

JSC-1A Lunar Regolith Simulant Production Summary and Lessons Learned

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Timeline of Development

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|---------------------------|---|
| 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 |



Production Process



Basalt cinders are first mined from a commercial mine at the Merriam Crater.

This is subject to mine availability.



The cinders are then hand-picked to remove impurities or unwanted deposits.

This is incredibly time consuming, but improves the finished product.

Production Process

- Drying
 - Tons of cinders are dried outdoors to remove excess moisture before milling
- Milling of fine fraction
- Milling of larger fraction
- Mixing fine/large in predetermined quantities
- Packaging of the simulant into 1 ton containers



JSC-1AF



JSC-1A

Production Issues

- Drying
 - Weather dependent, prone to delays
- Milling
 - Abrasiveness of cinders wears down mill, requires frequent part replacement
- Mixing
 - Difficult to determine the proper mixing procedure
- Packaging into 1 ton containers
 - Requires fork lift, loading dock



JSC-1AF



JSC-1A

Production Issues

- A change of production equipment = developing new processing procedure
 - Each type of mill will grind differently (time, distribution), so transferring production to a new mill requires characterization of the new production process
 - During the JSC-1A development process, the milling equipment changed twice due to commercial mining operation priorities
 - Dr. Carter had to develop a new production approach, but he was able to improve the particle size distribution in the JSC-1A compared to Apollo samples

Characterization Issues

- Users expect characterization (chemical and mechanical) at the time of simulant delivery
 - Commercial characterization labs can take months to complete and carry a high cost
 - Characterization through NASA, USGS, or universities takes the characterization out of the simulant developers control (months may turn into years!)
- The characterization data needs to be approved by NASA for simulant users to feel confident in using them

Distribution Issues

- Receiving
 - Loading dock, forklift
- Repackaging
 - Remixing required (cement mixer)
 - Incredibly dusty facility
- Storage
 - Climate controlled storage space for small containers through 1-ton packages
- Distribution
 - Order entry system, credit card processing, shipping, MSDS



Distribution

- Be prepared for order types to vary widely if sales of simulant are not restricted by application
 - Education (Teachers, museums, science fair students)
 - Research (universities, industry, international organizations)
 - Moon geeks
 - Movie studios
 - Product developers (pens, candles, cups)

