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SHIFT-CCA

Physics AI for Collaborative Combat Aircraft Optimization

PROBLEM

Collaborative Combat Aircraft (CCAs) programs must converge on credible designs under extreme uncertainty, compressed timelines, and unprecedented production scale, while remaining affordable. Early configuration decisions are often made with limited visibility because traditional CFD is slow and resource-intensive, constraining how broadly teams can explore the design space during early program phases.

SOLUTION

Physics AI expands exploration while reducing risk

SHIFT-CCA is an open-source dataset and Physics AI model focused on aerodynamic performance for Group 5 UAV-class configurations, developed in collaboration with nTop. Predictions are generated in seconds, enabling interactive comparison across thousands of configurations. This speed is leveraged to run multi-objective optimization across thousands of geometric variants—exploring conflicting objectives like Range (L/D) and Endurance ($4 \cdot CD_0$)—to identify robust regions and strengthen early architectural decisions before committing to resource-intensive high-fidelity CFD

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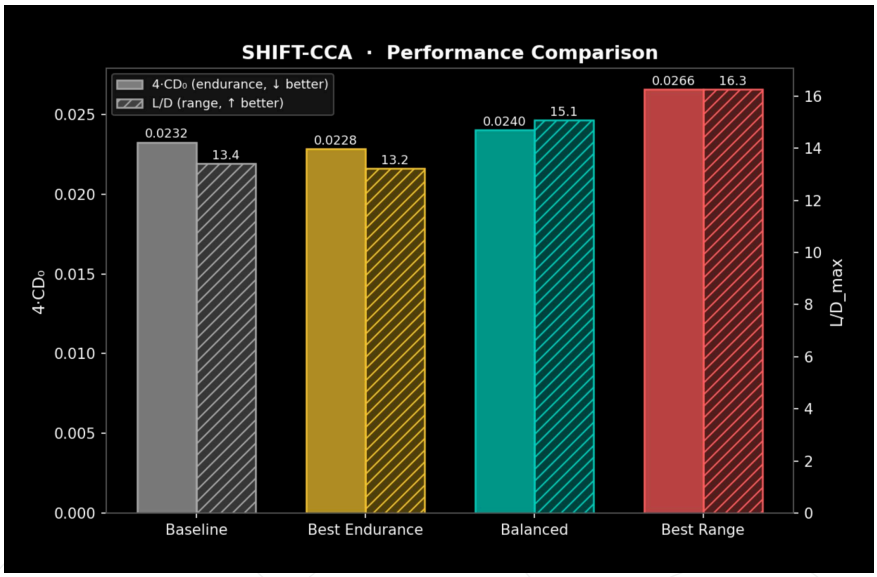
RESULTS

AI optimized designs improve range by 15% and endurance by 1.5%

WHAT THE MODEL LEARNED

AI Model predicts key aerodynamic quantities

SHIFT-CCA predicts field quantities such as surface pressure and wall shear stress, along with integrated quantities including lift, drag, and lift-to-drag ratio. The model demonstrates strong agreement with CFD ground truth across the sampled design space, with similar metrics between training and validation sets, indicating stable generalization.



"Physics AI is the next level of complexity in AI, and Northrop Grumman is bringing this technology to our design engineers to dramatically speed up hardware development."

Han Park
Vice President,
AI Integration
NORTHROP GRUMMAN

LEARN MORE

Try the CCA prediction demo:

https://www.luminary.ai/demo/

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