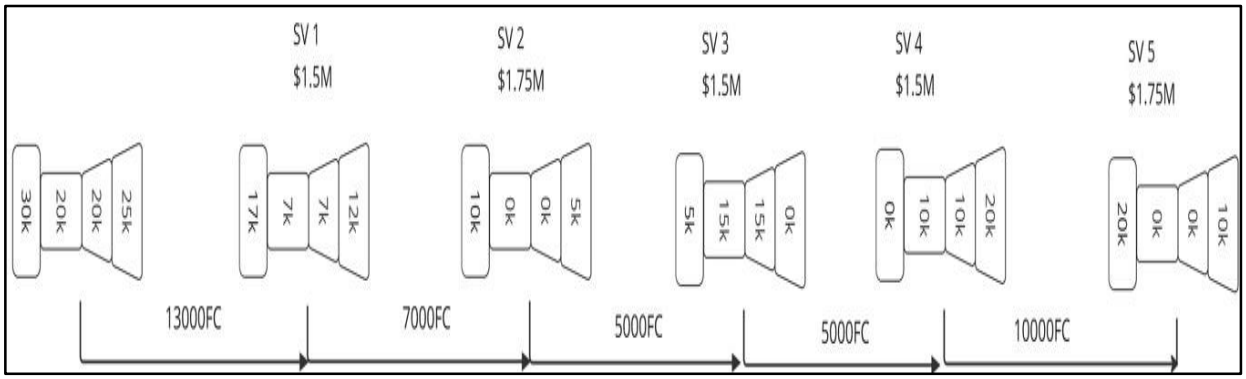

SV 1
$1.5M
SV 2
$1.75M
SV 3
$1.5M
SV 4
$1.5M
SV 5
$1.75M
30k
20k
20k
25k
17k
7k
7k
12k
10k
0k
0k
5k
5k
15k
15k
0k
0k
10k
10k
20k
20k
0k
0k
10k
13000FC
7000FC
5000FC
5000FC
10000FC

Figure 1

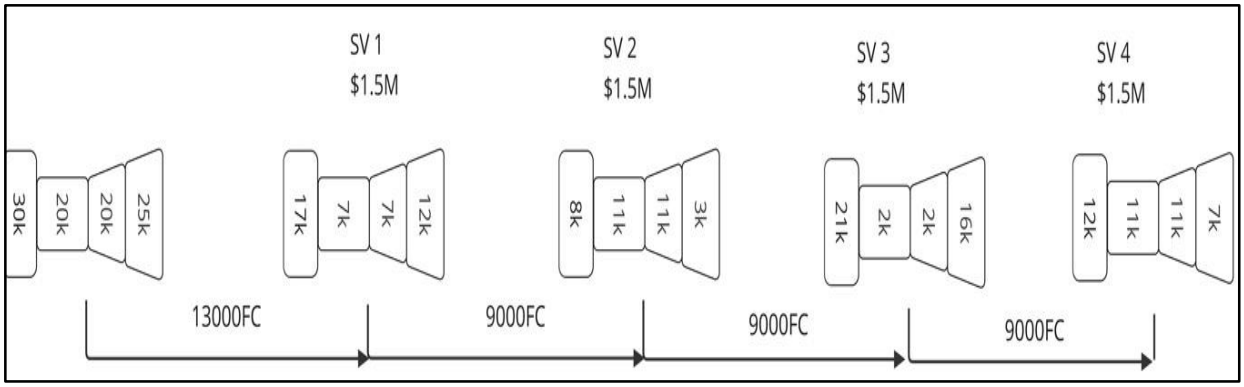

SV 1
$1.5M
SV 2
$1.5M
SV 3
$1.5M
SV 4
$1.5M
30k
20k
20k
25k
17k
7k
7k
12k
8k
11k
11k
3k
21k
2k
2k
16k
12k
11k
11k
7k
13000FC
9000FC
9000FC
9000FC

Figure 2

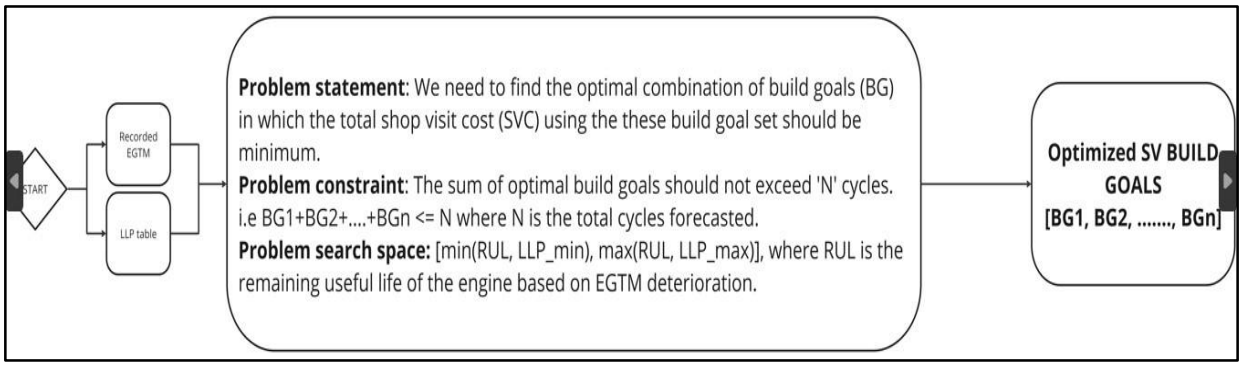

START
Recorded EGTM
LLP table
Problem statement: We need to find the optimal combination of build goals (BG) in which the total shop visit cost (SVC) using the these build goal set should be minimum.
Problem constraint: The sum of optimal build goals should not exceed 'N' cycles. i.e BG1+BG2+....+BGn <= N where N is the total cycles forecasted.
Problem search space: [min(RUL, LLP_min), max(RUL, LLP_max)], where RUL is the remaining useful life of the engine based on EGTM deterioration.
Optimized SV BUILD GOALS
[BG1, BG2, ..., BGn]

Figure 3

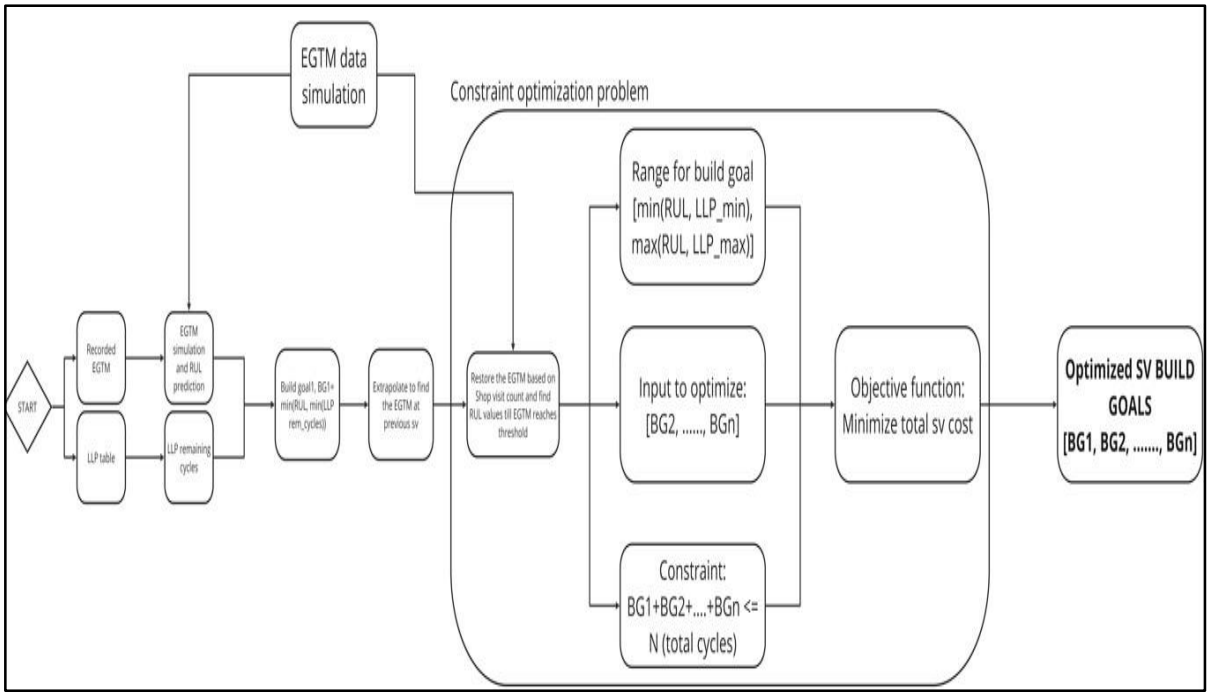

EGTM data simulation
Constraint optimization problem
START
Recorded EGTM
LLP table
EGTM simulation and RUL prediction
LLP remaining cycles
Build goal1, BG1+ min(RUL, min(LLP rem_cycles))
Extrapolate to find the EGTM at previous sv
Restore the EGTM based on Shop visit count and find RUL values till EGTM reaches threshold
Range for build goal [min(RUL, LLP_min), max(RUL, LLP_max)]
Input to optimize: [BG2, ..., BGn]
Constraint: BG1+BG2+....+BGn <= N (total cycles)
Objective function: Minimize total sv cost
Optimized SV BUILD GOALS [BG1, BG2, ..., BGn]

Figure 4

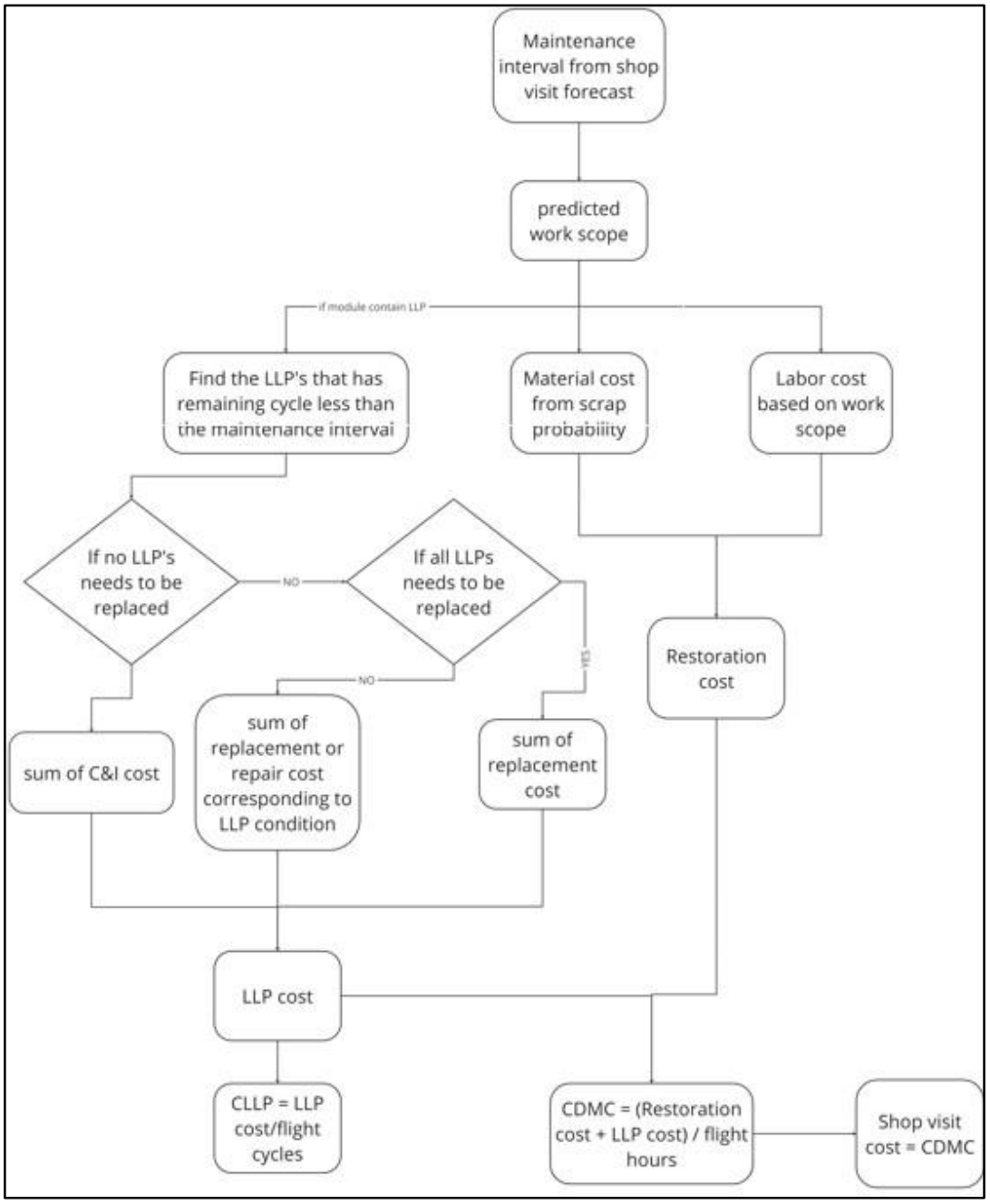

Maintenance interval from shop visit forecast
predicted work scope
if module contain LLP
Find the LLP's that has remaining cycle less than the maintenance interval
Material cost from scrap probability
Labor cost based on work scope
If no LLP's needs to be replaced
NO
If all LLPs needs to be replaced
YES
NO
Restoration cost
sum of C&I cost
sum of replacement or repair cost corresponding to LLP condition
sum of replacement cost
LLP cost
CLLP = LLP cost/flight cycles
CDMC = (Restoration cost + LLP cost) / flight hours
Shop visit cost = CDMC

Figure 5

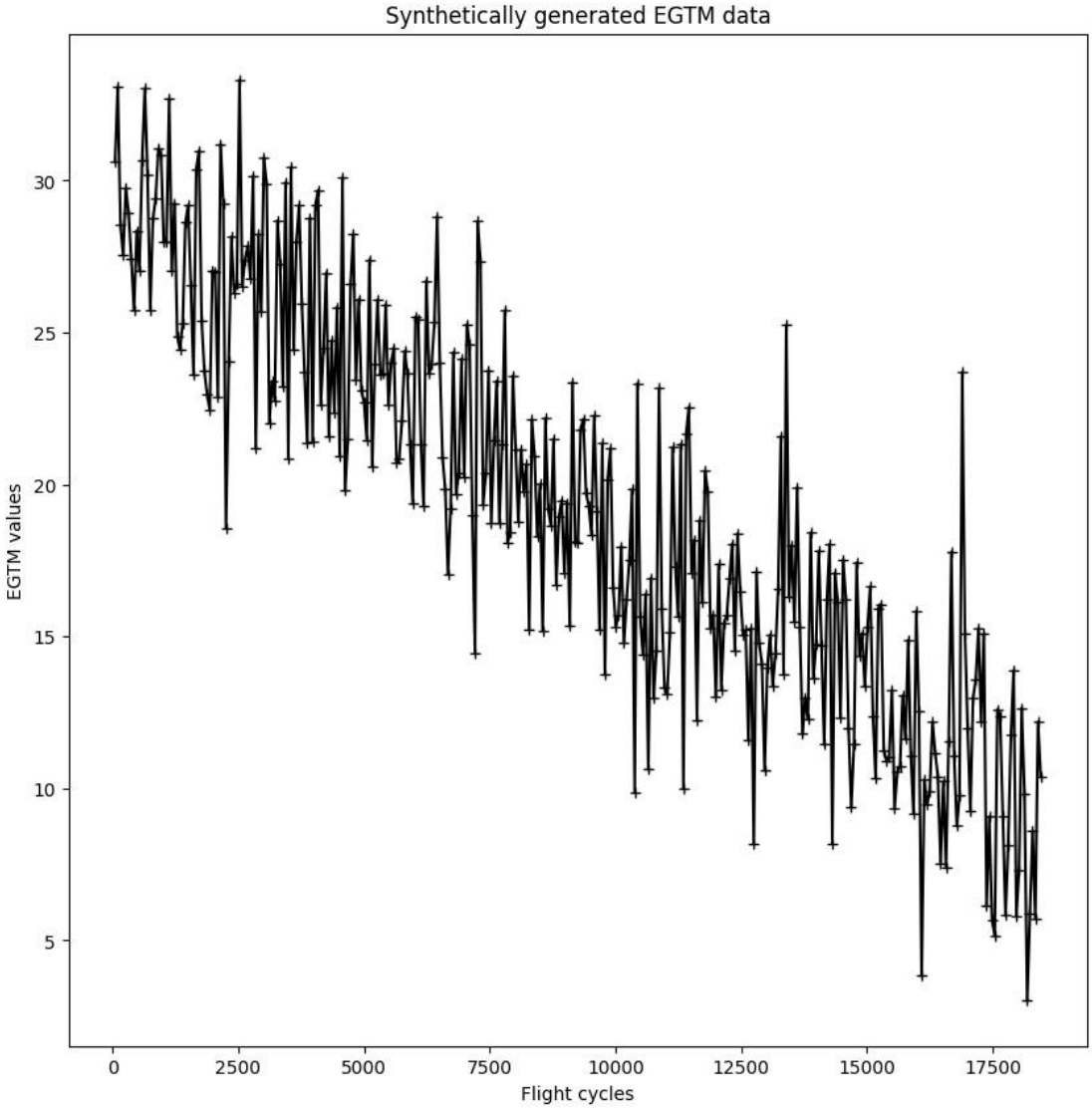

Synthetically generated EGTM data
EGTM values
Flight cycles
30
25
20
15
10
5
0
2500
5000
7500
10000
12500
15000
17500

Figure 6

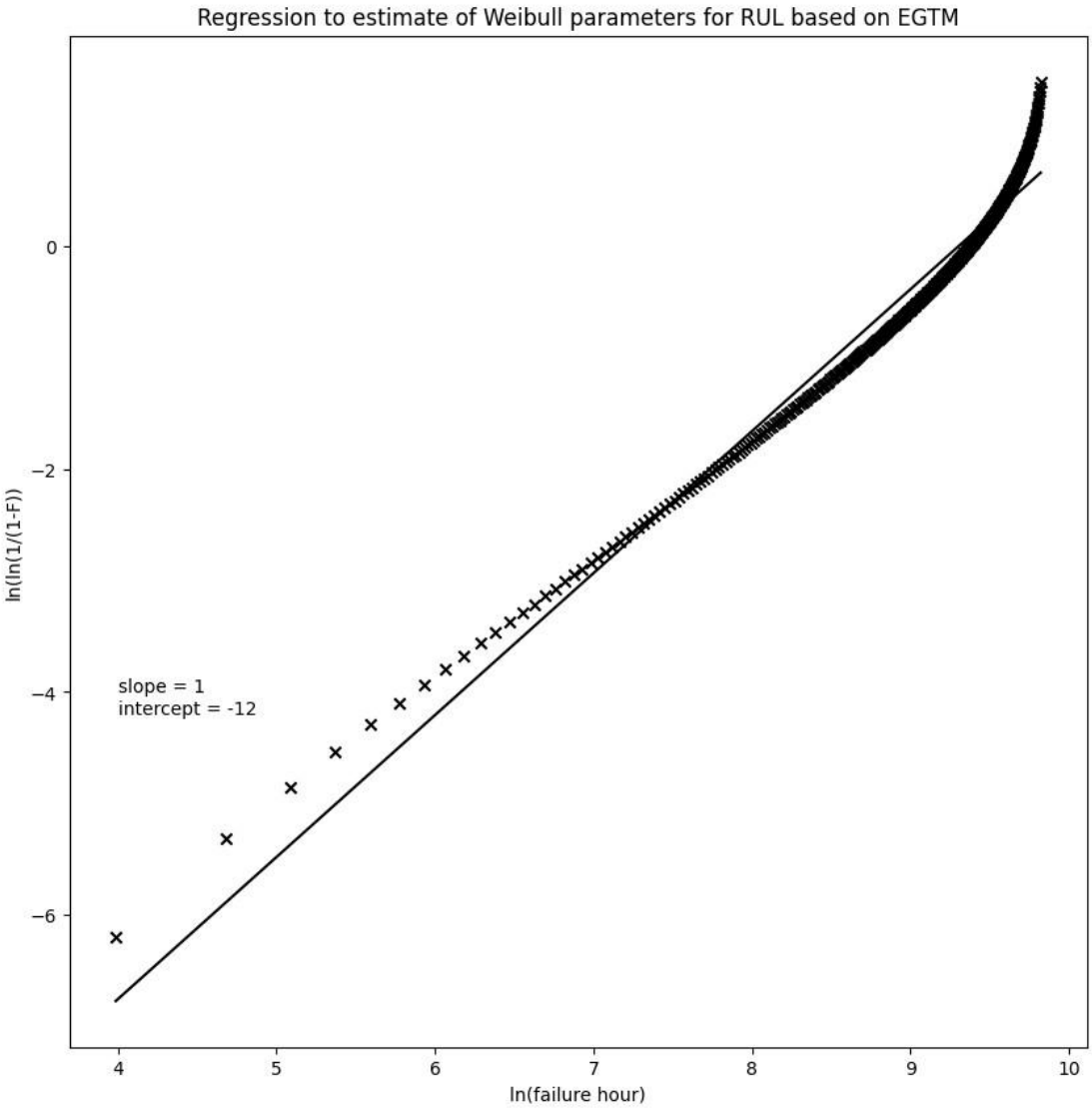

Regression to estimate of Weibull parameters for RUL based on EGTM
ln(ln(1/(1-F)))
0
−2
−4
−6
slope = 1
intercept = -12
4
5
6
7
8
9
10
ln(failure hour)

Figure 7