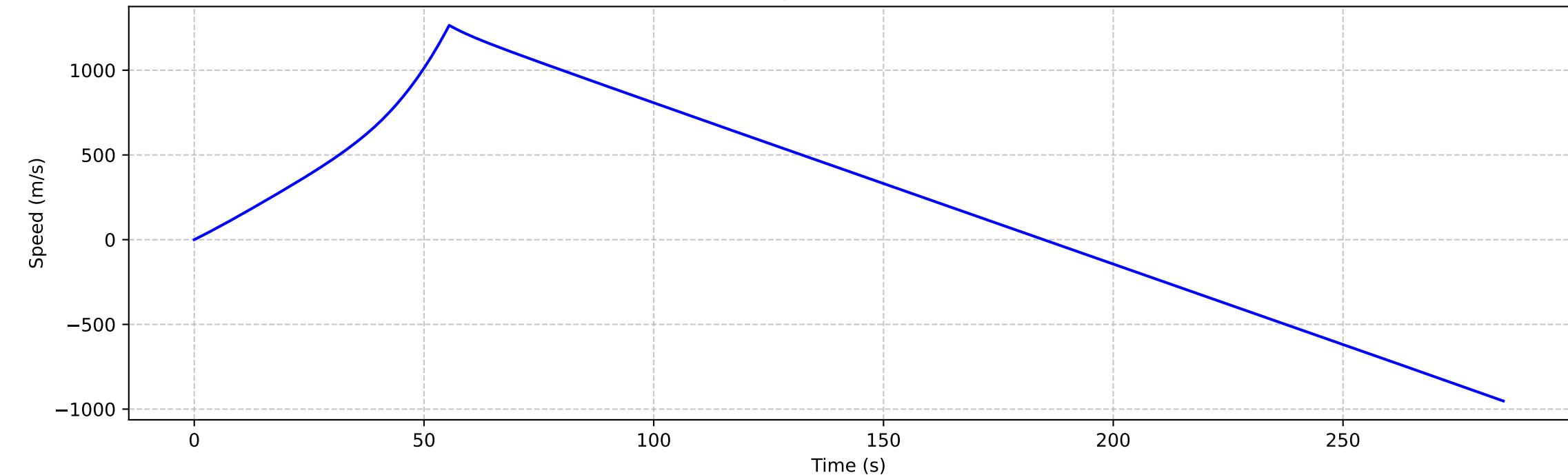
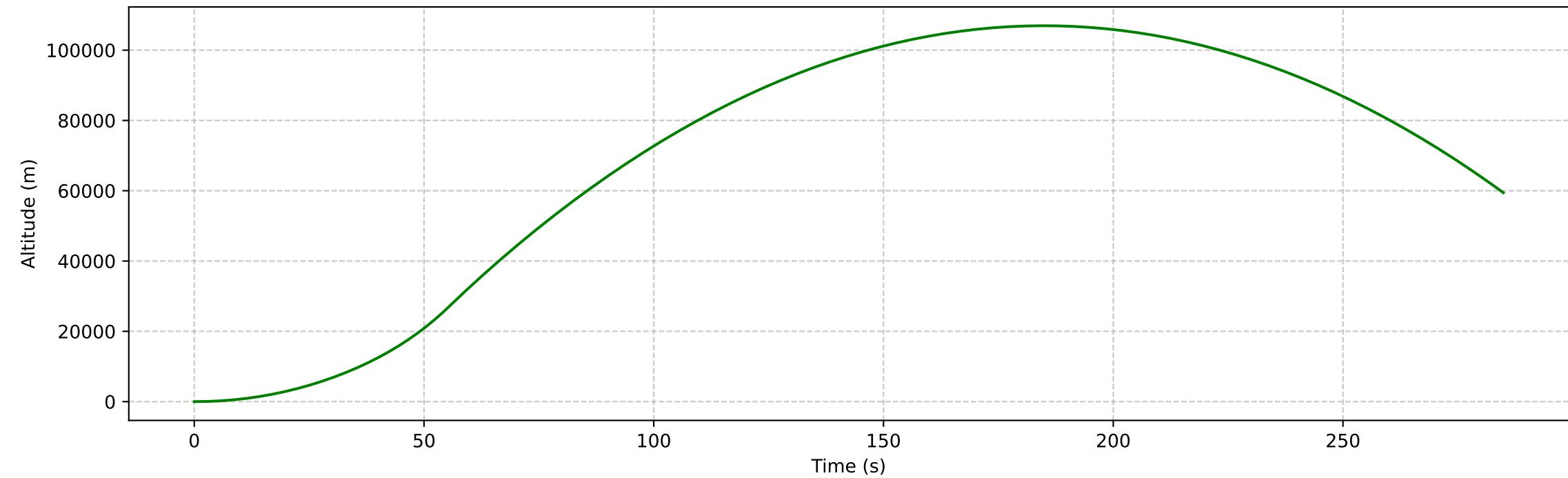


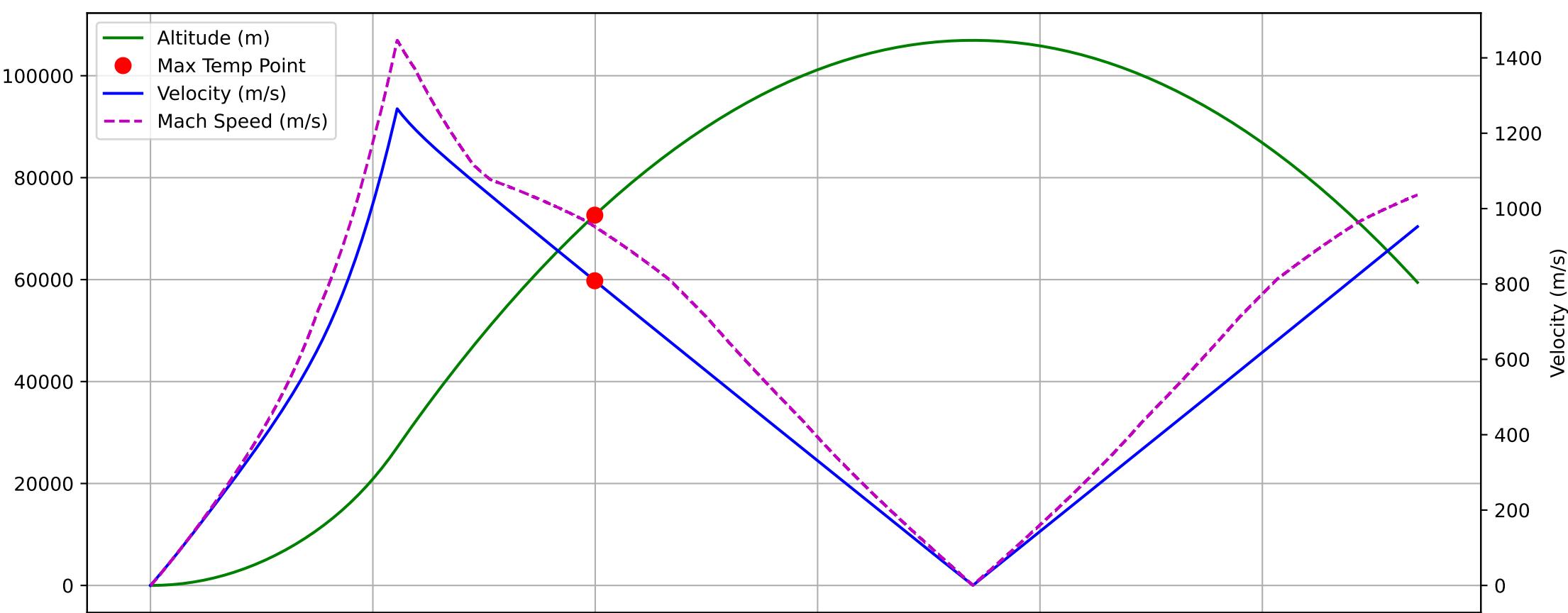
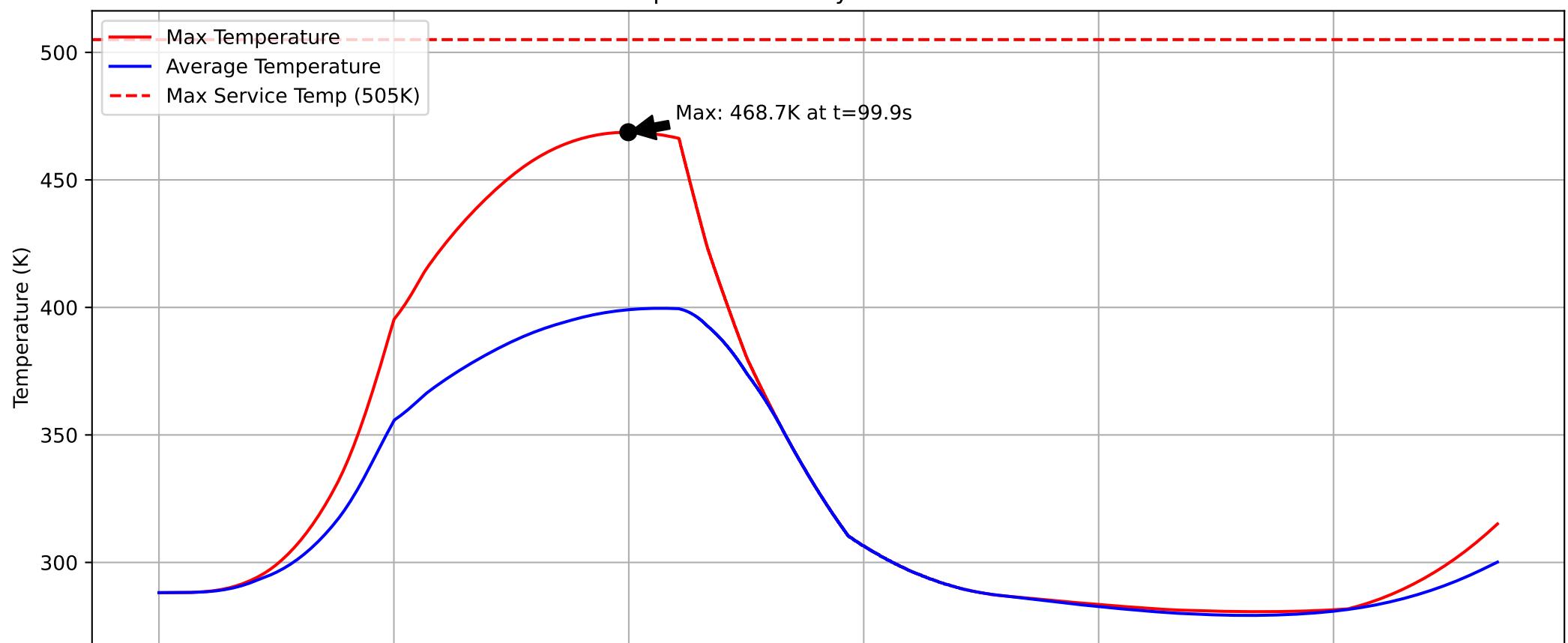
Speed vs Time



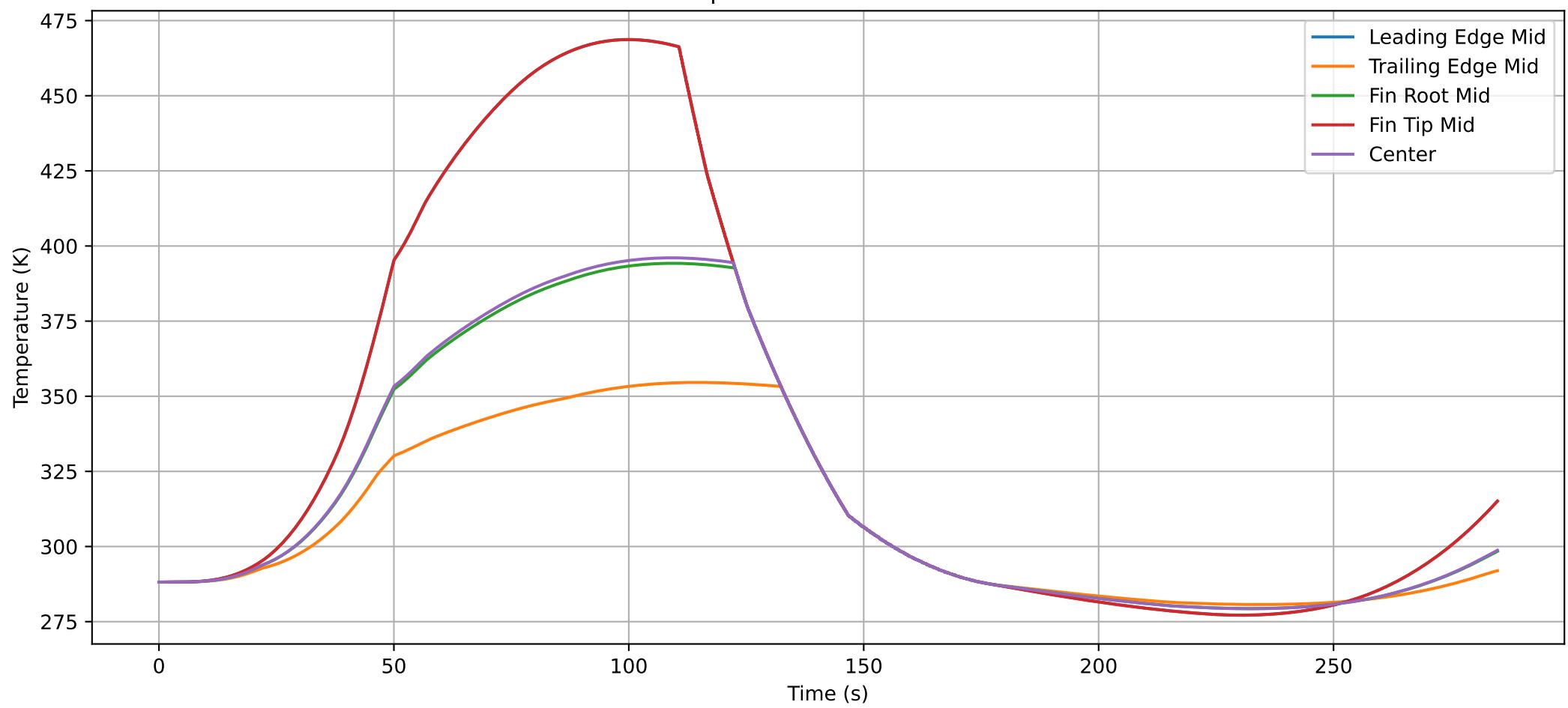
Altitude vs Time



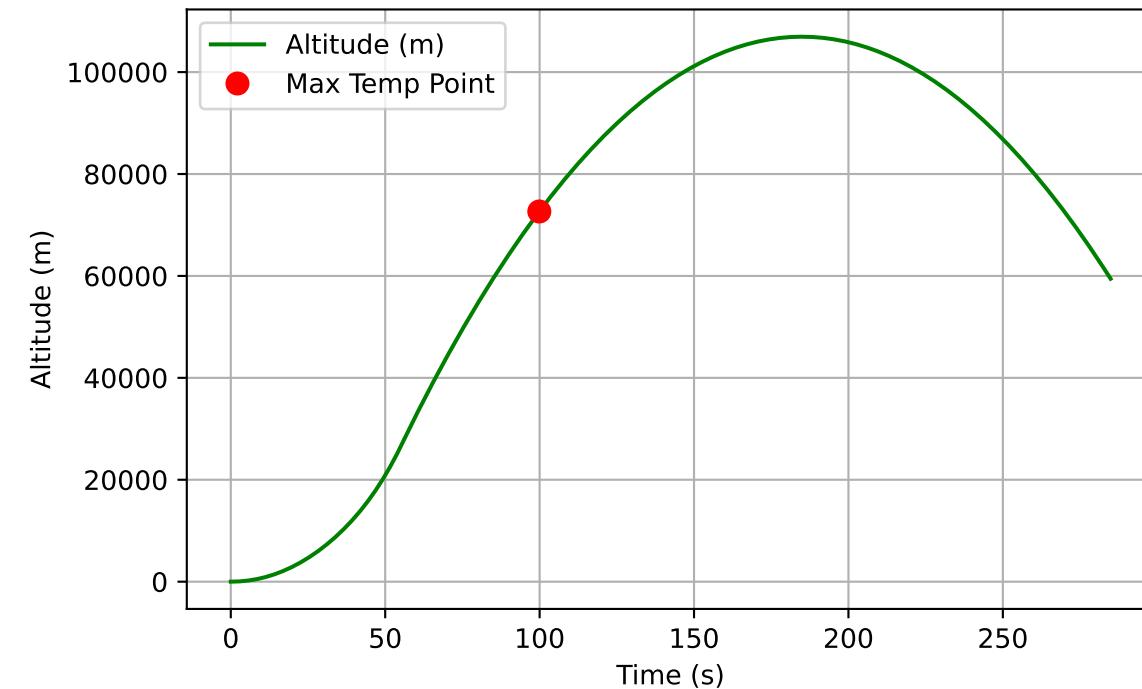
### Fin Temperature History - Titanium Ti-6Al-4V



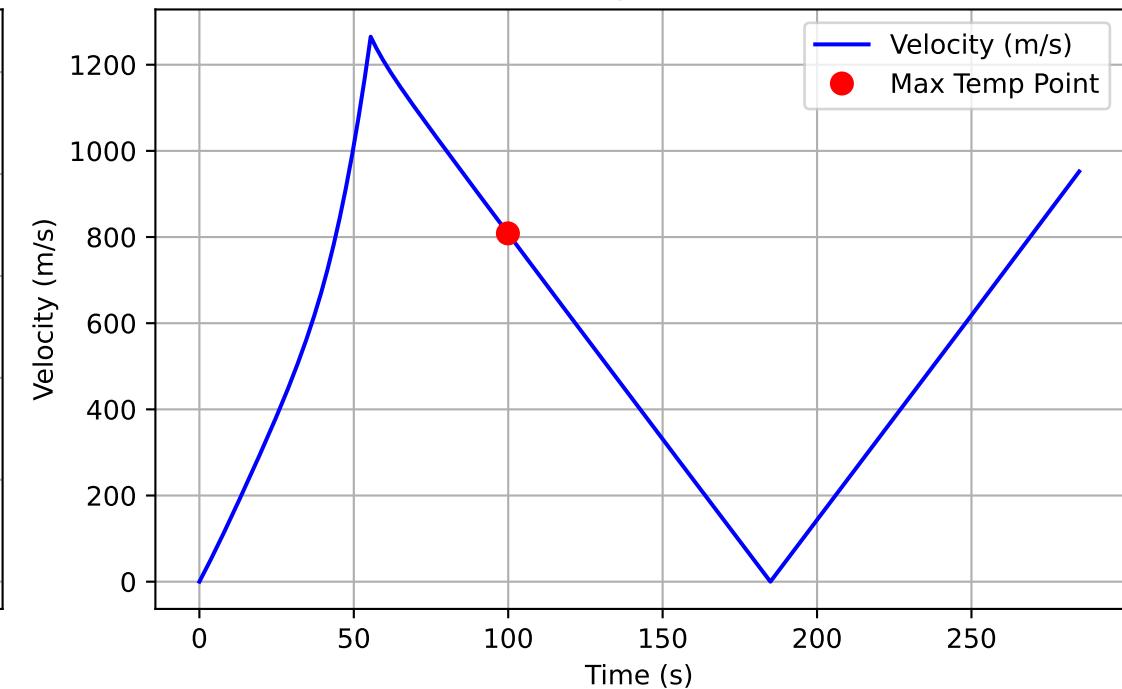
Temperature at Track Points



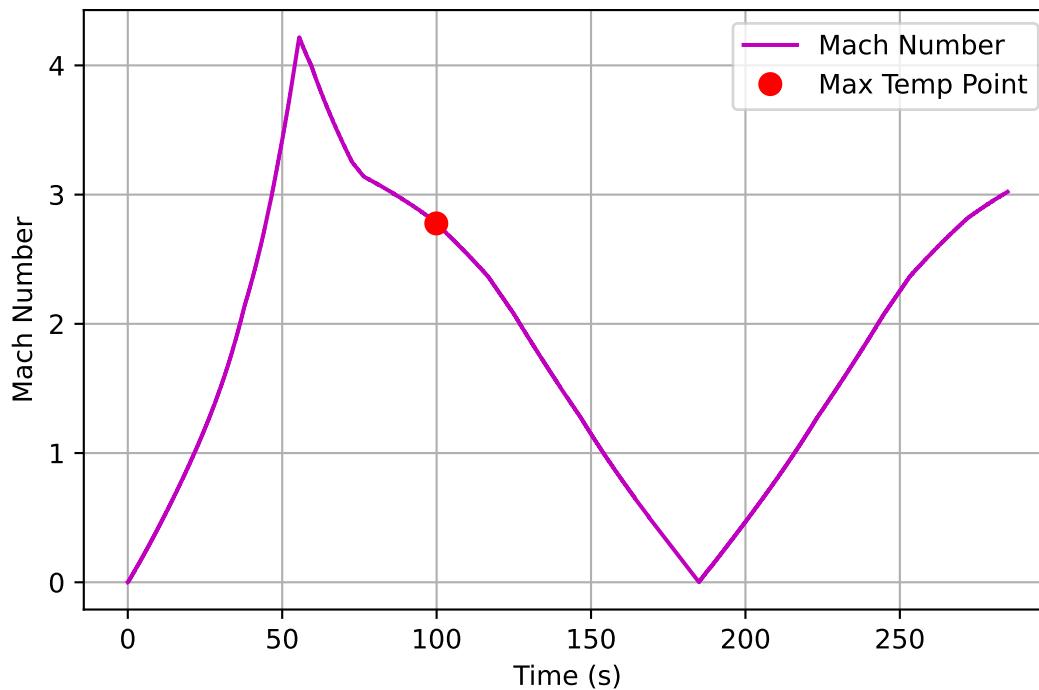
### Altitude vs Time



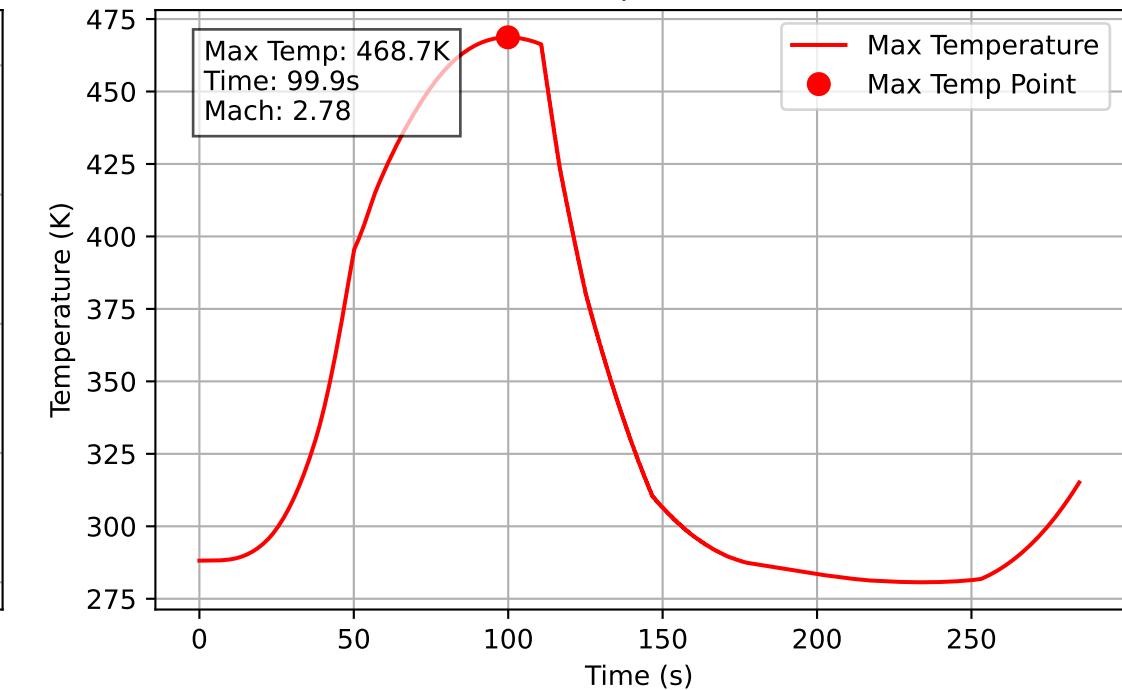
### Velocity vs Time



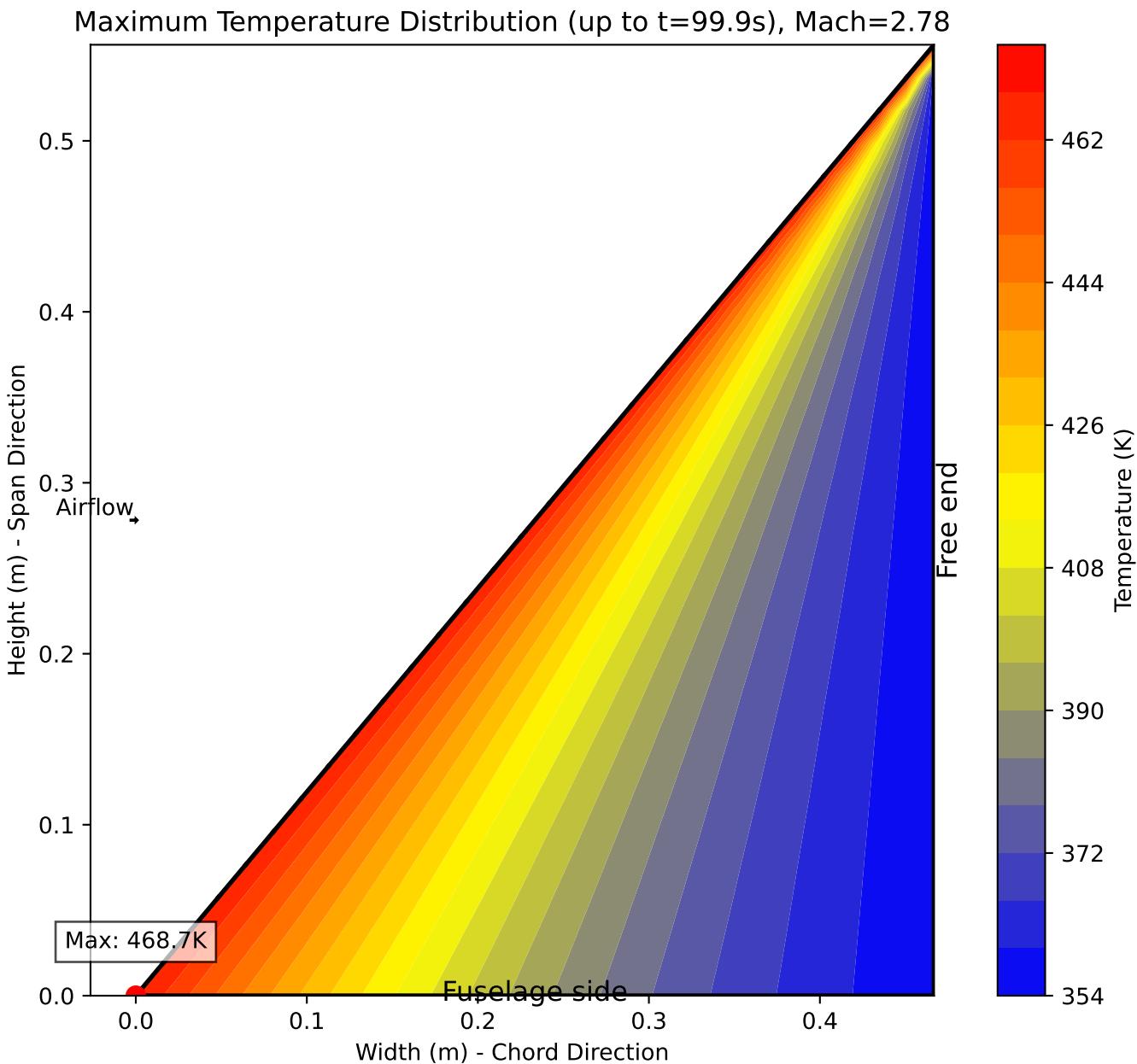
### Mach Number vs Time



### Maximum Temperature vs Time



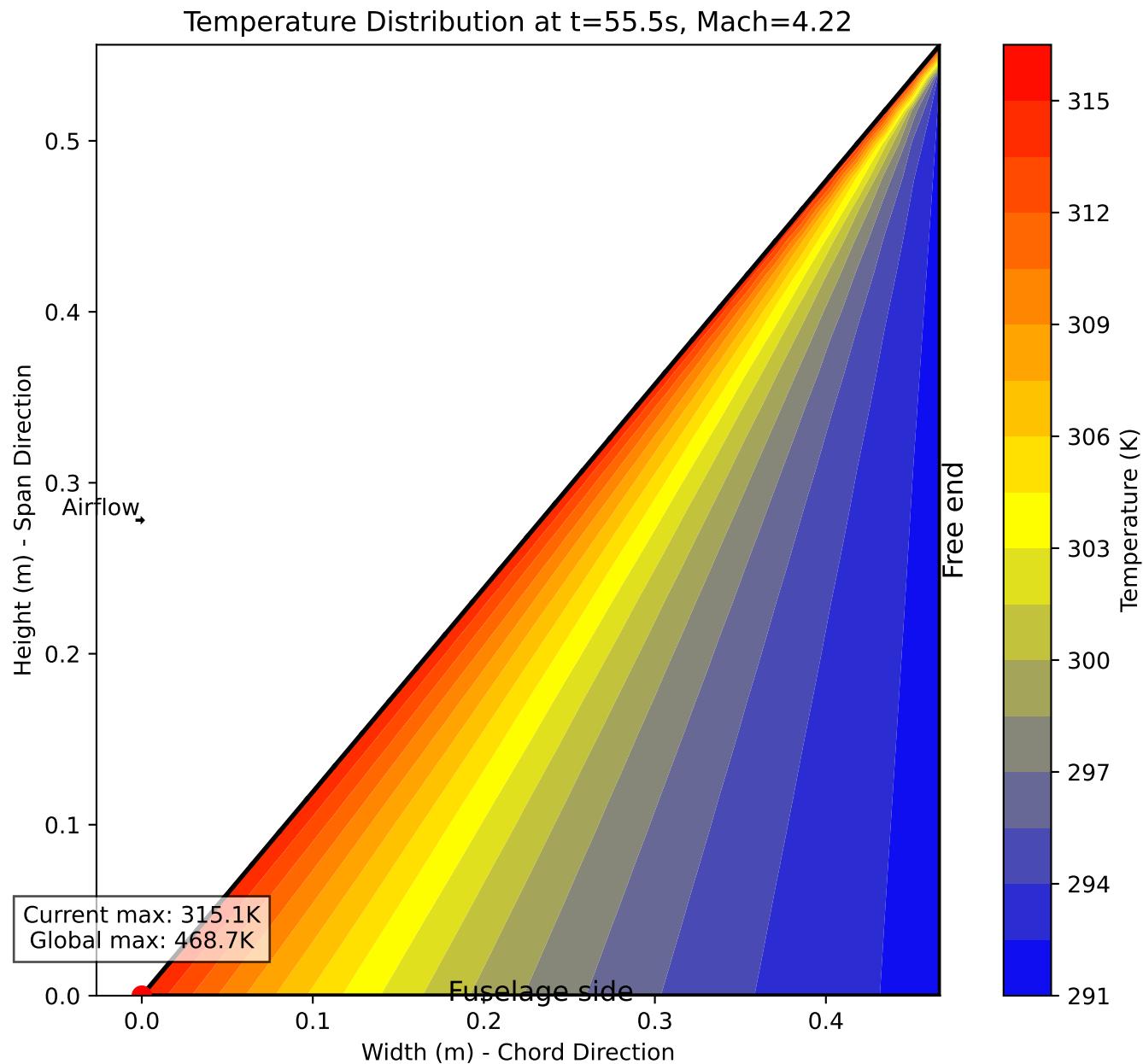
# Temperature Distribution at Maximum Temperature



Flight Conditions:  
Time: 99.9 s  
Velocity: 808.5 m/s  
Altitude: 72646.8 m  
Mach: 2.78

Material: Titanium Ti-6Al-4V  
Max Service Temp: 505 K  
Peak Fin Temp: 468.7 K  
Safety Margin: 36.3 K

# Temperature Distribution at Maximum Velocity



Flight Conditions:  
Time: 55.5 s  
Velocity: 1265.0 m/s  
Altitude: 27079.4 m  
Mach: 4.22

Material: Titanium Ti-6Al-4V  
Max Service Temp: 505 K  
Peak Fin Temp: 468.7 K  
Safety Margin: 36.3 K

# INITIAL CONDITIONS AND PARAMETERS

## FLIGHT SIMULATION

Generated: 2023-11-15 15:39:01

### SIMULATION PARAMETERS

Fin Material:	Titanium Ti-6Al-4V
Fast Mode:	False
Time Step (dt):	0.01 s
After Top Reached:	10000 cycles
Animation Enabled:	False

### COMPONENT MASSES AND POSITIONS

Component	Mass (kg)	Position (m)	Team
nose_cone	10.230	0.450	aero
fuselage_oxi	55.330	4.500	fuselage
propellant	244.080	3.000	fuselage
helium_tank	43.500	1.400	fuselage
fuselage_shell	60.250	4.000	fuselage
combustion_chamber	12.830	5.500	fuselage
nozzle	7.993	7.349	nozzle
fins (calculated)	8.162	2.100	aero
Total Dry Mass	198.295		
Total Propellant	244.080		
Total Mass	442.375		
Mass Ratio	2.231		

### ROCKET GEOMETRY

Rocket Length:	2.5 m
Rocket Diameter:	0.5 m
Rocket Radius:	0.175 m
Nose Cone Length:	0.3 m
Nose Cone Shape:	ogive

### ENGINE PARAMETERS

ISP Sea Level:	235 s
ISP Vacuum:	300 s
Fuel Flow Rate:	4.4 kg/s

### INITIAL CONDITIONS

Initial Velocity:	0 m/s
Initial Altitude:	0 m
Initial Dynamic Pressure:	0 Pa

Page 1 of 2

### AERODYNAMIC PARAMETERS

Drag Coefficient:	0.5
Max Dynamic Pressure:	82800.0 Pa

## **INITIAL CONDITIONS (CONTINUED) - PAGE 2**

### **FLIGHT SIMULATION**

Fin Width: 466.72 mm  
Fin Mass (single): 2.040431 kg  
Total Fin Mass: 8.161724 kg  
Wall Thickness: 4 mm  
Fin Set CG Position: 2.1 m

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#### **MATERIAL PROPERTIES**

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Thermal Conductivity: 25 W/(m·K)  
Density: 3930 kg/m<sup>3</sup>  
Specific Heat: 610 J/(kg·K)  
Max Service Temperature: 505 K  
Yield Strength: 1050 MPa  
Thermal Expansion: 6.6e-06 1/K  
Emissivity: 0.63