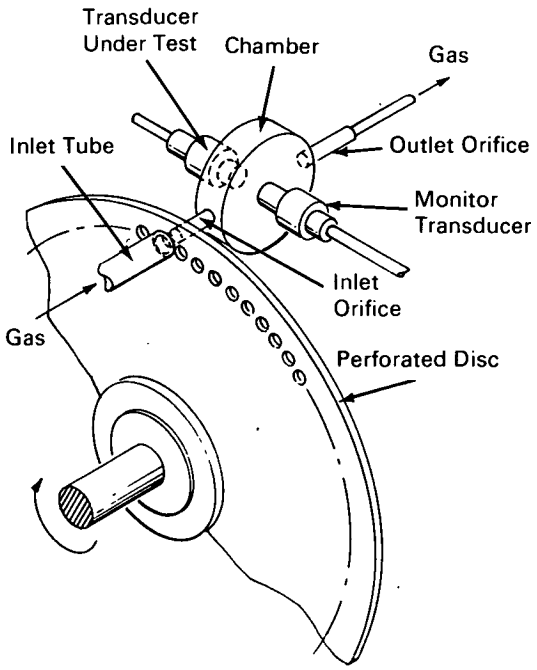
November 1970

Brief 70-10635

NASA TECH BRIEF

High Amplitude Sinusoidal Pressure Generator

A sinusoidal pressure generator capable of generating large-amplitude, high-frequency pressure fluctuations at high average static pressures has been built and tested. The generator is capable of producing pressure oscillations as high as 120%, 18% and 12% of the mean chamber pressure at frequencies of 1, 10 and 15kHz, respectively. Mean pressure of the chamber can be varied from 15 psia to 1500 psia.



Inlet-Area-Modulated Sinusoidal Pressure Generator

The generator is an inlet-area-modulated, gas-flow-through device using a rotating disc. It is similar in operation to a sinusoidal pressure generator previously described in NASA Tech Brief 66-10031. However, the newer generator varies the area of the inlet to the chamber rather than the outlet area, and thus is able to produce the high amplitudes described above. Also, this generator uses hydrogen gas for operation rather than helium. Hydrogen offers higher frequency and better waveshape capability because of its higher speed of wave propagation (speed of sound). The dynamic pressure at a given frequency and average chamber pressure are also highest for hydrogen because they are a function of the gas constant and the specific heat ratio.

The inlet-area-modulated generator is illustrated in the figure. Pressure oscillations in this type of generator are produced by controlling the gas flow into and out of a chamber. The pressure in the chamber is sensed by the test transducer and by a standard transducer. Sinusoidal pressure variation is obtained by varying the mass flow through the chamber in a sinusoidal manner as a function of time. This is done by varying the flow area to the chamber by rotating a circular disc, with holes located along a circle near the disc periphery, against the inlet nozzle throat. Rotation of the disc alternately blocks and opens the flow area. Pressure differences across the chamber are minimized by keeping the chamber dimensions smaller than the wavelength of the sinusoidal oscillation being generated. Thus, pressure wave propagation phenomenon is minimal. The chamber pressure change is therefore quasi-steady and is an expansion-compression phenomenon.

Notes:

1. The need for calibrating pressure transducers under these conditions was prompted by studies of high-frequency combustion instability in rocket engines.

(continued overleaf)

Other needs have also arisen, such as the quieting of advanced aircraft engines, experiments with fluidics, and the upgrading of internal combustion engine technology.

2. 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:
   NASA-CR-72656 (N70-23287), Development of a Sinusoidal Pressure Generator for Pressure Transducer Dynamic Calibration

3. Technical questions may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: TSP70-10635

Patent status:

No patent action is contemplated by NASA.

Source: Richard E. Robinson of
Battelle Memorial Institute
under contract to
Lewis Research Center
(LEW-11241)