Payload Range Diagram

Table of Contents

RunPayloadRange computes and plots the payload-range diagram

The main file for running the Design Case is **FindDesignPoint** For brief description type: *help FindDesignPoint*

Created by: D Rezgui, S Mitchell and M Gibbons

Initialise aircraft parameters

delete Par; clear Par;

```
clear; clc
disp(' ')
disp('        ******** Aircraft Performance Tool ********');
disp('        ********  Payload Range Diagram ********')
disp(['                   ', datestr(clock)]);
disp(' ')

% Read Aircraft data from a re-defined file, e.g. 'AC_B777_AJenk'or
 'AC_150C_twin'
ParFunc = 'AC_B777_AJenk'; % or ParFunc = 'AC_150C_twin';
Par     = eval(ParFunc);  % Set parameters in the "Par" object,
                          % Default values are set in the ParFunc

disp(['... Aircraft parameters are set, based on ', ParFunc, ' data
 file'])
disp(' ')

% Reset parameters from default values (other parameters can be
 changed in
% the Par object)
Par.PL_req    = 29050; % Required payload mass [kg]

% You can also reset the following parameters. (you can also change
 these parameters in the ParFunc file)
% Par.Range_req     =  4779;    % Required design range [nm]
% Par.S                     = 376.4;     % Wing area [m^2]
% Par.PLmax                 = 45000;     % Max payload [kg]
% Par.MFC                   = 80000;     % Max Fuel capacity [kg]
% Par.MTOM                  = 230000;    % Max Take Off Mass [kg]
% Par.Airframe              = 130000;    % Operating Mass Empty [kg]
% Par.Alt_Cruise       = 35000;     % Cruise Alt [ft]
```

```
% Par.DragRise        = 0;         % Flag to switch drag rise in the
 drag polar: 1 = Yes, 0 = No

% Reset engine data parameters (if needed)
Par.interp_method = 'linear'; % or 'spline' - 'spline' is slower but
 allows to extrapolate data
Par.M_ext = []; % Extend Mach number range to M_ext - change to
 something like 0.1 if needed
```

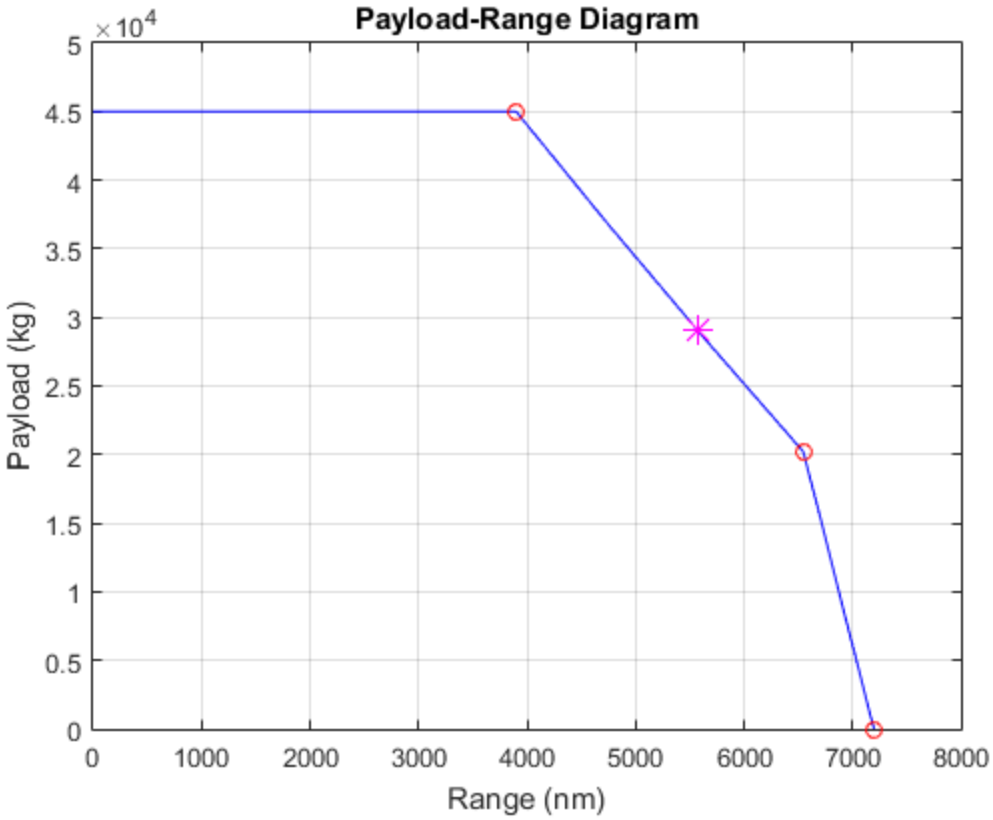
```
******** Aircraft Performance Tool ********
********  Payload Range Diagram ********
          20-Feb-2017 14:07:37

... Aircraft parameters are set, based on AC_B777_AJenk data file
```

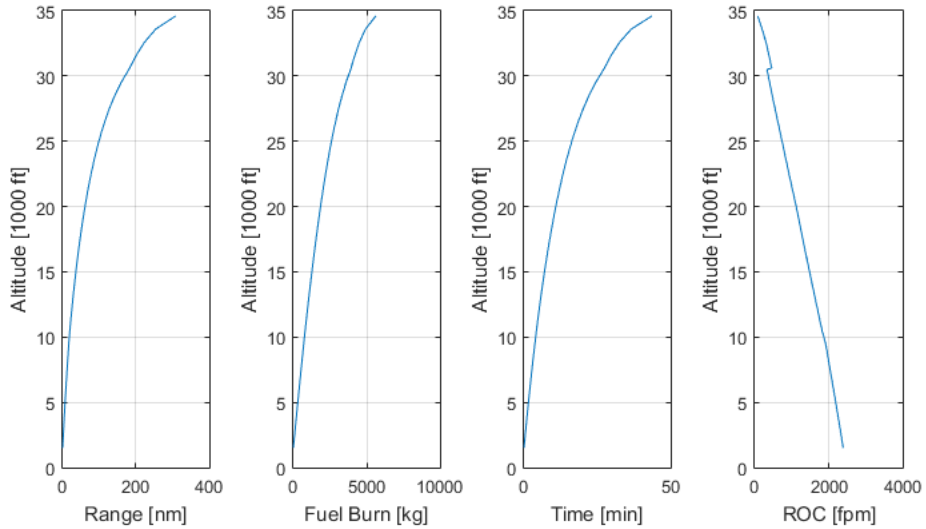
Payload range diagram for case : MTOM = 230000 kg (Max Take Off Mass)

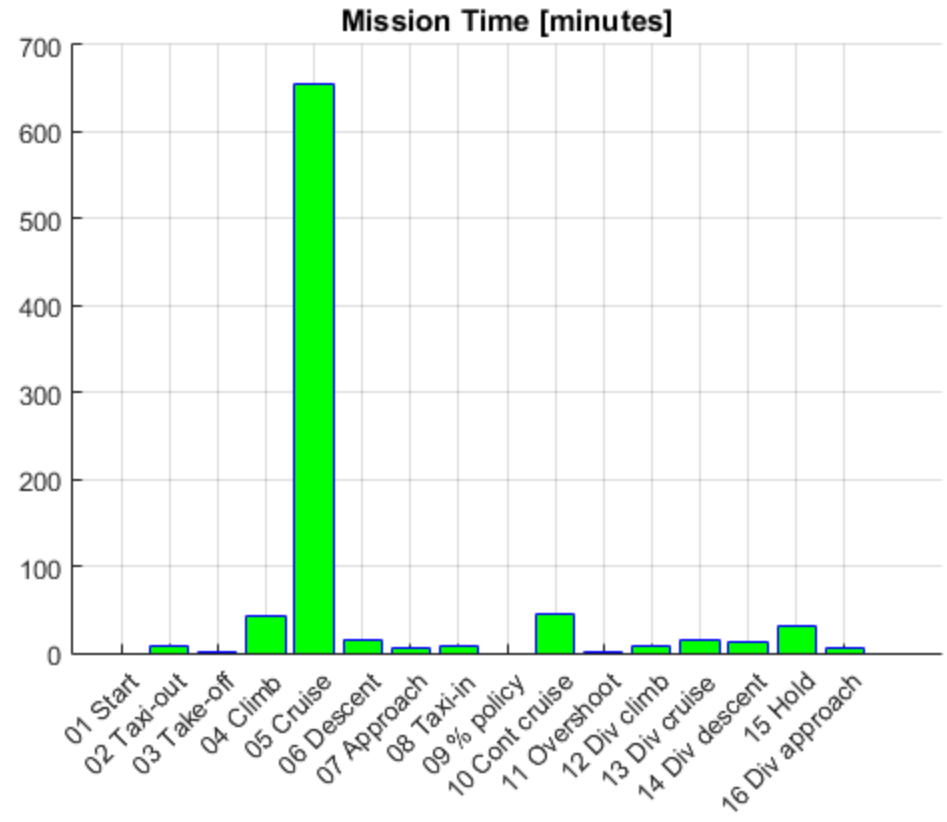
```
Par.MTOM  = 230000;;     % Max Take Off Mass [kg]

% Calculate the properties of the payload range diagram
plrd(1) = FindPayloadRangeDiag(Par);

% Plot the payload range diagram
PlotPLRD(plrd(1), 'b') % call plotter for payload range diagram

% Plot Mission Profile
PlotMission(plrd(1).dp.Mission) % Call plotter for mission profile
```

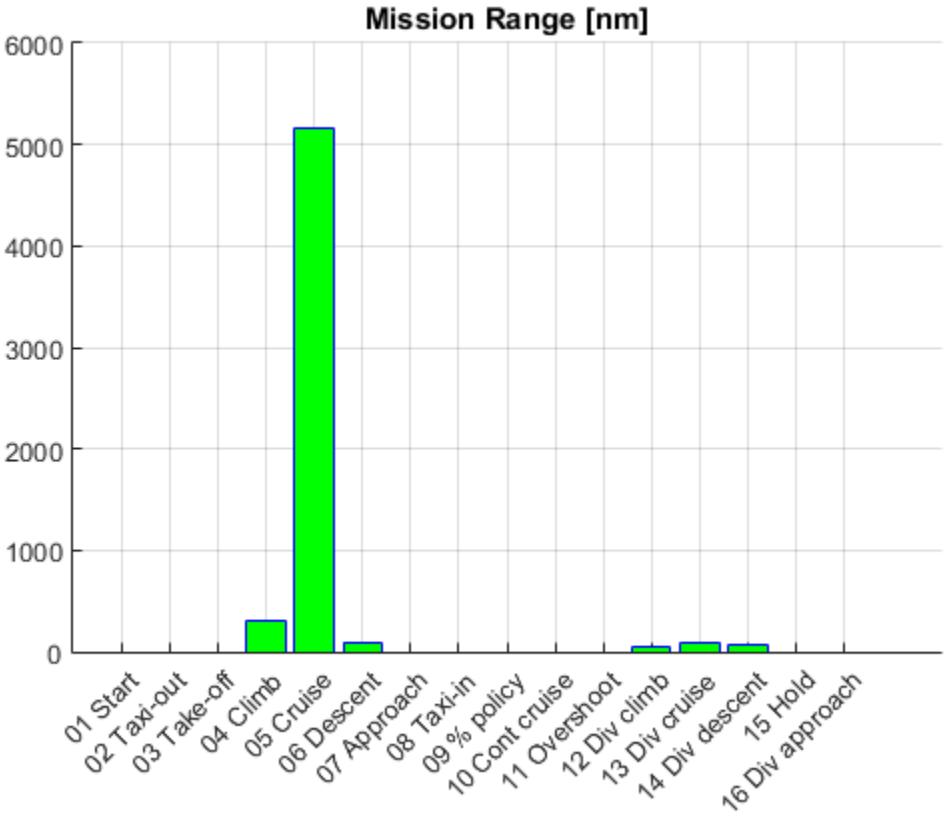
```
... Engine data prepared from UBB65Data

Calculate the value of payload at the intersection point of MTOM curve
 with MFC line
.............................. Done

Calculate the value of range at the intersection point of the MTOM
 curve with MFC curve
.... Done

Calculate the points along the curves that define the payload range
 diagram
For the MTOM curve, calculating the range at each point
....... Done

For the MFC curve, calculating the range at each point
....... Done

Calculating the range for the required design payload
.... Done
```

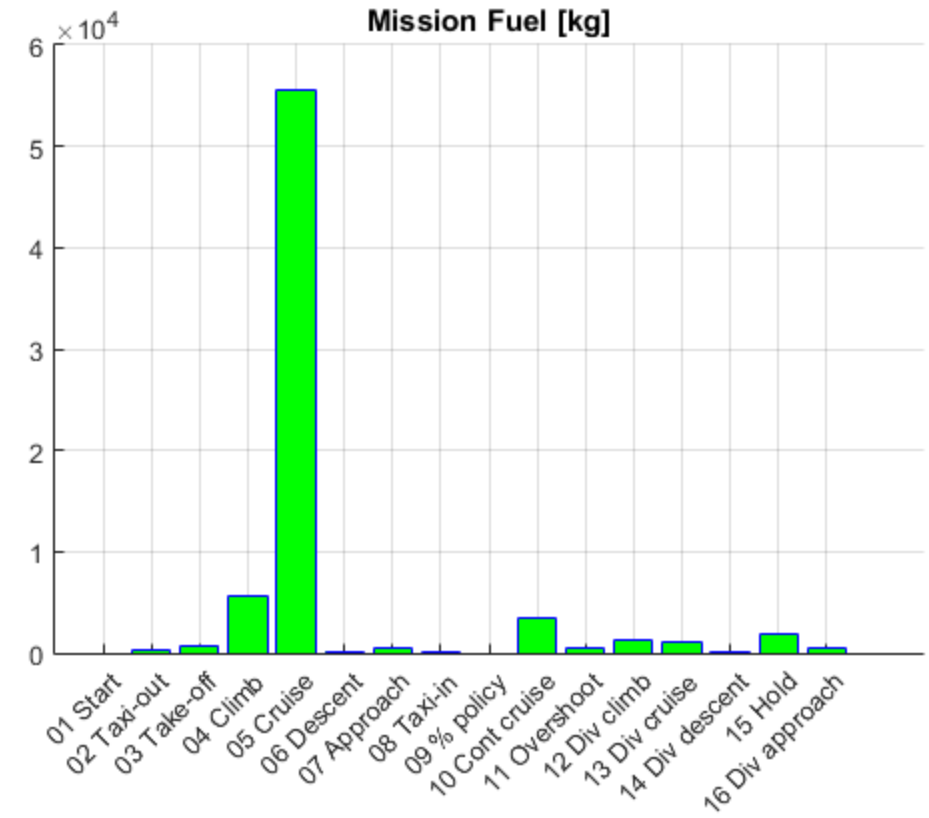
```
Plot Payload/Range Diagram
... Done ....
```

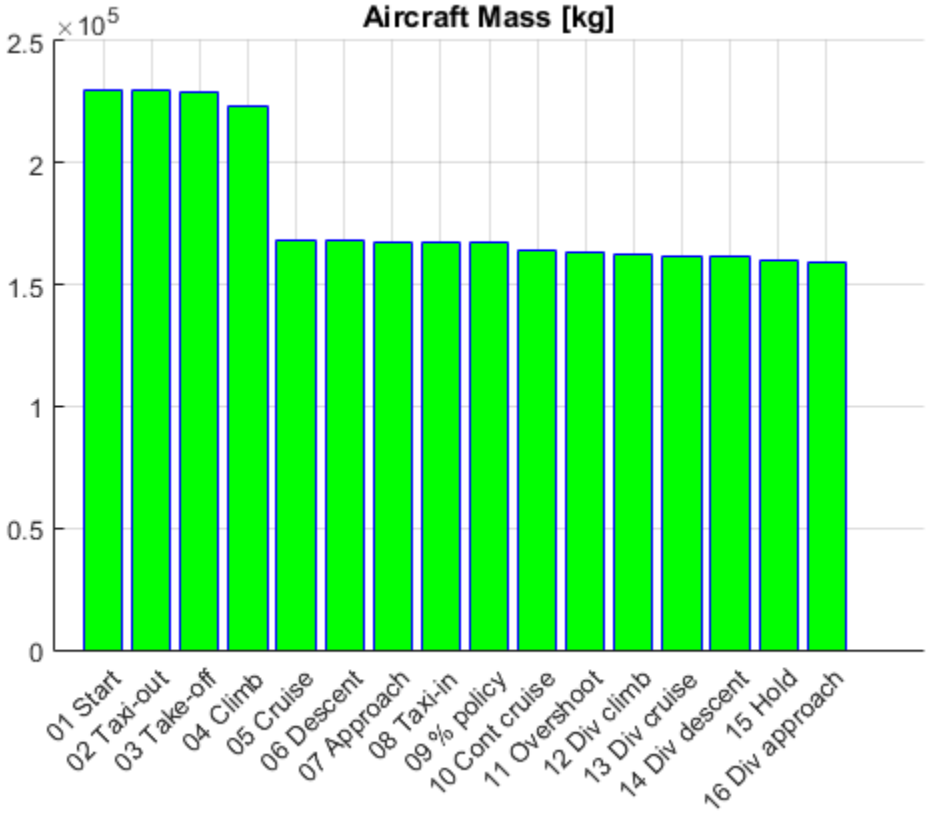





Mission Time [minutes]
700
600
500
400
300
200
100
0
01 Start
02 Taxi-out
03 Take-off
04 Climb
05 Cruise
06 Descent
07 Approach
08 Taxi-in
09 % policy
10 Cont cruise
11 Overshoot
12 Div climb
13 Div cruise
14 Div descent
15 Hold
16 Div approach


Mission Range [nm]
6000
5000
4000
3000
2000
1000
0
01 Start
02 Taxi-out
03 Take-off
04 Climb
05 Cruise
06 Descent
07 Approach
08 Taxi-in
09 % policy
10 Cont cruise
11 Overshoot
12 Div climb
13 Div cruise
14 Div descent
15 Hold
16 Div approach

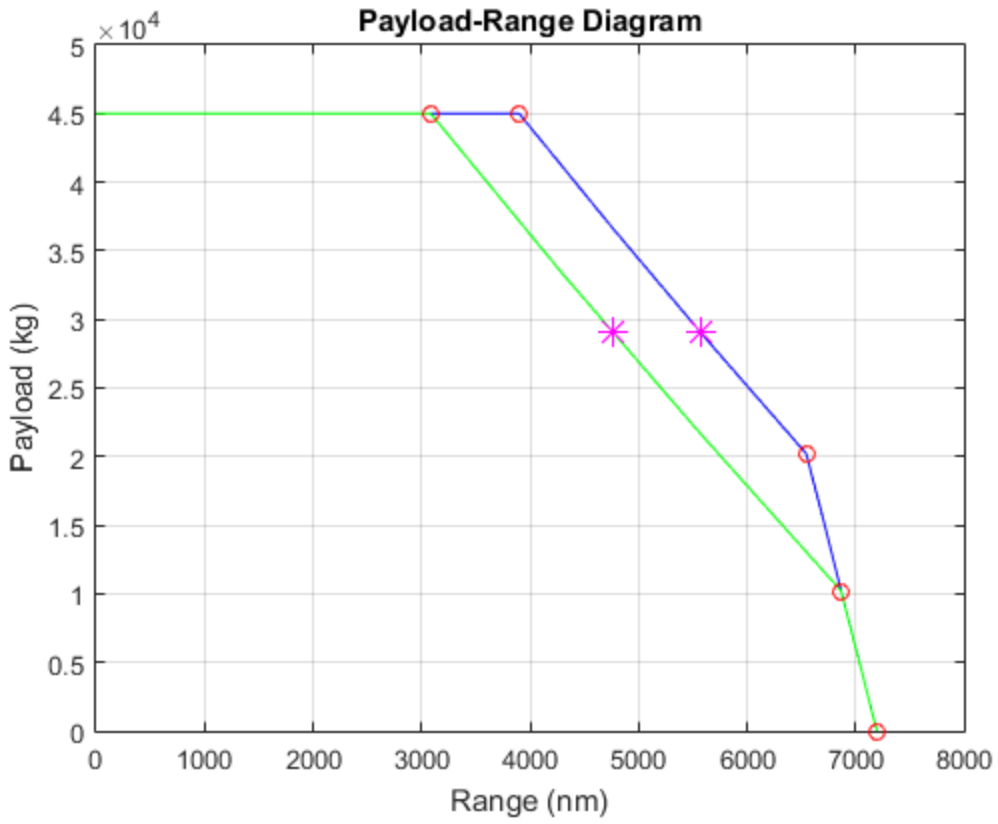

Mission Fuel [kg]
×10^4
6
5
4
3
2
1
0
01 Start
02 Taxi-out
03 Take-off
04 Climb
05 Cruise
06 Descent
07 Approach
08 Taxi-in
09 % policy
10 Cont cruise
11 Overshoot
12 Div climb
13 Div cruise
14 Div descent
15 Hold
16 Div approach

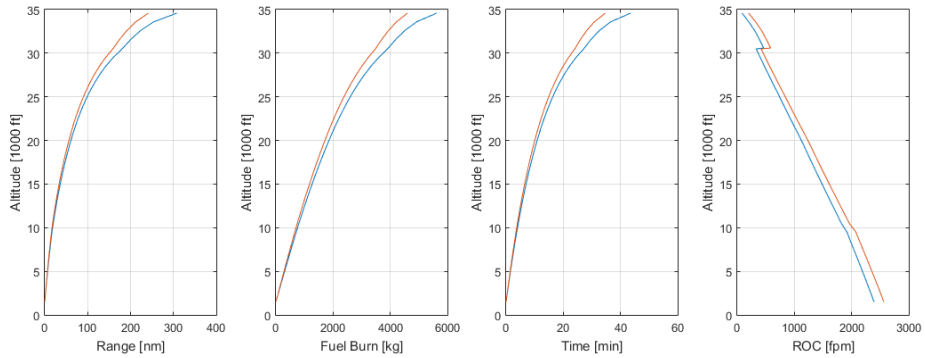

Aircraft Mass [kg]
×10^5
2.5
2
1.5
1
0.5
0
01 Start
02 Taxi-out
03 Take-off
04 Climb
05 Cruise
06 Descent
07 Approach
08 Taxi-in
09 % policy
10 Cont cruise
11 Overshoot
12 Div climb
13 Div cruise
14 Div descent
15 Hold
16 Div approach

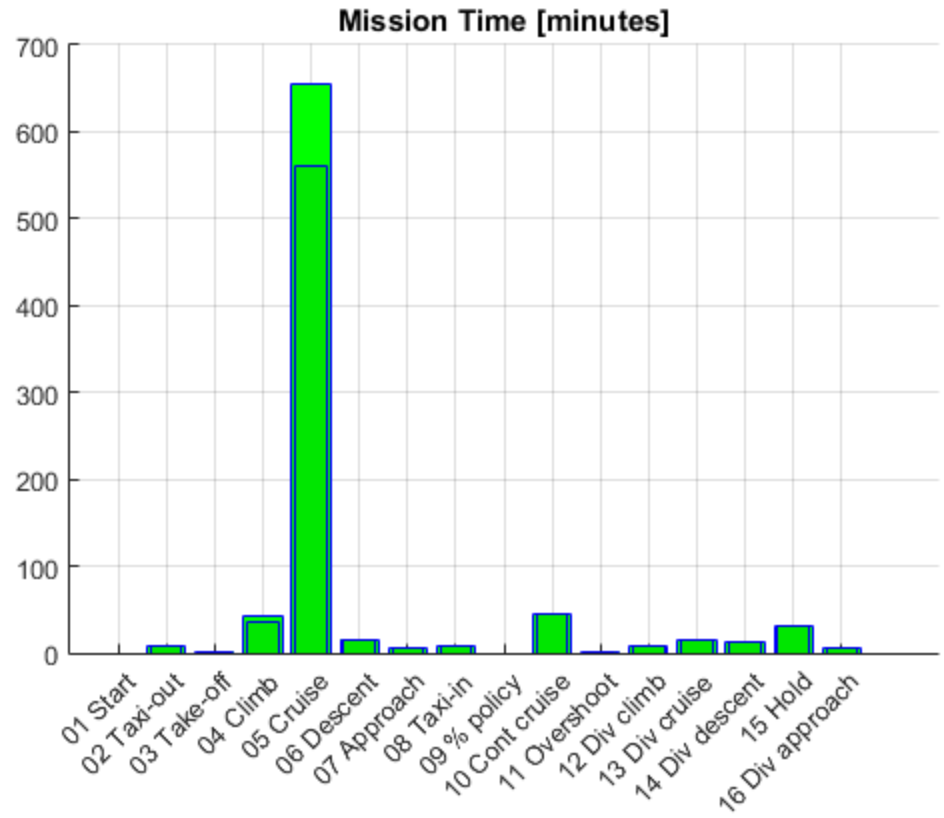
Payload range diagram for case : MTOM = 220000 kg (Max Take Off Mass)

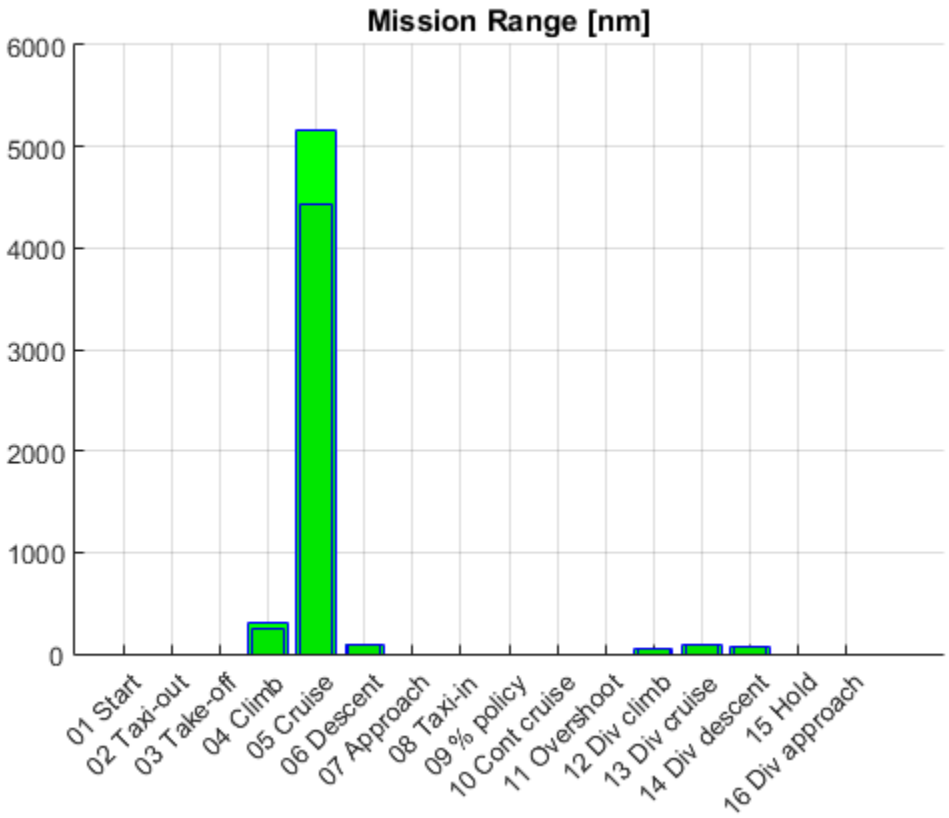
```
Par.MTOM = 220000;     % Max Take Off Mass [kg]

% Calculate the properties of the payload range diagram
plrd(2) = FindPayloadRangeDiag(Par);

% Plot the payload range diagram
PlotPLRD(plrd(2), 'g') % call plotter for payload range diagram

% Plot Mission Profile
PlotMission(plrd(2).dp.Mission) % Call plotter for mission profile
```

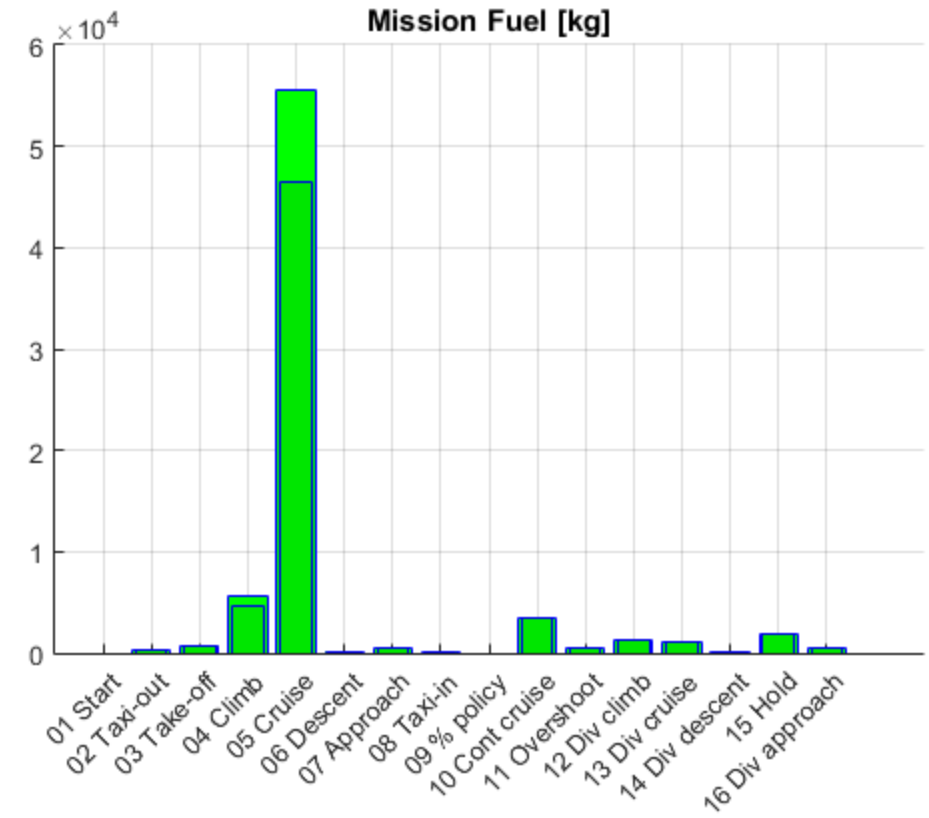
```
... Engine data prepared from UBB65Data

Calculate the value of payload at the intersection point of MTOM curve
 with MFC line
.............................. Done

Calculate the value of range at the intersection point of the MTOM
 curve with MFC curve
.... Done

Calculate the points along the curves that define the payload range
 diagram
For the MTOM curve, calculating the range at each point
....... Done

For the MFC curve, calculating the range at each point
....... Done

Calculating the range for the required design payload
.... Done

Plot Payload/Range Diagram
... Done ....
```

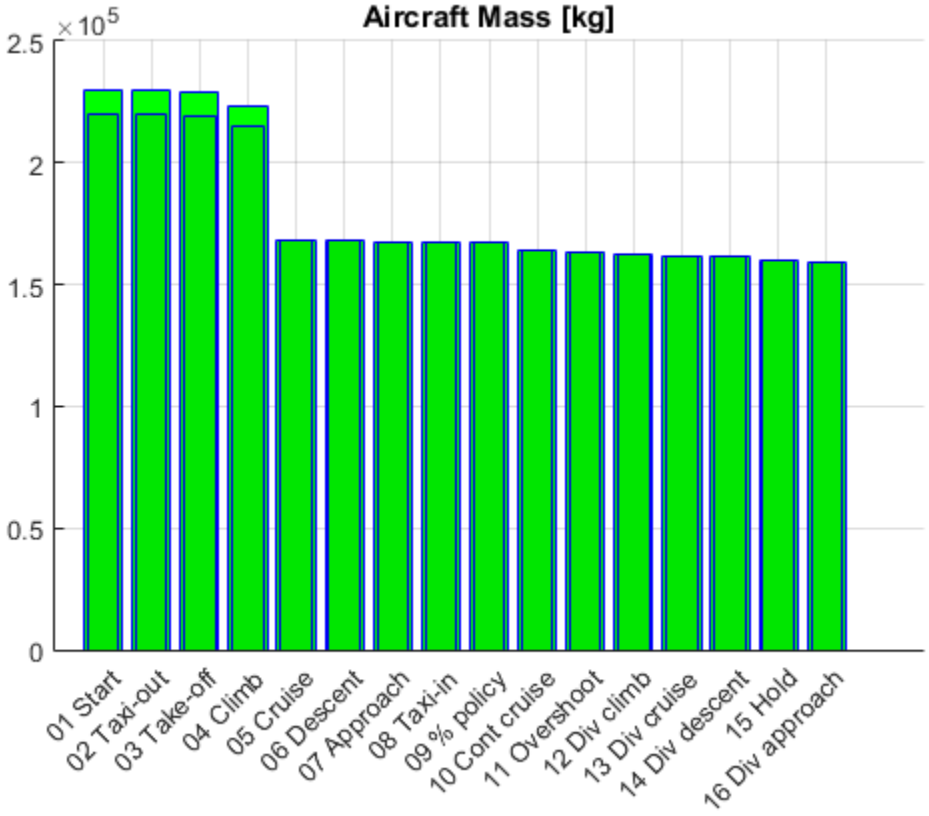

Payload-Range Diagram
×10^4
Payload (kg)
Range (nm)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
0
1000
2000
3000
4000
5000
6000
7000
8000


Altitude [1000 ft]
Range [nm]
Fuel Burn [kg]
Time [min]
ROC [fpm]


Mission Time [minutes]
700
600
500
400
300
200
100
0
01 Start
02 Taxi-out
03 Take-off
04 Climb
05 Cruise
06 Descent
07 Approach
08 Taxi-in
09 % policy
10 Cont cruise
11 Overshoot
12 Div climb
13 Div cruise
14 Div descent
15 Hold
16 Div approach


Mission Range [nm]
6000
5000
4000
3000
2000
1000
0
01 Start
02 Taxi-out
03 Take-off
04 Climb
05 Cruise
06 Descent
07 Approach
08 Taxi-in
09 % policy
10 Cont cruise
11 Overshoot
12 Div climb
13 Div cruise
14 Div descent
15 Hold
16 Div approach


Mission Fuel [kg]
×10^4
6
5
4
3
2
1
0
01 Start
02 Taxi-out
03 Take-off
04 Climb
05 Cruise
06 Descent
07 Approach
08 Taxi-in
09 % policy
10 Cont cruise
11 Overshoot
12 Div climb
13 Div cruise
14 Div descent
15 Hold
16 Div approach


Aircraft Mass [kg]
×10^5
2.5
2
1.5
1
0.5
0
01 Start
02 Taxi-out
03 Take-off
04 Climb
05 Cruise
06 Descent
07 Approach
08 Taxi-in
09 % policy
10 Cont cruise
11 Overshoot
12 Div climb
13 Div cruise
14 Div descent
15 Hold
16 Div approach

Save results

```
savefile = 'PayloadRange.mat';
save(savefile, 'plrd');
```

Published with MATLAB® R2015a