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# Essence of NACA Style Organization

Tiered Committee Structure:

To drive problem definition

Open Source Communication:

Intense peer review; intelligence offices; full reports

Simple Funding in 3 Pots:

Research Authorizations; Construction of Facilities; Personnel

Lab Culture:

Labs looked like committees, used any tool that worked, did experimental cross-validation, precision and commensurability in instrumentation

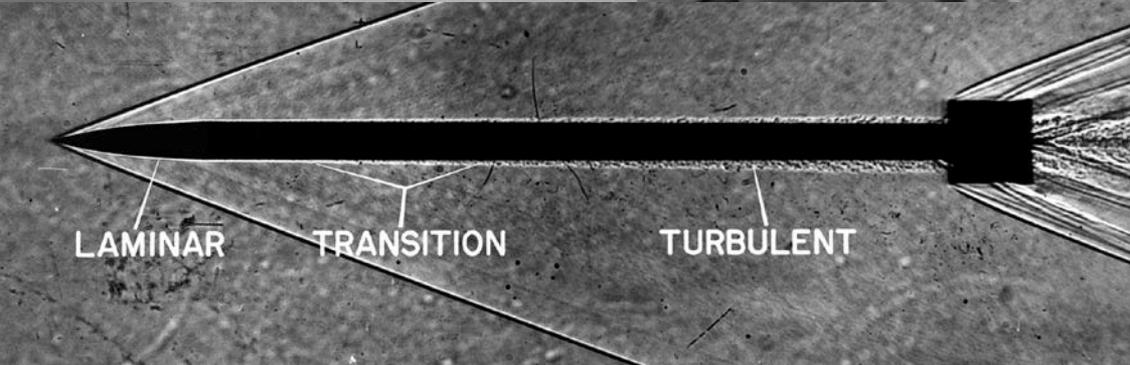
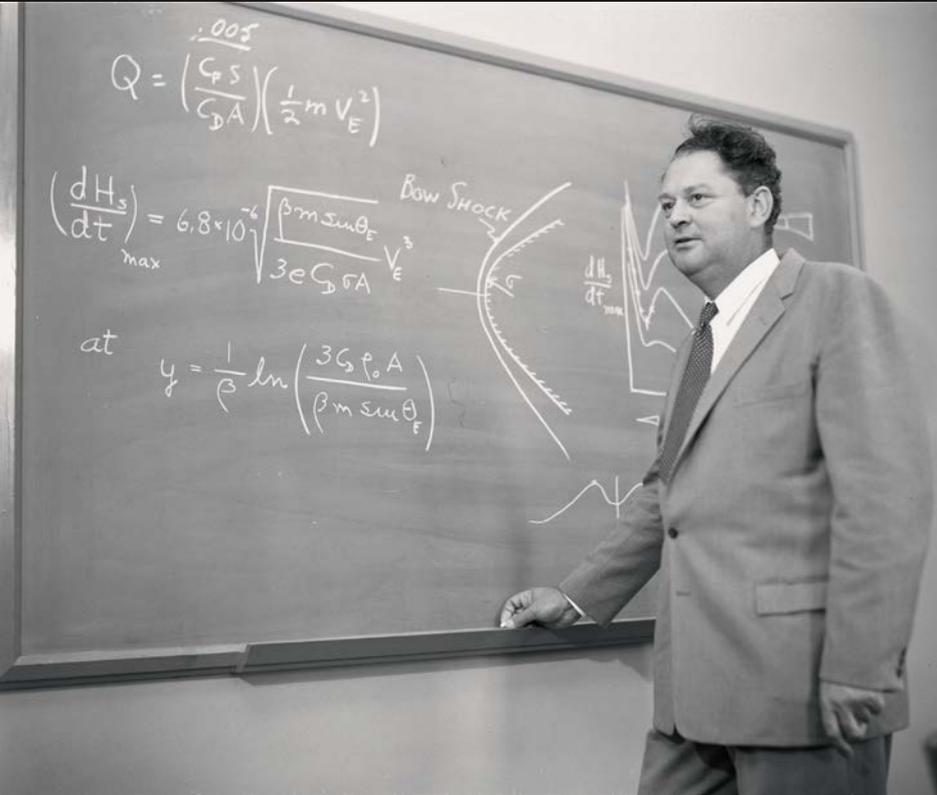
Manufacturing certainty in new technologies



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# Fundamental Engineering and Epistemology

## Engineering Epistemology:

Walter G. Vincenti, *What Engineers Know and How They Know It: Analytical Studies from Aeronautical History* (Johns Hopkins University Press 1990).

Eric Schatzberg, *Wings of Wood, Wings of Metal: Culture and Technical Choice in American Airplane Materials, 1914-1945* (Princeton University Press, 1999).

Glenn Bugos, "Lew Rodert, Epistemological Liaison and Thermal De-Icing at Ames," in *From Engineering Science to Big Science: The NACA and NASA Collier Trophy Winners* (NASA SP-4219, 1998)

## Epistemic Community

Michel Foucault, *The Order of Things: An Archaeology of Human Sciences* (Pantheon 1970).

Peter M. Haas, "Epistemic Communities and International Policy Coordination," *International Organization* 46 (1992) 1-35.

Lars Hakanson, "The Firms as an Epistemic Community: The Knowledge-Based View Revisited," *Industrial and Corporate Change* 19/6 (2010) 1814.



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# Walter Vincenti's Categories of Engineering Design Knowledge

## >Fundamental Design Concepts

The Normal Technology: Broad Operational Goals and Inherited General Configuration

## >Criteria and Specifications

The translation of utilitarian, qualitative goals for a device into concrete technical goals

## >Theoretical Tools

Mathematical tools and intellectual concepts like mass, force, efficiency and feedback

## >Quantitative Data

Empirical, descriptive, expressed in graphs; parametric values, physical constants

## >Practical Considerations

Techne, know-how, experience with tools and objects

## >Design Instrumentalities

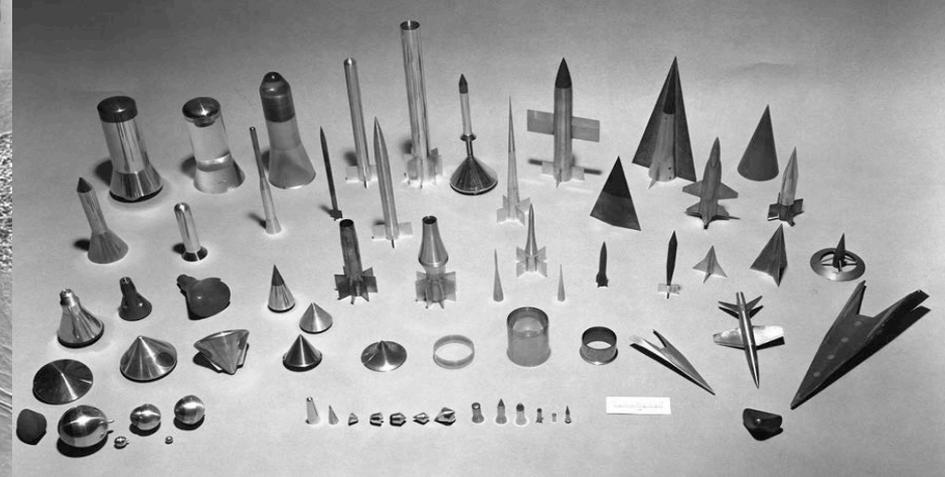
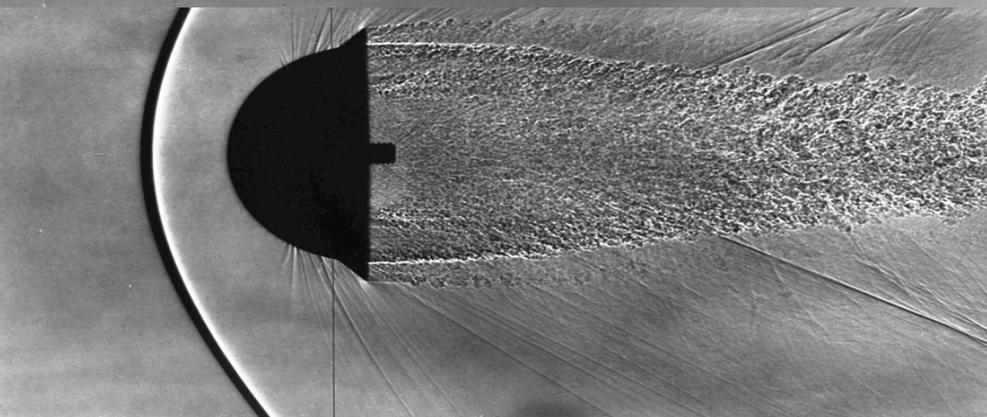
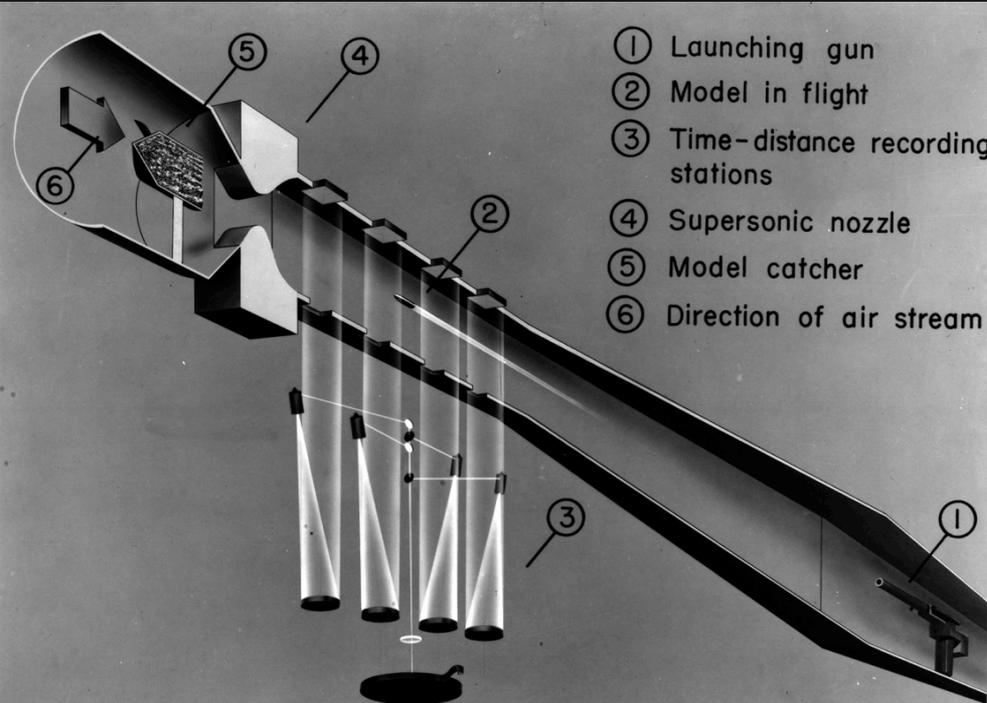
The process of working; using analogy; the mind's eye; divisions of engineering labor



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# Generalization

It is the purpose of this report to simplify and generalize the analysis of the heating problem in order that the salient features of this problem will be made **clear so that successful solutions to the problem will suggest themselves.**

These heating problems, of course, have been given considerable study in connection with the design of particular missiles, but these studies are very detailed in scope. There has been need for a generalized heating analysis intended to show in the broad sense the means available for minimizing the heating problems.

Wagner made a step toward satisfying this need by developing a laudably simple motion analysis. This analysis was not generalized, however, since it was his purpose to study the motion and heating of a particular missile,

Generally, the blunt shape with high pressure drag would appear to offer considerable promise of minimizing the heat transfer to **missiles of the sizes, weights, and speeds of usual interest.**

For simplicity, this problem has been treated in a relative rather than an absolute fashion. In any final design, there is, clearly, no substitute for step-by-step calculation of both the motion and aerodynamic heating of a specific missile.

Accurate conclusions regarding the dependence of heat transfer on shape...must await the availability of more reliable data on the static and dynamic properties of air at the high temperatures and pressures that will be encountered.

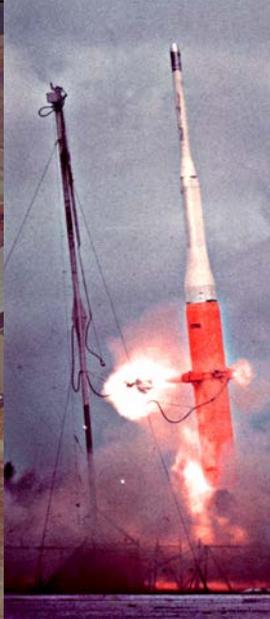
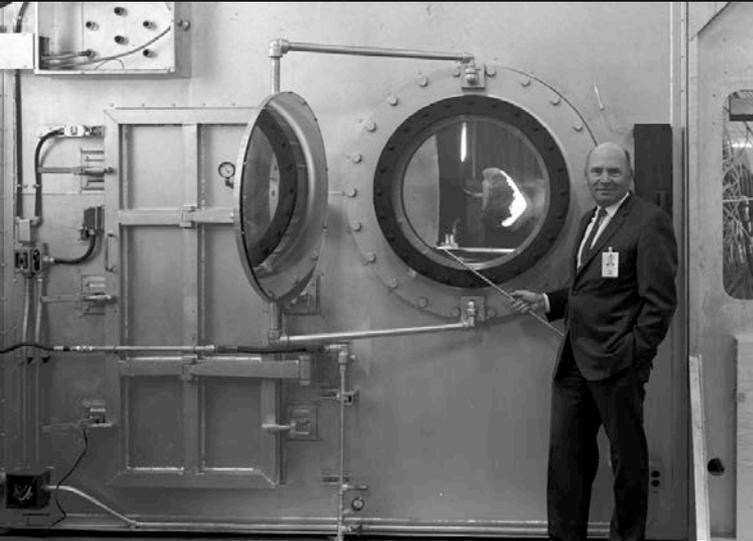
H. Julian Allen and A. J. Eggers, Jr., *A Study of the Motion and Aerodynamic Heating of Ballistic Missiles Entering the Earth's Atmosphere at High Supersonic Speeds*, NACA Technical Report 1381



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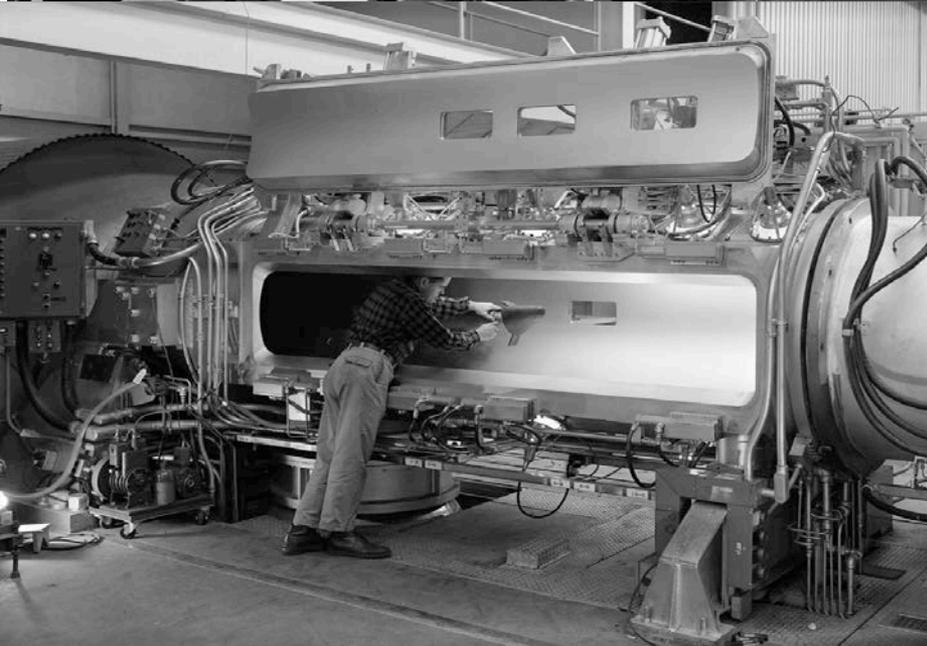
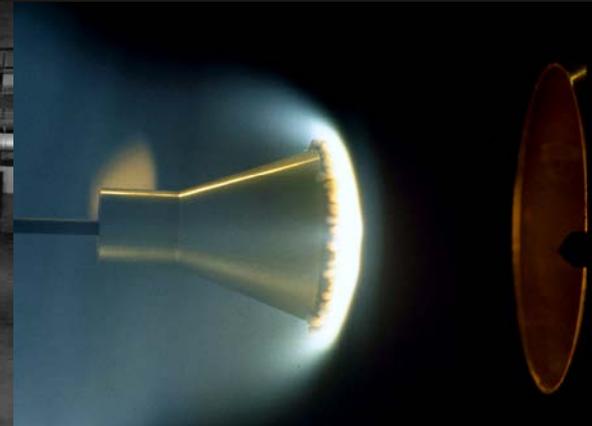
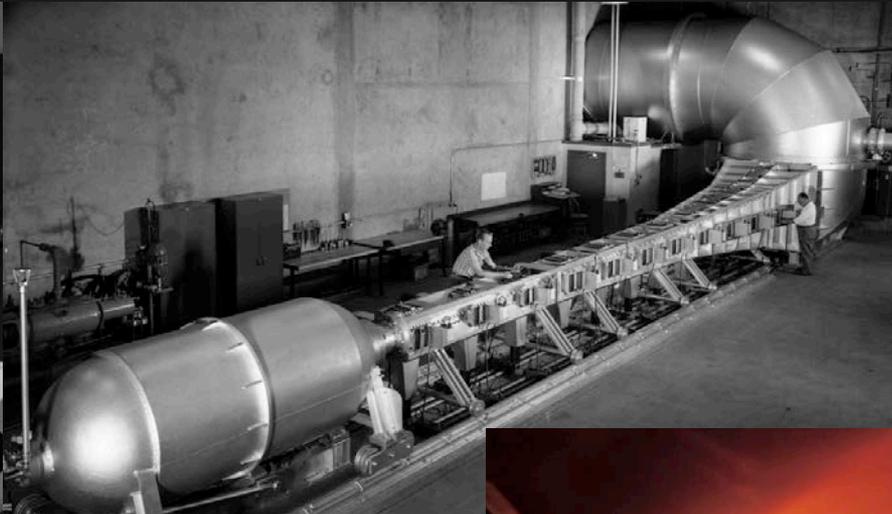




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# The NACA Transition to Space: Fundamental Engineering for the Blunt Body

Glenn E. Bugos  
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The NACA Centenary Symposium  
March 4, 2015