Financial Model for Capability Development in the MRO Industry: The Indian Case

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Abstract

India is a land of opportunities even though it has a population of 1.33 billion. It has immense growth potential in Aviation sector as well. During the 2005-2006 periods, the country had around 300 aircrafts which has increased over a period. With the aggressive order by Indigo Airline &SpiceJetfor a greater number of aircrafts there has been a substantial increase in the aircraft numbers today despite closure of Jet Airways. The complete aviation industry of the country today has around 643 aircraft (Source: List of scheduled operators, DGCA). This is an abysmal low count when compared to China which has more than 3500 aircrafts serving 1.39 Billion and USA which currently has a fleet of 7309 aircrafts serving a population of 0.329 Billion. The point to be noted here is that with 1.33 Billion populationsthe demand for travel by air route in India is expected to grow tremendously because of its geographical spread and increasing purchasing power of Indian common man. With an increase in the number of aircrafts in the Civil Aviation Sector, we can expect allied industries to grow as well. For example, MRO industry which is hardly present in the country is expected to grow on a large scale. Currently, the entire MRO industry is a $150 million industry and has the potential to grow over $1.5 billion(with current fleet size) if India promotes its MRO industry and push for indigenization. The current government in India emphasizes on 'Make in India'. We can, therefore, expect MRO industry to get its due recognition in Indian aviation industry.

MRO stands for maintenance repair overhaul of aircraft components. Currently, 90% of the activities required for this industry (MRO) is carried out in other countries due to technical and regulatory requirement. This states that most of the work in this industry is outsourced. In the coming years we can expect an increase in employment in Aviation MRO sector due to the government's drive and impetus towards this sector as an employment generator. For this to happen India needs to increase its MRO industry activitiesby many folds and many pedagogies. For e.g. Incentivised this industry from tax burden and encourage investment.This will enable a great jump in aviation MRO industry in the years to come. This will also result in big requirement of capability development which will enable component testing repair activities in India which will require a head-start to skill development and skill absorption.

This paper is about preparing a Working Financial Model for Capability development in MRO Industry. Capability Development means specific Aircraft Component Testing, Repair, Overhaul facility

Development. The capability of aircraft component repairmust be developed by inducting tested and proven infrastructure which will need approval by a regulatory authority. In India, the regulatory authority is the DirectorGeneral of Civil Aviation(DGCA). First the DGCAshould approve the capability for component repair.After the approval, an organizationcan service aircraft parts.

Keywords: MRO (Maintenance, Repair & Overhaul), CMM (Component Maintenance Manual), Director General of Civil Aviation (DGCA), Regulator, Capability Development, Hard Time Maintenance, Cost Structure, Capability Development

Introduction:

India's present i.e. 2019 MRO market is estimated to be around $900 million. Boeing forecasts this market is expected to grow at a 7% compound annual growth rate. However, due to lack of proper MRO facilities and high taxes being imposed on the provision of MRO services in India, 90% of the Indian MRO work is outsourced to countries like Singapore, Dubai, UAE, Sri Lanka, and others. There are hardly few major players in this market currently.Increase in the number of air passengers year on year last decade, drastic expansion of commercial fleet size by Indian Aviation companies, government initiatives and entry of low-cost carriers have been major push factors for the Aviation market.Hence Indian Aviation MRO Market which is the progeny of Aviation operators is also expected to grow rapidly. Indian Aviation was valued at around USD 20 billion in FY'19. The air passenger traffic of scheduled airlines grew from 103.7 million in 2013 to approximately 198 million in 2019. This increase along with growth in airline fleet sizes has increased demand for MRO services.

With the fleet size likely to double in coming years, the need for a strong domestic MRO industry is critical, not just desirable. Further recent government initiatives of exempting MRO service provider from customs duties on Aircraft part and toolkits and extension of storage period for Aircraft part up to 3 years have helped MRO companies to grow their businesses.Until recently Indian Airlines such as Indigo, Spice Jet used to send the Aircraft for C-check to Shri Lanka, Dubai, Singapore but Indian government duty exemption move made this industry cost competitive to get C-check done in India.

Objectives of Project:

Prepare a Model for Costing of New Capability development projects which will help for new entrepreneurs and existing MRO companies for more accurate investment or CAPEX planning for capability development and in turn help to do feasibility study of new capability planning.

This working Financial Model for Capability development for MRO Industrymust ensure all the necessary regulatory, technical, commercial, financial, and environmental aspects are considered which will ensure successful capability development with necessary regulatory approvals.

Research Methodology:

Stratified Random Sampling of Projects was carried out to finalize an appropriate and suitable model. Primary research carried out by interviewing the industry specialist in this Aviation MRO domain. The model is the outcome of the consensus received from industry professionals as well.

Process of Capability Development:

To develop the expertise and capability in this field, MRO Industry needs experienced manpower who can guide the organization for capability development. This is an important activity to develop and grow MRO industry on its own in India.Here we are elaborating the steps involved in nearly ideal capability development process in India. This takes in to account Indian Business macro conditions andsubsequently the processes are designed keeping in view the Risk Management in Capability Development.

To meet new capability development requirement the MRO Companymust invest in facility development. The investment can be high if there is a requirement of OEM special tools, OEM supplied equipment/ test benches and where equivalency cannot be established. With the current stature of the Indian economic cycle, it becomes necessary to develop these capabilities at lower cost without compromising on quality and deliver best output.

Before going through the steps involved in MRO capability development one should know the following:

New developed Capability can only take up commercial operation after approval from Regulators. E.g. DGCA approval for the new capability is must if part is to be fitted in Indian registered Aircraft. EASA/FAA approval is mandatory for the new capability if the component is to be used in European or US based Aircrafts unless otherwise the foreign regulators accepts the certificate issued by DGCA. Hence commercial operations of new capability can start only after above approval for the capability and MRO Organization has trained approved staff to perform MRO activity on the said component. Further approval needs to be yearly reviewed by regulators for their recency and upkeep with regulations and revised CMM requirement (if any).This also needsto be considered in

capability development and its costing.

Hence capability development has the following stages. This begins with:

1. Identifying the components in the Aircraft which require hard time/ on condition Maintenance. Hard Time maintenance ensures continuous and sustainable business as components are removed at fixed time interval. Then identifying whether Airlines is willing to outsource this maintenance activity to Indian MRO companies. If yes, how many Aircraft of this type which are flying and what amount of number of removals of the parts can we expect per year? What are the repair charges Airlines are willing to pay in India?Further information should be acquired of what the competitorsare charging for the same activity? This will help to determine the payback period for the Investment. Aircraft component MRO facility also needs to be developed for component which requires on-conditional removal. In this case yearly removal of the components is assessed based on their past data. If you have partnership with any of the international MRO, then this data can be obtaining through them or we can use Airline component removal data. Otherwise you need to use Delphi techniques wherein you will be asking industry experts for their estimation of removal. If the yearly removal dataisknown, then the service cost may be estimatedaccordingly,and Payback can be calculated. All the above factors are to be captured in the Model which is mentioned in Annexure 1(Initial feasibility report template)& Annexure 2 (Commercial Template Model).

2. The technical literature with regards to component overhaul, repair & testing is available in Component maintenance Manual (CMM). The MRO organization must arrange latest CMM from the airline or the Original Equipment Manufacturer (OEM).This will incuradditional cost to MRO. If the MRO is affiliated to any Airline, then it is very easy to arrange from them at free of cost. The source of this CMM with latest CMM declaration is must as a part of Regulatory requirement.

3. Technical team of MRO mustStudy these manual and prepare a 'Initial feasibility report template' (As per attached Annexure 1) based on identifying Test Bench requirement, Special Tools requirement, Process Requirement& Consumables requirement.

You will also be checking whether the test benches can be fabricated in India or to be imported? Point to be noted that if the part number of test bench is mentioned in the CMM then you need to import the same or else you should have OEM or Airline current serviceable bench diagram forin-house development of said test bench. This is must for proving the Regulator that your designed testbench is equivalent. Identifying the consumables requirement and their availability in India or in the international market is also must arrive at appropriate cost with minimum variance.

In case of Special tools as well, if part number is specified in the CMM then you need to purchase it from OEM or online Aircraft part suppliers like https://www. locatory.com; https://www. allsparesaviation.com; www. aircraftspruce. com, www.skygeek.cometc.

Also identify normal and specialize process required for repair or overhaul. Identify whether these processes can be done in India. If this cannot be done in India,then identifiesthe specialequipment's which are necessary for these special processes. If this can be purchased as the part of Capex, then arrange for landing cost of such equipment as MRO companies outgo will be based on landing price. If the Special processes cannot be done in India or it is too high, then such projects should be avoided as implementation cost of such projects will be too high to make feasible in India at competitive rates.

From the CMM consumables Also to be listed and to be check whether those consumables can be procured from Indian vendors to save cost. Individual Import of these consumables will be not economical for project implementation.

Modelled Excel sheet of initial template shows whether project feasibility checked for initial consideration with regards to Test Bench, Tooling & Equipment, Processes and Consumables.

4. Once as per model the feasibility is established then one mustproceed for preparation of 'Commercial Template Model' which is mentioned in Annexure 2 of this research paper. This 'Commercial Template Model' will have following aspects:

a. Calculating cost of CAPEX part i.e. Fixed Cost or capability development cost including direct indirect cost.

b. Calculate variable Cost for Aircraft part to be tested, repair or overhaul

Here in the first part of Capex calculation'Model Commercial Template' is mentioned

CAPEX & OH sheet of Model Excel workbook. It clearly calculates the initial investment in the project considering all direct costincluding the cost of infrastructure, Test bench, Equipment, Special & general tooling. Here approximate cost of each element is determined through Aviation reliable sources only. Test Bench and Special tools could be major cost some time for the project.

Variable Cost per Unit is calculated considering following: Man-hours required, Consumables required, electricity and other overheads required for performing the test. Further for variable cost per unit calculations we need to consider following:

Template-Man-hours574XXXX'Excel Sheet of Excel file 'Commercial Template Model' shows the man-hours required for performing individual task. Here man-hours are calculated for each process carried out in the MRO workshop.

Template-Consumables' Excel Sheet of Excel file 'Commercial Template Model' shows the cost of consumable considering their landing prices.

Template-Spares' Excel Sheet of Excel file 'Commercial Template Model' shows the cost of spares. These rates are available in OEM price list or Aviation spares suppliers. The estimation of removal rate of these spares is done based on the inputs received from experienced engineers who havealready worked on these components. It is crucial to take help of experts to identify the quantity of spares as Spares can change entire costing if not properly calculated. Further 'Workshop Report' from other MRO's or foreign partner maybe used for calculating removal rate.

Unit Flow & Costing' Excel Sheet of Excel file 'Commercial Template Model': This excel sheet also mentions how many units are expected per annum for testing and repair. This data can be arranged from foreign partner or India Aircraft Operators. Expected unit Flow Based on Number of Aircraft increase in Indian Airspace and Type of Aircraft (Secondary data from DGCA website for number of Aircrafts in India, Primary Data from PBH Contractor). This excel sheet also talks about the price of per unit testing in terms of generally 2 counts i.e. Testing and Repair. This cost will be compared with international prices or competitor prices basic comparison to establish base costing

Future Cash Flows' Excel Sheet of Excel file 'Commercial Template Model': This shows the expected yearly cash flows of the project based on unit expected to receive. Based on the same data, payback period and IRR of the project is calculated. Generally, a Payback period of less than 4 years is considered ideal for investment. Also, if we use IRR criteria the IRR of more than 18% is ideal.

5.After preparing the above, prepare a Gantt chart based on activities involved (WBS)in execution of this project. This is prepared based on engineering lead time required for the project and the procurement lead time for special tooling, test bench and other parts. The spare lead time is not considered for the project as it is applicable post project successful implementation activity.

6. Based on all the 3 documents such as Initial Template, Commercial template and the Project scheduled plan, this project need to be presented to Board or top management of the MRO organization for their 'Go-Ahead' or consent for the project. This is very much needed as top management will allocate funds for the project.

7. Once the 'Go-Ahead' from the Board received then project activity begins. Acquire all the special tool, general tools, and Test equipment from the identified sources and ensure that they are in position to supply necessary documents such as 'Manufacturer Test Report' wherever applicable of 'Certificate of Conformance'. If you have used equivalent tooling or benches, you need to create an equivalency document which is prepared based on the guideline mentioned in ARINC 668 methodology.

8. Ensure that project should be Monitored and Control at each stage to maintain the timelinementioned in Project Schedule. Any deviation in Project plan and implementation schedule needs to be substantiated with reasoning.

9. Prepare the procedure sheet as per CMM method. Ensure that the latest CMM is used for reference. If extra equipment acquired, then use Operation manual of the said equipment maintaining the requirement of CMM.

10. Get the training done for the staff at OEM place or at the other Airline/MRO facility which has got the capability to do the said component testing, repair, and overhaul. This is the mandatory requirement of Regulator.

11. Validate the test set up by using GOLD Unit (which indicates that serviceable unit which has all the testing parameter and results) that can be compared. These values should be validatedon the new set up as well.

12. Submit all the documents to the Regulator (through your Quality Assurance Department) for their inspection at the MRO facility for capability approval.

13. Regulators need to be convinced through the evidences for the capability readiness with appropriate documents such as CMM (with source of recency confirmation), procedure sheet for testing as well as repair/ overhaul, COC for all the equipment's, validation documents, OEM or Operators (with capability) training documents for all the staff who will be working on those component, Spares and consumables supply sources are identified with lead time, Validation documents. After submission of the above to regulators, they may come for the inspection of facility as well as actual capability readiness. If the regulator gets convinced with the capability readiness, they will issue

Clearance for including the said capability in'MRO capability list'.

14. After formal receipt of Regulators, you can start commercial operation of the said capability.

In this research paper the above process practically explains each step required in new capability development requirement.

Justification of the Model:

This paper explains a financial model for the MRO industry and how to optimize its cost to cater the need and to bridge the gap.This financial Working Model is showing, how the capability development cost can be determined in the aviation MRO industry? This is very important for a newMRO company. There are times when a new MRO companies are not aware of the requirement of this industry and its implication on cost.By proper adaption of the Model will help entrepreneurs and industrialists to take up the new challenges and set up new capabilities at minimum cost making it a successful business case.

This paper will benefit new MRO organizations leading to indigenization and fulfilling the Indian government's vision to increase employment. This can be a pivotal contributor for India to become a $5trillion economy promoting Make in India. Further this research paper emphasizeson localization of test set up and special tooling developmentmaintaining the safety standards which will ensure Indian MRO's capability is at par with the global test setups.

Looking at the optimistic market for the aviation industry and the increasing demand in air travel by the Indian population and the diaspora abroad, the requirement of aircraft services will increase leading to many operational requirements/ services. Increasing the number of aircraft will make a robust and profit-making industry increasing employment for future pilots, flight crew, administration department, and other categories of workers including MRO staff. This Model will contribute to MRO Industry growth in India.

Current issues with MRO Industries in India:

In the absence of a well-developed MRO base in India, there are currently around 40 overseas maintenance providers approved by the Indian aviation authority DGCA to conduct work on Indian-registered aircraft, in locations including the UK, Germany, France, Romania, Jordan, Israel, the UAE, Sri Lanka, China, Singapore, Malaysia and Australia. Meanwhile, some of the large global MRO players are in the process of establishing MRO bases in India.

Until recently, Thailand faced a similar situation. In 2017, 60% of aircraft maintenance services for Thai carriers were provided by foreign companies. The Thai government took steps to change that situation by promoting the domestic maintenance industry, including generous tax incentives modelled on Singapore's program. There, MRO providers are also turning to state-of-the-art technology such as automation to offer high-quality maintenance, thus keeping their competitive edge. Hence Indian Government also needs to support this Industry by reducing the GST rate for Indian MRO industry.

Further the two main airports in New Delhi and Mumbai charge rents to MRO providers that are 50-100% higher than those charged at equivalent facilities in Europe and Turkey. The two main airports also impose a royalty charge of about 20% on maintenance work at the airports. And demands from the MRO industry to the government to slash these rates was sternly opposed by the airport operators.

If India can also translate the changes that are being discussed into reality, it could be a game-changer for the MRO industry in India.

Conclusion:

In view of the above Indian MRO Industry has a great opportunity to grow.If these MRO's used the templates attached with this paper for their capability development, itwill help them for better cost management of the project leading to successful MRO capability development intern it will result in successful MRO organization. The Model highlighted the micro details which are generally ignored by current MRO industry professionals leading to failure or non-competitive services. The paper is to make MRO industry self-reliant keeping in view the concept of' Entrepreneurship Development in MRO Sector' & 'Make in India'.

Limitation of Study:

The study is limited to MRO activities in civil aviation segment only. There is need for MRO activities in defence Aviation as well;however, the need for this is substantially different than Civil Aviation.

Further, it is assumed that the existing MRO organization is developing the new capability, has CAR 145 approval is needed for set up of new MRO organization. Further, it is also assumed that the MRO organization has necessary infrastructure and key manpower resources like Accountable Manager, Quality Manager, and Workshop Manager & Approved Engineer.

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Annexure 1

Annexure 1.1 Initial Feasibility: Bench

Technology :	PNEUMATIC/Hydraulic/Mechanical/ Electro-mechanical/ Electrical	Date:	19-Oct-XX
Product Group :	Main Part of Aircraft	Rev:	0

Feasibility Outcome			
Feasible in India	Feasible but some parts to be imported from Abroad	Feasible but all parts to	Not Feasible

Description	PN	OEM	CMM
(Main Part or Subpart Name)	574XXXX-XX	Part Manufacturer Name	21-XX-XX 21-XX-XX-R

Bench description	Bench PN (if any)	OEM	CMM ref	CMM page	PN tested	Tested parameters - Range - Accuracy	Type	Experts feedback if any
Pressure Gauge (P1)	0 to 7.5 ±.1 Bar	Commercial	21-XX-XX	1yyy	5740XXX-XX	Unit of Measurement		
PROCESSMETER (Q1)		Commercial	21-XX-XX	1yyy	5740XXX-XX	Unit of Measurement		
PROCESSMETER (T1)		Commercial	21-XX-XX	1yyy	5740XXX-XX	Unit of Measurement		
Millohmmeter		Commercial	21-XX-XX	1yyy	5740XXX-XX	Unit of Measurement		
AIR PRESSURE SOURCE		Commercial	21-XX-XX	1yyy	5740XXX-XX	Unit of Measurement		

Annexure 1.2 Initial Feasibility: Tools

Technology :	PNEUMATIC	Date:	19-Oct-XX
Product Group :	Main Part Description	Rev:	0

Feasibility Outcome			
Feasible in India	Feasible but some parts to be imported from Abroad	Feasible but all parts to be imported	Not Feasible

Description	PN	OEM	CMM
(Main Part or Subpart Name)	574XXXX-XX	Part Manufacturer Name	21-XX-XX

Tool description	Tool PN	OEM	CMM ref	CMM page	PN handled	QTY	Purpose	Expert feedback if any
Tool 1	EM87XXXXX1	Part Manufacturer Name	21-XX-XX	9yyy	574XXXX-XX	1	PROCESS TEST	
Tool 2	EM87XXXXX2	Part Manufacturer Name	21-XX-XX	9yyy	574XXXX-XX	1	PROCESS TEST	
Tool 3	EM87XXXXX3	Part Manufacturer Name	21 XX XX	9yyy	574XXXX XX	1	PROCESS TEST	
Tool 4	EM87XXXXX4	Part Manufacturer Name	21 XX XX	9yyy	574XXXX XX	1	PROCESS TEST	
SPECIAL TOOL	MICROMETER	Commercial	21 XX XX	9yyy	574XXXX XX	1	INSPECTION/CHECK	

Annexure 1.3 Initial Feasibility: Process

Technology :	PNEUMATIC	Date:	19-Oct-XX	Feasibility Outcome			
Product Group :	Main Part Description	Rev:	0	Feasible in India	Feasible but some parts to be imported from Abroad	Feasible but all parts to be Imported	Not Feasible

Description	PN	OEM	CMM
(Main Part or Subpart Name)	574XXXX-XX	Part Manufacturer Name	21-XX-XX

Part Number Held	CMM reference	CMM page	Task SEQ	Task description	OEM	Man Hours Mins
TESTING AND FAULT ISOLATION (TASK 21-XX-XX-XXX)						
574XXXX-XX	21-XX-XX	1yyy	1	Process test 1	Part Manufacturer Name	30
574XXXX-XX	21-XX-XX	1yyy	2	Process test 2	Part Manufacturer Name	20
574XXXX-XX	21-XX-XX	1yyy	3	Process test 3	Part Manufacturer Name	20
574XXXX-XX	21-XX-XX	1yyy	4	EC Test	Part Manufacturer Name	10
DISASSEMBLY (TASK 21-XX-XX-XXX)						
574XXXX-XX	21-XX-XX	3001	1	Removal of the ZZZ	Part Manufacturer Name	5
574XXXX-XX	21-XX-XX	3001	2	Removal of the ZZZ	Part Manufacturer Name	5
Processing (TASK 21-XX-XX-XXX)						
574XXXX-XX	21-XX-XX	4002	1	Proceess 1	Part Manufacturer Name	30

Annexure 1.4 Initial Feasibility: Consumables

Technology :	PNEUMATIC	Date:	19-Oct-XX
Product Group :	Main Part Description	Rev:	0

Feasibility Outcome			
Feasible in India	Feasible but some parts/consumables to be imported from	Feasible but all parts to be Imported	Not Feasible

Description	PN	OEM	CMM
(Main Part or Subpart Name)	574XXXX-XX	Part Manufacturer Name	21-XX-XX

Sr.No	Consumables description	Designation P/N and specification	OEM/Vendor code	CMM ref	CMM page	PN handled	Used For	Query for Experts	Expert feedback if any
1	Consumable MATERIAL1	(MIL-C-XXXX)	Commercial	21-XX-XX	9yyy	574XXXX-XX	REPAIR		
2	Consumable MATERIAL2	VARNISH 1	Commercial	21-XX-XX	9yyy	574XXXX-XX	REPAIR		
3	ADHESIVE MATERIAL	ADHESIVE2	Commercial	21-XX-XX	9yyy		REPAIR		
4	PENETRANT INSPECTION MATERIAL	PENETRANT 1	Commercial	21-XX-XX	9yyy	574XXXX-XX	REPAIR		

Annexure 2: Commercial Template

2.1 CT CAPEX

Description	Qty. Expected	
Average load expected /year	524	(30% Risk Factor)

A Expenses for Developing the Capability

Column1	Attributes	Life (In years)	Frequency of Expenses	In Rs/-	Per year
1	Infrastructure (Quantity of Part Nos.)	8	One time	3,000,000	375,000
2	Special Tools (As mentioned in CMM)	8	One time	3,000,000	375,000
3	Equipments	8	One time	6,000,000	750,000
4	General Tooling	8	One time	500,000	62,500
5	Test Bench	8	One time	2,000,000	250,000
6	DGCA Approval or European or US Regulator or Gulf Regulator Charges	8	One time	600,000	75,000
7	Charges paid to OEM for their technical support like CMM & Queries	10	One time	500,000	50,000
	Total Expenses			15,600,000	1,937,500

Column1	Column2	Column3	Column4	Column5	Column6
B	Expenses for Maintaining the Capability (Annually to be Paid)				
1	Calibration Charges for gauges , meters etc.		Annual	350,000	350,000
2	Annual Maintenance charges		Annual	650,000	650,000
3	DGCA Approval and European or US Regulator charges or Gulf Regulator Charges		Annual	200,000	200,000

C Additional Charges to be levied on each unit

1	Operational / Working Cost	Hr	KW	Industrial Power Rate (Rs)	Total Cost (Rs/-)
	a) Electricity for M/c , Test bench & Equipment	1.5	40	9	540
	b) Electricity for A/c ,of test Laboratory	7	6	9	378
2	Approval Charges Ammortise on number of Units				382
3	Calibration & maintenance charges Ammortise over number of units				1909
4	Depreciation Cost Ammortise Per Annum per Unit (If not accounted in cash flows)				0
5	Additional Charges to be levied on each unit				3209

2.2 CT-MH

UNIT PN:	574AXXXX-XX
DESIGNATION:	'Aircraft part Name' for Capability Development
CMM:	21-XX-XX
OEM:	Part manufacturer Name
REMOVALS:	

MAN HOURS FOR TESTING

SR	WORKSCOPE	ACTIVITY	MIN	HRS
1	TEST	Incoming Inspection & paper work	30	0.5
2	TEST	Testing	110	1.8
3	TEST	Final paperwork and packing	45	0.75
TOTAL MAN HOURS FOR TESTING ONLY			185	3.08

MAN HOURS FOR REPAIR

SR	WORKSCOPE	ACTIVITY	MIN	HRS
1	REPAIR	Incoming Inspection & paper work	30	0.50
		TESTING		0.00
1	REPAIR	Test1	20	0.33
2	REPAIR	APL Test 2	30	0.50
3	REPAIR	APL Test 3	30	0.50
4	REPAIR	EL Test 4	15	0.25
5	REPAIR	AB	15	0.25
		DISASSEMBLY		0.00
1	REPAIR	Removal of the ZZZ	5	0.08
2	REPAIR	Removal of the ZZZ	5	0.08
3	REPAIR	Removal of parts	5	0.08
		PROCESSING		0.00
1	REPAIR	Process1	30	0.50
2	REPAIR	Process2	30	0.50
3	REPAIR	Process3	30	0.50
4	REPAIR	IC & EC with New System	30	0.50
		INSPECTION/CHECK		0.00
1	REPAIR	Visual Inspection of the Parts	30	0.50
2	REPAIR	Special Checks	15	0.25
		REPAIR		0.00
1	REPAIR	Removal of the ZZZ	20	0.33
2	REPAIR	Replacement of the ZZZ	30	0.50
3	REPAIR	Repair of Leak (10% Repair)	120	2.00
4	REPAIR	Repair of the ZZZ using consumables	30	0.5
		ASSEMBLY		0.00
1	REPAIR	Installation of the ZZZ	5	0.08
2	REPAIR	Installation of the part	5	0.08
3	REPAIR	Final testing	110	1.83
4	REPAIR	Final paperwork and packing	45	0.75
TOTAL MAN HOURS FOR MINOR REPAIR AND TESTING			685	11.42
TOTAL MAN HOURS FOR MINOR REPAIR AND TESTING			585	9.75

MAN HOURS FOR PROCESS AND TESTING

SR	WORKSCOPE	ACTIVITY	MIN	HRS
1	TEST & PROCESS	Incoming Inspection & paper work	30	0.5
2	TEST & PROCESS	Process 1	30	0.5
3	TEST & PROCESS	Process 2	30	0.5
4	TEST & PROCESS	Process 3	30	0.5
5	TEST & PROCESS	Process with New System	30	0.5
6	TEST & PROCESS	Final testing	110	1.8
7	TEST & PROCESS	Final paperwork and packing	45	0.75
TOTAL MAN HOURS FOR PROCESS AND TESTING			305	5.08

2.3 CT-Consumables

Technology:	PNEUMATIC	Date:	05/06/2019	Column1
Product Group :	Aircraft Part Nam	Rev:		0
Description	PN	OEM	CMM	REMOVALS
'Aircraft part Nar	S74AXXXX-XX	Part Manufacturer	21-XX-XX	N/A

Currency conversion:

€	85
US $	70.5
£	94

LIST OF CONSUMABLES

TO BE FILLED BY PROJECT | TO BE FILLED BY PROCUREMENT | TO BE FILLED BY PROJECT MONITOR

SR.NO	DESCRIPTION	PART NUMBER	SPECIFICATION	CMM	PAGE	WORKSCOPE	QTY/ASSY	UNIT	VENDOR	MOQ	UNIT2	MOQ RATE	CURRENCY	INCOTERMS	LEAD TIME (DAYS	TOTAL COST (INR)	DGR/NON-DGR	LANDED COST (INR)	COST/UNIT (INR)	COST/ASSY (INR)
1	Process MATERIA	X1	Not Specified	21-XX-XX	9yyy	CLEAN & TEST	4	LTS	Local	100	LTS	500	INR		120	61900	NON DG	74280	743	2971
2	Process MATERIA	X2	Not Specified	21-XX-XX	9yyy	CLEAN & TEST	1	kg	Foreign	25	kg	6.5	usd		45	11456.25	DGR	17184	687	687
3	Process MATERIA	X3	Not Specified	21-XX-XX	9yyy	REPAIR & TEST	1	LTS	LOCAL	1	LTS	450	INR		15	450	NON-DG	540	540	540
4	Process MATERIA	X4	Not Specified	21-XX-XX	9yyy	CLEAN & TEST	0.25	LTS	LOCAL	1	LTS	450	INR		15	450	NON-DG	540	540	135
5	ADHESIVE MATER	X5	Not Specified	21-XX-XX	9yyy	REPAIR & TEST	20	ml	LOCAL	50	ml		INR		15	2,403.53	NON-DG	2884	58	1154
6	ALODINE	(MIL-C-XXXXA)	Not Specified	21-XX-XX	9yyy	REPAIR & TEST	10	grams	Foreign	1000	gms	101	GBP		60	8875.677	DGR	13314	13	133
7	Process MATERIA	X7	Not Specified	21-XX-XX	9yyy	CLEAN/REPAIR &	250	ml	LOCAL	400	ml		INR		15	3491	NON-DG	4189	10	2618
8	VARNISH MATERI	X8	Not Specified	21-XX-XX	9yyy	REPAIR & TEST	0.5	kg	Foreign	5	kg		INR		30	88125	NON-DGR	105750	21150	10575
																Basic cost/Assy (Minor Repair)				18814
																Add marging @ 15%				2822
																Total cost/Assy (Minor Repair) INR				21636
																Total cost/Assy (Minor Repair) Euros				255
																Basic cost/Assy (Test & clean)				6952
																Add marging @ 15%				1043
																Total cost/Assy (Test & clean) INR				7995
																Total cost/Assy (Test & clean) Euros				94

2.4 CT- Spares

Technology :	PNEUMATIC	Date:	48191	Removal for minor repair per YR
Product Group :	Aircraft Part name	Rev:	0	54

Description	PN	OEM	CMM	REMOVALS	MSR
'Aircraft part Name' for Capability Development	S74AXXXX-XX	Part Manufacturer	21-XX-XX	N/A	N/A

Currency conversion:

€	84.4
US $	7.53
£	95.47

LIST OF SPARES

TO BE FILLED BY PROJECT | TO BE FILLED BY PROCUREMENT | TO BE FILLED BY PROJECT MONITOR

SR.NO	PART NUMBER	DESCRIPTION	CMM	Page Number	Fig No.	ITEM	Workscope	Type of Spare	Total removals expected	OCCURANCE	QTY/ASSY	Vendor	MOQ	UNIT	MOQ RATE	CURRENCY	INCOTERMS	LEAD TIME (DAYS)	Total Cost (INR)	DGR/NON-DGR	LANDED COST (INR)	COST/UNIT (INR)	COST/ASSY (INR)
2	S2xxxx-xx	BUSH	21-XX-XX	100yy	1	022C	REPAIR	EXPENDABLE		20.00%	3	Foreign OEM name	5	each	150	USD	EXW	60	1129.5	NON-DGR	1298.9	259.8	156
4	R1xxxxx	RIVET	21-XX-XX	100yy	1	022C	REPAIR	EXPENDABLE		20.00%	4	Foreign OEM name	100	each	2008	USD	EXW	71	15060.0	NON-DGR	17319.0	173.2	139
1	R2xxxxx	RIVET	21-XX-XX	100yy	1	022C	REPAIR	EXPENDABLE		20.00%	2	Foreign OEM name	10	each	308	USD	EXW	60	2259.0	NON-DGR	2597.9	259.8	104
5	S3xxxx-xx	BUSH	21-XX-XX-I	100yy	1	022C	REPAIR	EXPENDABLE		20.00%	3	Foreign OEM name	1	each	100	USD	EXW	10	753.0	NON-DGR	866.0	866.0	520
3	S3xxxx-xx	BUSH	21-XX-XX	100yy	1	022C	REPAIR	EXPENDABLE		20.00%	3	Foreign OEM name	1	each	100	USD	EXW	10	753.0	NON-DGR	866.0	866.0	520
6	S3xxxx	Name Plate	21-XX-XX-I	100yy	1	022C	REPAIR	EXPENDABLE		5.00%	1	Foreign OEM name	5	each	600	USD	EXW	60	4518.0	NON-DGR	5195.7	1039.1	52
																				Basic cost/Assy (Minor Repair)			1493
																				Add marginin @ 15%			224
																				Total cost/Assy (Minor Repair) INR			1718
																				Total cost/Assy (Minor Repair) Euros			20

2.5 CT- Unit Flows

Manhour Rate 1,600

Internal Costing of Service of Component

Part No.	Description	Costing For	% of Expected volume	MH	Internal Labour Cost	Consumable Cost per unit	sub-Total	Additional Charges from the cost Sheet	Total Cost to Company	EXCLUSIONS
574XXXX-XX	Aircraft part Name' for Capability Development	Tesing & Processing	90%	5.08	8,133	7,995	16,128	3209	19,337	Repairs & Special processes
574XXXX-XX	Aircraft part Name	Repair, test & Process	10%	9.75	15,600.00	21636	37,236	3209	40,445	Majcr repair & Special processes

Expected unit Flow Based on Number of Aircraft increase in Indian Airspace and Type of Aircraft (Secondary data from DGCA website for number of Aircrafts in India, Primary Data from PBH Contractor)

Flow of Parts in Year 2019-20	Flow of Parts in Year 2020-21	Flow of Parts in Year 2021-22	Flow of Parts in Year 2022-23	Flow of Parts in Year 2023-24	Flow of Parts in Year 2024-25	Flow of Parts in Year 2025-26	Flow of Parts in Year 2026-27
260	350	467	624	835	900	900	900
Average Unit Flow	655						

Notes:
Above rates are ex Works, 'your City' basis.
GST: As applicable for all Indian airline customers only.

2.6 CT- Future Cash Flow of the Project

Future Cash Flows of Project

25%	year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Year of Future Cash Flow	-	1	2	3	4	5	6	7	8
No. of Units	-	260	350	467	624	835	900	900	900
Service Price per Unit for (Category 1:Testing & Processing) (35% Rise .. Includes Organization Overheads & Profits)	-	25,138	26,144	27,190	28,277	29,408	30,585	31,808	33,081
Service Price per Unit for (Category 2:Repair Testing & Processing) (35% Rise .. Includes Organization Overheads & Profits)		52,579	54,682	56,869	59,144	61,510	63,970	66,529	69,190
Total Service Revenue (Rs.)		7,249,450	10,160,829	14,096,317	19,580,746	27,233,964	30,530,991	31,752,231	33,022,320
Cost of service Per Unit		19,337	20,304	21,319	22,385	23,505	24,680	25,914	27,210
Total Cost of Services		5,027,698	7,114,579	9,965,101	13,975,303	19,624,510	22,211,855	23,322,448	24,488,570
EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization)		2,221,752	3,046,250	4,131,216	5,605,443	7,609,454	8,319,137	8,429,784	8,533,750
(-) Depreciation @8 years of investment		1,950,000	1,950,000	1,950,000	1,950,000	1,950,000	1,950,000	1,950,000	1,950,000
EBIT		271,752	1,096,250	2,181,216	3,655,443	5,659,454	6,369,137	6,479,784	6,583,750
EBIT (1-Tax rate)		203,814	822,187	1,635,912	2,741,582	4,244,591	4,776,852	4,859,838	4,937,813
Cash flows to all Investors (Assuming No Salvage Value)	(15,600,000.00)	2,153,814	2,772,187	3,585,912	4,691,582	6,194,591	6,726,852	6,809,838	6,887,813
PV Factor @12% COC	-	0.89	0.80	0.71	0.64	0.57	0.51	0.45	0.40
Present Value of Cash inflows	-	1,923,048	2,209,971	2,552,381	2,981,585	3,514,977	3,408,033	3,080,425	2,781,872
Total PV of Cash inflows		22,452,292							
Investment		15,600,000							
NPV		6,852,292							
Pay-Back period									
Expected Growth rate in Service Prices	4%								
Expected Growth rate in Cost Prices	5%								
Cashflows for IRR calculations	**(15,600,000)**	**2,153,814**	**2,772,187**	**3,585,912**	**4,691,582**	**6,194,591**	**6,726,852**	**6,809,838**	**6,887,813**
PV Factor @21.18% COC	21.18%	0.83	0.68	0.56	0.46	0.38	0.32	0.26	0.22
Present Value of Cash inflows		1,777,368	1,887,820	2,015,147	2,175,683	2,370,598	2,124,351	1,774,680	1,481,268
Total PV of Cash inflows		15,606,915							
Investment		(15,600,000)							
NPV		6,915							
Hence approx. IRR=	21.18%								