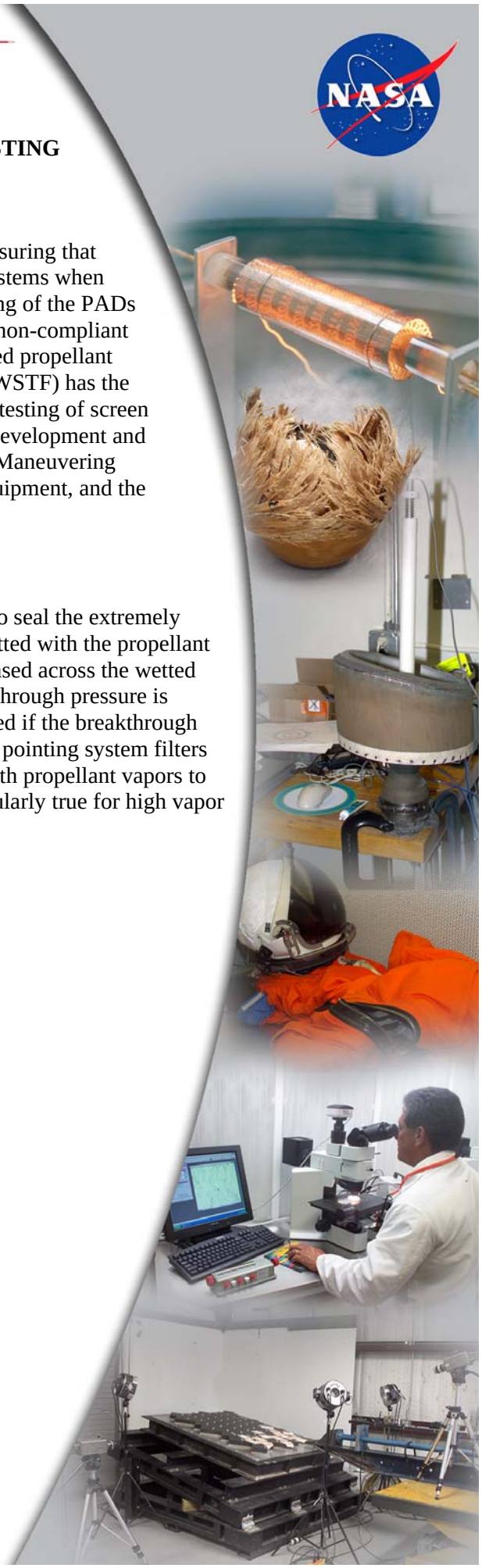
IN SITU PROPELLANT ACQUISITION DEVICE BUBBLE POINT TESTING



SUMMARY

Screen-type propellant acquisition devices (PADs) are used as one means of ensuring that propellant pressurization gases are not drawn into spacecraft propellant feed systems when operating in the zero or micro gravity environment of space. Bubble point testing of the PADs at the component level is a well-known process that can identify damaged and non-compliant areas of the screens. However, bubble point testing of the PADs in the integrated propellant system with use fluids is much more difficult. The White Sands Test Facility (WSTF) has the proven capability to develop processes and equipment to perform bubble point testing of screen PADs while still in integrated test articles. A primary example of this was the development and qualification of Shuttle Forward and Aft Reaction Control System and Orbital Maneuvering System propellant tank system bubble point test procedures and ground test equipment, and the provision of training classes.

PROCESS

The *in situ* bubble point process relies on the surface tension of the propellant to seal the extremely small passages through the acquisition devices. The screen must be entirely wetted with the propellant before starting the bubble point process. A differential pressure is slowly increased across the wetted screen until a breakthrough is detected by sensitive instrumentation. The breakthrough pressure is inversely related to passage size. Screen or manifold damage would be suspected if the breakthrough differential pressure is very low. Special procedures are used to prevent bubble pointing system filters that are not part of the PAD. Also, the pressurant gas is sometimes saturated with propellant vapors to prevent screen dry-out and the resulting incorrect measurements. This is particularly true for high vapor pressure propellants such as nitrogen tetroxide.

CONTACT

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