

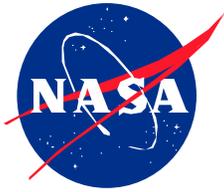


Safety Awareness Campaign

**GROUND-BASED
PRESSURE SYSTEMS SAFETY**

**Stanley Chan / 540,
RECERT Manager**

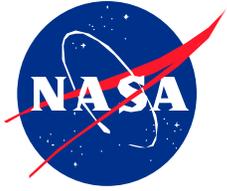
May 11, 2006



OVERVIEW



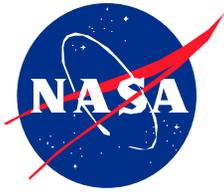
- PURPOSE OF THIS PRESENTATION ----- 3
- BACKGROUND & COVERAGE ----- 4
- PV/S RECERT REQUIREMENT DOC'S ----- 5
- PV/S RECERT REQUIREMENT NUTSHELL ----- 6
- REQUIRED PV/S DOCS FOR SYSTEM CERTIFICATION ----- 8
- PV/S TESTS & INSPECTIONS ----- 9
- SAMPLE PV/S RECERT TAGS ----- 10
- LESSONS LEARNED----- 12
- THE SLEEPING GIANT ----- 22
- A TYPICAL SAFETY MANIFOLD SYSTEM ----- 23
- DO'S ----- 24
- DON'TS ----- 25
- RECERT ON-LINE DOCUMENTS & CONTACTS----- 26



PURPOSE OF THIS PRESENTATION



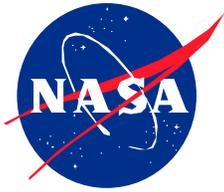
- **To heighten audience awareness on ground-based pressure systems safety**
- **Center policy requirements – Recertification Program (RECERT)**
- **Lessons Learned**
- **Safety Do's and Don'ts**



BACKGROUND



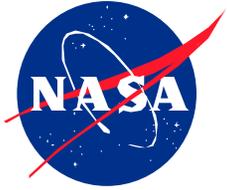
- **The Ground-Based Pressure Vessels & Pressurized Systems (PV/S) RECERT Program was instituted at GSFC in 1978.**
- **Current Coverage:**
 - **Greenbelt: Main & East Campuses; Areas 100, 200, 300, 400.**
 - **WFF: Main Base, Wallops Island; NSBF - Palestine, TX, & Ft. Sumner, NM; PFRR - Fairbanks, Alaska.**



PV/S RECERT REQUIREMENT DOCUMENTS



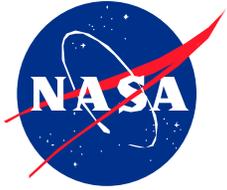
- **OSHA 29CFR1960, 29CFR1910.169, et al.**
- **NPD 8710.5 (Policy for Ground-Based & Flight PV/S Safety).**
- **NPR 8715.3 (Safety Manual - in revision).**
- **NPR 8715.4 (In-service Inspection of PV/S - in revision, will be issued as NASA-STD-8719.17).**
- **GPR 8710.3 (Cert & Recert of ground-based PV/S).**



PV/S RECERT REQUIREMENT NUTSHELL



- **RECERT requirements apply to NASA-owned or operated ground-based PV/S (including vacuum systems) at GSFC and WFF:**
 - **Systems: cryogenic, compressed air, compressed gases, vacuum chambers, hydraulic, jet fuel, elevated water storage tanks.**
 - **Components: vessels, piping & tubing, pipe/tube supports, flex hoses, relief valves, gages.**
 - **Included in RECERT commencing in FY05: purge carts & panels, Payload Environmental Transportation Systems (PETS), R&D setups.**



PV/S RECERT REQUIREMENT NUTSHELL (Cont'd)



- **All ground-based PV/S are required to be Certified by RECERT prior to operation and Recertified periodically.**



REQUIRED PV/S DOCUMENTATION FOR SYSTEM CERTIFICATION



- **Before we can certify a system we need the following from the owner:**
 - A. Building #, Room #, and/or location
 - B. Manufacturing Data Reports (MDR) MDR Form U-1A, as applicable (should have been supplied or can be obtained from the vendor)
 - C. Piping info, as applicable
 1. Design and operating conditions
 2. Material Specification (ASTM or ASME)
 3. Pipe/tubing Size
 4. Pipe/tubing Wall thickness
 5. Pipe/tube fitting type and class (socket weld, butt weld, threaded, mechanical (swage))
 6. Valve type, manufacturer, model number, material of construction (body, stem, seat(s), pressure and temperature rating)
 7. Overpressure protection: Manufacturer, model number, type, size, capacity, set point, seat material
 8. Pressure Regulators: Manufacturer, model number, type (single stage, dual stage), material, size, max inlet pressure, max outlet pressure
 9. Pressure gages: Manufacturer, model number, inlet size, range
 10. As-built piping and instrumentation diagram
 11. Certificate of Compliance from fabricator and/or installer that the System meets the Code fabrication and installation requirements
 12. Record of Code-required NDT
 13. Record of Code-required pressure test
- **For non-compliant systems, the owner must prepare a Variance Request including a risk analysis, risk acceptance, processed and approved in accordance with NASA and GSFC requirements.**



PV/S TESTS & INSPECTIONS



➤ PV/S Tests:

- Pneumatic & hydrostatic pressure tests.
- Relief valve set point certification.
- Selected pressure gage calibration.
- Intervals vary by component and contained medium, and currently range from 1 to 2 years.

➤ PV/S Inspections:

- System & component nondestructive testing (NDT) - visual (VT), dye penetrant (PT), magnetic particle (MT), and ultrasonic (UT).
- Intervals vary by component and contained medium, and currently range from 1 to 10 years.



SAMPLE PV/S RECERT TAGS




**GODDARD SPACE FLIGHT CENTER
 RECERTIFICATION PROGRAM
 CERTIFIED**

SYSTEM NO: SAMPLE
MAC NO: XXXXXX
UPV NO: XXXXXXXX
MAWP/MDP: XXX PSI @ XXX °F
EXPIRATION DATE: XXXXXXXX
RECERT SUPPORT: (301) 286-5181


**GODDARD SPACE FLIGHT CENTER
 RECERTIFICATION PROGRAM
 CERTIFIED**

In accordance with NASA requirements and GPR 8710.3 periodic in service inspections have been performed by RECERT Support on SAMPLE To pressure system Number: SAMPLE and certified in accordance with the following checked of applicable procedures.

<u> XXXXXXXX </u>	NMP-101, Magnetic Particle Test
<u> XXXXXXXX </u>	NMP-102, Liquid Penetrant Test
<u> XXXXXXXX </u>	NMP-109, Ultra Sonic Test
<u> XXXXXXXX </u>	NMP-111, Liquid Penetrant Test
<u> XXXXXXXX </u>	NMP-113, Magnetic Particle Test

If there is a problem with or a question regarding this vessel, contact RECERT Support at extension: (301) 286-5181.
 Report Number : XXXXXXXX Expiration Date: XXXXXXXX



SAMPLE PV/S RECERT TAGS



GODDARD SPACE FLIGHT CENTER
RECERTIFICATION PROGRAM
CERTIFIED
GAGE INSPECTION TAG

I.D. # SAMPLE

MAWP: XXXXXX

INSPECTION DATE: XXXX

EXPIRATION DATE: XXXX

REPORT # XXXXXXXXXX

INSPECTOR: XXXXXXXXXX

RECERT SUPPORT: (301) 286-5181

GODDARD SPACE FLIGHT CENTER
RECERTIFICATION PROGRAM
CERTIFIED
RELIEF VALVE INSPECTION TAG

I.D. # SAMPLE

SET PRESSURE: XXXXXX

INSPECTION DATE: XXXXXX

EXPIRATION DATE: XXXXXX

REPORT # XXXXXXXXXX

INSPECTOR: XXXXXX

RECERT SUPPORT: (301) 286-5181

GODDARD SPACE FLIGHT CENTER
RECERTIFICATION PROGRAM
CERTIFIED
GAGE VT INSPECTION TAG

I.D. # SAMPLE

MAWP: XXXXXXXXXX

INSPECTION DATE: XXXXXX

EXPIRATION DATE: XXXXXX

REPORT # XXXXXXXXXX

INSPECTOR: XXXXXX

RECERT SUPPORT: (301) 286-5181

GODDARD SPACE FLIGHT CENTER
RECERTIFICATION PROGRAM
CERTIFIED
FLEX HOSE INSPECTION TAG

I.D. # SAMPLE

MAWP: XXXXXXXXXX

INSPECTION DATE: XXXXXX

EXPIRATION DATE: XXXXXX

REPORT # XXXXXXXXXX

INSPECTOR: XXXXXX

RECERT SUPPORT: (301) 285-5181

GODDARD SPACE FLIGHT CENTER
RECERTIFICATION PROGRAM
MAG PARTICLE INSP. TAG

PROJECT: SAMPLE

ID. # XXXXXXXXXX

INSPECTION DATE: XXXXXXXXXX

TYPE: XXXX METHOD XXXX

REPORT # XXXXXXXXXX

INSPECTOR: XXXXXXXXXX

RECERT SUPPORT: (301) 286-5181

GODDARD SPACE FLIGHT CENTER
RECERTIFICATION PROGRAM
DYE PENETRANT INSP. TAG

PROJECT: SAMPLE

ID. # XXXXXXXXXX

INSPECTION DATE: XXXXXXXXXX

TYPE: XXXX METHOD XXXX

REPORT # XXXXXXXXXX

INSPECTOR: XXXXXXXXXX

RECERT SUPPORT: (301) 286-5181



LESSONS LEARNED



- **Underground Compressed Air Line Failure**
- **Plug Failure in Discharge Tank of Compressor**
- **Liquid Oxygen Cylinder Explosion**

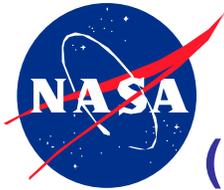


UNDERGROUND COMPRESSED AIR LINE FAILURE



- A 4" diameter, 150 psi compressed air line installed in 1950's failed due to corrosion.
- Crater 6-8 feet in diameter.
- No injuries





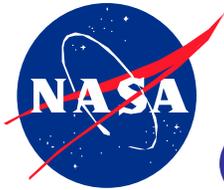
PLUG FAILURE IN DISCHARGE TANK OF COMPRESSOR

(Material excerpted from MTI Investigation Report)



- Side of discharge tank where plug ejected through insulation
- Ejected plug struck adjacent compressor foundation





PLUG FAILURE IN DISCHARGE TANK OF COMPRESSOR

(Material excerpted from MTI Investigation Report)



- Failed plug
- Damage to adjacent office safety windows





PLUG FAILURE IN DISCHARGE TANK OF COMPRESSOR

(Material excerpted from MTI Investigation Report)



- Scattered debris on floor looking back towards compressor





PLUG FAILURE IN DISCHARGE TANK OF COMPRESSOR

(Material excerpted from MTI Investigation Report)



- Debris landed 75 to 80 feet away.
- Exit choke tube found in discharge tank caused pressure buildup.
- No injuries.





LIQUID OXYGEN CYLINDER EXPLOSION

(Material excerpted from SAFECOR Airgas)



- Unsafe modification to cylinder design
- Cylinder exploded while in pickup truck





LIQUID OXYGEN CYLINDER EXPLOSION

(Material excerpted from SAFECOR Airgas)



- Pressure relief device location was plugged using a threaded cap
- Cylinder had no vacuum



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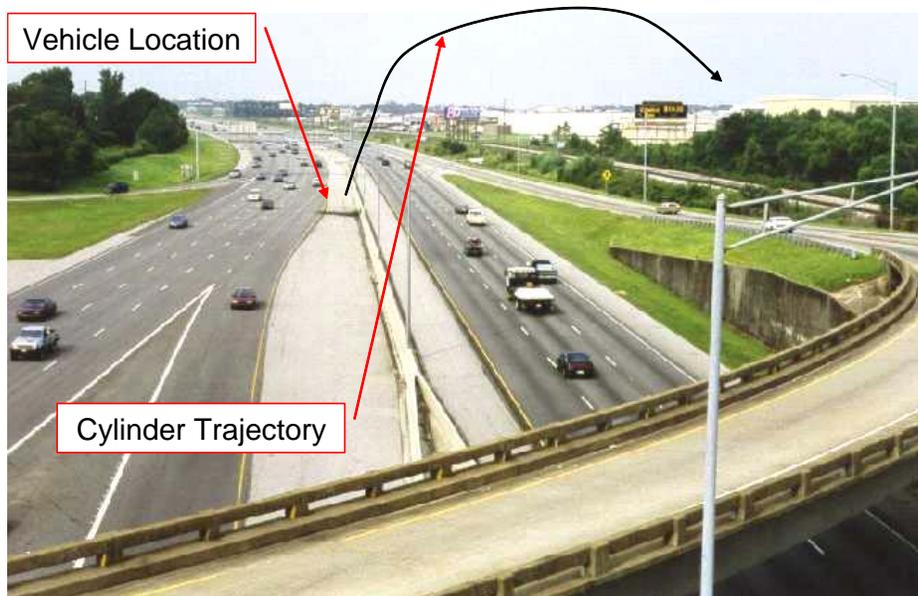


LIQUID OXYGEN CYLINDER EXPLOSION

(Material excerpted from SAFECOR Airgas)



- The explosion threw one individual across 5 lanes of traffic, the other was blown approx. 40 feet. Both survived.





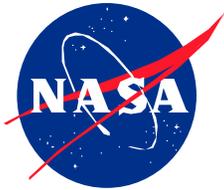
LIQUID OXYGEN CYLINDER EXPLOSION

(Material excerpted from SAFECOR Airgas)



- Cylinder flew 1/4 mile and went through the roof of an apartment.
- No injuries.





THE SLEEPING GIANT

I AM A HIGH PRESSURE, COMPRESSED GAS CYLINDER



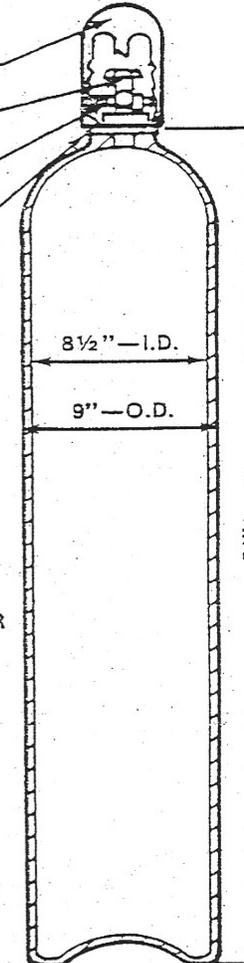
I stand 57 inches tall.
I am 9 inches in diameter.
I weigh in at 155 pounds when filled.
I am pressurized at 2,200 pounds per square inch (psi).
I have a wall thickness of about ¼ inch.
I wear a regulator and hose when at work.
I wear a label to identify the gas I'm holding. My color is not the answer.
I transform miscellaneous stacks of material into glistening ships and many other things—when properly used.
I may transform glistening ships and many other things into miscellaneous stacks of material—when allowed to unleash my fury unchecked.
I can be ruthless and deadly in the hands of the careless or uninformed.
I am too frequently left standing alone on my small base without other visible means of support—my cap removed and lost by an unthinking workman.
I am ready to be toppled over—when my naked valve can be damaged or even snapped off—and all of my power unleashed through an opening no larger than a lead pencil.
I am proud of my capabilities—here are a few of them:
—I have on rare occasions been known to jetaway—faster than any dragster.
—I might smash my way through brick walls.
—I might even fly through the air.
—I may spin, ricochet, crash and slash through anything in my path.
You can be my master only under these terms:
—Full or empty—see to it that my cap is on, straight and snug.
—Never—repeat—never leave me standing alone. Secure me so that I cannot fall.

REMOVABLE METAL CAP

BRONZE VALVE

SAFETY DEVICE

PRESSED STEEL NECK RING

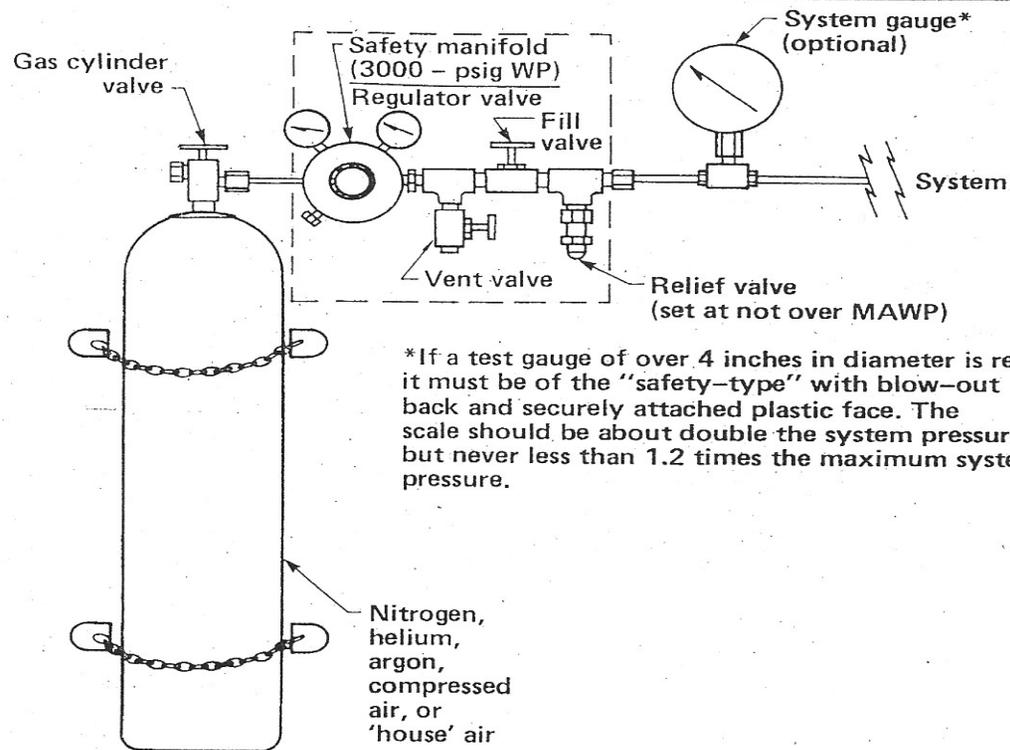


OXYGEN CAPACITY OF CYLINDER
244 CU.FT.
AT 2200 LB. PER SQ. IN. PRESSURE
AT 70°F

“TREAT ME WITH RESPECT—I AM A SLEEPING GIANT.”



SAFETY MANIFOLD SYSTEM





TO ASSURE PV/S SAFETY



➤ Do's

- Design, Procure, and install to Code and NASA requirements
- Submit design to RECERT/540 for Code compliance review and approval prior to implementation
- PV/S must be Certified prior to operation
- Operate and maintain PV/S per OEM recommendations
- Contact RECERT if you need technical assistance:
 - Greenbelt: Stanley Chan/540, x6-4209; or Warren Thomas/540.5 ManTech, x6-5183
 - Wallops: Prasad Hanagud/500.W, x-1359; or Bill Hargrove/540.5.W, ManTech, x-1797



TO ASSURE PV/S SAFETY



➤ Don'ts

- Proceed with procurement without design approval by RECERT/540
- Procure non-ASME vessels
- Operate PV/S without Certification
- Ignore OEM recommended maintenance requirements
- Modify system without RECERT approval (will void system certification)



RECERT ON-LINE DOCUMENTS & CONTACTS



➤ Please visit:

<http://mscweb.gsfc.nasa.gov/549web/recert/recert.htm>