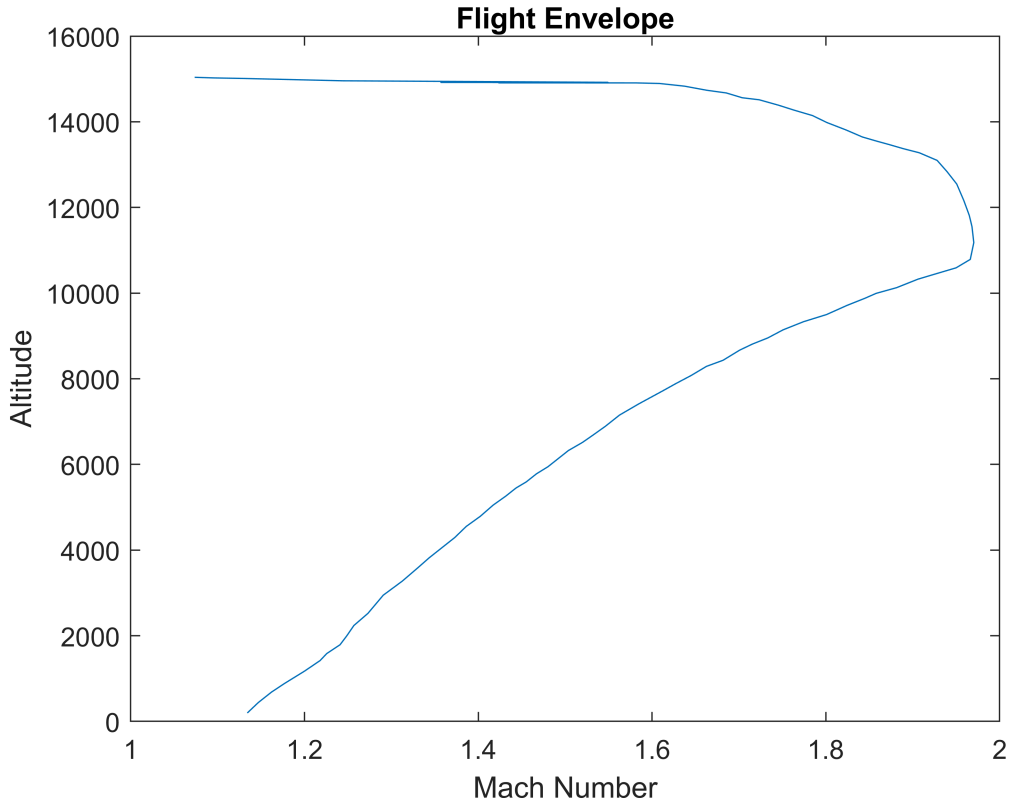
OEMP 1 Work

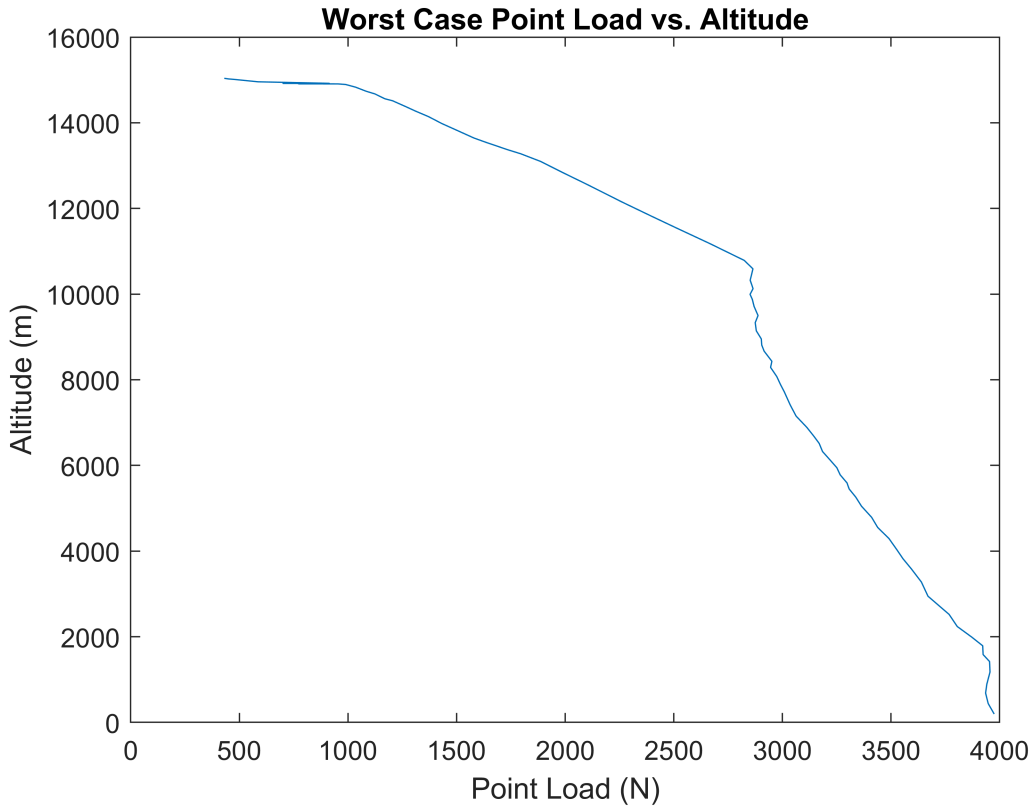
Load in data, plot flight envelope for "inspiration"

```
load("OEMP1_data.mat")
flight_envelope(1,:) = [];
plot(flight_envelope.mach,flight_envelope.altitude)
title("Flight Envelope")
xlabel("Mach Number")
ylabel("Altitude")
```



Using the equations: F = A * Q * C_d and Q = (1/2) * rho * v^2, plot force versus altitude.

```
A = (0.3048 * 0.12192); % m^2
C_d = 1.2; % assumed for a flat plane (simplification)
flight_envelope.Velocity = flight_envelope.mach .* flight_envelope.speed_of_sound;
flight_envelope.Dynamic_Pressure = (1/2) .* flight_envelope.air_density .* (flight_envelope.Vel
flight_envelope.Force = A .* flight_envelope.Dynamic_Pressure .* C_d;
plot(flight_envelope.Force,flight_envelope.altitude)
title("Worst Case Point Load vs. Altitude")
xlabel("Point Load (N)")
ylabel("Altitude (m)")
```



Given your curve, what is the maximum point load on the turbine blade, and what altitude and aircraft speed does it occur at? Did you need to make any assumptions?

```
maxForce = max(flight_envelope.Force)
```

```
maxForce = 3.9747e+03
```

```
% test: minForce = min(flight_envelope.Force)
maxForce_Altitude = flight_envelope.altitude(flight_envelope.Force == maxForce,1)
```

```
maxForce_Altitude = 196.2095
```

```
maxForce_Velocity = flight_envelope.Velocity(flight_envelope.Force == maxForce,1)
```

```
maxForce_Velocity = 385.0902
```

The maximum force is just under 4 kN, which occurs at an altitude of ~196 m with an aircraft velocity of ~385 m/s. I assumed that air density changed with altitude as provided by the data, and of course the 6 assumptions we made at the beginning.