JSC-1A Lunar Regolith Simulant

Availability and Characterization

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Timeline of Development

March 2004	ORBITEC and Dr. James Carter create partnership to investigate re-creation of JSC-1 lunar mare simulant
January 2005	ORBITEC awarded contract to determine feasibility and cost of JSC-1 reproduction
August 2005	NASA submits order for 16 metric tons of JSC-1AF, JSC-1A and JSC-1AC as “stop gap” simulants
April 2006-March 2008	Distribution of JSC-1AF, JSC-1A and JSC-1AC to NASA-approved orders

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The JSC-1A Simulant Family

- **JSC-1AF**
  - Average particle size 27 µm
- **JSC-1A**
  - Reproduction of JSC-1 (< 1mm)
- **JSC-1AC**
  - Distribution from 5mm down to fines

JSC-1AF

JSC-1A

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NASA-funded Production

- **JSC-1AF**
  - 1 metric ton
- **JSC-1A**
  - 14 metric tons
- **JSC-1AC**
  - 1 metric ton

Basalt cinders from the Merriam Crater used to produce the JSC-1A family of simulants

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JSC-1A Characterization

- JSC-1AF characterization (chemical and mechanical) available from December 2006
  - Available at http://www.planet-llc.com/pages/products/simulant.htm
- NASA's draft characterization of JSC-1A (mechanical) became available in June 2007
  - Errors identified in the FeO/Fe_2O_3 content requested to be fixed prior to final release
- Waiting on grain size distribution of JSC-1AC to be published

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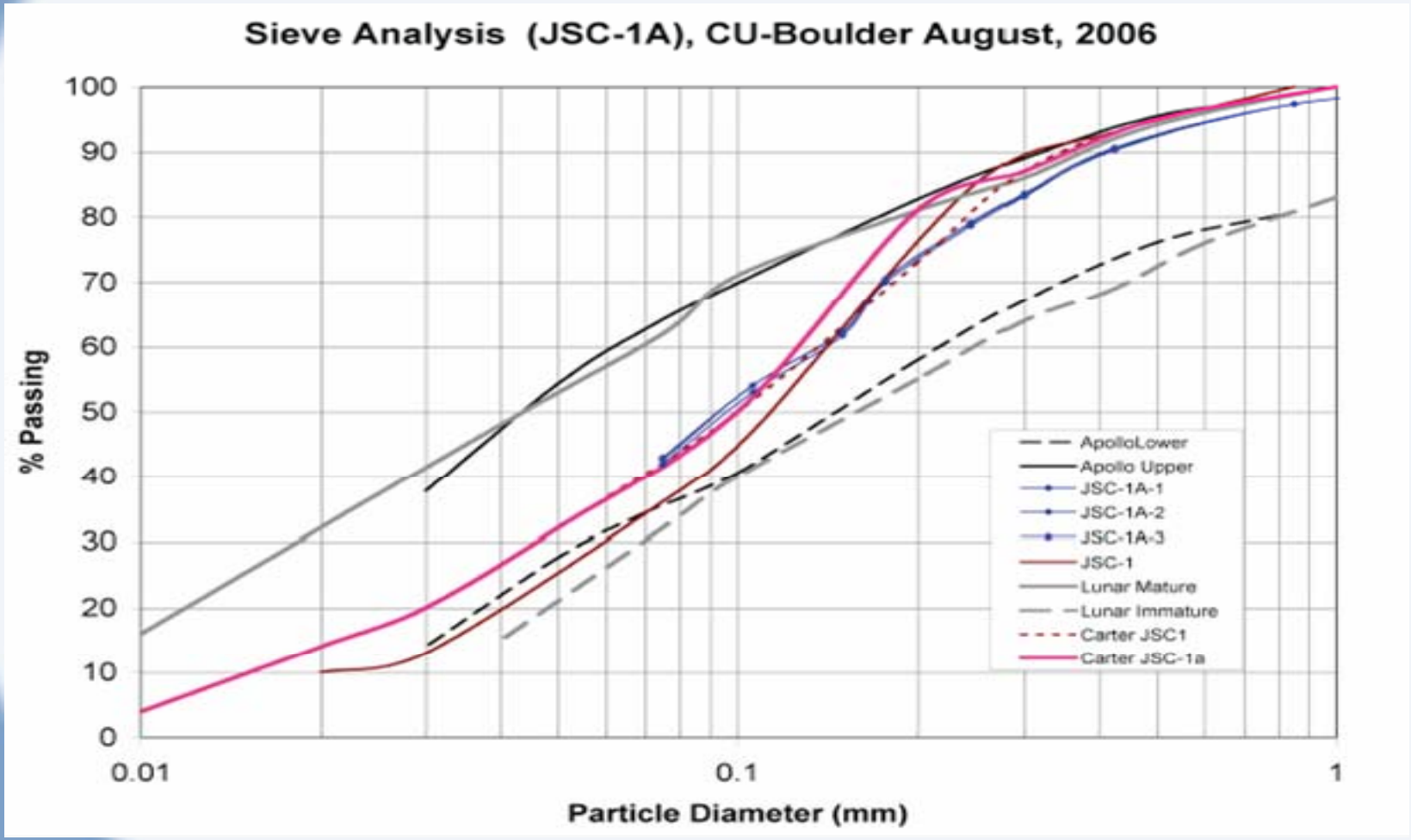
JSC-1 vs. JSC-1A Grain Size



Analyses courtesy of Dr. Susan Batiste at CU-Boulder and Dr. James Carter of ET Simulants

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JSC-1 vs. JSC-1A Composition

Oxide	JSC-1A (wt%)	JSC-1 (wt%)	Lunar Soil 14163
SiO_2	46.67	47.71	47.3
TiO_2	1.71	1.59	1.6
Al_2O_3	15.79	15.02	17.8
Fe_2O_3	3.41 (JSC-1AF)*	3.44	0.0
FeO	7.57 (JSC-1AF)*	7.35	10.5
MnO	0.19	0.18	0.1
MgO	9.39	9.01	9.6
CaO	9.90	10.42	11.4
Na_2O	2.83	2.70	0.7
K_2O	0.78	0.82	0.6
P_2O_5	0.71	0.66	--

** Note: JSC-1AF characterization values are used here due to a discrepancy in the JSC-1A iron oxide data*

NASA Order Summary

- Orders were collected from the website www.lunarmarssimulant.com
  - 200 requests were logged
  - 92 fulfilled (many orders were combined for redistribution at the center or project level)
  - Website is no longer online
- Non-approved orders (i.e. commercial, educational or non-ESMD research) were directed to commercial order placement

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Commercial Order Summary

- An additional production run of 15 tons of JSC-1A and 100 kg of JSC-1AF was funded by ORBITEC for commercial sale
  - Available at www.planet-llc.com, www.enasco.com
  - Over 220 orders fulfilled through February 2009
  - ~3 tons of JSC-1A remain available for purchase in packages of 57 g (2 oz.), 0.9 kg (2 lbs.), 4.5 kg (10 lbs.), and 23 kg (50 lbs.), or 1016 kg (2000 lbs.)
  - An 8 ton sandbox of commercial JSC-1A is available for daily rental from the California Space Authority

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Future JSC-1A Development

- A JSC-1A-VF (very fine) prototype was developed by Dr. James Carter
- ORBITEC has no plans to fund additional production of more JSC-1A, JSC-1AF, JSC-1AC, or JSC-1AVF in the future
  - After the remaining 3 tons of JSC-1A are sold, it may not be available again due to the intellectual property holdings of ETSimulants
  - NU-LHT simulant development may make JSC-1A family of simulants obsolete

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