Kerbal Space Program - Bug #13412

Radiator behavior in high-speed low-atmospheric pressure flight is not physically accurate

12/11/2016 09:14 PM - foamyesque

Status:	New	**Start date:**	12/11/2016
Severity:	Normal	**% Done:**	0%
Assignee:			
Category:	Physics		
Target version:			
Version:	1.2.2	**Language:**	English (US)
Platform:	Windows	**Mod Related:**	No
Expansion:			

Description

I had an extensive discussion (http://forum.kerbalspaceprogram.com/index.php?/topic/153222-ksp-122-radiators-do-not-work-correctly-in-atmospheres/) with sal_vager about how radiators work in the low-atmospheric pressure, high-speed flight regime. The radiator's heat pumps have two thermal termination conditions: one when the radiator exceeds its operational temperature (maxTemp * headroom) and another if the external temperature exceeds that of the radiator.

The second one is not correct behaviour. It matches up reasonably well at high atmospheric pressures, when convective heat transfer dominates, but in low-pressure, high speed flight (such as a coast to apoapsis during launch, or the initial stages of a reentry), it results in radiators disengaging when they should, according to the thermal system, be able to operate without issues.

This can be seen easily with the thermal action group debugs turned on, where radiators at 69km up will correctly read as having no convective heat flux, but have no active heat pumping and will remain at the same temperature as the craft, effectively behaving like a structural panel.

The first termination clause -- of heat pumps disengaging as the radiator climbs beyond its operating temperatures -- is necessary, but it should also be sufficient, with the rest of the thermal system accounting for potential external heating causes.

Supplementally, radiators have extraordinarily high operating temperatures and efficient heat pumps, which if radiators operation did not have the arbitrary cutoff rule could lead to spam use of them to cool things during re-entry. A reduction in the headroom multipliers should combat that as there would be a relatively long blackout period around peak heat loads, while still allowing their use for cooling fragile parts or ISRU systems in other circumstances.