Run Design Case

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This file (RunDesignCase) illustrates how to calculate mission parameters (mass, fuel and range) for a set of design missions defined by a target payload, target range and aircraft parameters. The climb performance parameters are also calculated.

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

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Initialise aircraft parameters

delete Par; clear Par

```
clear; clc
disp(' ')
disp('        ******** Aircraft Performance Tool ********');
disp('        ********  Run Design Mission Set ********')
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]
Par.Range_req =  4779; % Required design range [nm]

% You can also reset the following parameters. (you can also change
 these parameters in the ParFunc file)
% 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 ********
        ********  Run Design Mission Set ********
                  20-Feb-2017 14:13:46

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

Calculate the mass, fuel and range for required mission

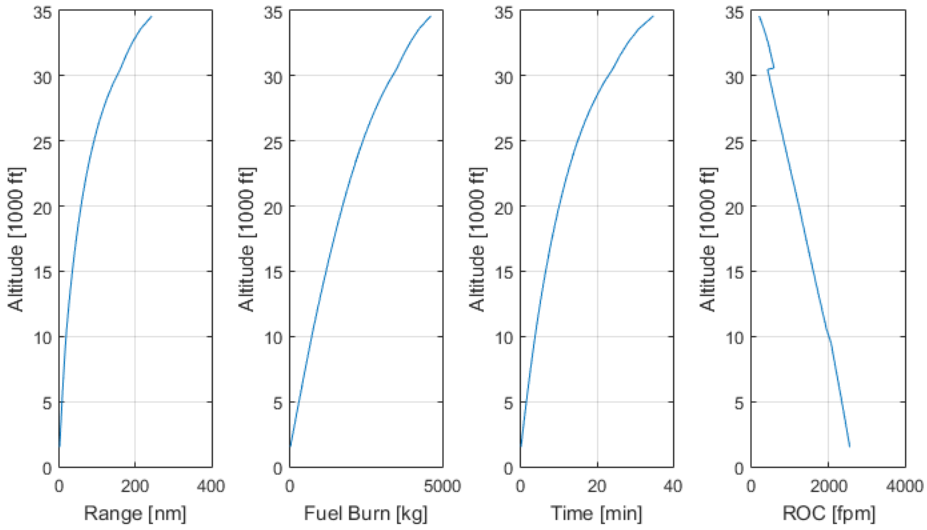
Find mission mass, fuel and range for each mission phase Call function FindDesignPoint to calculate mission characteristics

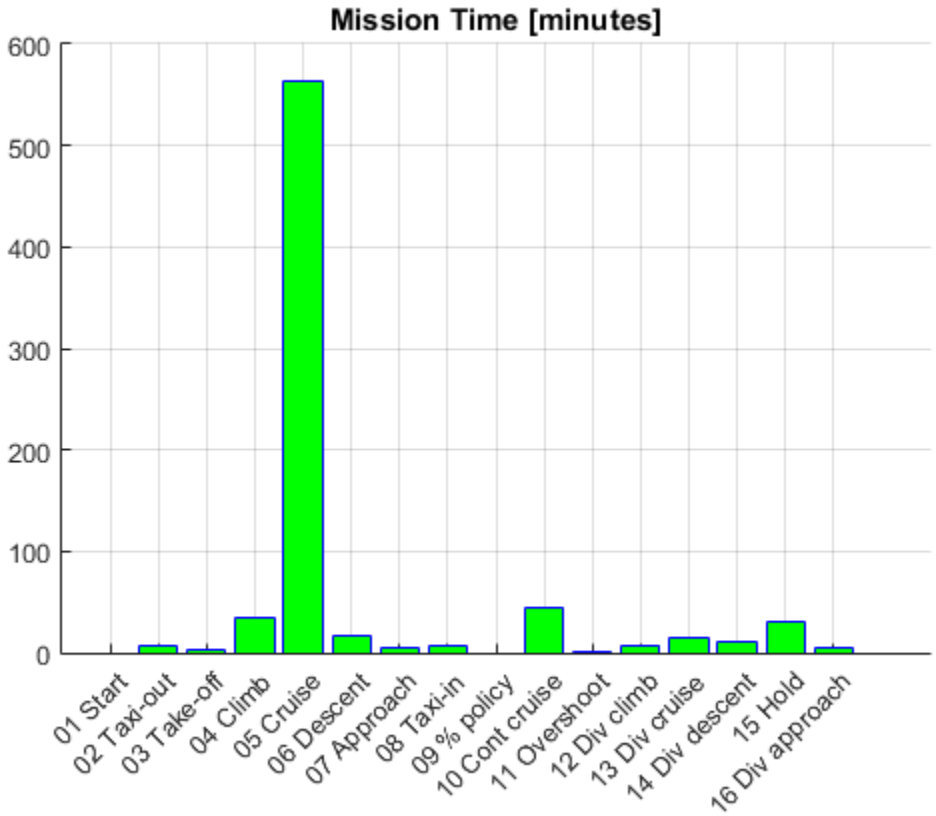
```
dp(1) = FindDesignPoint(Par); % The calculated results of the mission
 elements are store in the object *dp*.

% Display Mission elements
Mission = dp.Mission

% Display Mission phases
Phase = dp.Mission.Phase


... Engine data prepared from UBB65Data

... Calculating the value of aircraft Take-Off Mass (TOM) for the
 required design case
Payload required :  29050 kg
Range required   :  4779 nm
Cruise altitude  :  35000 ft
Cruise Mach No.  :  0.82

.............................. Done
Elapsed time is 10.980723 seconds.

Calculate fuel burn for the required design case
.... Done
```

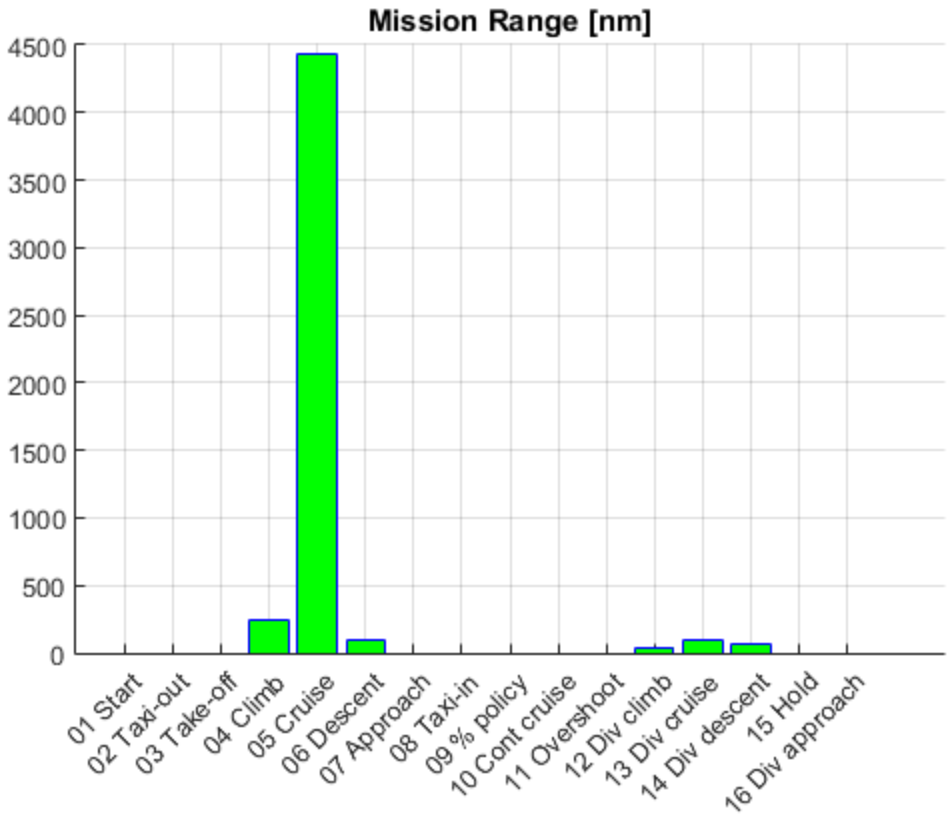
```
Elapsed time is 0.318913 seconds.

TOM for required the mission  :  220234 kg
Block time for the mission    :  636 minutes
Block fuel for the mission    :  53193 kg
Reserve fuel for the mission  :  8790 kg
Total fuel for the mission    :  61830 kg


Mission =

     Time: [1x16 double]
    Range: [1x16 double]
     Fuel: [1x16 double]
     Mass: [1x16 double]
    Phase: {16x1 cell}
     Data: [1x1 struct]


Phase =

    '01 | Start of taxi-out'
    '02 | End of taxi-out / Start of take-off'
    '03 | End of take-off / Start of climb'
    '04 | End of climb / Start of cruise'
    '05 | End of cruise / Start of descent'
    '06 | End of descent / Start of approach'
    '07 | End of approach / Start of taxi-in'
    '08 | End of taxi-in'
    '09 | Percentage policy reserves'
    '10 | Continued cruise reserves'
    '11 | End of overshoot / Start of climb'
    '12 | End of climb / Start of cruise'
    '13 | End of cruise / Start of descent'
    '14 | End of descent / Start of hold'
    '15 | End of hold / Start of approach'
    '16 | End of diversion approach'
```

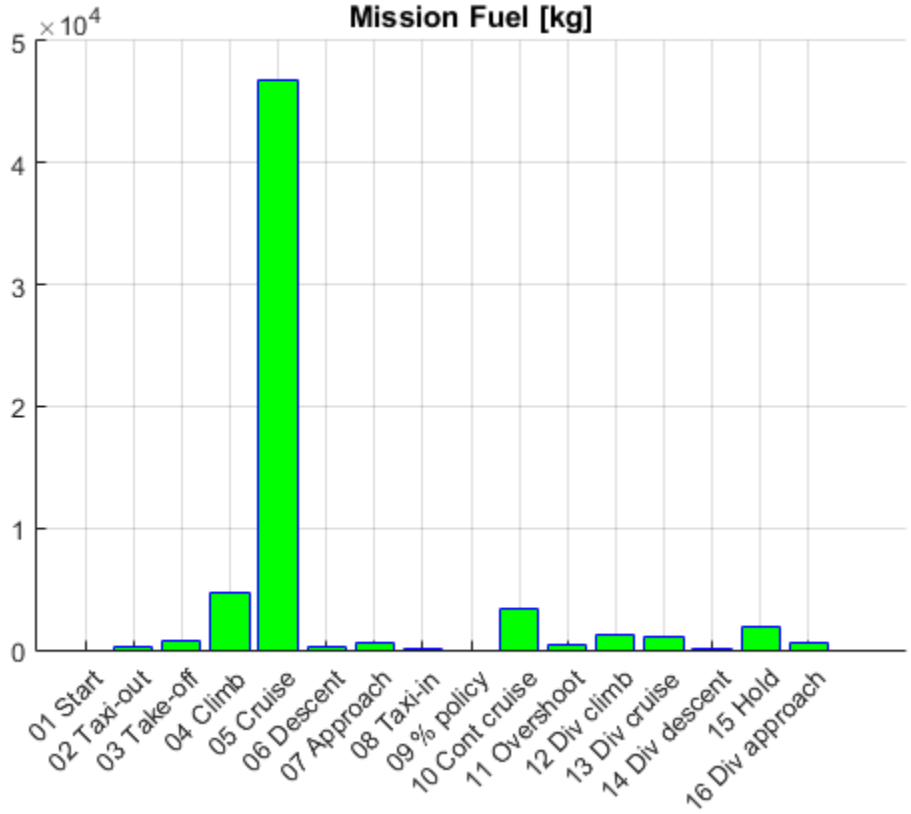
Plot Mission Profile, Climb Performance results are also plotted

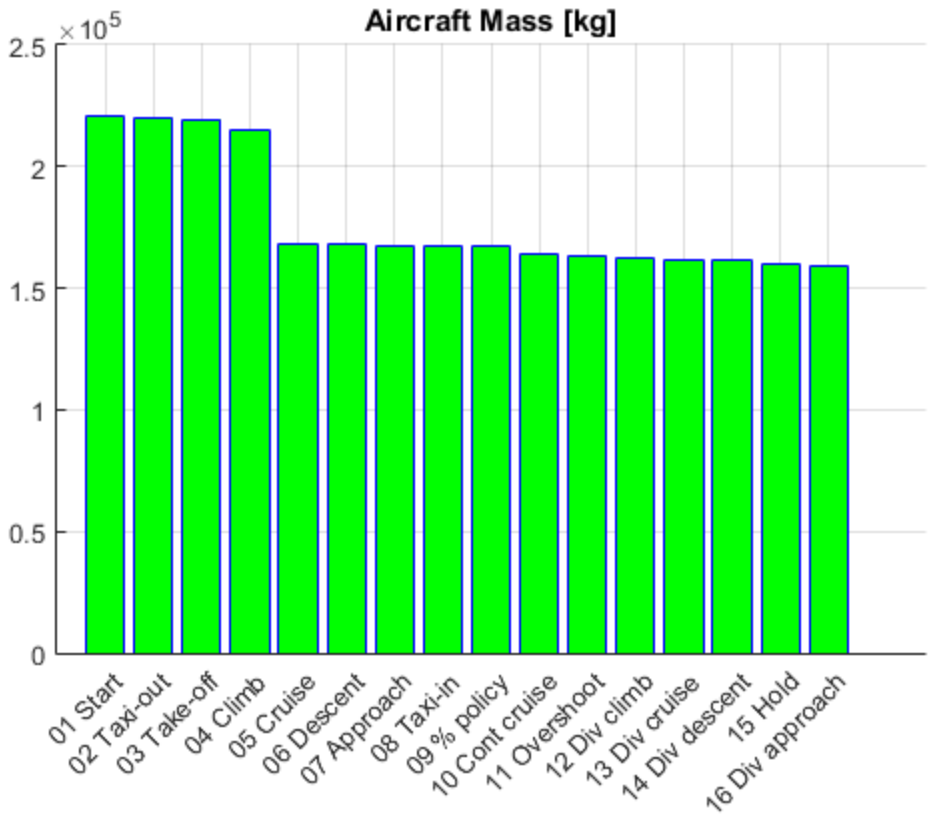
```
PlotMission(dp(1).Mission) % Call plotter for mission profile
```


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


Mission Time [minutes]
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]
4500
4000
3500
3000
2500
2000
1500
1000
500
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

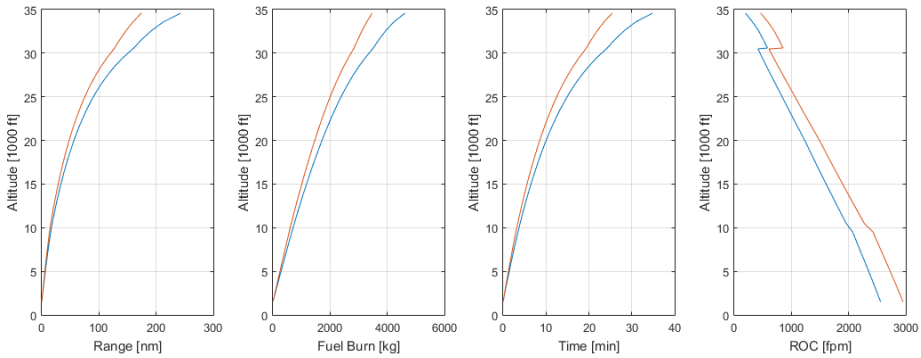

Mission Fuel [kg]
×10^4
5
4
3
2
1
0
01 Start
02 Taxi-out
03 Take-off
04 Climb
05 Cruise
06 Descent
07 Approach
08 Taxi-in
09 % policy
10 Cont cruise
11 Overshoot
12 Div climb
13 Div cruise
14 Div descent
15 Hold
16 Div approach

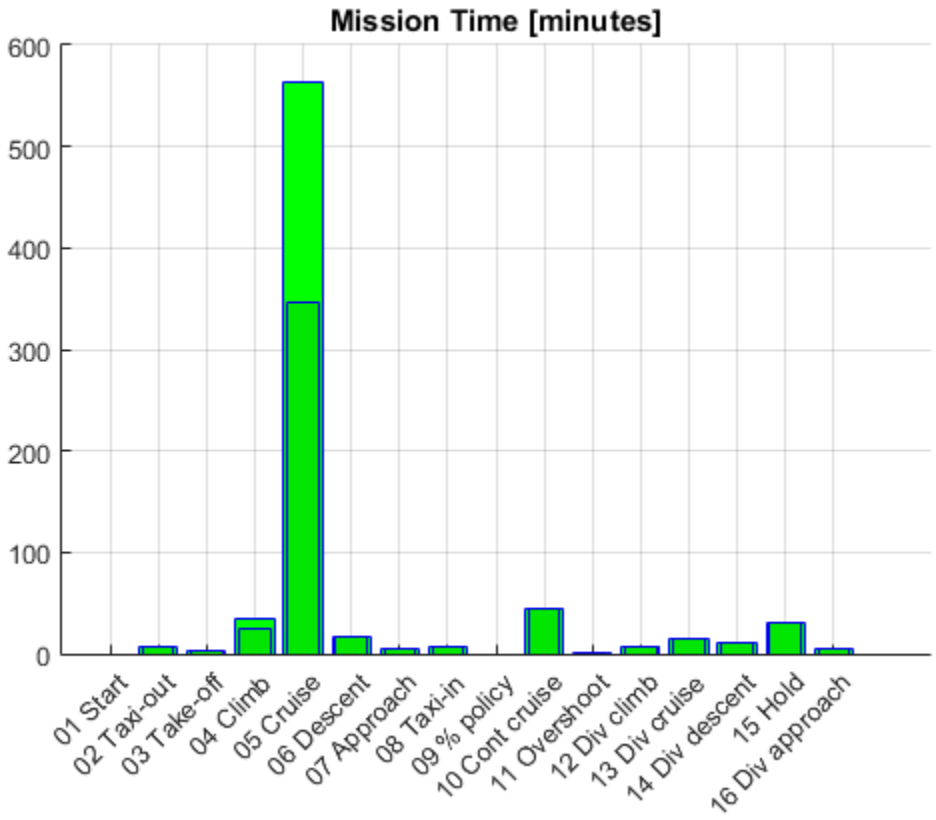


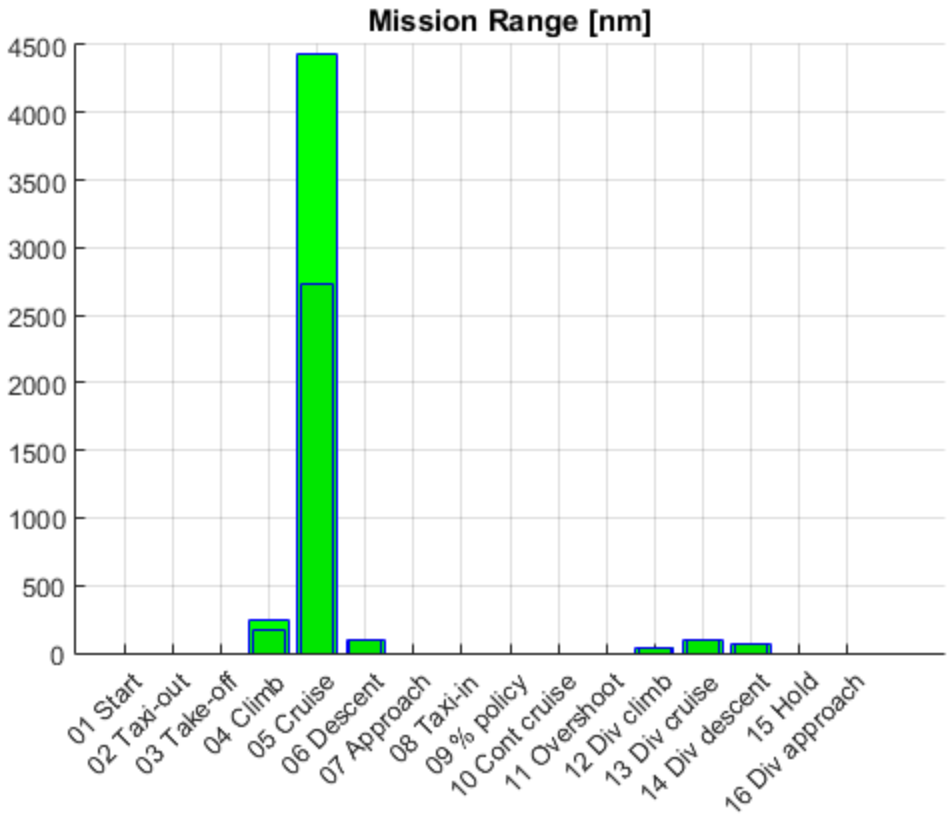
Calculate the mass, fuel and range for a second mission with reduced required range

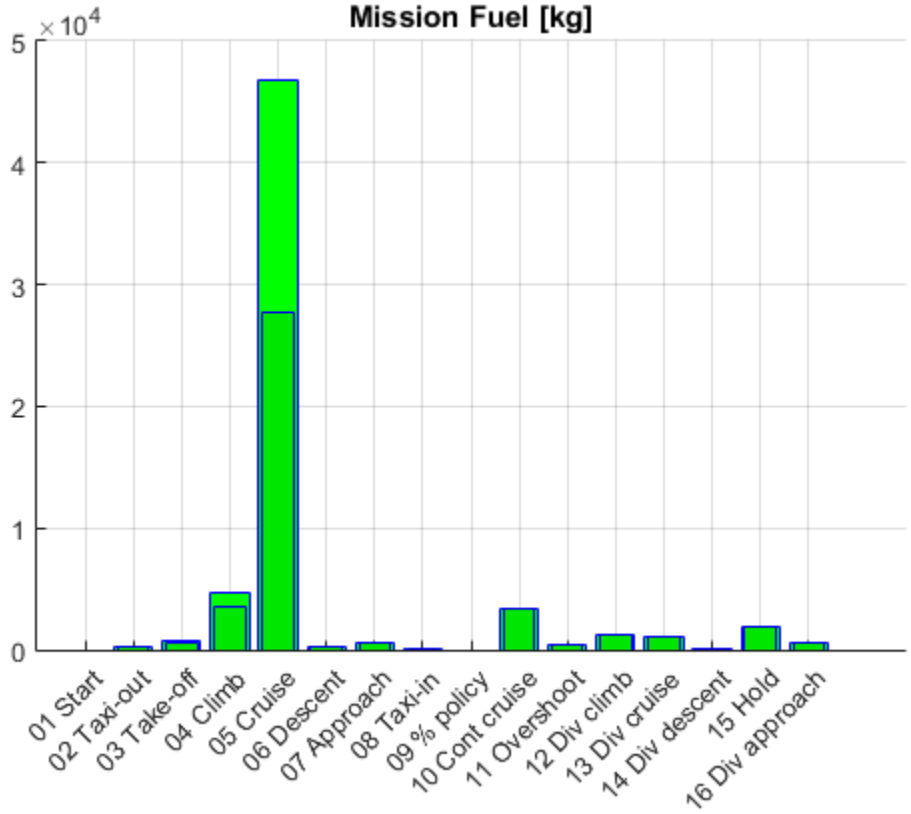
```
Par.Range_req =  3000; % Required design range [nm]
% Call function FindDesignPoint to calculate mission characteristics
dp(2) = FindDesignPoint(Par); % The calculated results of the mission
 elements are store in the object *dp*.

% Plot Mission Profile, Climb Performance results are also plotted
PlotMission(dp(2).Mission) % Call plotter for mission profile


... Engine data prepared from UBB65Data

... Calculating the value of aircraft Take-Off Mass (TOM) for the
 required design case
Payload required :  29050 kg
Range required   :  3000 nm
Cruise altitude  :  35000 ft
Cruise Mach No.  :  0.82

.............................. Done
Elapsed time is 10.995878 seconds.

Calculate fuel burn for the required design case
```

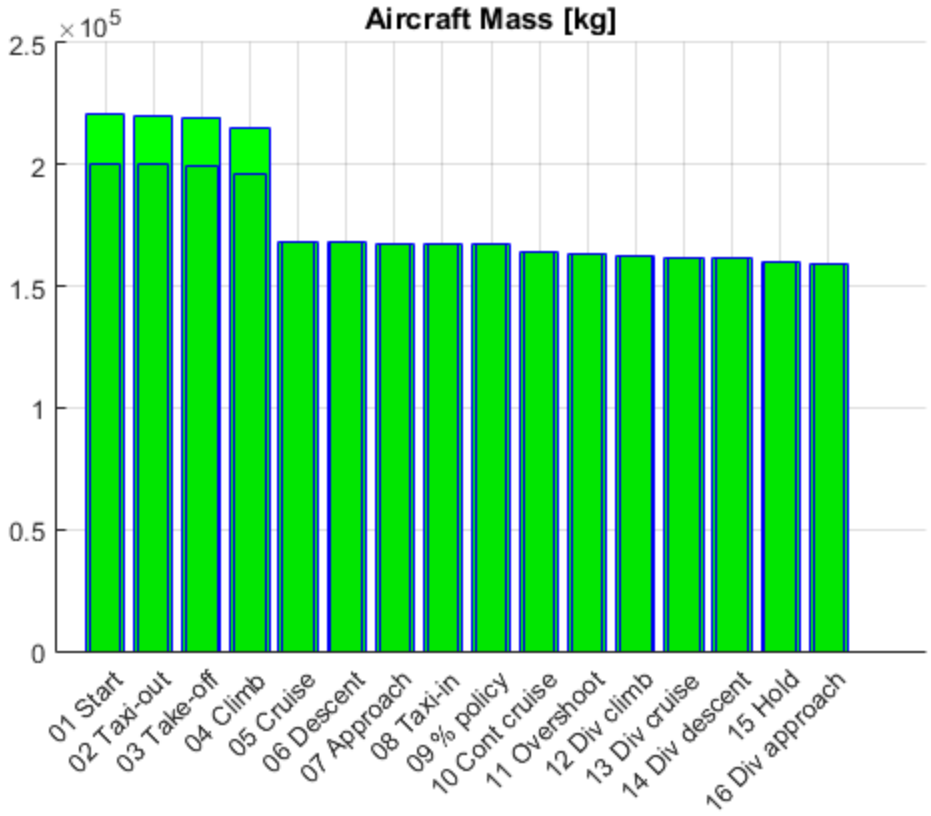
```
.... Done
Elapsed time is 0.328830 seconds.

TOM for required the mission  :  199871 kg
Block time for the mission    :  409 minutes
Block fuel for the mission    :  32829 kg
Reserve fuel for the mission  :  8790 kg
Total fuel for the mission    :  41466 kg
```






Mission Range [nm]
4500
4000
3500
3000
2500
2000
1500
1000
500
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
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



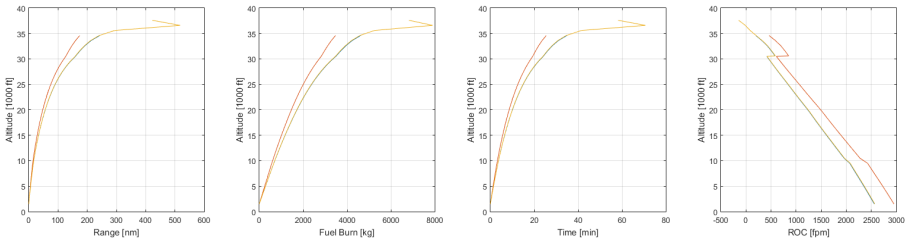
Calculate the mass, fuel and range for a third mission with higher cruise altitude

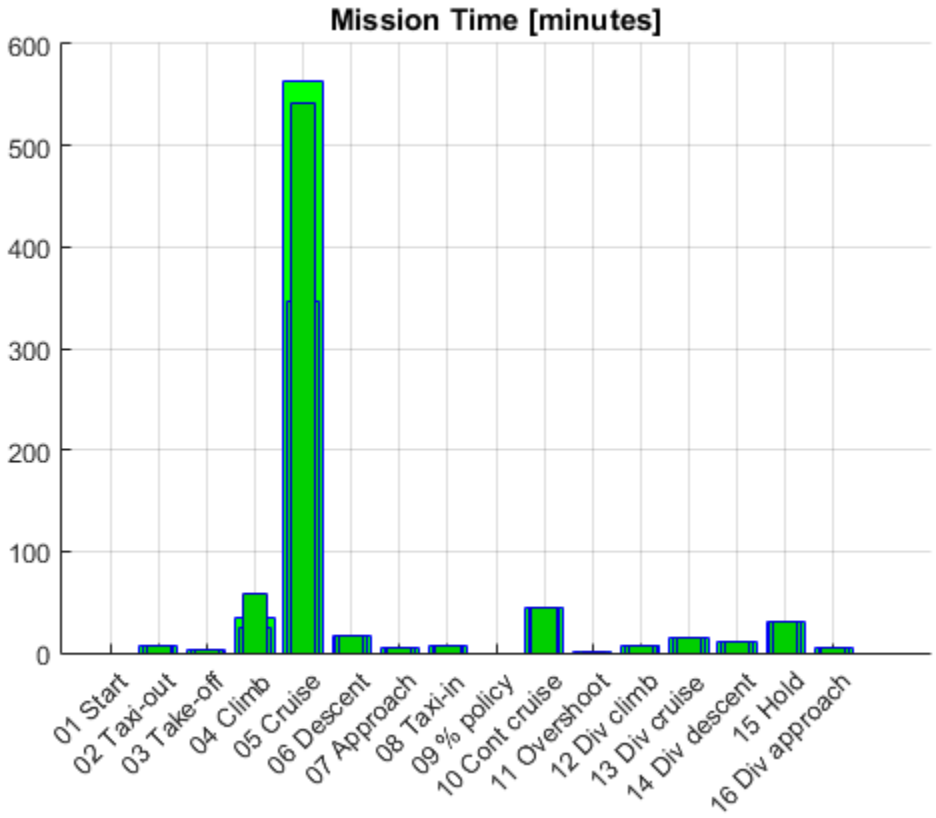
```
Par.Range_req  =  4779; % Required design range [nm]
Par.Alt_Cruise = 38000; % Cruise Alt [ft]
% Call function FindDesignPoint to calculate mission characteristics
dp(3) = FindDesignPoint(Par); % The calculated results of the mission
 elements are store in the object *dp*.

% Plot Mission Profile, Climb Performance results are also plotted
PlotMission(dp(3).Mission) % Call plotter for mission profile
```

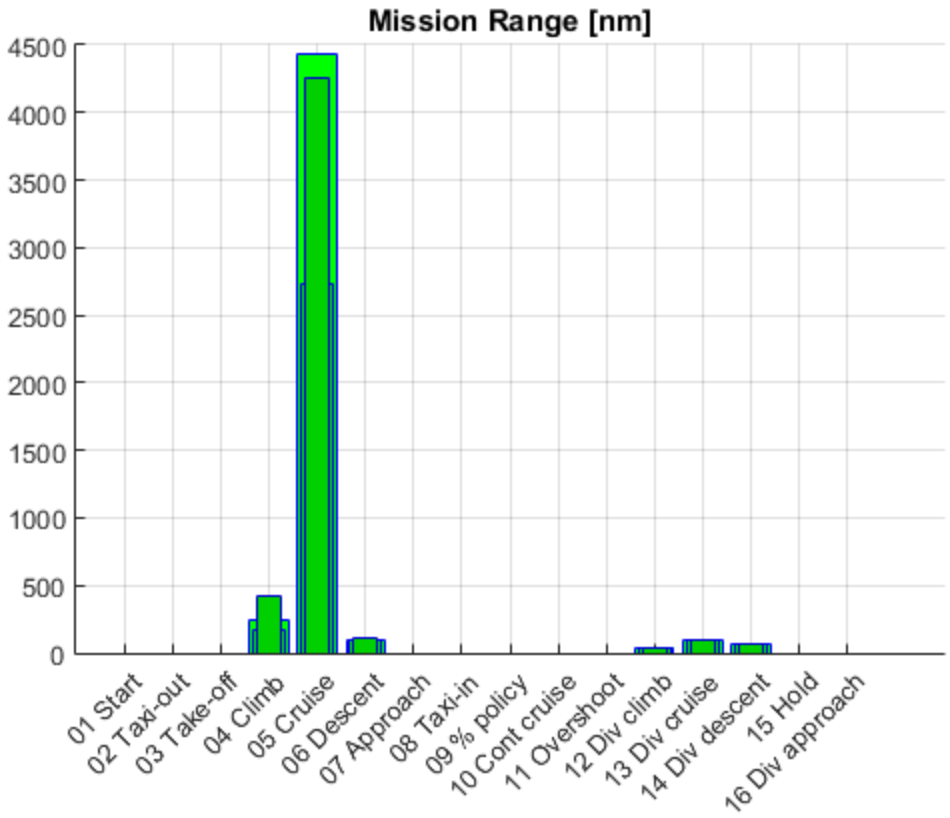
```
... Engine data prepared from UBB65Data

... Calculating the value of aircraft Take-Off Mass (TOM) for the
 required design case
Payload required :  29050 kg
Range required   :  4779 nm
Cruise altitude  :  38000 ft
Cruise Mach No.  :  0.82

.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -11.9777
```

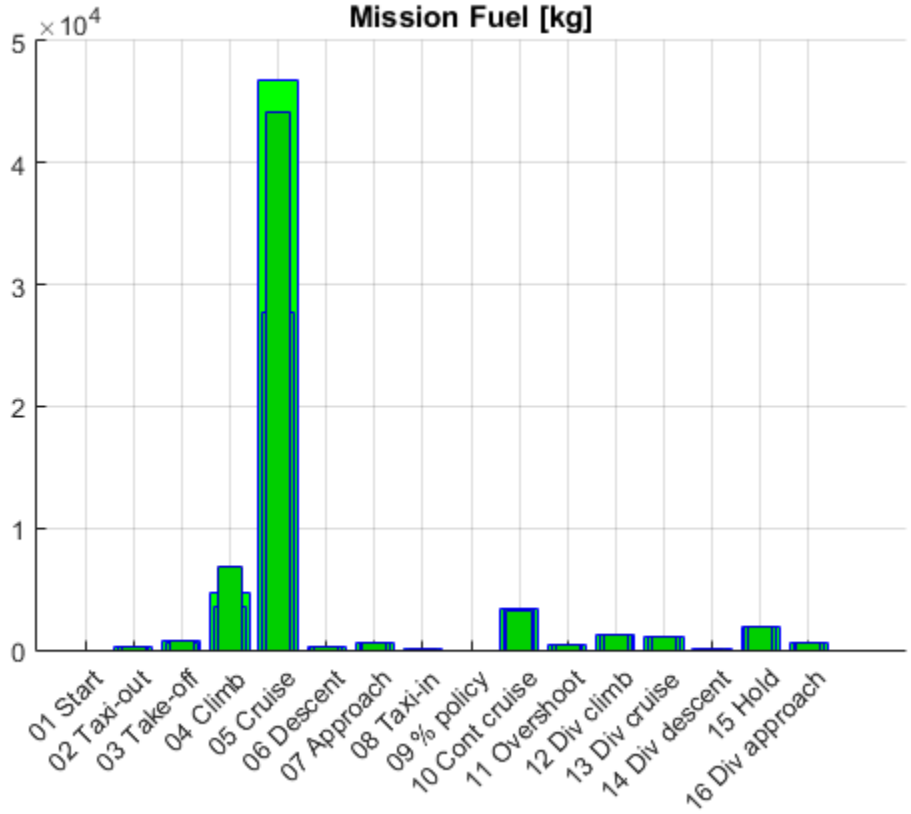
```
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -11.9777
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -11.98
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -11.98
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -11.9858
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -11.9858
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -12.0002
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -12.0002
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -12.0361
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -12.0361
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -12.1225
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -12.1225
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -12.3223
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -12.3223
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -12.7191
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -12.7191
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -106.4699
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -106.4699
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -109.4038
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -109.4038
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -130.2445
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 37595 ft. The RoC this altitude is -130.2446
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 36595 ft. The RoC this altitude is -13.8083
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 36595 ft. The RoC this altitude is -13.8084
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 36595 ft. The RoC this altitude is -13.8966
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 36595 ft. The RoC this altitude is -13.8967
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 36595 ft. The RoC this altitude is -13.8967
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 36595 ft. The RoC this altitude is -13.8967
```

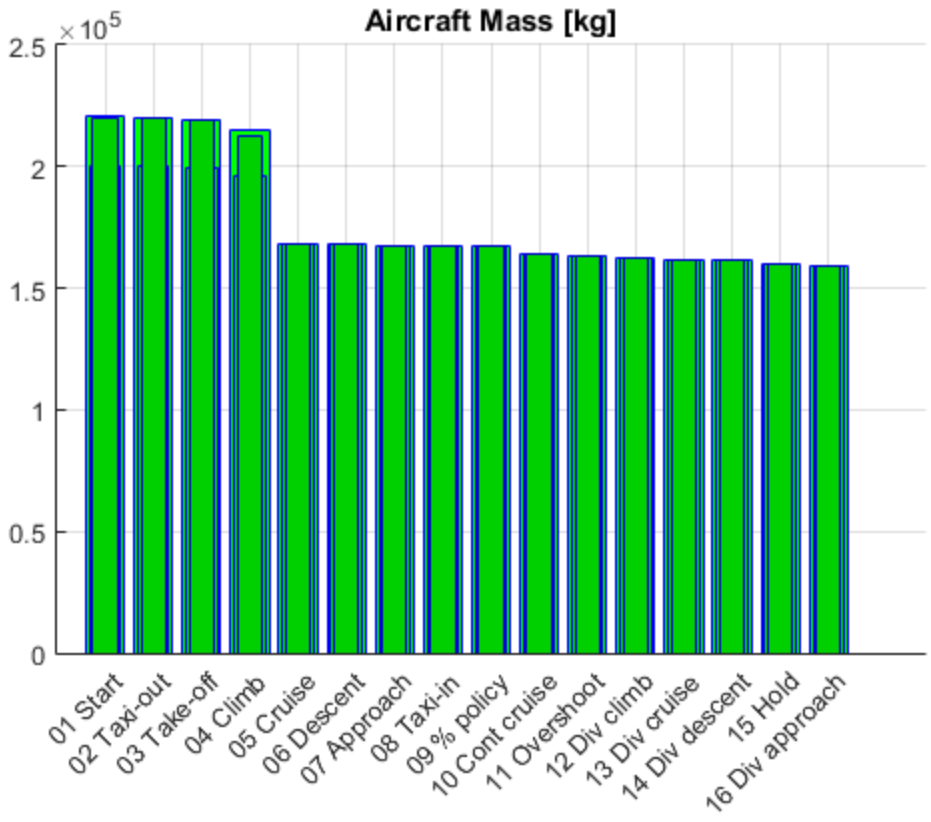
```
... Done
Elapsed time is 11.995718 seconds.

Calculate fuel burn for the required design case
.Warning: ... Altitude Ceiling reached for Mission Climb just below
 36595 ft. The RoC this altitude is -13.8967
... Done
Elapsed time is 0.347311 seconds.

TOM for required the mission  :  219717 kg
Block time for the mission    :  639 minutes
Block fuel for the mission    :  52812 kg
Reserve fuel for the mission  :  8653 kg
Total fuel for the mission    :  61313 kg
```






Mission Range [nm]
4500
4000
3500
3000
2500
2000
1500
1000
500
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
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



Save results

```
savefile = 'DPoint1.mat'; % You should change the name of this file
 for different cases
save(savefile, 'dp');
```

Load saved data to workspace

delete Par;

```
clear % clear workspace
load 'DPoint1.mat';
whos % show available variables in the workspace
```

```
  Name        Size              Bytes  Class          Attributes

  dp          1x3              182822  designpoint
```

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