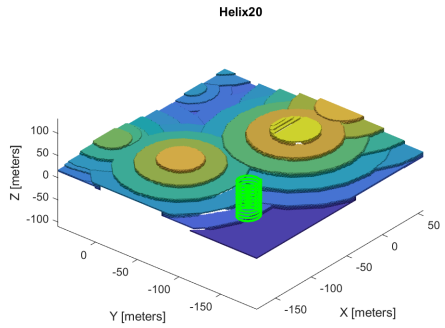
Running Trade Studies

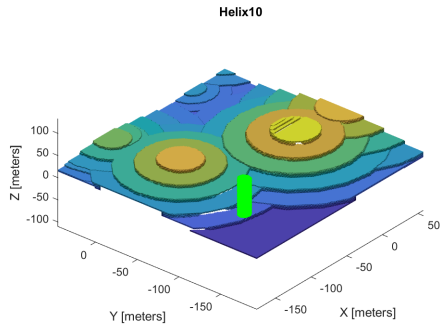
Looking at the affect different path planning parameters have on battery state-of-charge throughout our mission.

Load Paths from Path Planner

```
load HelixPaths.mat; load UUVSceneLowResMap3.mat;
figure; show(omap); hold on;
plot3(helix1(:,1),helix1(:,2),helix1(:,3),"LineWidth",2,"Color","g");
xlim([-176 57]); ylim([-193 45]); zlim([-110 133])
title("Helix20"); hold off
```




```
figure; show(omap); hold on;
plot3(helix2(:,1),helix2(:,2),helix2(:,3),"LineWidth",2,"Color","g");
xlim([-176 57]); ylim([-193 45]); zlim([-110 133])
title("Helix10"); hold off
```



Open Model

```
mdl = "AUV_ControlsPreliminary_PowerCalc_TS";
open_system(mdl);
set_param(mdl,"FastRestart","on");
%set_param(mdl,"SimMechanicsOpenEditorOnUpdate",'off');
sim(mdl);
```

Run Simulations

```
trajectories = ["Helix10","Helix20"];
simlengths = ["2000", "1000"];
```

```
signalEditorBlock = strcat(mdl,"/Reference Trajectory/Reference Trajectory");

for i = 1:length(trajectories)
    in(i) = Simulink.SimulationInput(mdl);
    in(i) = setBlockParameter(in(i), signalEditorBlock, "ActiveScenario", trajectories(i));
    in(i) = setModelParameter(in(i),'StopTime',simlengths(i));
end

out = sim(in);
```

```
[12-Apr-2021 11:10:28] Running simulations...
[12-Apr-2021 11:12:11] Completed 1 of 2 simulation runs
[12-Apr-2021 11:13:00] Completed 2 of 2 simulation runs
```

Plot Simulation Results

```
tiledlayout(3,1);

for i = 1:length(trajectories)

    % Get simulation data
    x = out(i).logsout_controls.get("VehFdbk").Values.CoM.World.Xe.X.Data;
    y = out(i).logsout_controls.get("VehFdbk").Values.CoM.World.Xe.Y.Data;
    z = out(i).logsout_controls.get("VehFdbk").Values.CoM.World.Xe.Z.Data;
    ts_speed = out(i).logsout_controls.get("speed (knots)").Values;
    ts_soc = out(i).logsout_controls.get("SOC").Values;

    % Plot simulation data
    nexttile(1); plot3(x,y,z); hold on;
    nexttile(2); plot(ts_speed.Time,ts_speed.Data,"LineWidth",2); hold on;
    nexttile(3); plot(ts_soc.Time,ts_soc.Data,"LineWidth",2); hold on;

end

% Format plots
nexttile(1); title("AUV Trajectory"); legend(trajectories);
xlabel("X (m)"); ylabel("Y (m)"); zlabel("Z (m)"); hold off;
nexttile(2); title("AUV Speed"); legend(trajectories,"Location","bestoutside");
xlabel("Time (s)"); ylabel("Speed (knots)"); hold off;
nexttile(3); title("Battery State of Charge"); legend(trajectories,"Location","bestoutside");
xlabel("Time (s)"); ylabel("State of Charge %"); hold off
```