National Aeronautics and Space Administration

# Low Density Sabot Catcher

## for Hypervelocity Impact Tests

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## OVERVIEW

The monolithic steel plate traditionally used to intercept sabot pieces during light-gas gun operations was replaced by low density material. The idea was to decrease the shock stress in these plastic sabot pieces to values below the vaporization threshold, thereby reducing the prominent soot-deposits that characterize typical target surfaces. The project was a collaboration between Orbital Debris and Planetary Science interests at JSC/ARES.

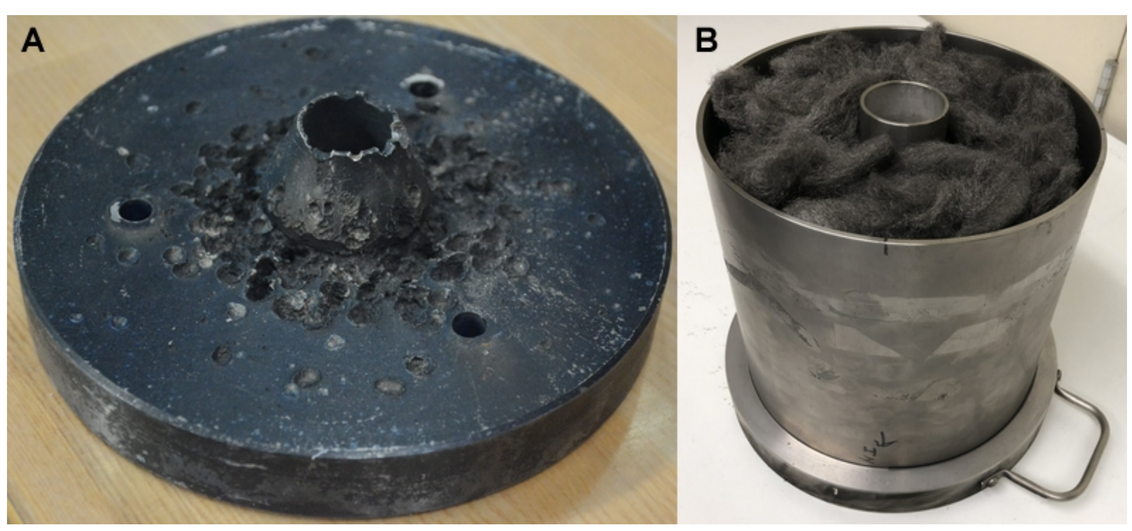


Figure 1. (A) Closeup of a standard steel sabot catcher, showing the damage caused by high-speed impacts of plastic sabot pieces from multiple experiments. (b) The improved sabot catcher used in this study, loaded with pads of steel wool. A sheet of thin aluminum foil covered the steel wool during the shot.

## RESULTS

Readily available in three different fiber widths (coarse, 100 µm; medium, 35 µm; and fine, 25 µm), commercially available steel wool was used as the low-density material. Individual pads were loosely placed into a newly fabricated sabot bucket (Fig. 1), which took the place of the traditional steel plate. A total of 4 experiments were conducted, with fiber width and bulk density (from 0.0020 to 0.0127 g/cm$^3$) of the steel wool being the variables of interest. All experiments used 1/8" aluminum spheres as projectiles, which were launched at 5.5 km/s at $Al_{6061}$ plates. Figure 2 illustrates the results: all experiments with the low-density catcher display significantly less contamination than typically encountered with massive steel plates. The basic idea thus works as expected, but we found no discernible effect due to fiber width or bulk density. Because penetration is greatest in the lowest bulk-density material, however, it is the superior option, as sabot vapor and fragments are trapped at greater depths.

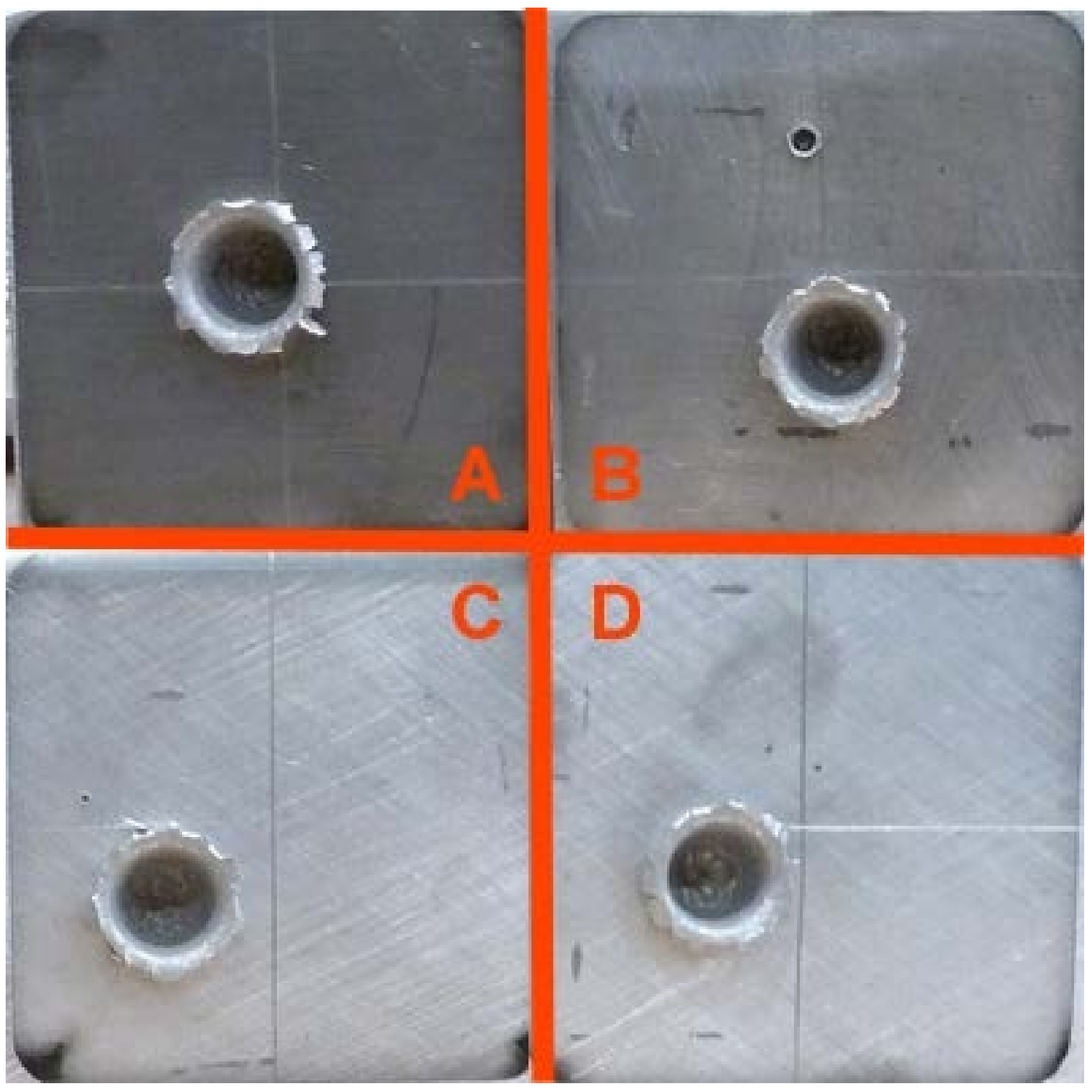


Figure 2. Examples of post-impact deposits on aluminum targets. (A) Control experiment, standard sabot catcher (Fig. 1A). (B) Improved sabot catcher, fine steel wool. (C) Improved sabot catcher, medium steel wool. (D) Improved sabot catcher, coarse steel wool. Each aluminum plate is approximately 2.75" across.

## FUTURE WORK

This ICA Project must be viewed as a pilot study which demonstrates that undesirable contamination of the target by organic compounds can be greatly reduced with low-density sabot catchers. Additional experiments with different materials (*e.g.*, glass-fiber batting or foamed metals) to optimize the approach seem highly desirable. They will, however, have to be sponsored by a program in need of contamination-free targets. We will produce a short report, describing the current experiments in detail, to assist in obtaining such funding from established programs in NASA or DoD, for instance.