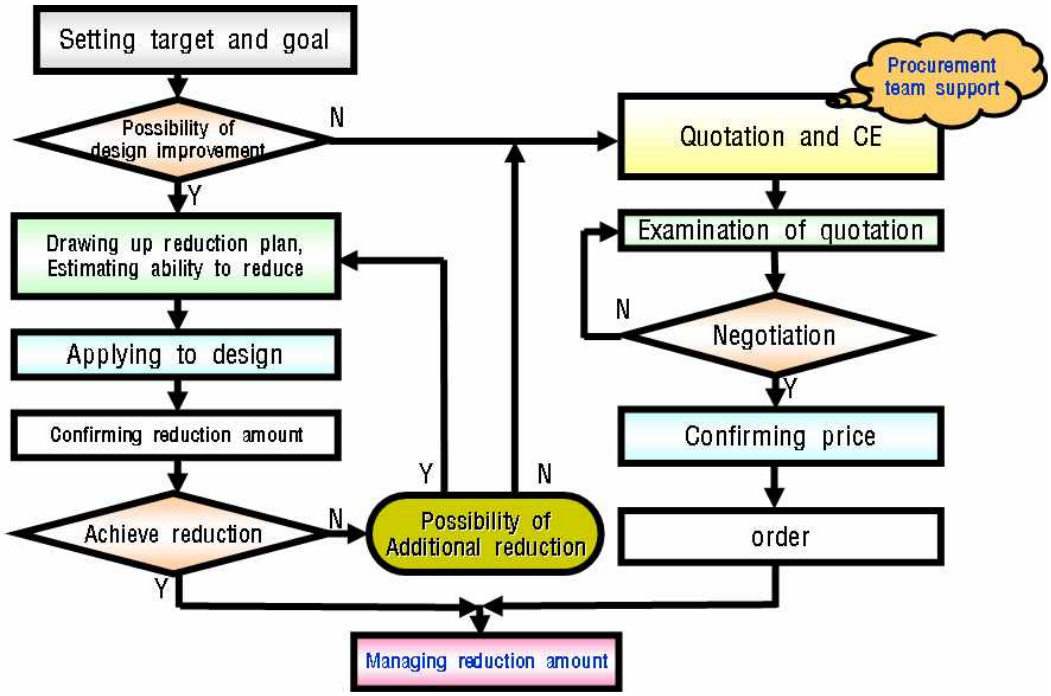
Third, the best practice of commercial field should be introduced actively in military field and the cost reduction should be performed continuously by applying the value engineering technique and creative cost reduction technique at early stage. Table 2 shows you the cost reduction plan summary.

<Table 2> Cost Reduction Plan Summary

Classification	Application Method	Application Object
Design	Simplification, Standardization	Shape, Process
	Optimal Design	Performance, Function
	Civilian Standard, Change Material	Standard, Material
	Localization	Imports
The Others	Price Negotiation	

3.2 Cost Reduction Process

If target item is selected out for cost reduction by cost analysis, target cost can be set up. First of all, I consider the possibility of cost down by design modification. If possible, I make out reduction plan, apply the improvement on drawings, fix curtailed cost and manage it. If curtailed cost does not meet the target cost, I consider the possibility of cost down one more time and conclude whether cost can be reduced by design modification or by following estimation process. If I decide that additional cost down is impossible, we should follow the estimation management process showing right side of figure 6, and should support price negotiation by parametric cost analysis.



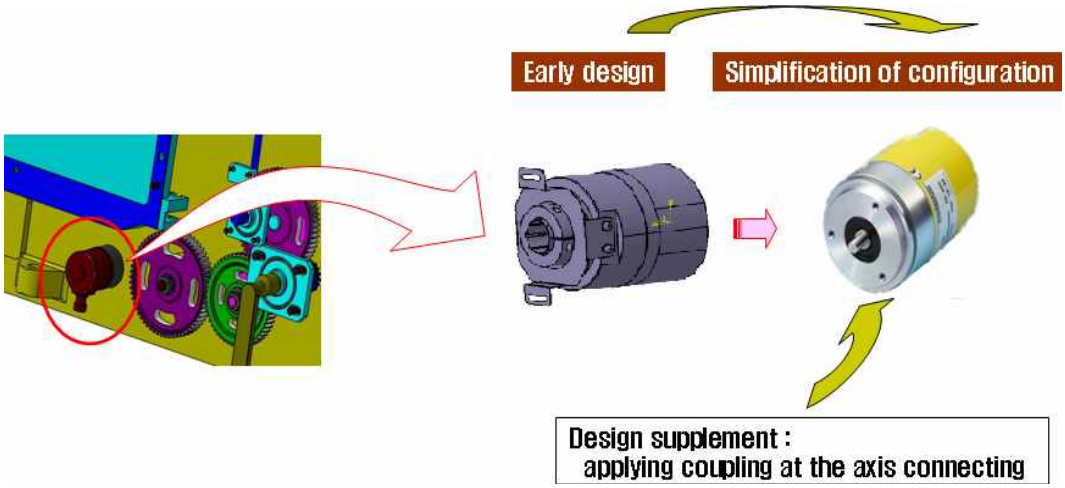
<Figure 6> Procedure of Cost Reduction

4. Cases of Cost Reduction

In this chapter, I introduce representative cases of cost reduction shown at table 2 in chapter 3.1.

4.1 Simplification of Design

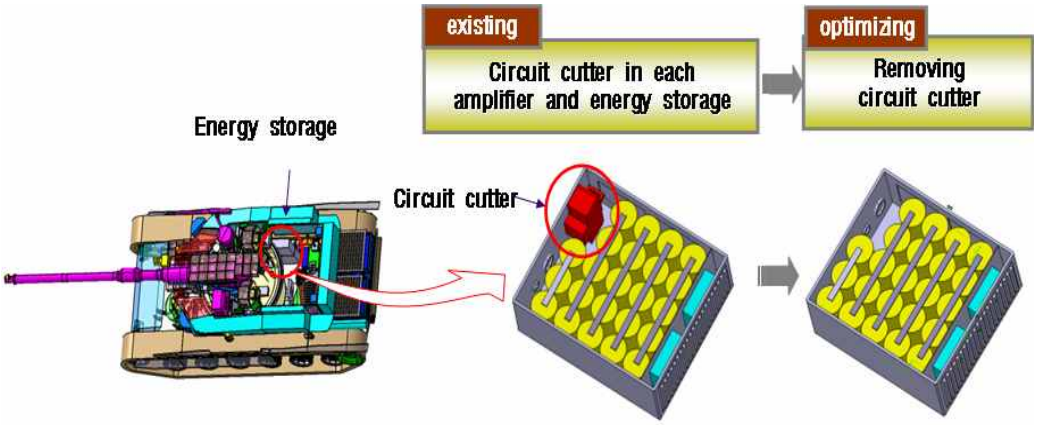
This one shown at figure 7 is absolute encoder, a part of some equipment of K2. It shows you the cost down 8% case by the simplification of design that its hollow shaft was replaced with solid shaft.



<Figure 7> Simplification of Design

4.2 Optimization of Design

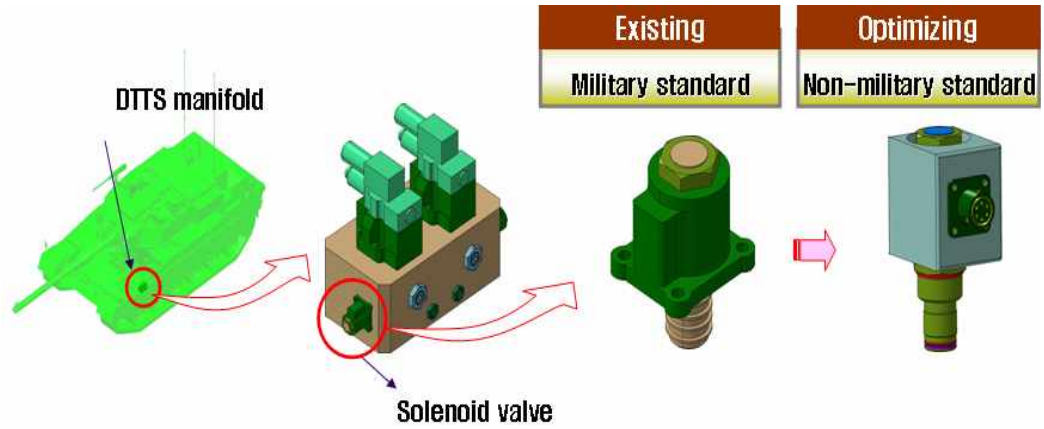
This one shown at figure 8 is the circuit breaker that protects capacitor by cut over-current. Initially, each one of it is contained at boosting transformer and energy capacitor. The one in energy capacitor can be deleted by design optimization and it caused the cost to down 20%.



<Figure 8> Optimization of Design

4.3 Specification Alternation

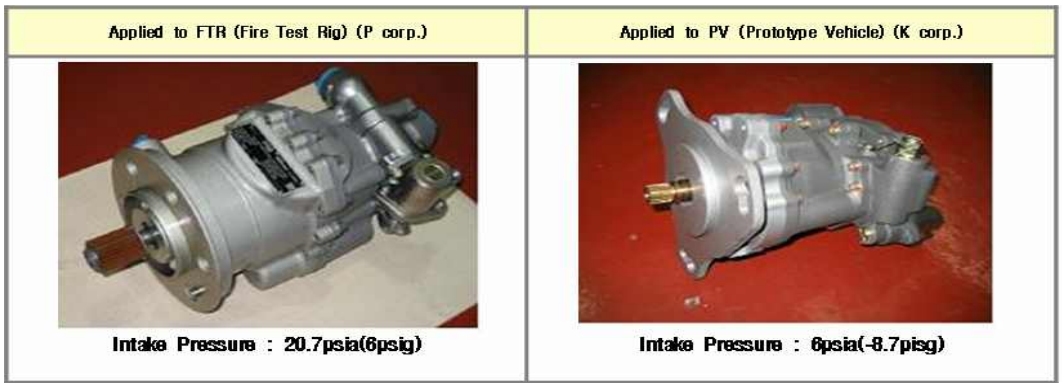
This one shown at figure 9 is the case of the design improvement of control manifold that is in track traction controller which protects abnormal states of track. The initial model which is developed on the basis of military specification is alternated with the model which can be purchased commercially except connector and only developed connector on the basis of military specification. It caused the cost to down 20%.



<Figure 9> Specification Alternation

4.4 Localization

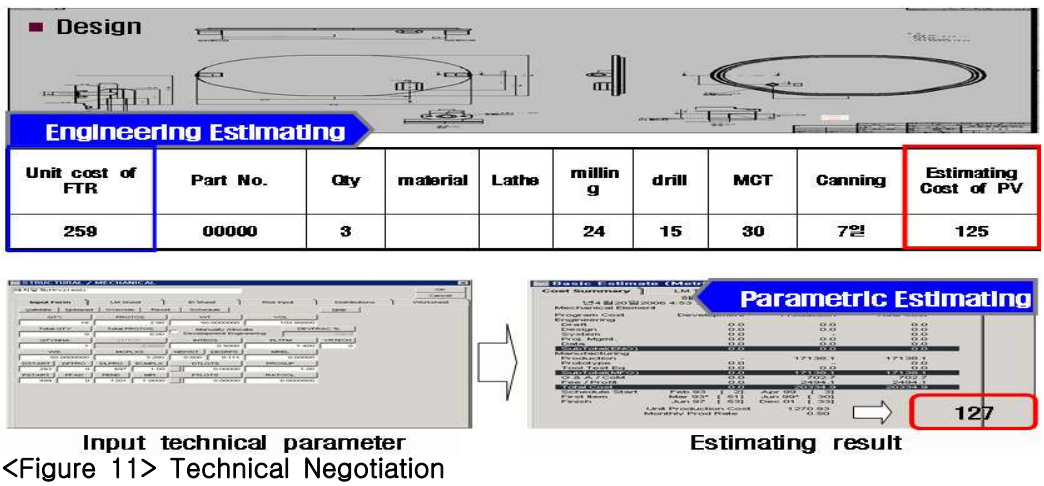
This one shown at figure 10 is refueling pump from the foreign company, P. It is alternated with refueling pump that is improved on existing domestic pump. It caused the cost to down 45%.



<Figure 10> Localization

4.5 Technical Negotiation

This one shown at figure 11 is the case of lowering the purchase price by alternating the price negotiation method with the technical negotiation method by parametric cost estimation without complaint of maker.



<Figure 11> Technical Negotiation

5. Conclusion

It is very difficult to reduce cost satisfying marked performance. But, If you follow the way suggested in this paper, you can achieve two goals, performance and cost.

To sum up, First, set up the aggressive target cost from early stage.

Second, deviating from the past developing way for performance of the priority, promote the design that should consider cost of the highest priority.

Third, construct systematic process to control and manage the cost.

Forth, if military forces, organization and related companies make every effort continuously to develop the equipment high-performance, low-cost, it is possible sufficiently.

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