# NUCLEATION EXPERIMENTS IN A MICROGRAVITY ENVIRONMENT

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A simple experimental apparatus (Figure 1) will be described in which a wide variety of vapor phase nucleation studies of refractory materials could be performed aboard NASA's KC-135 Research Aircraft. The chief advantage of a microgravity environment for these studies is the expected absence of thermally driven convective motions in the gas. The absence of convection leads to much more accurate knowledge of both the temperature distribution in the system and the time evolution of the refractory vapor concentration as a function of distance from the crucible.

We will describe the evolution of the apparatus as we gain more experience with the microgravity environment. Expected modifications include the addition of a programmable thermal gradient away from the crucible and a dye laser probe coupled with a detector system based either on a reticon array or a series of diodes. This latter system should make it possible to obtain a great deal of information not only on the conditions under which nucleation occurs, but also on the optical scattering and absorption characteristics of the particles produced in the experiments. These particles will be collected for SEM/TEM analysis. Comparison between the experimental results and the predictions of Mie theory for the measured particle size distribution will be made. In addition, an attempt will be made to measure the coagulation coefficient for a variety of materials and particle sizes by monitoring the time evolution of the size distribution.

We expect that a significant amount of nucleation data can be collected using the KC-135; considerably less information will be collected on the coagulation of the particles due to the short period of time in which the data can be obtained. Nevertheless, such experiments will be used to prepare for similar ones carried out aboard either the Shuttle or the Space Station where considerably longer duration experiments are possible.

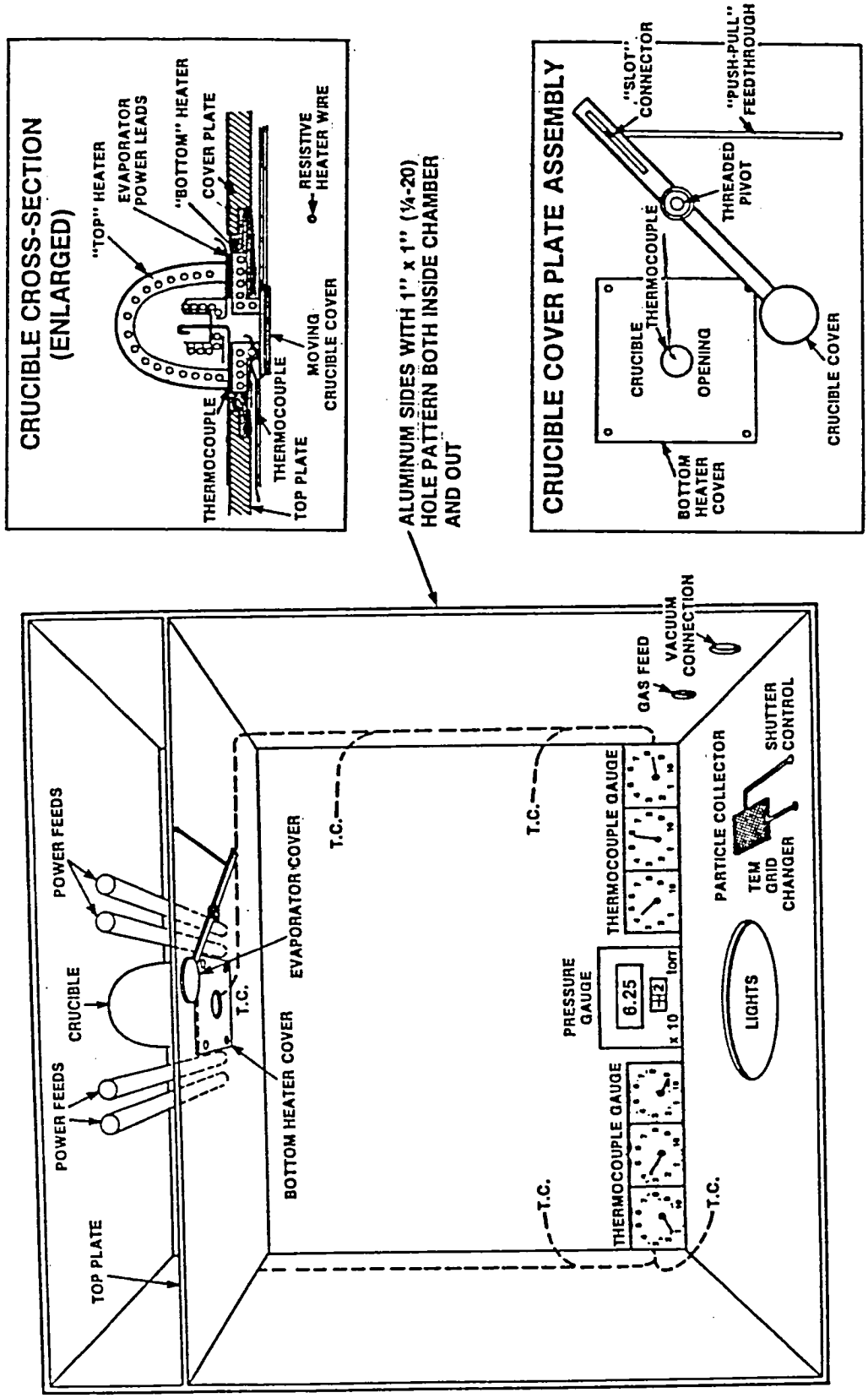
CRUCIBLE CROSS-SECTION (ENLARGED)
"TOP" HEATER
EVAPORATOR POWER LEADS
"BOTTOM" HEATER
COVER PLATE
RESISTIVE HEATER WIRE
THERMOCOUPLE
THERMOCOUPLE
MOVING CRUCIBLE COVER
TOP PLATE
CRUCIBLE COVER PLATE ASSEMBLY
"SLOT" CONNECTOR
"PUSH-PULL" FEEDTHROUGH
THREADED PIVOT
CRUCIBLE
THERMOCOUPLE
OPENING
BOTTOM HEATER COVER
CRUCIBLE COVER
ALUMINUM SIDES WITH 1" x 1" (¼-20) HOLE PATTERN BOTH INSIDE AND OUT
VACUUM CONNECTION
GAS FEED
SHUTTER CONTROL
PARTICLE COLLECTOR
TEM GRID CHANGER
THERMOCOUPLE GAUGE
PRESSURE GAUGE
6.25
x 10
TORR
LIGHTS
T.C.
T.C.
T.C.
T.C.
T.C.
POWER FEEDS
CRUCIBLE
POWER FEEDS
TOP PLATE
BOTTOM HEATER COVER
EVAPORATOR COVER
T.C.

Figure 1.