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September 1969

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#### Brief 69-10360

# NASA TECH BRIEF



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## Improved Gyro-Flotation (Damping) Fluids

#### The problem:

Develop an improved stabilizer fluid for floated gyros. Floated gyros, depend upon high density (2.38 gm/cc), medium viscosity (900 cs), and gyro-flotation fluids to support the float, minimize the friction in the float bearings and damp the movement of the float. The sensitivity of a gyro can be increased with a fluid of higher density which could support a heavier float.

#### The solution:

Synthesize a metal-stabilized halophosphazene compound with a density of 3 gm/cc at 137°F.

### How it's done:

The process used in this study was as follows: 123 gm SbCl<sub>3</sub>, 186 gm PCl<sub>3</sub>, 259 gm Br<sub>2</sub>, 220 gm NH<sub>4</sub>Br and 300 cc 1,2,4-trichlorobenzene (TCB) were brought to 145° in an oil bath and maintained at this temperature until the evolution of hydrogen halides was complete as measured by trapping in a caustic trap and back titration. The reaction was filtered hot and washed with hot TCB. The filtrate was then distilled in vacuo until the color indicated that it was bromine-free. Two phases form: a lower polymer phase, and an upper solvent phase. The solvent was siphoned off and the polymer washed free of cyclic phosphazene by-products with two 150 cc portions of CCl<sub>4</sub>. The CCl<sub>4</sub> was in turn siphoned off. The lower polymer

phase was then brought to  $150^{\circ}$ C and  $30 \mu$  pressure and held until it was solvent free. The yield was 189 gm of a dark, viscous, oil,  $d^{20}_4$  -2.93 gm/cc 58° -700 cs. The oil had the composition P<sub>3</sub>N<sub>2</sub>Br<sub>8</sub>Cl<sub>3</sub>Sb. The molecular weight determined cryoscopically in nitrobenzene was 1180.

#### Notes:

- 1. This disclosure should be of interest to manufacturers of precision instruments, and the chemical industry.
- 2. Documentation is available from:

Clearinghouse for Federal Scientific and Technical Information Springfield, Virginia 22151 Price \$3.00 Reference: TSP69-10360

#### Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

> Source: Sanford S. Jacobs of M and T Chemicals, Inc. subcontractor to MIT under contract to Manned Spacecraft Center (MSC-13217)

> > Category 03

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