

Credibility Decision Record

HPT Blade CHT — Cruise Steady-State (COU2)

Context of Use	Cruise steady-state peak temperature and creep-life
System Class	Class III (certification-facing propulsion life analysis)
Model Risk Level	MRL 4 (High)
Decision	NOT ACCEPTED
Decision Date	April 10, 2026
Criteria Set	NASA-STD-7009B
Decided By	Dr. A. Patel, Propulsion Credibility Board
Related COU	COU1 (Take-off Transient, MRL 3, Accepted March 20, 2026)

Rationale

The model is **NOT ACCEPTED** at MRL 4 for cruise creep-life assessment. The credibility assessment identified a systematic applicability gap in the validation evidence package, manifesting as five factors that cannot be assessed at cruise operating conditions with the existing evidence:

1. **Verification evidence transfers cleanly from COU1.** Code verification (MMS), numerical solver error, mesh convergence at mid-span, and use error all meet MRL 4 required levels. No new verification concerns.

2. **Validation evidence does not transfer to cruise operating point.** The cascade rig was designed and instrumented for take-off Reynolds number (1.26e6, cascade Re 1.20e6 within 4.8 percent). Cruise engine Reynolds is 0.85e6 — 41 percent below the cascade rig Reynolds. This is a regime mismatch, not a small-parameter mismatch: the flow transitions from fully-turbulent to transitional-turbulent across that Reynolds range, changing the Nu-Re scaling exponent from approximately 0.8 to 0.7 for HPT blade heat transfer.

3. **Five factors recorded as Not Assessed for cruise COU:** Factor 2.1 (Model Form), Factor 2.4 (Test Conditions), Factor 3.1 (Equivalency of Input Parameters), Factor 3.2 (Output Comparison), and Factor 4.2 (Relevance of Validation to COU). These factors cannot be assessed at cruise operating conditions because no cruise-regime validation evidence exists for this blade geometry. The five Not Assessed factors share a single root cause — cascade-to-cruise regime mismatch — and reflect one systematic applicability gap surfaced by the standard from five assessment angles.

4. **Recording as Not Assessed rather than Level 1 is deliberate.** A Level 1 rating would imply that an assessment was performed with a low-credibility outcome. The actual situation is that no valid assessment has been performed at cruise conditions. Not Assessed is the honest characterization (review minutes Item 5).

5. **Probabilistic UQ was completed** (1500-sample Monte Carlo) but reflects input-parameter uncertainty only. It does not include model-form uncertainty from the applicability extrapolation. The

reported 8.1K standard deviation on predicted peak temperature is therefore a lower bound on predictive uncertainty.

6. Error-bar expansion to cover regime uncertainty was considered and rejected (review minutes Item 6). Expanding error bars to cover unvalidated operating regimes is not a credibility argument and would also misrepresent Not Assessed as Assessed.

Path to Acceptance

The model may be accepted at MRL 4 upon completion of cruise-regime validation evidence. Three options were identified (review minutes Item 6): (B1) cascade re-instrumentation for cruise Reynolds, (B2) engine ground-test instrumented run at cruise power, or (B3) scaled rig campaign matching cruise Reynolds and Nusselt ranges. Test Lead to evaluate feasibility within 30 days. Upon completion of any of these, the five Not Assessed factors may be re-evaluated.

Interim Use

The model MAY continue to be used for preliminary comparative studies at cruise (delta predictions, parametric trends) with explicit non-certification caveats. Absolute cruise peak temperature predictions from this model are NOT credible at MRL 4 with the current evidence package, and shall not be used for certification-facing creep life analysis, retirement-for-cause interval setting, or any safety-critical decision until validation is complete.