

Sustainable Product Replacement Efforts at NASA

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Agenda

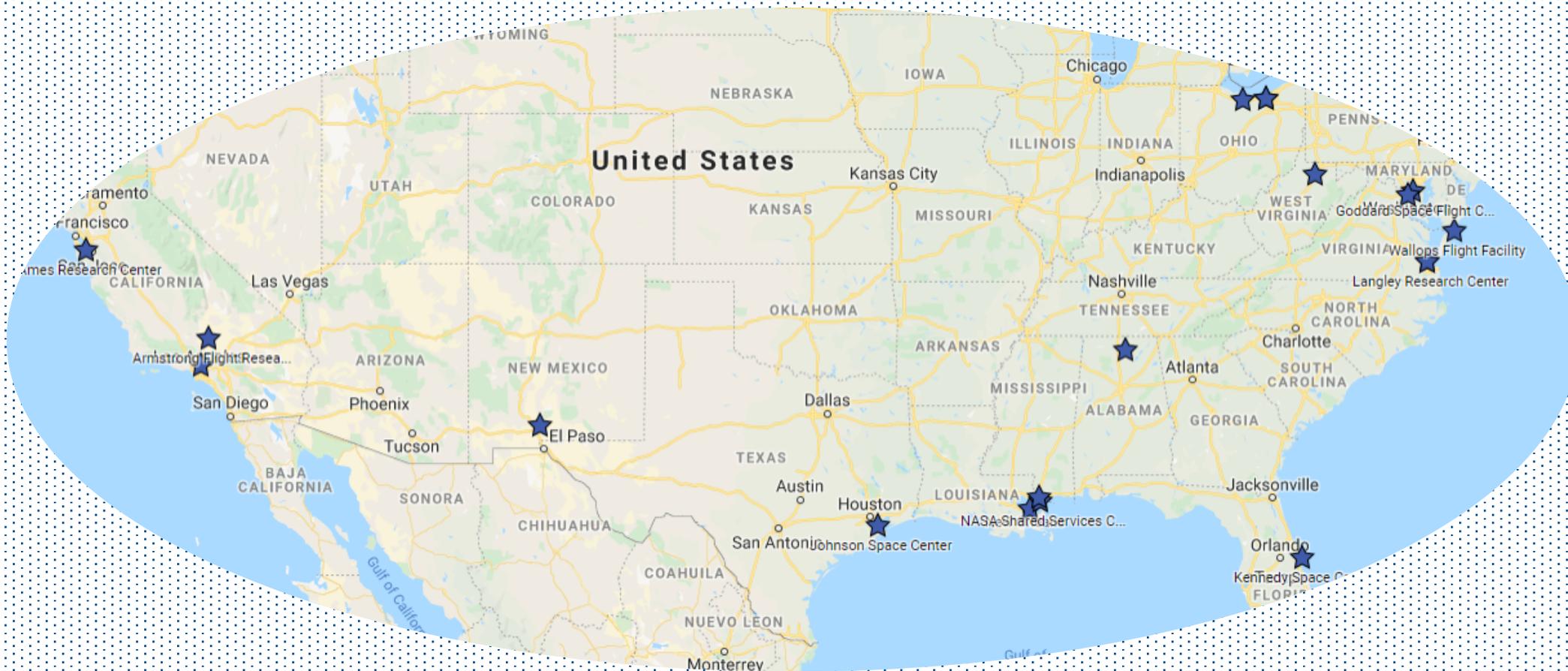
- USDA labeling
- Overview of NASA biobased procurements
- Joint DoD/NASA projects
 - Biobased grease
 - Biobased engine oil
- The path forward - future sustainable solutions opportunities

What Does the "USDA Certified Biobased Product" Label Mean?



Learn more about the USDA BioPreferred® program at www.biopreferred.gov.

National Aeronautics and Space Administration (NASA) Centers



Sustainable Acquisition AKA green purchasing



CPG – recycled content/made with recovered materials



BioPreferred – biobased content



Energy Star – Energy Efficiency



Safer Choice – products that perform and are safer for human health and the environment

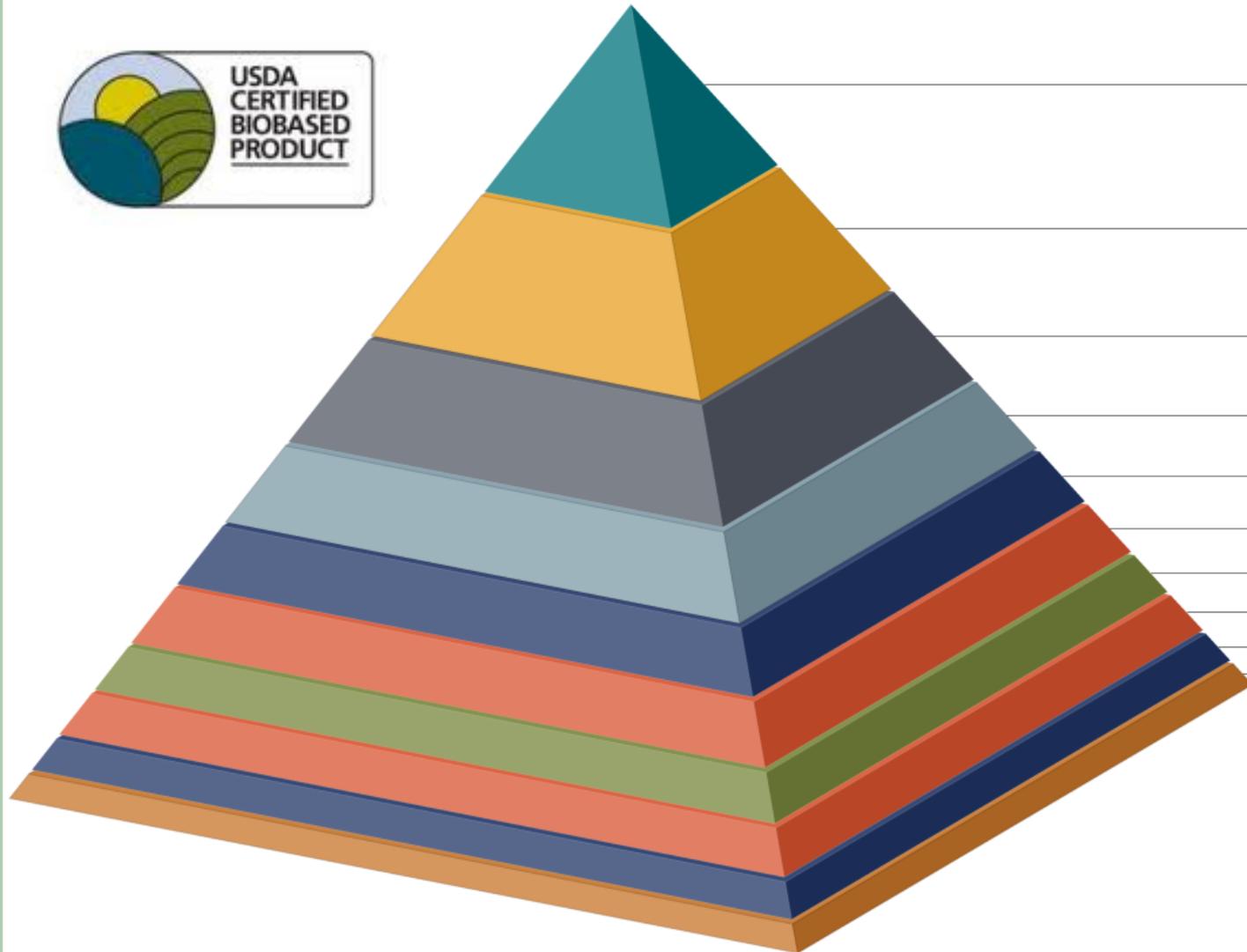


WaterSense – Water Efficiency



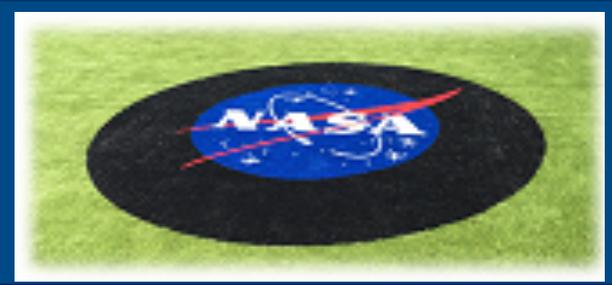
Significant New Alternatives Policy (SNAP) - substitutes for ozone-depleting substances

NASA Biobased purchases FY 18



- Disposable Tableware (plates, bowls, cups)
- Artificial Turf
- Plastic Bags
- Composite Panels - Acoustical
- Hand Cleaners and Sanitizers: Hand Cleaners
- Packing and Insulating Materials
- Greases - Food Grade
- Composite Panels - Interior Panels
- Electronics Accessories
- Disposable Cutlery

Biobased Product Implementation



Demonstrating Sustainable Solutions - DoD / DLA sponsored product demonstrations

1. Biobased grease
2. Biobased engine oil



Demo 1: Biobased Grease

- Tested in forklifts, mowers, utility van, freightliner at 2 NASA Centers
- Qualitative test
- 3 manufactures, 5 products
- USDA Biopreferred – 72% biobased content multi purpose greases
 - Biodegradable
 - reduced petroleum usage



Demo 1: Feedback Survey

- Grease Performance
- Equipment Performance
- Grease Application

<u>Biobased Trail Feedback Form</u>		
Installation/Facility:		Make:
Date:		Model:
Equipment ID:		Year:
Inspection Only <input type="checkbox"/>	Grease Applied <input type="checkbox"/>	Quantity of Grease Applied:

Grease Performance
Are you applying the biobased grease at the same amount as the old grease? <input type="checkbox"/> Same <input type="checkbox"/> Less <input type="checkbox"/> More Comments:
Are you applying the same amount, less, or more of the old grease? <input type="checkbox"/> Same <input type="checkbox"/> Less <input type="checkbox"/> More Comments:
Does the grease show signs of breakdown? <input type="checkbox"/> Yes <input type="checkbox"/> No Comments:
Equipment Performance
Are there any changes in equipment performance since the grease was applied? If Yes, is the condition grease related? <input type="checkbox"/> Yes <input type="checkbox"/> No Comments:
Does the equipment show increased signs of wear since the grease was applied? If Yes, is the condition grease related? <input type="checkbox"/> Yes <input type="checkbox"/> No Comments:
Grease Application
Overall, was the biobased grease easy to apply? <input type="checkbox"/> Yes <input type="checkbox"/> No Comments:
Provide feedback on grease consistency, a

Demo 1: Conclusions

- Trial feedback:
 - Positive performance received
 - The biobased greases do not separate
 - Performance was comparable to baseline greases
 - 1 product exhibited hardening when applied to external surface areas
 - Added benefit-
 - did not liquify - candidate for strict, no spill clean room/laboratory
 - Applied to mower front wheel casters and hubs appears to attract less dust & dirt
- Meets original Equipment Manufacturer requirements - no documentation changes are required for transition to the demonstrated biobased grease products
- DLA Aviation is establishing NSNs for biobased greases to facilitate procurement by the federal gov.

Demo 2: Biobased fully synthetic 4 cycle engine oil

- Tested in 25 passenger vehicles at 4 NASA Centers
- Quantitative test
- 3 fully synthetic biobased engine oils
 - USDA Biopreferred- 25% biobased content or >
 - Biodegradable
 - Reduced petroleum usage
- Sampled at 6 month intervals



Demo 2: Sampling constituents

- 10 wear metals (ASTM D6595-00)
- 5 contaminants
- 6 additives
- viscosity (ASTM D2270-98)
- degradation of the lubricant (ASTM E2412)
 - Total Base Number (TBN) - measures the level of base additive remaining

Location:	Main > DLA CTC NASA KSC Delaware North
Unit ID:	2011 GMC Sierra 1500 235
Model:	
Machine Type:	Engine



All elements are acceptable. Oil is suitable for continued use.
Re-sample at normal intervals.

Demo 2: Analysis Results

- TBN depletion is the primary indicator that oil should be changed
- Wear metal levels are within acceptable limits
- Oil viscosity remained within acceptable limits
- Si contamination may be a concern - sand/dusty environment
 - Si contamination should be considered when establishing oil change intervals for higher mileage vehicles
- Biobased engine oils meet current NASA site oil change intervals in all demonstration vehicles
- potential to extend mileage interval by 9 - 45% depending on location

Supporting Biobased Product Efforts and beyond

- Earth Day exhibits – biobased vendors
- Annual face to face meetings and quarterly video meetings - biobased demo status/summary
- Other conferences/meeting – biobased capabilities discussions and take back to interested NASA Centers
- Future coordination - DoD Demos and sustainable solutions



Questions?

Backup

Biobased Oil Analysis Results

ASTM D6595-00 WEAR METALS	Iron	ppm	0 - 150	9
	Chrome	ppm	0 - 10	<1
	Nickel	ppm		<1
	Molybdene	ppm		62
	Aluminium	ppm	0 - 20	2
	Lead	ppm	0 - 25	2
	Copper	ppm	0 - 120	<1
	Tin	ppm	0 - 10	<1
	Silver	ppm		<1
	Titanium	ppm		<1
ASTM D6595-00 CONTAMINANT S	Silicon	ppm	0 - 25	16
	Sodium	ppm	0 - 15	4
	Vanadium	ppm		<1
	Potassium	ppm		<1
	Lithium	ppm		<1
ASTM D6595-00 ADDITIVES	Calcium	ppm		1879
	Magnesium	ppm		22
	Phosphorus	ppm		784
	Zinc	ppm		871
	Barium	ppm		<1
	Boron	ppm		<1

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MET-MEC-005	Fuel dilution	%		2
ASTM D445	Viscosity at 40°C	cSt		
ASTM D445	Viscosity at 100°C	cSt	8.3 - 12.5	11.3
ASTM D2270-98	Viscosity index	°C		
	TBN	mg KOH/g	<2.00	3.87
	WaterPPM	ppm		288.0
	Oxidation By-Products	abs/mm2		7.6
ASTM E2412	Nitration By-Products	abs/mm2		14.7
	Sulfation By-Products	abs/mm2		3.9
	Glycol	%	0.0 - 0.5	0.0
	Soot	%wt		0.0