

Kerbal Space Program - Feedback #23989

drag of Mk2 fuselages should depend on AoA-squared

10/20/2019 05:06 AM - Anonymous

Status:	New		
Severity:	Low		
Assignee:			
Category:	Physics		
Target version:			
Version:	1.3.1	Language:	English (US)
Platform:	Windows	Mod Related:	No
Expansion:	Core Game		

Description

Currently, the drag of non-wing parts has a contribution from each face proportional to the cosine of the angle between the airflow and the face normal.

Simple aerodynamic theory would have the total force proportional to this cosine, but of that force the component in the direction of drag gets another factor of the cosine; for glancing angles, the cosine is very small, and the bulk of the force on the surface is body lift.

In KSP, the Mk2 fuselage parts show the difference dramatically. At a 3° angle of attack, the bottom face of the Mk2 parts see the airflow with an angle whose cosine is 0.05. KSP applies 0.05 of the drag that bottom face would feel if normal to the airflow to the craft; one would expect only $0.05^2 = 0.0025$ of the 'belly-flop' drag would apply in the direction to slow the craft.

All parts except those with wing-like aerodynamics are affected; there is a bit more context at

<https://forum.kerbalspaceprogram.com/index.php?topic/182616-the-drag-of-parts/>

The attached plot of drag versus AoA is made by the informational mod 'Wind Tunnel'.

The drag of wings depends on AoA squared, as expected.

Changing this would disrupt gameplay balance, so I categorized this as feedback only. Players have responded to this aspect of KSP by avoiding Mk2 fuselages for space-planes, or more interestingly by giving wings an angle of incidence sufficient to give 1-G lift as they cross the sound barrier with the nose of the space-plane precisely along the airflow.

History

#1 - 10/20/2019 05:08 AM - Anonymous

- Description updated

#2 - 01/03/2020 05:15 AM - Anonymous

"Players have responded to this aspect of KSP by avoiding Mk2 fuselages for space-planes, or more interestingly by giving wings an angle of incidence ..."

or even more interestingly, by turning the Mk2 parts on their side, so that the edge points down.

<https://forum.kerbalspaceprogram.com/index.php?topic/190374-around-the-world-in-80-minutes/&do=findComment&comment=3722569>

This way, the smaller area and smaller $C_d=0.61$ (which is cubed at high speeds after version 1.2) gives less force from the now downward-facing X-side of the drag cube than similar mk1 round parts.

If the force of the size we would expect for body lift, are applied in the direction of drag, it pays to design so as to avoid body lift.

Files

aoa.jpg	58.7 KB	10/20/2019	Anonymous
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