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Report Card 2019/2020 Summer

8/10/2020

Max Lan Grade: 8

ONLS-PHF: Physics of Flight

Teacher: Mika Latva-Kokko

ONLINE

Airplane Design Fundamentals

Students will show understanding of center of lift, center of mass, center of drag, thrust, forces, wing design, mass and how an airplane's performance is affected by their relative placement.

Rocket Design Fundamentals

Students will demonstrate understanding of Newton's Laws, forces, mass, thrust-to-weight ratio, Delta-V, resource flow analysis, flow priority and purpose and optimization of each rocket stage

Flight Simulation

Students can simulate the piloting of preexisting and newly designed aircraft. Ability to take-off, maneuver in stable flight and land successfully in a variety of conditions. Show an understanding of the challenges of piloting.

Fluid Dynamics

Students will conduct virtual analysis of a 2D flow pattern; able to produce a quantitative result to satisfy a specific engineering design question..

Iterative Craft and Mission Design

Students will evaluate competing design solutions using a systemic process to determine how well they meet the criteria and constraints of the problem.

PM4

DM5

PM4

DM5

DM5

Course Description: Forty students came together virtually this summer in *The Physics of Flight*, a mastery-based course covering the theory and application of Newtonian mechanics in flight. The goal of the course was to equip students to think, observe and analyze the challenges of flight both historically and in their own designs. Each week had a specific focus on a learning goal with a variety of inquiry-based investigations that created the space for students to more fully explore the theoretical concepts presented. We started with the basic core physics theory related to aircraft design, jet engines and rockets to bring everyone to the same level and lay a strong foundation. From there students chose either an aero or astro

Extending Mastery (EM)	6	High Honors	A+
Demonstrating Mastery (DM)	5	Honors	A
Progressing Toward Mastery (PM)	4	Good	B
Progressing Toward Mastery (PM)	3	Satisfactory	C
Emerging (E)	2	Minimally Passing	D
Emerging (E)	1	Failure	F

specialty and dove into the history of design and a plethora of "hands-on" building with flight simulators. They then demonstrated their design knowledge with creating a craft of their own and analyzing its functionality. This served as the foundation for flight simulation where students built and refined their flight maneuvering techniques. Using existing and custom crafts, each student demonstrated their mastery in takeoff, landing and inflight scenarios in many different conditions. After this, we did a brief overview of fluid dynamics where students explored 2-D flow patterns related to the aerodynamics of a stall, wake turbulence and Mach regimes. This built towards the students demonstrating mastery by designing an airplane wing to meet certain design conditions using FoilSim, a wind tunnel simulator created by NASA. Each of these topics built toward our final project which was focused on iterative craft and mission design. Students collaborated with their instructor to create a flight mission, break it down into key components and then build a craft that can accomplish each leg of the journey. The edge of the in-simulator universe is truly the limit. Throughout the flight simulator activities, theory exploration and project, students were challenged daily, to think, observe, and analyze, both on the ground and in the sky and far reaches of space to demonstrate a deeper understanding of the mechanics of flight.

Airplane Design Fundamentals: Progressing Toward Mastery

While Max did work toward mastery in his airplane design he did not complete the final design or core theory assessments. Instead he worked on rocket design and plane design activities showing some growth and mastery. I am having a hard time judging how much, as the assessments would have given me a more comprehensive view of what Max accomplished.

Rocket Design Fundamentals: Progressing Toward Mastery

Similar to airplane design I only have some design activities to go by. Some of this has been very creative, but it is hard for me to judge how much of the physical principles Max has learned.

Flight Simulation: Demonstrating Mastery

Max did a good job on challenges of flight activity and with his flight simulation assessments. It is clear that he has mastered most aspects of flight, but there still remains room for improvement.

Fluid Dynamics: Demonstrating Mastery

Max worked on understanding aerodynamics of stall, and used Computational Fluid Dynamics simulators to gain understanding on how quantities such as speed, angle of attack, camber, and size of the wing changed the lift produced by a wing.

Iterative Craft and Mission Design: Demonstrating Mastery

As his final design project Max decided to work on a plane capable of water take-off and landing. The platform he used for this was simple planes. He decided to use dihedral wing design to help water landing and assist with plane stability. It is worth checking out his final video of his final project. Very impressive flying (especially if you ignore the crashes toward the end).

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