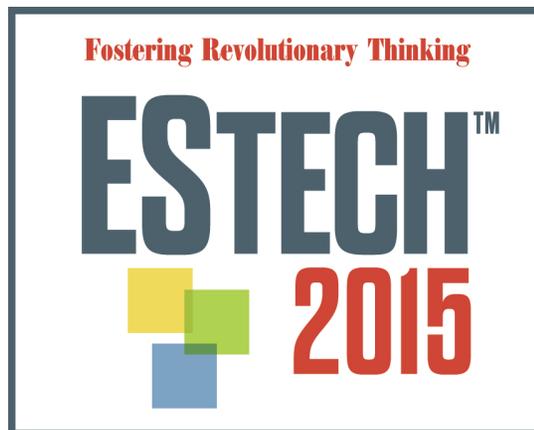


DEVELOPMENT OF TEST PROTOCOLS FOR INTERNATIONAL SPACE STATION PARTICULATE FILTERS

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OBJECTIVES

**Develop test protocols for ISS filters
after use
in storage**

**Develop new test, storage and in use replacement
protocol**

BACKGROUND

HEPA-grade filters

21 Filters in US segment.

Replacement interval between 2-5 years

On-orbit frequent vacuuming of face screen.

Filters in stock reaching the end of “use life”.

FAILURE MECHANISMS

Deterioration of binder in the media

Oxidation or loss of volatile constituents in the sealing adhesive

Crystallization of the glass fiber media

ISS FILTER ELEMENT



S INC. ERS RD. 27889	RESISTANCE (WG)	TEST FLOW	PENETRATION (X)
	.269	70 CFM	.03%
R 22D	FFI ORDER NUMBER : C934091		CUSTOMER ORDER NUMBER : SS523405KM
	MEDIA LOT NUMBER : D07H5214110294		
	SERIAL NUMBER : 283245		

FILTER DETAILS

Al frame mini pleat HEPA filter

29" x 4" x 4.375".

20-mesh (0.84-mm clear opening) face screen,

(Nomex™) at inlet;

aluminum at outlet.

TEST SPECIFICATION

99.9% efficiency @ 0.3 microns @ 70 CFM

Mil Std 282

IEST RP 001

IEST RP 034?

EXPERIMENT

Leak testing per IEST RP 034

Filters per spec as acquired

Failure will show as leak

in storage

after use

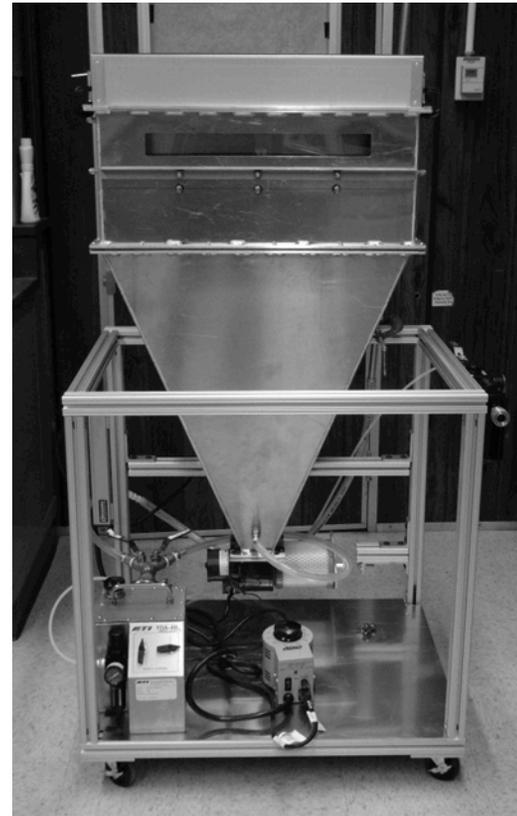
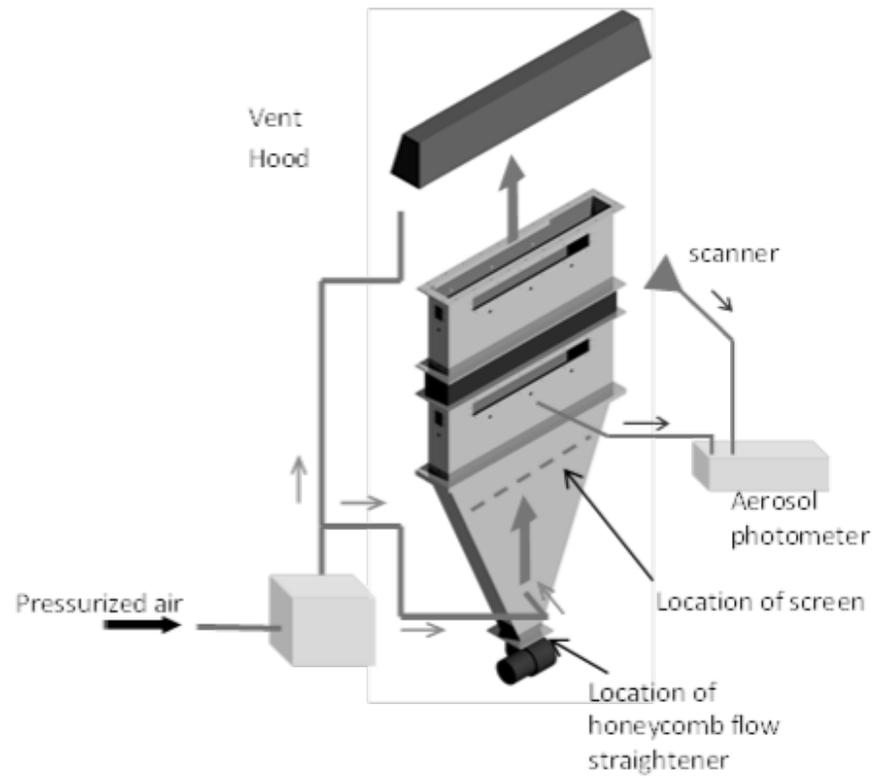
TEST SET UP

Leak testing

RP 034 recommended design

Overall efficiency (future needs)

NASA GRC FILTER TEST SYSTEM



TEST INSTRUMENTS

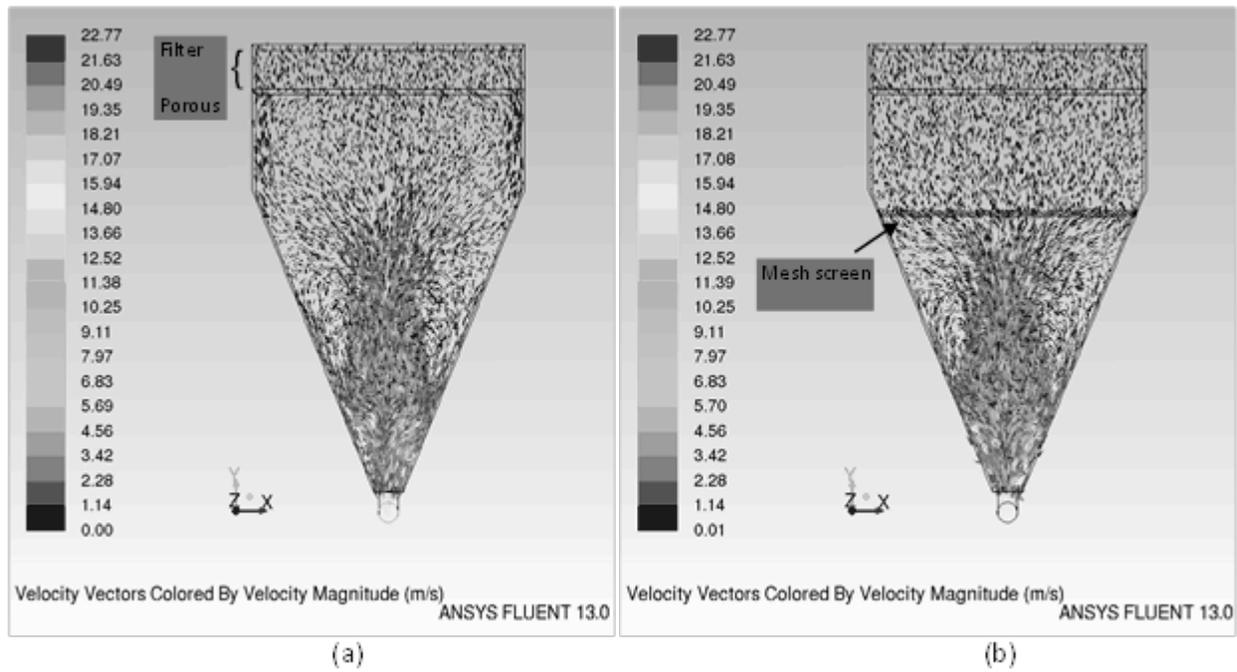


**Laskin Nozzle
(ATI Model 4B)**

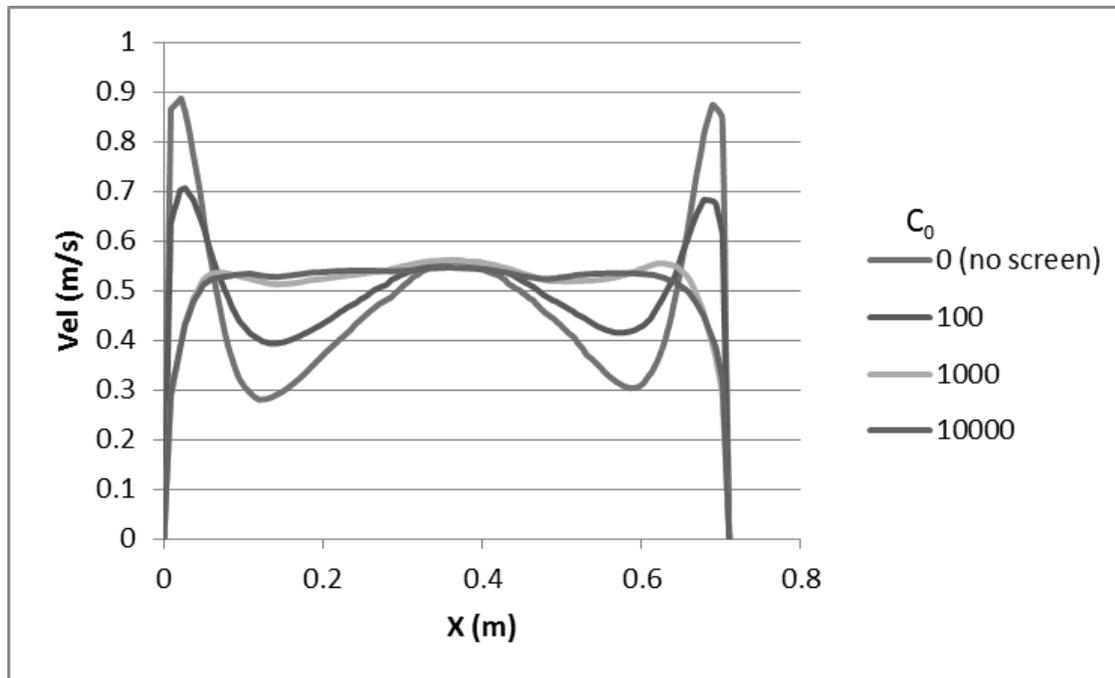


**Photometer
(TEC Services Model 4B)**

FLOW MODELING

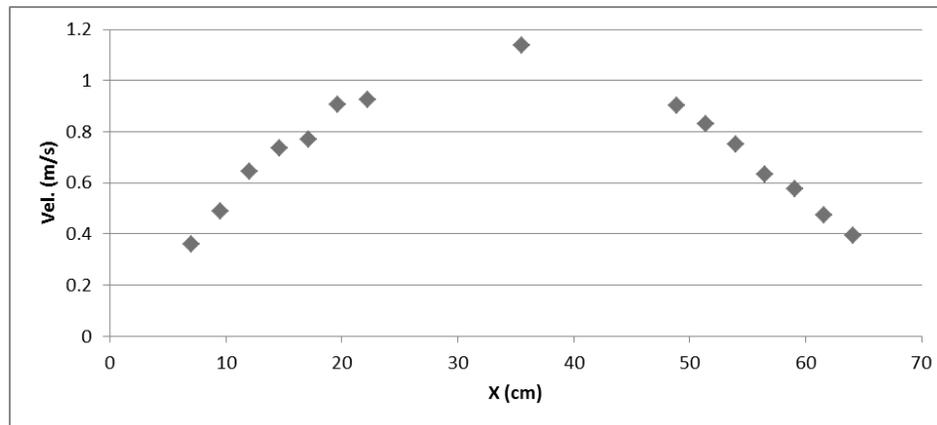


FLOW MODELING

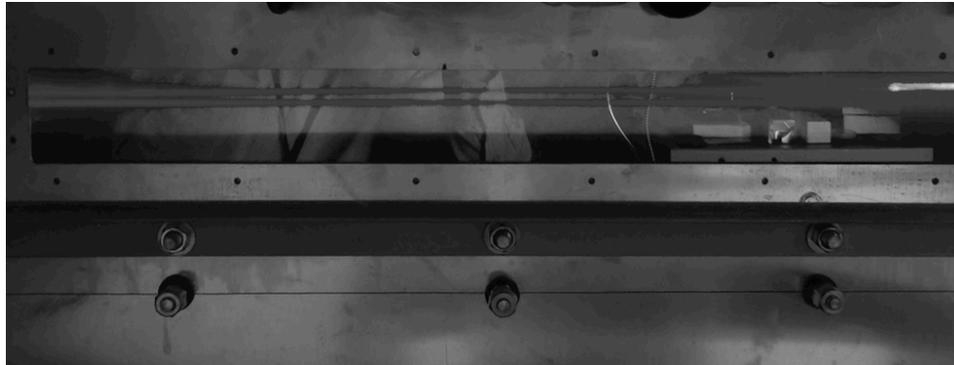


Good uniformity with screen

FLOW AND AEROSOL DISTRIBUTION MEASUREMENTS



FLOW AND AEROSOL DISTRIBUTION MEASUREMENTS



Light sheet visual aerosol uniformity

TEST FILTERS

One filter from ISS after ~ 1 year use

One filter after other engineering evaluations.

LEAK TESTING PRELIMINARY RESULTS

Test without Nomex screen

Scan entire filter cross-section

Follow IEST RP 034 guidelines

LEAK TESTING PRELIMINARY RESULTS (CONT.)

Filter #1:

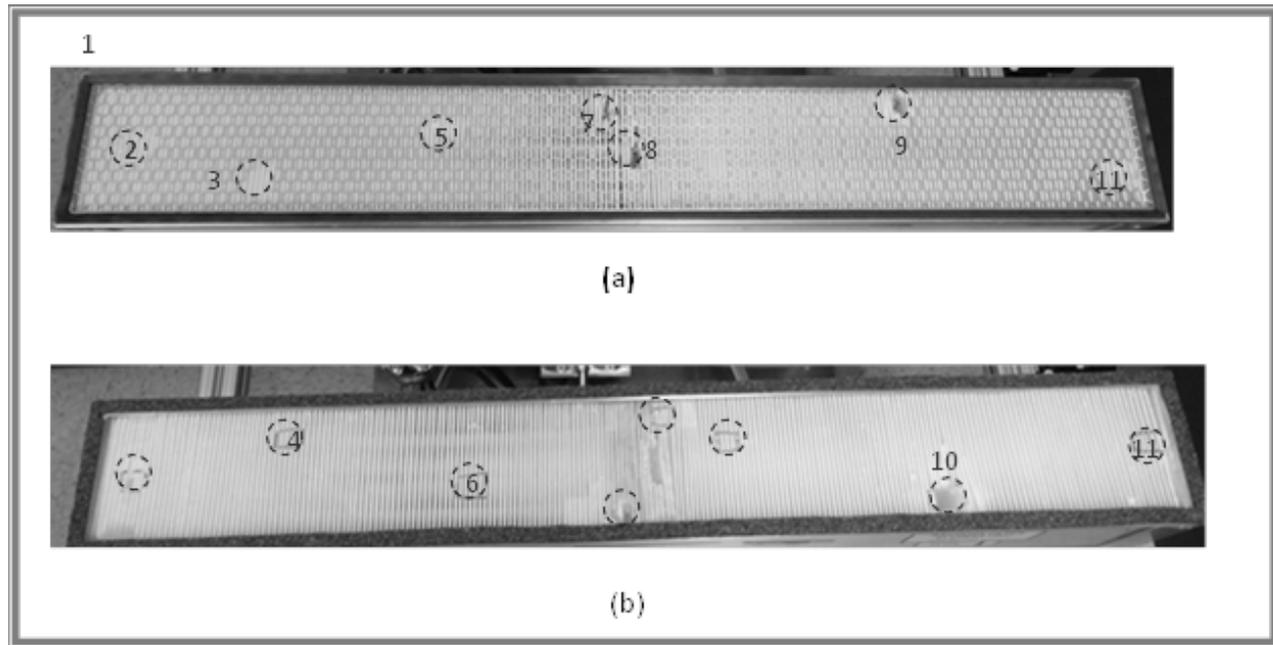
Nominal penetration 0.2-5% with spikes in the readings as noted below.

Several readings did not correlate with known damage.

Filter #2: Scans showed values typically <0.001 with incidental readings in the 0.01 range.

Test point	Location (in cm from LHS)	Measured penetration (%)
1	0 (left edge)	18-20%
2	5	0.0018-0.0021
3	10	0.0008
4	16.8	55.0, 52.4
5	20.3	0.64-0.66
6	28	6.80-7.00
7	34.3	19.0-23.9
8	36.5	47.9-48.5
9	45.7	0.0000
10	58.4	0.0000
11	73.7 (right edge)	0.54, 0.82, 0.93

LEAK TESTING PRELIMINARY RESULTS (CONT.)



SUMMARY

Test system met best practice for air and aerosol uniformity

Preliminary results indicate ability to detect leak

Better ability to validate good filter

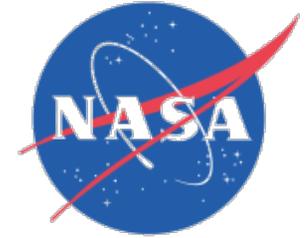
FUTURE WORK

Improve fidelity of leak testing

Modify or develop revised test setup for efficiency testing.

Develop NASA acceptance test protocol for filters and test systems

Develop revised life and storage criteria.



THANK YOU (FINAL) PAGE

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