



INSTITUTE FOR DEFENSE ANALYSES

Projecting Aircraft Performance Using Regional Climate Data

(Presentation)

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Projecting Regional Climate Change Effects on Aircraft Performance

DATAWorks Session 6B: Methods for DoD System Supply Chain and Performance Estimation

April 27, 2023

R. Abraham Holland
Research Staff Member, Institute for Defense Analyses

Background & Objective

IDA identified several analytical strategies within the open academic literature for connecting climate change and DoD operations that may interest the test and evaluation community

We will present a McRae et al. *Assessing Aircraft Performance in a Warming Climate* (2021) inspired example using public data

Our key performance metric is the internal load capacity of a military helicopter

Local environmental conditions influence a range of aircraft performance characteristics:

- Power margin
- Maximum gross weight/load capacity
- Hover ceiling
- Max range
- Fuel Consumption



McRae et al. (2021) used climate models and general FAA guidance to project changes in UH-60L Blackhawk performance for aircraft operating at Little Rock Air Force Base, Arkansas

We use Army aircraft performance charts to project internal load capacity changes for a UH-60L operating in Luzon, Philippines in 2050

***TM 1-1520-237-10**

TECHNICAL MANUAL

OPERATOR'S MANUAL
FOR

UH-60A HELICOPTER

UH-60L HELICOPTER

EH-60A HELICOPTER



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*This manual supersedes TM 1-1520-237-10, dated 31 August 1994, including all changes.

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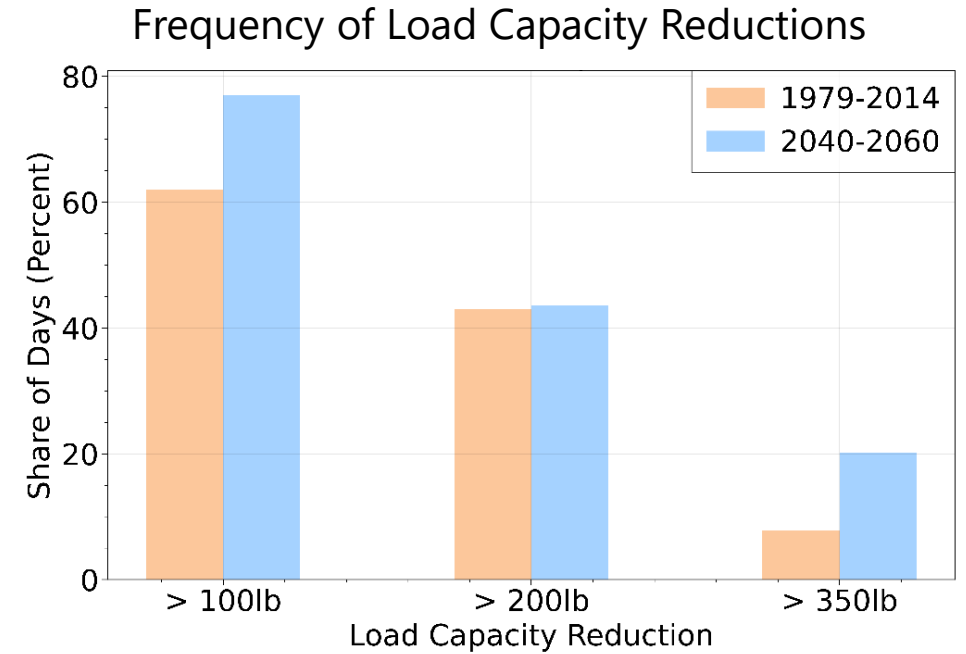
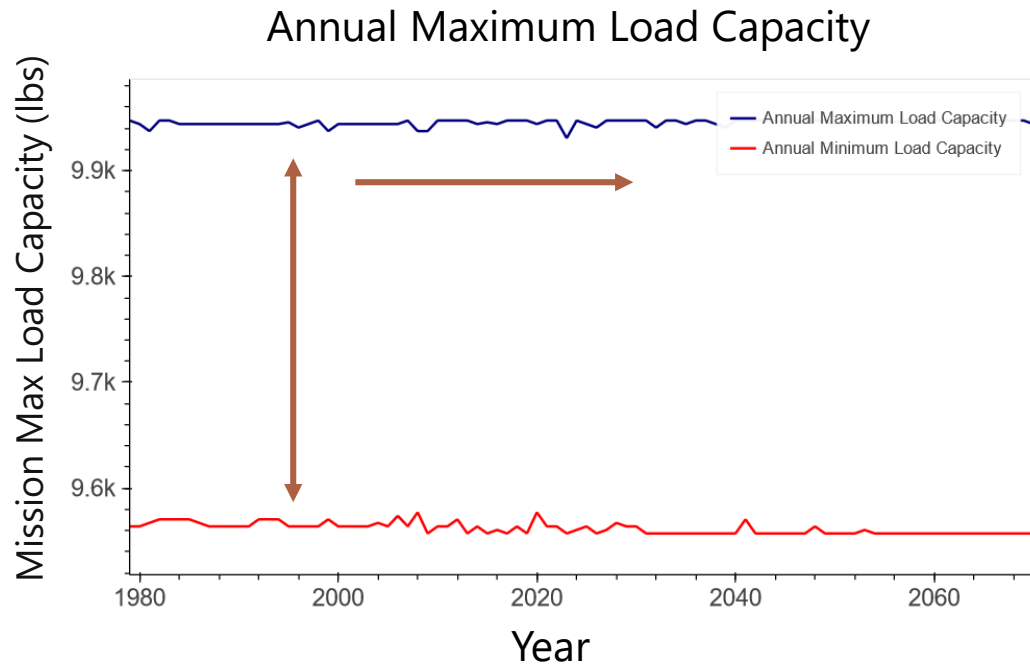
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NCAR CESM2 Large Ensemble

- Global climate model with 100 ensemble members with a combination of different oceanic and atmospheric initial states
- Resolution: 1 degree (~111 km²)
- Global coverage from 1980 to 2100
- One scenario CMIP6: SSP3-7.0 (which represents the "current trajectory")
- 3-hourly data

The projected climate change effects are orders of magnitude smaller than existing seasonal variation, but could remain operationally relevant



There is a wide range of potential applications for this analytical approach beyond what has been presented in today's presentation

Other metrics to analyze include:

- Range
- Required torque
- Hovering out of ground effect
- Carrying external loads

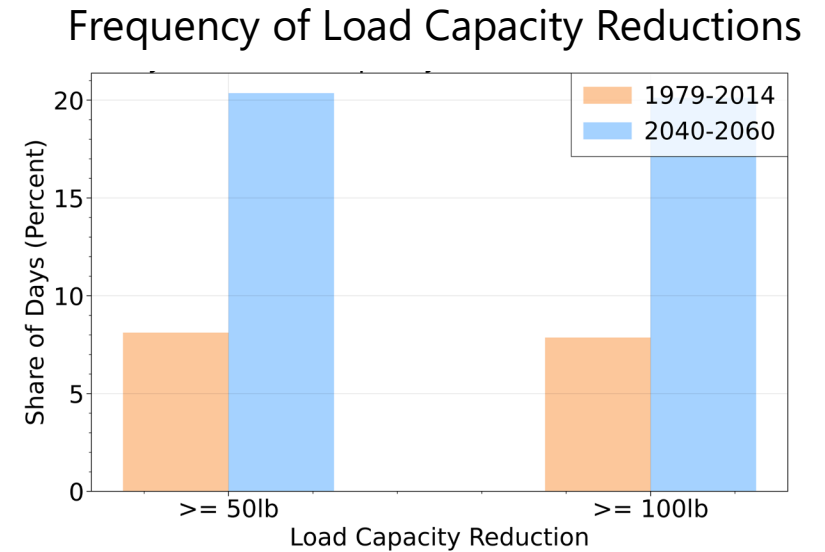
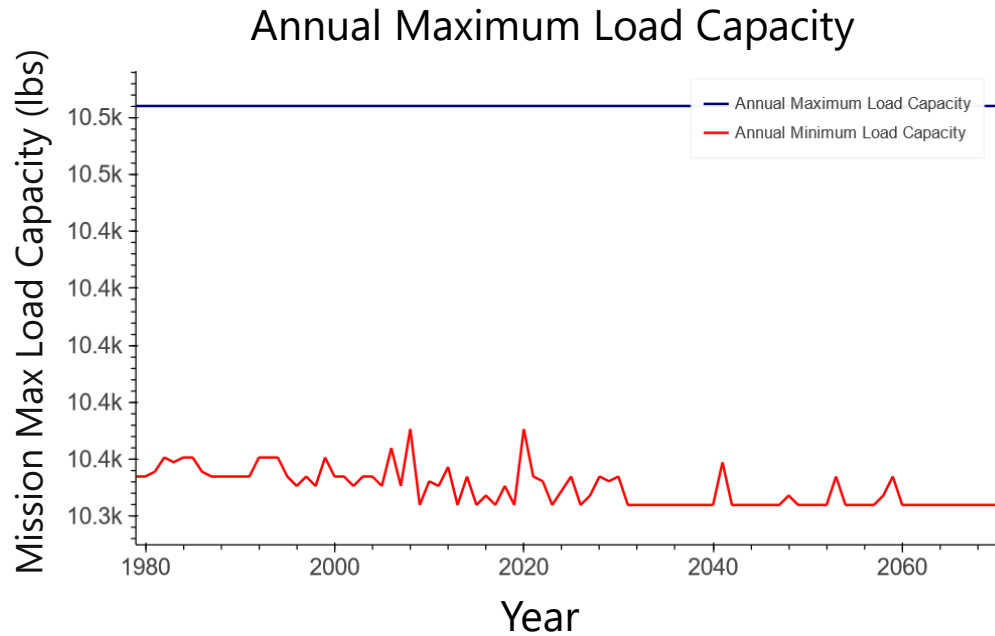
Putting effects into operational context by introducing scenarios used in training exercises

- Example: carrying an external load of 5,000 lbs 150 nautical miles to a landing zone at high altitude

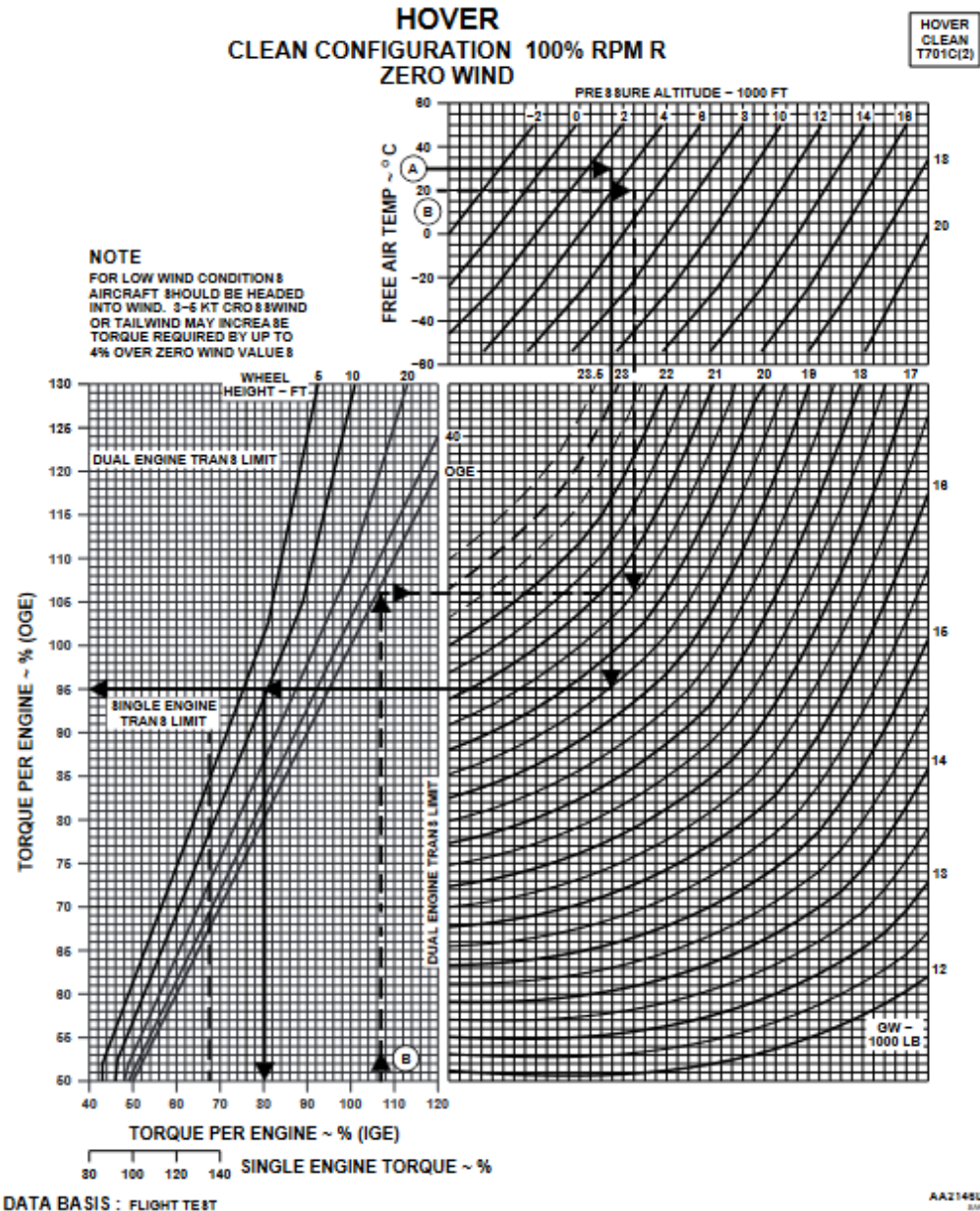
Thank You

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The projected climate change effects are an order of magnitude smaller than existing seasonal variation, but could remain operationally relevant



Explanation of hover load capacity calculation



Hover chart (left)

Took temperatures in 5C increments (0C, 5C, 10C, ...) and PA

In 1000ft increments (-1000, 0, 1000, 2000, ...) and drew line down to gross weight region

Drew line from 100 or 95% torque on bottom to intersect with either 10ft or 20ft line

Took gross weight at the intersection of two lines for each (temperature, PA) pair

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