SAMPLE CALCULATION

Design Mission:

Number of passengers (PAX)	275
Cargo	12,000 pounds
Range	6000 nautical miles
Initial cruise altitude	35,000 feet
Initial cruise Mach number	0.82
Takeoff field length	9000 feet
Landing approach speed	140 knots

Note: Takeoff and landing at sea-level hot day (84° F).
Maximum landing weight with 25% fuel.

1. $M = .82$ @ 35,000 FT

SELECT CONVENTIONAL AIRFOIL

$\Lambda = 35°$, $A = 8$

2. ASSUME $C_L = .50$

FROM FIG. 2 $\Delta M_{DIV} = .016$

3. $M_{DIV} = (M_{CRUISE} + .004) - \Delta M_{DIV}$

$= .82 + .004 - .016 = .808$

4. FROM FIG. 1a AT $\Lambda = 35°$ & $M_{DIV} = .808$

$t/c = .108$

5. $\cos^2\Lambda (t/c)^2 A = .0626$

FROM FIG. 3 $C_{L_{max}}\big)_{T/O} = 1.86$, $C_{L_{max}}\big)_{LDG} = 2.78$

6. $W/S\big)_{LDG} = \left(\frac{V_{AP}}{1.3}\right)^2 \frac{\sigma\, C_{L_{max}})_{LDG}}{296}$

$= \left(\frac{140}{1.3}\right)^2 \frac{.953 \times 2.78}{296} = 104\ \#/FT^2$

7. $V_{CRUISE} = .82 \times 576.4 = 473$ KTS

$R_{AD} = 6000 + 200 + .75 \times 473 = 6555$ N MI

8. FROM FIG 4 $W_S/W_{T/O})_{JT8D} = .480$

9. $W_S/W_{T/O})_{JT9D} = W_S/W_{T/O})_{JT8D} \times \frac{SFC)_{JT9D}}{SFC)_{JT8D}}$

$= .480 \times \frac{.61}{.78} = .375 \rightarrow$ USE $.390$

10. $W/S)_{T/O} = W/S)_{LDG} / (1 - x\, W_S/W_{T/O})$

$= 104/(1-.75\times.390) = 147\ \#/FT^2$

11. $W/S)_{IC} = .965 \times 147 = 142\ \#/FT^2$

12. $C_L)_{IC} = \dfrac{142}{1481\times.2360\times.82^2} = .604 \neq .50$

TRY $C_L = .59 \rightarrow \Delta M_{DIV} = -.014$

$M_{DIV} = .824 - (-.014) = .838$

$\rightarrow t/c = .094$

$\cos^2 35 \times .094^2 \times 8 = .0474$

$\rightarrow C_{L_{MAX}})_{T/O} = 1.72,\ C_{L_{MAX}})_{LDG} = 2.64$

$W/S)_{LDG} = \left(\dfrac{140}{1.3}\right)^2 \cdot \dfrac{.953\times 2.64}{296} = 99\ \#/FT^2$

$W/S)_{T/O} = 99/(1-.75\times.390) = 139\ \#/FT^2$

$W/S)_{IC} = 139\times.965 = 134\ \#/FT^2$

$C_{L_{IC}} = \dfrac{134}{1481\times.2360\times.82^2} = .57$

TRY $C_L = .58 \rightarrow \Delta M_{DIV} = -.010$

$M_{DIV} = .824 - (-.010) = .834 \rightarrow t/c = .098$

$(\cos^2 \Lambda) = .516 \rightarrow C_{L_{MAX}})_{T/O} = 1.76,\ C_{L_{MAX}})_{LDG} = 2.68$

$W/S)_{LDG} = 100,\ W/S)_{T/O} = 141,\ W/S)_{IC} = 136$

$C_{L_{IC}} = .58$ ✓

RHL

TOFL

3 ENGINES, TOFL = 9000 ft

FROM FIG. 5 $\left.W/S\ W/T\right)_{.7V_{LO}} \frac{1}{\sigma C_{L_{MAX\,T/O}}} = 274$

$$\left.W/T\right)_{.7V_{LO}} = \frac{274}{141} \times .953 \times 1.76 = 3.26$$

$$V_{HO} = 1.2\left[\frac{296\,(W/S)_{T/O}}{\sigma C_{L_{MAX\,T/O}}}\right]^{1/2} = 1.2\left(\frac{296\times 141}{.953\times 1.76}\right)^{1/2} = 189 \text{ KTS}$$

$$M_{HO} = 189/661/(.953)^{1/2} = .29 \qquad .7M_{HO} = .21$$

FROM JT9D CHART @ SEA LEVEL

$$T_{SLST} = 45{,}500\#$$

$$T_{M=.21} = 37{,}200\#$$

$$W/T = \left.W/T\right)_{.7V_{HO}} \times \frac{T_{M=.21}}{T_{SLST}} = 3.26 \times \frac{37{,}200}{45{,}500} = 2.67$$

RAC

WEIGHT

$$W_w = \frac{.00945\, A^{.8} (1+\lambda)^{.25} K_w n^{.5}}{(t/c)^{.4} \cos\Lambda\, (W/S)^{.695}} W_{T/O}^{1.195}$$

$$= \frac{.00945\,(8)^{.8}(1.35)^{.25} \times 1.01 \times 3.75^{.5}}{(.128)^{.4} \cos 35^\circ (141)^{.695}} W_{T/O}^{1.195}$$

$$= \boxed{.009373\, W_{T/O}^{1.195}}$$

$$W_{SUS} = .6727\, K_s\, l^{.6}\, d^{.72}\, \eta^{.3}\, W_{T/O}^{.235}$$

$$l = \left(3.76\,\frac{275}{8} + 33.2\right) \times 1.10 = 179 \text{ FT}$$

$$d = (1.75 \times 8 + 1.58 \times 2 + 1.0)\, 1.10 = 20 \text{ FT}$$

$$W_S = .6727 \times 11.5 \times (179)^{.6} (20)^{.72} (3.75)^{.3}$$

$$= \boxed{2235\, W_{T/O}^{.235}}$$

$$W_{LG} = \boxed{.04\, W_{T/O}}$$

$$W_{N+P} = \frac{.0555}{W/T} W_{T/O} = \frac{.0555}{2.67} W_{T/O} = \boxed{.0208\, W_{T/O}}$$

$$W_{T/S} = K_{T/S} W_W = (.17 + .08/3) W_W = .1967\, W_W$$

$$W_{W+T/S} = 1.1967\, W_W = \boxed{.0112\, W_{T/O}^{1.195}}$$

$$W_{PP} = \frac{W_{T/O}}{3.58\, W/T} = \frac{1}{3.58 \times 2.67} W_{T/O} = \boxed{.1046\, W_{T/O}}$$

$$W_S = 1.0275\, \frac{W_S}{W_{T/O}} W_{T/O} = 1.0275 \times .39 = \boxed{.4007\, W_{T/O}}$$

$W_{P/L} = 215\ PAX + W_{CARGO}$

$= 215 \times 275 + 12{,}000 = \boxed{71{,}125^{\#}}$

$W_{FE} = 132\ PAX + 300 N_e + .035\ W_{T/O}$
$+ 260 N_{FC} + 170 N_{CA}$
$= 132 \times 275 + 300 \times 3 + .035\ W_{T/O}$
$+ 260 \times 2 + 170 \times 6 = 38{,}740 + .035\ W_{T/O}$

$.0112\ W_{T/O}^{1.195} + 2235\ W_{T/O}^{.235}$
$+ (.04 + .0208 + .1046 + .4007 + .035 - 1)\ W_{T/O}$
$+ 64{,}125 + 38{,}740 = 0$

$.0112\ W_{T/O}^{1.195} + 2235\ W_{T/O}^{.235} - .3989\ W_{T/O} + 109{,}865 = 0$

600,000	11,447
650,000	21,476
650,000	15,00
670,000	-2455
657,000	115
658,000	-83

$S = W_{T/O} / (W/S)_{T/O} = 658{,}000 / 141 = 4667\ FT^2$

$b = (RS)^{1/2} = (8 \times 4667)^{1/2} = 193\ FT,\ c_{MAC} \approx \frac{4667}{193} = 24\ FT$

$T = W_{T/O} / (W/T) = \frac{658{,}000}{2.67} = 246{,}442^{\#},\ T_e = 82{,}147^{\#}$

RAL

DRAG

$h = 30K$ FT $\quad RNK = 2.852\times10^6 \times .5 = 1.426\times10^6/FT$

WING: $RN = 1.426\times10^6 \times 24 = 34\times10^6 \rightarrow C_f = .0027$

FUSELAGE: $RN = \sim \times 179 = 26\times10^7 \rightarrow C_f = .0018$

WING: $S_{WET} = 2\times(4667 - 20\times30)\times1.02 = 8297$

FROM SHEVELL FIG 11.3 $\quad K_W = 1.165$

$$f_{WING} = 1.165\times.0027\times8297 = \boxed{26.10\ FT^2}$$

FUSELAGE: $S_{WET} = .9\pi dl = .9\pi\times20\times179 = 10,122\ FT^2$

FROM SHEVELL FIG 11.4 $\quad K_f = 1.12$

$$f_{FUS} = 1.12\times.0018\times10,122 = \boxed{20.41\ FT^2}$$

TAIL: $f_{TS} = .38\, f_{WING} = \boxed{9.92}\ FT^2$

NACELLES: $S_{WET} = 2.1(T_e)^{1/2} N_e = 2.1(82,147)^{1/2}\times3 = 1806\ FT^2$

$$f_{NAC} = 1.25\times.0027\times1806 = \boxed{6.10\ FT^2}$$

PYLONS: $f_{PYL} = .20\, f_{NAC} = \boxed{1.22\ FT^2}$

TOTAL: $f = 63.75\times1.06 = \boxed{67.58\ FT^2}$

$$C_{D_0} = \frac{67.58}{4667} = \boxed{.0145}$$

$$e = \frac{1}{1.035 + .38 C_{D_0}\pi AR} = \frac{1}{1.035 + .38\times.0145\times\pi\times8}$$

$$\boxed{e = .852}$$

CLIMB

$$V_{CL} = 1.3 \times \frac{12.9}{(\sigma e)^{1/4}} \left(\frac{W}{Tb}\right)^{1/2}$$

$$= 1.3 \times \frac{12.9}{(67.58 \times .852)^{1/4}} \left(\frac{646,485}{.5702 \times 193}\right)^{1/2} = 467 \text{ KTS}$$

$$M = .81$$

$$T_r)_{CL} = \frac{T \sigma V^2}{296} + \frac{94.1}{Te} \left(\frac{W}{b}\right)^2 \frac{1}{V^2}$$

$$= \frac{.5702 \times 67.58 \times 467^2}{296} + \frac{94.1}{.5702 \times .852} \left(\frac{646,485}{193}\right)^2 \frac{1}{467^2}$$

$$= 28,391 + 9965 = 38,356\#$$

$$T_a)_{4T9D} = 16,800\#, \; C = .66 \; @ \; 15,000 \text{ FT}$$
$$= 14,000\#, \; C = .63 \; @ \; 25,000 \text{ FT}$$
$$= 15,400\#, \; C = .65 \; @ \; 20,000 \text{ FT}$$

$$T_a = \frac{82,147}{45,500} \times 15,400 = 27,804$$

$$R/C = 101 \frac{(T_a - T_r)}{W} V$$

$$= 101 \frac{(3 \times 27804 - 38,356) 467}{646,485} = 3287 \text{ FT/min}$$

$$TIME)_{CL} = 35,000 / 3287 = 10.65 \text{ min}$$

$$RANGE)_{CL} = 467 \times \frac{10.65}{60} = 83 \text{ n. mi}$$

$$W_S)_{CL} = 3 \times 27,804 \times .65 \times \frac{10.65}{60} = 9624\#$$

RAL

RANGE

$$W_0 = W_{T/O} - W_F)_{CL} = 658{,}000 - 9624 = 648{,}376\ \#$$

$$W_1 = (1 - W_F/W_{T/O})\,W_{T/O} = (1 - .390)\,658{,}000 = 401{,}350\ \#$$

$$C_L)_{AVG} = \frac{(W_0 + W_1)/2S}{1481.8\ M^2}$$

$$= \frac{(648{,}376 + 401{,}350)/2 \times 4667}{1481.2360 \times .82^2} = .479$$

$$C_{D_i} = C_L^2/\pi AR_E = .479^2/\pi \times 8 \times .852 = .0107$$

$$C_D = C_{D_0} + C_{D_i} + \Delta C_{D_C} = .0145 + .0107 + .0010 = .0262$$

$$L/D = C_L/C_D = .479/.0262 = 18.27$$

$$T_R = (W_0 + W_1)/2 \,/\, L/D = 524{,}878/18.27 = 28{,}729\ \#$$

$$T_R)_{1\,TPD} = 28{,}729 \times \frac{45{,}500}{82{,}147} = 15{,}913 = 5304\ /_{ENG}$$

$M = .82$ @ 35 KFT, $T = 5304 \rightarrow C = .63$

$$R_{CRUISE} = \frac{V}{C}\, L/D\, \ln_e(W_0/W_1)$$

$$= \frac{473}{.63} \cdot 18.27\, \ln_e\left(\frac{648{,}376}{401{,}380}\right) = 6578\ n.mi$$

$$R = R_{CL} + R_{CR} = 83 + 6578 = 6661\ n.mi$$

$$R_{A/D} = 6555 \quad \text{REQ'D}$$

CHECK ON T_{REQ} AT TOP OF CLIMB —

$$C_{L_{IC}} = \frac{648,576/4667}{1481 \times .2360 \times .82^2} = .59$$

$$C_{D_i} = .59^2/\pi \times 8 \times .852 = .0163$$

$$C_D = .0145 + .0163 + .0010 = .0318$$

$$L/D = .59/.0318 = 15.05$$

$$T_{REQ} = 648,576/15.05 = 43,094 = 14,365/\text{ENG}$$

$$T_R)_{ITQD} = 14,365 \times \frac{45,500}{82,147} = 7956^{\#}6$$

$$T_{AVIL})_{ITQD} = 10,000^{\#} \rightarrow \text{OK}$$

TRIAL

CLIMB GRADIENTS

1ST SEG: $C_{L_{T/O}} = C_{L_{MAX\,T/O}} / (1.2)^2 = \frac{1.76}{(1.2)^2} = 1.22$

$C_{L_{T/O}} / C_{L_{MAX\,T/O}} = 1/(1.2)^2 = .694 \rightarrow$ FIG. 6 $\Delta C_{D_o} = .014$

$C_D = C_{D_o} + \Delta C_{D_o} + \Delta C_{D_{GEAR}} + C_L^2/\pi AR e$

$= .0145 + .0140 + .0145 + 1.22^2/\pi 8 \times .852 = .1125$

$L/D)_{T/O} = 1.22/.1125 = 10.84$

$T_{REQ} = 658{,}000/10.84 = 60{,}681\ \#$

$T_{AVAIL} = \frac{82{,}147}{45{,}500} \times 34{,}500 = 62{,}287$

$GRAD)_1 = \frac{2 \times 62{,}287 - 60{,}681}{658{,}000} \times 100 = 9.7\%$

$.3\%$ REQ'D

2ND SEG:

$C_D = C_{D_o} + \Delta C_{D_o} + C_L^2/\pi AR e = .0980$

$L/D = 1.22/.0980 = 12.45$

$T_{REQ} = 658{,}000/12.45 = 52{,}851\ \#$

$GRAD)_2 = \frac{2 \times 62{,}287 - 52{,}851}{658{,}000} \times 100 = 10.9\%$

2.7 REQ'D

TRL

3RD SEG:

$t/c = .098$, $\Lambda = 35° \rightarrow C_{L_{max}})_{CLEAN} = 1.10$

$V = 1.2\left[\frac{296 \times 141}{.925 \times 1.10}\right]^{1/2} = 243$ KTS

↑ HOT DAY @ 1000 FT

$M = 243/659 = .37$, $C_L = 1.10/(1.2)^2 = .764$

$C_D = .0145 + .764^2/\pi \times 8 \times .852 = .0418$

$L/D = .764/.0418 = 18.30$

$T_{REQ} = 658{,}000/18.30 = 35{,}958$

$T_{a/EDG} = \frac{82{,}147}{45{,}500} \times 26{,}500 = 47{,}844$

$GRAD)_3 = \frac{2 \times 47{,}844 - 35{,}958}{658{,}000} \times 100 = 9.08\%$

1.5% REQD

APPROACH: $C_{L_{AP}} = C_{L_{MAX\,T/O}}/(1.3)^2 = 1.76/1.3^2 = 1.04$

$C_{L_{AP}}/C_{L_{MAX}} = 1/1.3^2 = .592 \rightarrow \Delta C_{D_0} = .0108$

$C_D = .0145 + .0108 + 1.04^2/\pi 8 \times .852 = .0758$

$L/D = 1.04/.0758 = 13.72$, $W_{LDG} = 100 \times 4667 = 466{,}700\#$

$T_{REQ} = 466{,}700/13.72 = 34{,}020\#$

$V = \left[\frac{296 \times 100}{.953 \times 1.04}\right]^{1/2} = 173$ KTS, $M = .26$

$T_a = \frac{82{,}147}{45{,}500} \times 29{,}500 = 53{,}260$

$GRAD)_{AP} = \frac{2 \times 53{,}260 - 34{,}020}{466{,}700} \times 100 = 15.53\%$

2.4% REQ'D

TRIAL

LANDING:

$C_L)_{LDG} = C_{Lmax})_{LDG} / 1.3^2 = 2.68/1.3^2 = 1.59$

$C_L/C_{Lmax} = 1/1.3^2 = .592 \rightarrow \Delta C_{D_0} = .0198$

$C_D = C_{D_0} + \Delta C_{D_0} + \Delta C_{D_{GEAR}} + C_L^2/\pi AR e$

$= .0145 + .0198 + .0145 + 1.59^2/\pi 8 \times .852 = .1662$

$L/D = 1.59/.1662 = 9.56$

$T_{REQ} = 466{,}700/9.56 = 48{,}795$

$V = 140$ KTS $\rightarrow M = .21$

$T_a = \frac{82{,}147}{45{,}500} \times 37{,}200 = 67{,}162$

$GRAD)_{LDG} = \frac{3 \times 67{,}162 - 48{,}795}{466{,}700} \times 100 = 32.72\%$

3.2 REQD

RKL

DIRECT OPERATING COST

BLOCK SPEED (MPH)

$$V_B = \frac{D}{T_{GM} + T_{CL} + T_D + T_{CR} + T_{AM}}$$

$D = 6000 \times 1.15 = 6900$ STATUTE MILES

$T_{GM} = .25$ HR

$T_{CL} = .18$ HR

$T_D = 0$ (SIMP. & MOD.)

$T_{AM} = .10$

$$T_{CR} = \frac{D + K_a + 20 - D_{CL} - D_D}{V_{CR}}$$

$$= \frac{6900 \times 1.02 + 20 - 83 \times 1.15}{473 \times 1.15} = \boxed{12.8 \text{ HR}}$$

$$V_B = \frac{6900}{.25 + .18 + 12.8 + .1} = \boxed{518 \text{ mph}}$$

BLOCK TIME

$$T_B = T_{GM} + T_{CL} + T_D + T_{CR} + T_{AM}$$

$$= .25 + .18 + 12.8 + .1 = 13.33 \text{ HR}$$

BLOCK FUEL

$$F_B = F_{GM} + F_{CL} + F_D + F_{CR} + F_{AM}$$

$F_{CL} = 9624\#$

$$F_{CR} + F_{AM} = T_{REQ})_{AVG} * C(T_{CR} + T_{AM})$$

$$= 28{,}729 \times .63 (12.8 + .10) = 233{,}481\#$$

$$F_B = 9624 + 233{,}481 = \boxed{243{,}105\#}$$

RIAL

FLYING OPERATIONS COST

a. FLIGHT CREW

$P = 71{,}125/2000 = 35.56$ TONS

$$\$/BLK\,HR = 17.849\left(V_c \times \frac{W_{TO}}{105}\right)^{.3} + 40.83$$

$$= 17.849\,(544 \times 6.58)^{.3} + 40.83 = \$248.69/HR$$

$$C_{TM} = \$/BLK\,HR \,/\, V_B \times P$$

$$= 248.69 \,/\, (518 \times 35.56) = \boxed{.0135}$$

b. FUEL & OIL

$$C_{TM} = \frac{1.02\,F_B C_F + N_e C_{OT} \times T_B \times .135}{D \times P}$$

$C_F = .40/GAL \times 1/6.4/GAL = .0625/\#$

C_{OT} = COST OF OIL (TURBINE) $= \$2.15/\#$

$$C_{TM} = \frac{1.02 \times 243{,}105 \times .0625 + 3 \times 2.15 \times 13.33 \times .135}{6900 \times 35.56} = \boxed{.0632}$$

c. HULL INSURANCE

$C_T = C_a + N_e$

$C_a = 2.4 \times 10^6 + 87.5\,W_a$

$W_a = W_{TO} - W_F - W_{P/L} - \cancel{W_{FCR}}^{\simeq 0} - W_e$

$= 658{,}000\,(1 - .390) - 71{,}125 - .1046 \times 658{,}000$

$= 254{,}322\#$

$C_a = 2.4 \times 10^6 + 87.5 \times 254{,}322 = \$24{,}653{,}158$

$C_e = 590{,}000 + 16\,T_e = 590{,}000 + 16 \times 82{,}147 = \$1{,}314{,}942$

$C_T = 24{,}653{,}158 \times 3 \times 1{,}314{,}942 = \$28{,}597{,}984$

RKR

HULL INS (CONT.)

$$C_{TM} = \frac{IR_A \times C_T}{U\ V_B P}$$

IR_A = INS. RATE / $ VALUE = .01

$$U = 630 + 4000 \Big/ \left(1 + \frac{1}{T_B + .5}\right) = 4360 \text{ HR/YR}$$

$$C_{TM} = \frac{.01 \times 28,597,984}{4360 \times 518 \times 35.56} = \boxed{.0036}$$

DIRECT MAINTENANCE

a. AIRFRAME - LABOR

$$C_{TM} = \frac{K_{FHa} T_S + K_{FCa}}{V_B T_B P} R_L$$

$$K_{FHa} = 4.9169 \log_{10}\left(\frac{W_a}{10^3}\right) - 6.425 = 5.4020 \frac{MH}{FH}$$

$$K_{FCa} = .21256 \left[\log_{10}\left(\frac{W_a}{10^3}\right)\right]^{3.7375} = 5.6514 \frac{MH}{CYCLE}$$

$T_F = T_B - T_{GM} = 13.08$ HR

R_L = LABOR RATE = $8.62/HR (1975)

$$C_{TM} = \frac{5.4020 \times 13.08 + 5.6514}{518 \times 13.33 \times 35.56} \times 8.62 = \boxed{.0027}$$

b. AIRFRAME MATERIAL

$$C_{TM} = \frac{C_{FHa} T_F + C_{FCa}}{V_B T_B P}$$

$C_{FHa} = 1.5994\ C_a/10^6 + 3.4263 = 42.86$

$C_{FCa} = 1.9229\ C_a/10^6 + 2.2504 = 49.66$

$$C_{TM} = \frac{42.86 \times 13.08 + 49.66}{245,540} = \boxed{.0025}$$

TRAL

c. ENGINE - LABOR

$$C_{TM} = \frac{KFHe\, T_F + KFCe}{V_B T_B P} R_L$$

$KFHe = Ne(Te/10^3) / [.82715(Te/10^3) + 13.639] = 3.02$

$KFCe = .20 Ne = .6$

$$C_{TM} = \frac{3.02 \times 13.08 + .6}{245,540} \times 8.60 = .0014$$

d. ENGINE - MATERIAL

$$C_{TM} = \frac{CFHe\, T_F + CFCe}{V_B T_B P}$$

$CFHe = (28.2353\, Ce/10^6 - 6.5176) Ne = 91.84$

$CFCe = (3.6698\, Ce/10^6 + 1.3685) Ne = 18.58$

$$C_{TM} = \frac{91.84 \times 13.08 + 18.58}{245,540} = .0050$$

e. TOTAL MAINTENANCE - BURDENED

$= (a+b+c+d) \times 2$

$C_{TM} = (.0027 + .0025 + .0014 + .0050) \times 2 = .0232$

DEPRECIATION

$$C_{TM} = \frac{1}{V_B P} \left(\frac{C_T + .06(C_T - Ne\, Ce) + .3 Ne\, Ce}{Da\, U} \right)$$

USE $Da = 14$ yrs TO 10% VALUE

$\rightarrow C_{TM} = .0278$

TOTAL D.O.C

FLIGHT CREW	.0135	10.3%
FUEL & OIL	.0632	48.1%
INSURANCE	.0036	2.7%
MAINTENANCE	.0232	17.7%
DEPRECIATION	.0278	21.2%
	$.1313 / TON MILE	

$.1313 \times \frac{35.56}{275} = \$.0170$ / PAX MILE