

# NASA TECH BRIEF



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## Properties of Air and Combustion Products of Fuels with Air

Thermodynamic and transport properties have been calculated for air, the combustion products of natural gas and air, and the combustion products of ASTM-A-1 jet fuel and air. Properties calculated include: ratio of specific heats, molecular weight, viscosity, heat capacity, thermal conductivity, and Prandtl number. These properties have been calculated for temperatures from 300° to 2500°K and for pressures of three and ten atmospheres. The data for natural gas and ASTM-A-1 were calculated for fuel-air ratios from zero to stoichiometric. Adiabatic combustion temperatures of natural gas burned in air and ASTM-A-1 burned in air were also calculated over this range of fuel-air ratios. The data are presented in the reference report in Note 1.

The calculated data for thermal conductivity and Prandtl number were compared with experimental values of these properties available in the literature. Agreement within 5 percent was found between the theoretical and experimental data.

The calculated data presented in the report are for the combustion products of defined fuels. However, it is estimated that the difference between calculated properties of the combustion products of the defined natural gas and the properties of any nominal natural gas composition burned in air will be less than three percent. Likewise, errors of less than three percent will be introduced if the properties of the combustion products of ASTM-A-1 are used for the properties of the combustion products of any of the typical fuels which were considered.

The analytical investigation described was conducted to determine properties for the gas compositions, pressures, and temperatures encountered in jet engine cooling studies. Accurate values of the thermo-

dynamic and transport properties were not available in the literature and are required when basic heat transfer correlations are being developed to improve the reliability of predicting local turbine blade and vane temperatures.

The data should be useful for general applications in gas turbines and for a variety of industrial combustion processes.

### Notes:

1. The following documentation may be obtained from:

Clearinghouse for Federal Scientific  
and Technical Information  
Springfield, Virginia 22151  
Single document price \$3.00  
(or microfiche \$0.65)

Reference: TND-5452 (N69-37936) Thermo-  
dynamic and Transport Properties of Air and  
the Combustion Products of Natural Gas and  
ASTM-A-1 with Air.

2. Technical questions may be directed to:  
Technology Utilization Officer  
Lewis Research Center  
21000 Brookpark Road  
Cleveland, Ohio 44135  
Reference: B69-10711

### Patent status:

No patent action is contemplated by NASA.

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