Health in Buildings:
Measuring asset performance through occupant surveys

Bill Brodt and Kim Toufectis
Facilities and Real Estate Division
Office of Strategic Infrastructure

Learning Objectives:

A “Total Cost of Ownership” approach to facility stewardship involves mission/people factors

Actionable science based research is needed (and available)

Facility professionals need compelling stories supported by credible internal data for management to pay attention

Stewardship goals involve people

Goals our industry chose 25 years ago:

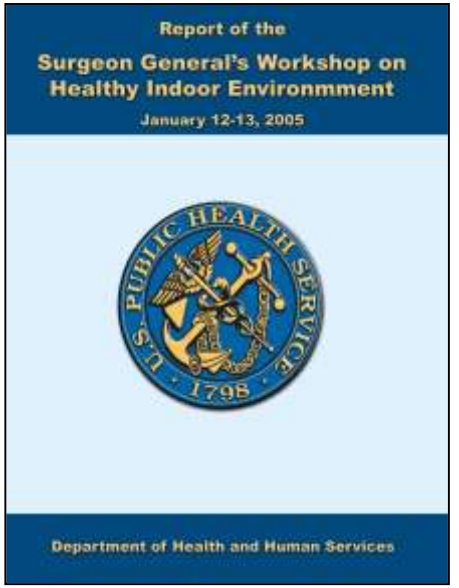
- **50% Reduction in Delivery Time**
- **50% Reduction in O&M and Energy Costs**
- **50% Less Waste and Pollution**
- **50% More Durability and Flexibility**
- **50% Less Construction Illnesses/Injuries**
- **50% Fewer Occupant Illnesses and Injuries**
- **30% Increase in Productivity and Comfort**

Source:
***National Construction Goals*, National Science & Technology Council, Office of Science and Technology Policy (1994)**

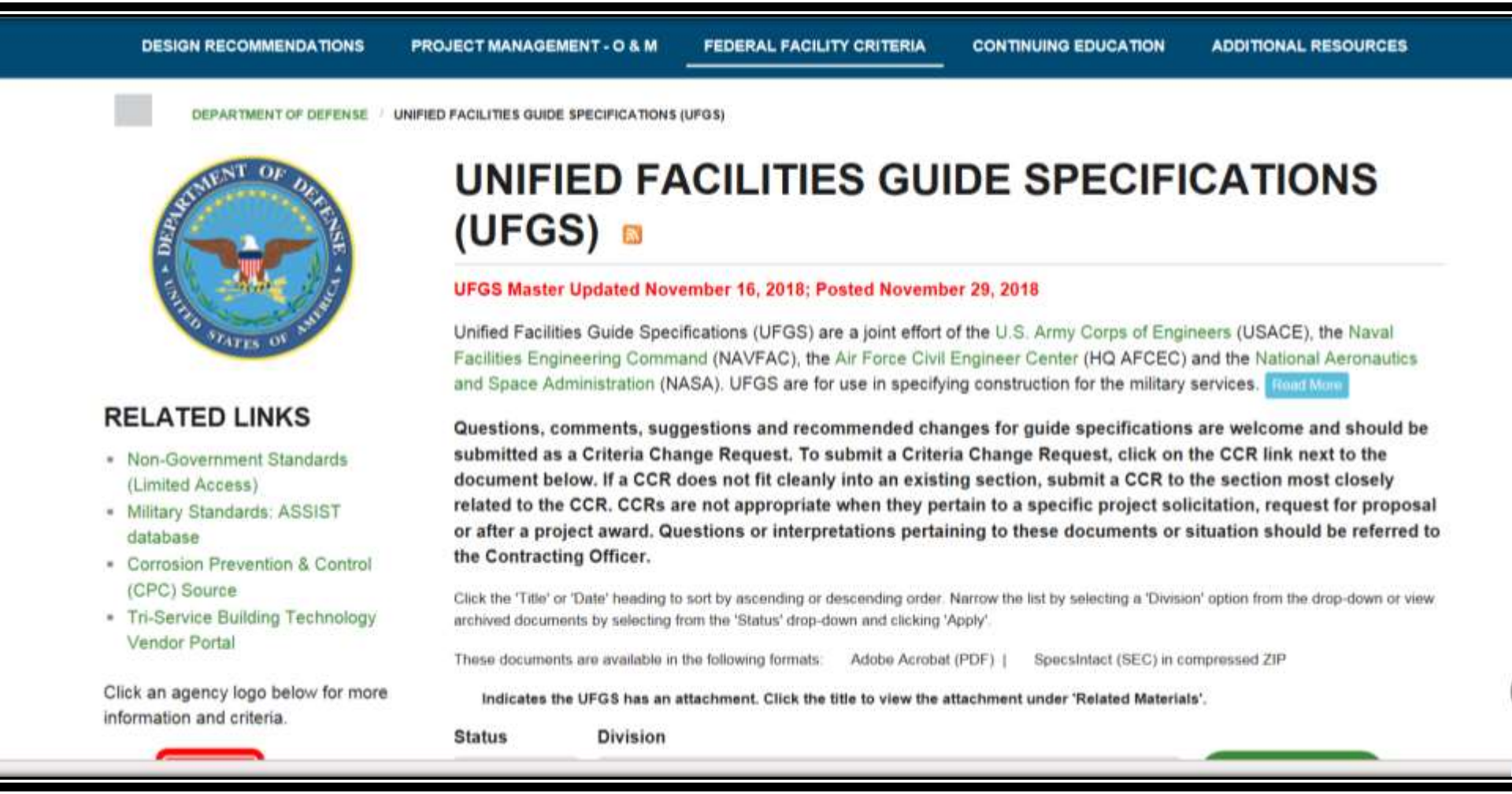
Medical Research at our Door…

2003:

National Academy of Sciences and the Surgeon General of the United States Public Health Service conduct workshops



Codes and Specifications to the rescue?



DESIGN RECOMMENDATIONS | PROJECT MANAGEMENT - O & M | FEDERAL FACILITY CRITERIA | CONTINUING EDUCATION | ADDITIONAL RESOURCES

DEPARTMENT OF DEFENSE / UNIFIED FACILITIES GUIDE SPECIFICATIONS (UFGS)

UNIFIED FACILITIES GUIDE SPECIFICATIONS (UFGS)

UFGS Master Updated November 16, 2018; Posted November 29, 2018

Unified Facilities Guide Specifications (UFGS) are a joint effort of the U.S. Army Corps of Engineers (USACE), the Naval Facilities Engineering Command (NAVFAC), the Air Force Civil Engineer Center (HQ AFCEC) and the National Aeronautics and Space Administration (NASA). UFGS are for use in specifying construction for the military services. Read More

Questions, comments, suggestions and recommended changes for guide specifications are welcome and should be submitted as a Criteria Change Request. To submit a Criteria Change Request, click on the CCR link next to the document below. If a CCR does not fit cleanly into an existing section, submit a CCR to the section most closely related to the CCR. CCRs are not appropriate when they pertain to a specific project solicitation, request for proposal or after a project award. Questions or interpretations pertaining to these documents or situation should be referred to the Contracting Officer.

Click the 'Title' or 'Date' heading to sort by ascending or descending order. Narrow the list by selecting a 'Division' option from the drop-down or view archived documents by selecting from the 'Status' drop-down and clicking 'Apply'.

These documents are available in the following formats: Adobe Acrobat (PDF) | SpecsIntact (SEC) in compressed ZIP

Indicates the UFGS has an attachment. Click the title to view the attachment under 'Related Materials'.

Status Division

RELATED LINKS

- Non-Government Standards (Limited Access)
- Military Standards: ASSIST database
- Corrosion Prevention & Control (CPC) Source
- Tri-Service Building Technology Vendor Portal

Click an agency logo below for more information and criteria.

[Getting better, but they lag…]

For authoritative references…

WBDG
WHOLE BUILDING DESIGN GUIDE
a program of the
National Institute of Building Sciences

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DESIGN RECOMMENDATIONS | PROJECT MANAGEMENT - O & M | FEDERAL FACILITY CRITERIA | CONTINUING EDUCATION | ADDITIONAL RESOURCES

DESIGN OBJECTIVES / PRODUCTIVE / PROMOTE HEALTH AND WELL-BEING

DESIGN OBJECTIVES

- Accessible
- Aesthetics
- Cost–Effective
- Functional / Operational
- Historic Preservation
- **Productive**
  - Integrate Technological Tools
  - Assure Reliable Systems and Spaces
  - Design for the Changing

PROMOTE HEALTH AND WELL-BEING

the WBDG Productive Committee
Updated: 09-04-2018

OVERVIEW

Indoor environments have strong positive effects on occupant well-being and functioning, especially attributes such as the amount and quality of light and color, the sense of enclosure, the sense of privacy, access to window views, connection to nature, sensory variety, and personal control over environmental conditions. Designing to enhance psychological well-being will therefore have positive impacts on work effectiveness and other high value outcomes, such as stress reduction, job satisfaction, and organizational commitment.

WITHIN THIS PAGE

- Overview
- Recommendations
- Relevant Codes and Standards
- Additional Resources

Feds also contribute research

We've made some changes to EPA.gov. If the information you are looking for is not here, you may be able to find it on the EPA Web Archive or the January 19, 2017 Web Snapshot. Close

EPA United States Environmental Protection Agency

Environmental Topics | Laws & Regulations | About EPA | Search EPA.gov

CONTACT US SHARE

Indoor Air Quality (IAQ)

- Indoor Air Quality Home
- IAQ by Building Type
- Network and Collaborate
- Regional and State IAQ Information
- Popular IAQ Topics
  - Air Duct Cleaning
  - Asthma
  - Health, Energy Efficiency and Climate Change
  - Flood Cleanup
  - IAQ at Home
  - Indoor airPLUS
  - Mold
  - Radon
  - Schools
  - Secondhand Tobacco Smoke

Indoor Air Quality in Offices and Other Large Buildings

Indoor air quality (IAQ) problems are not limited to homes. In fact, many office buildings have significant air pollution sources. Some of these buildings may be inadequately ventilated. For example, mechanical ventilation systems may not be designed or operated to provide adequate amounts of outdoor air. Finally, people generally have less control over the indoor environment in their offices than they do in their homes. As a result, there has been an increase in the incidence of reported health problems.

ASHRAE Indoor Air Quality Design Guide Now Available for Free

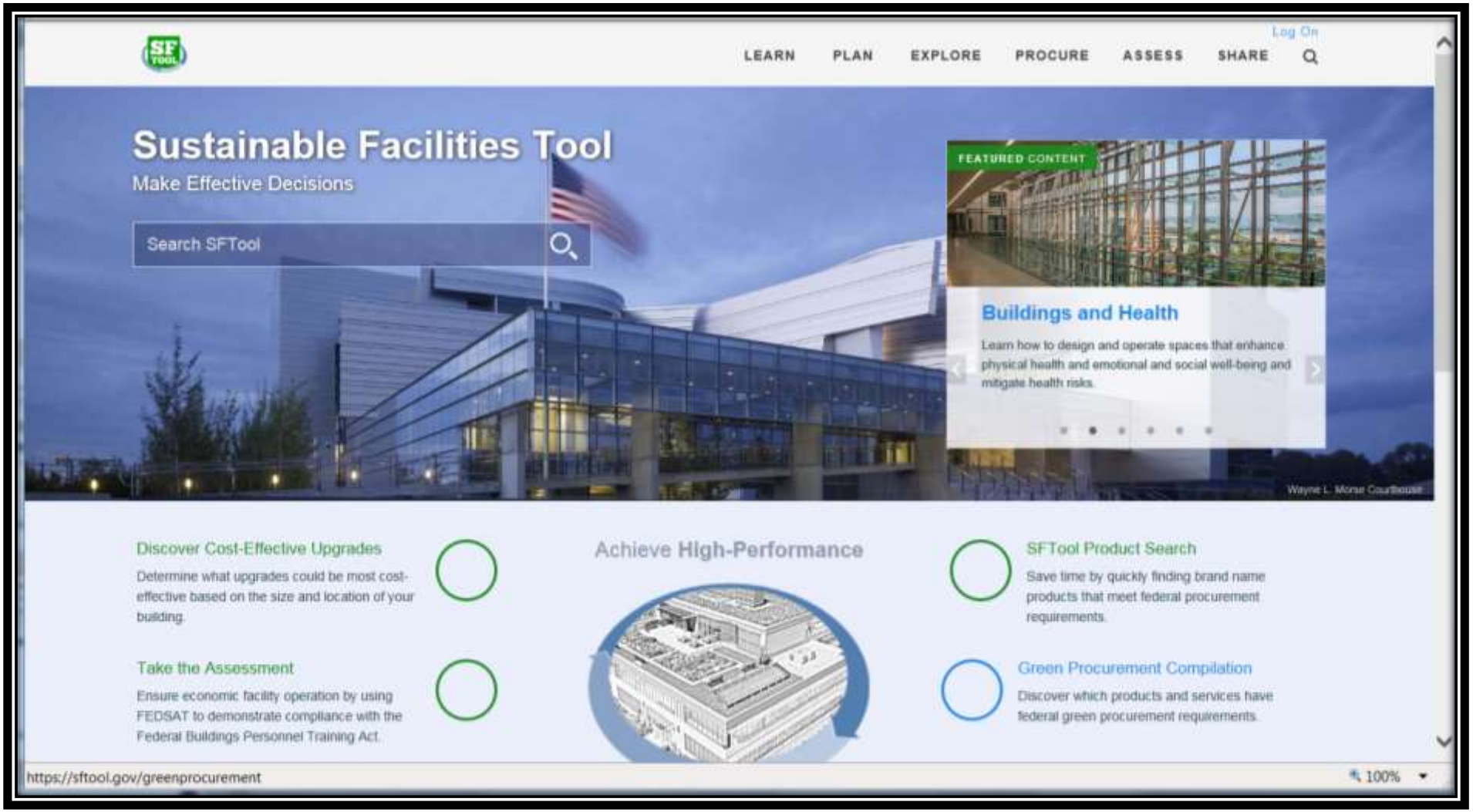
The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) is now making the IAQ design guide and all of its reference materials available to the public at no cost through its website.

The Indoor Air Quality Guide: Best Practices for Design, Construction and Commissioning is designed for:

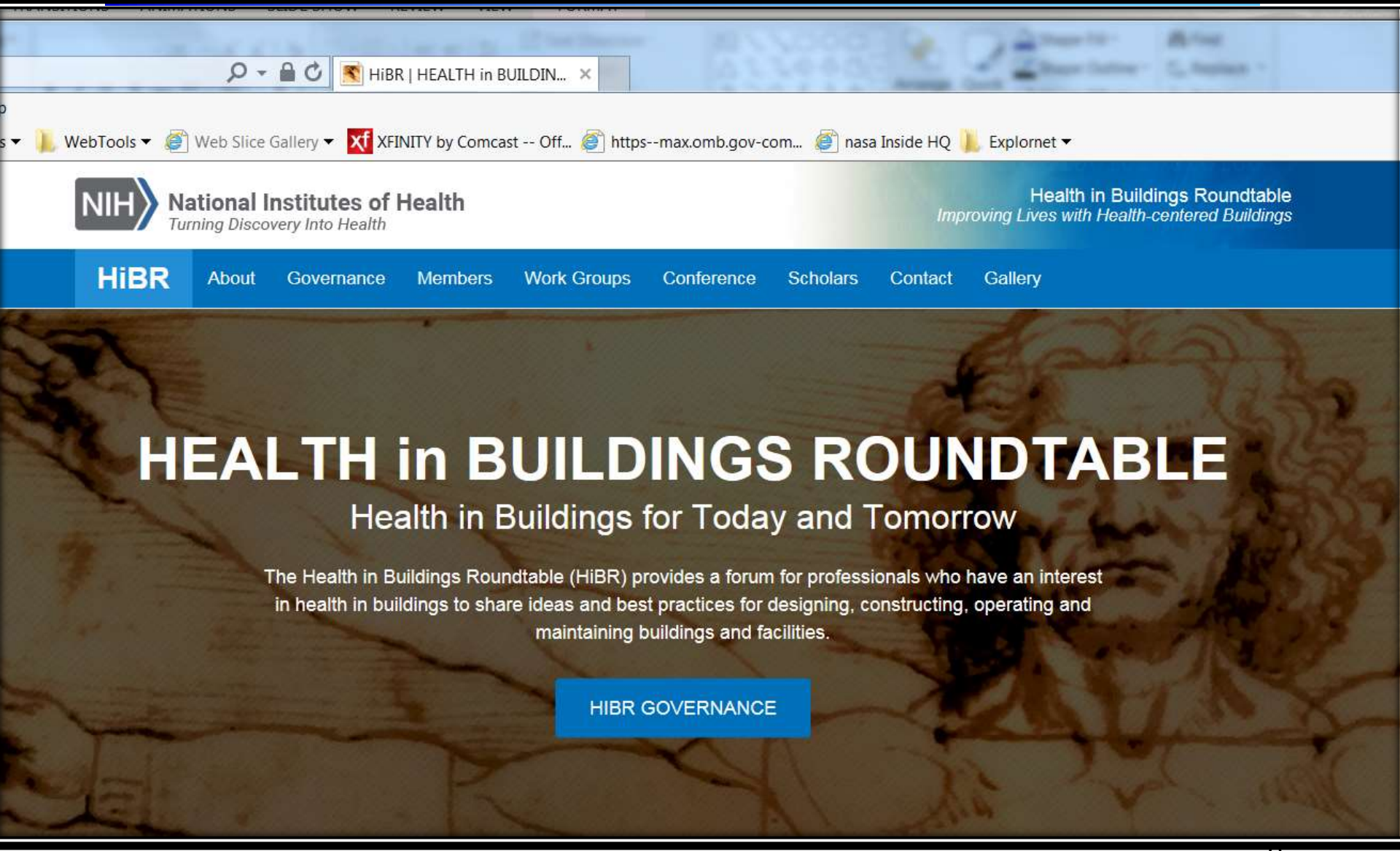
- architects

- ASHRAE Indoor Air Quality Design Guide
- Green Building
- Science and Technology
- IAQ Building Education and Assessment Model (I-BEAM)
- I-BEAM Text Modules

…and offer some great tools…



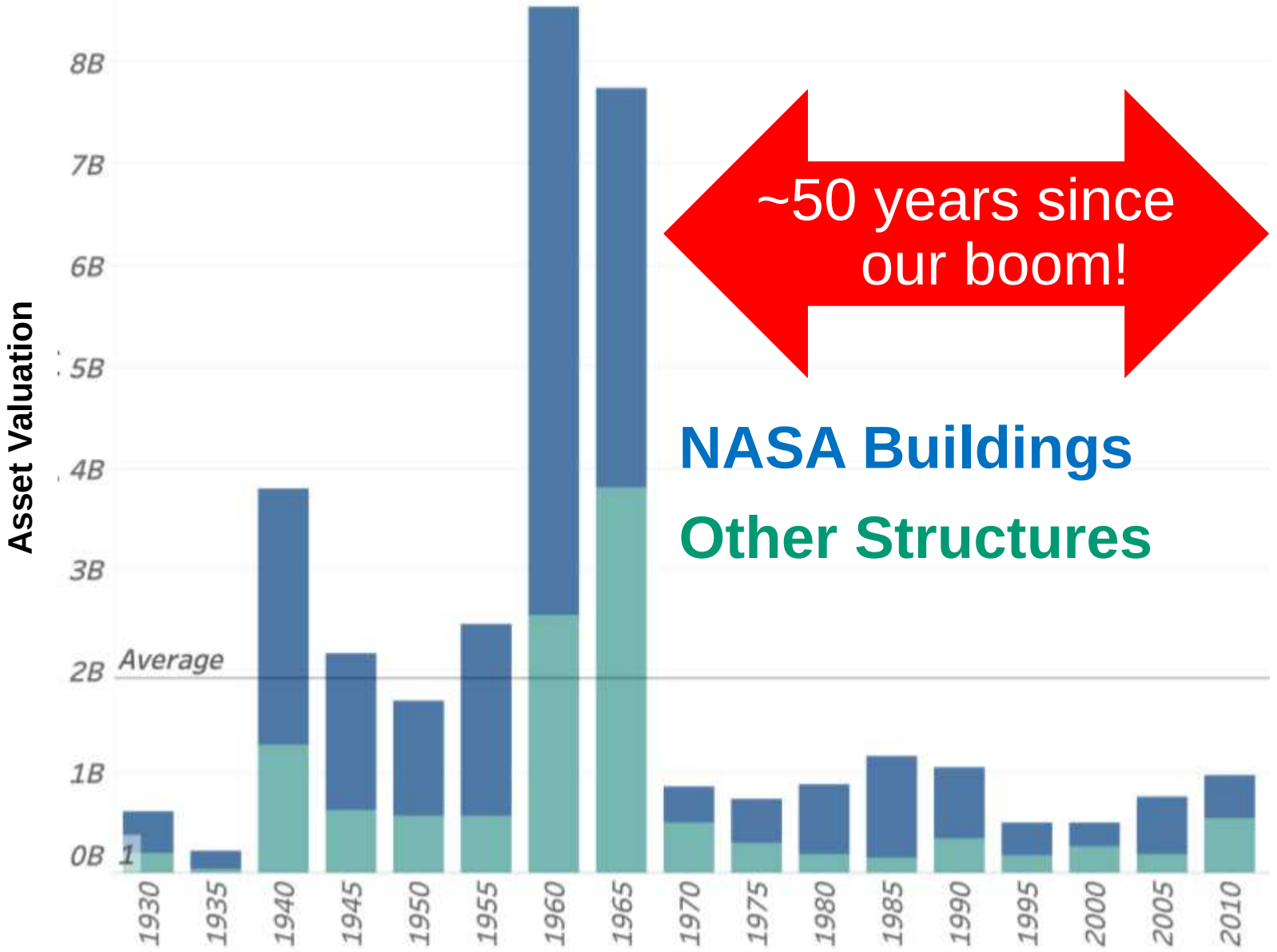
…and the research continues forward.



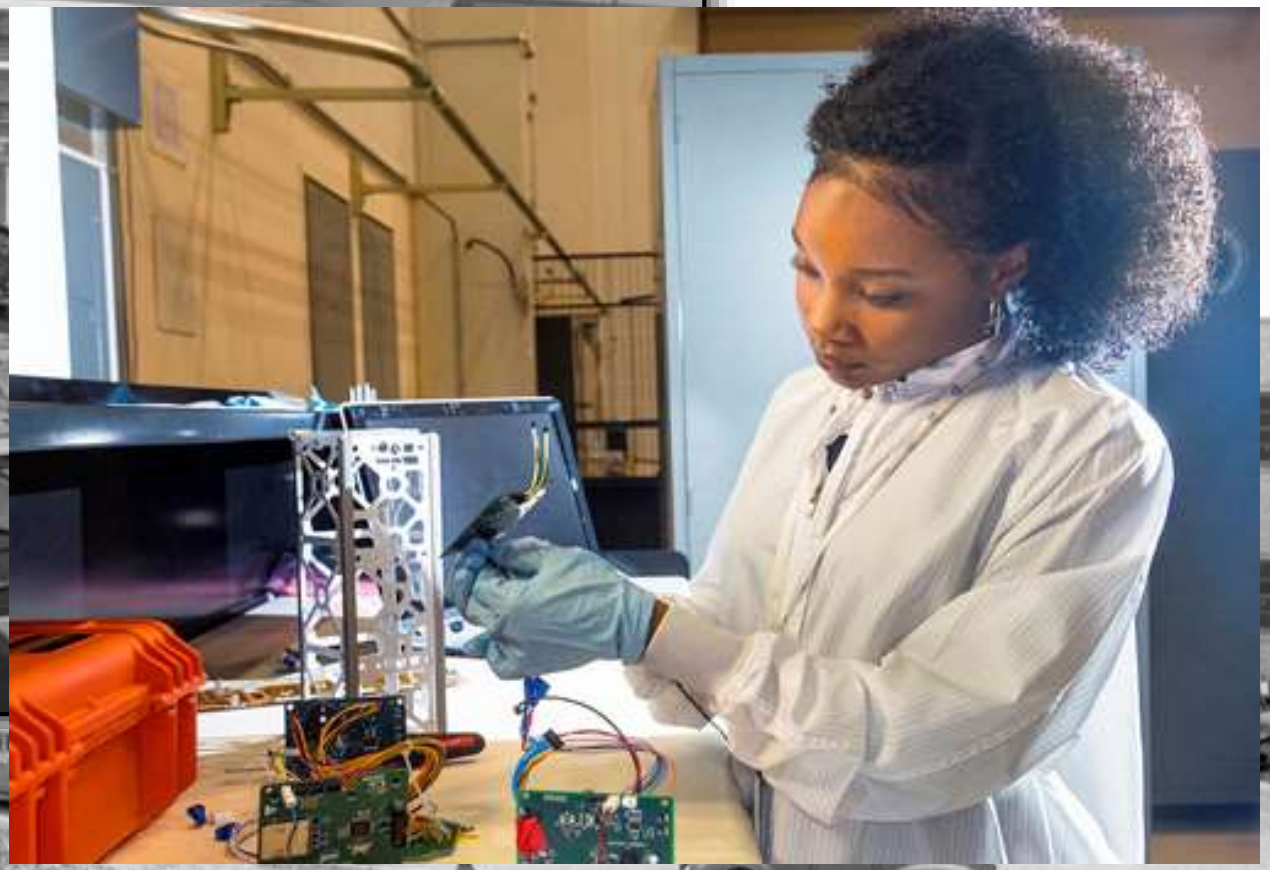
NASA builds some cool/sustainable stuff…

Ames Research Center's Collaborative Support Facility
LEED Platinum
One of 45 NASA buildings meeting Federal sustainable building criteria.

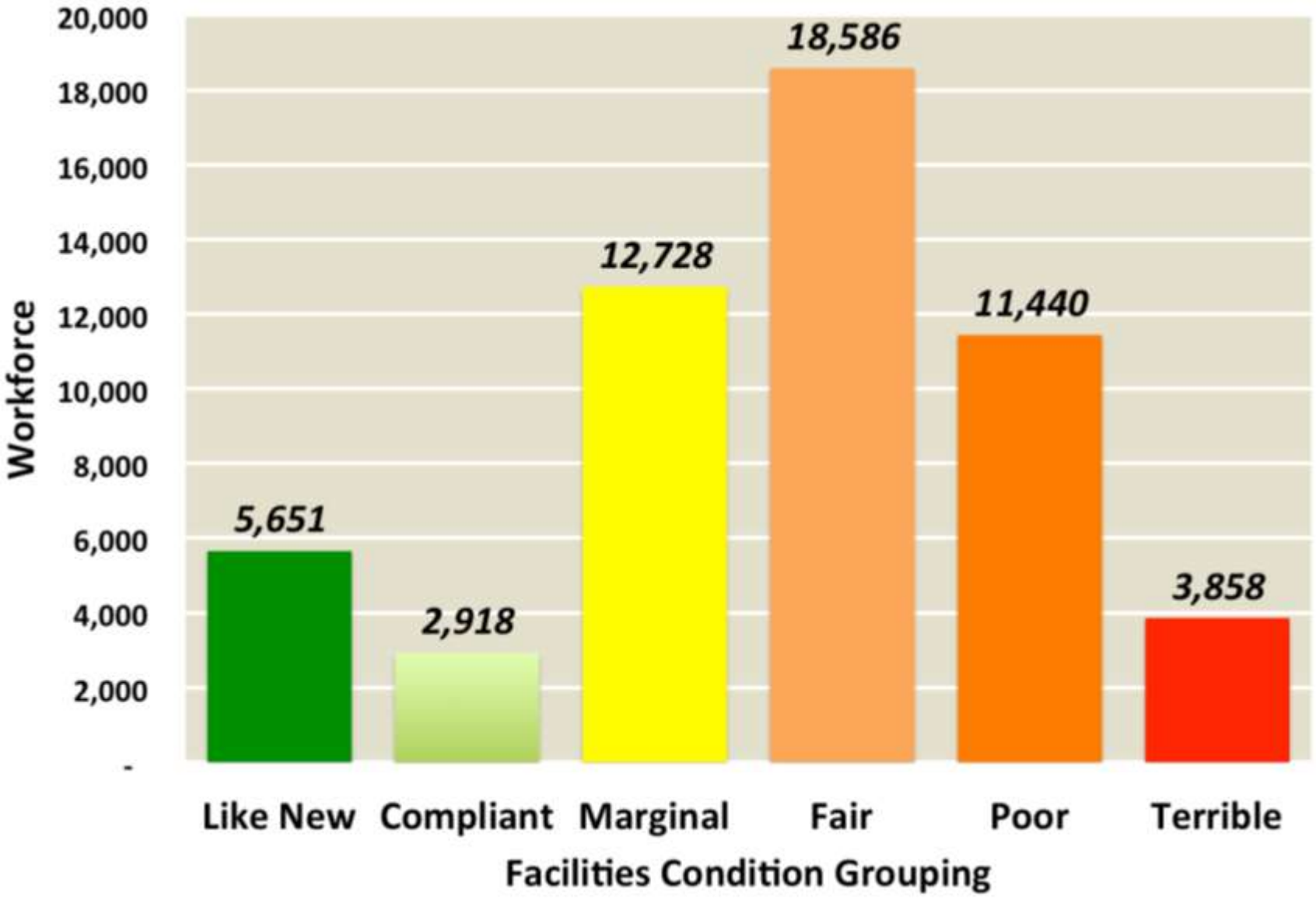
…but most NASA assets are obsolete…



Legacy capabilities box in tomorrow's work



Reframing our data in people terms…



…but where's people data to dig deeper?

NASA gathers data about our facilities as many do:

- ***Capacity*** SF, LF, CY, ettc.
- ***Obsolescence*** Age
- ***Degradation*** Condition
- ***Criticality*** MDI
- ***Affordability*** O&M, CapEx
- ***Sustainability*** Resource usage

…but our measures tell us little about how our facilities actually affect people…

We want to corroborate the research!

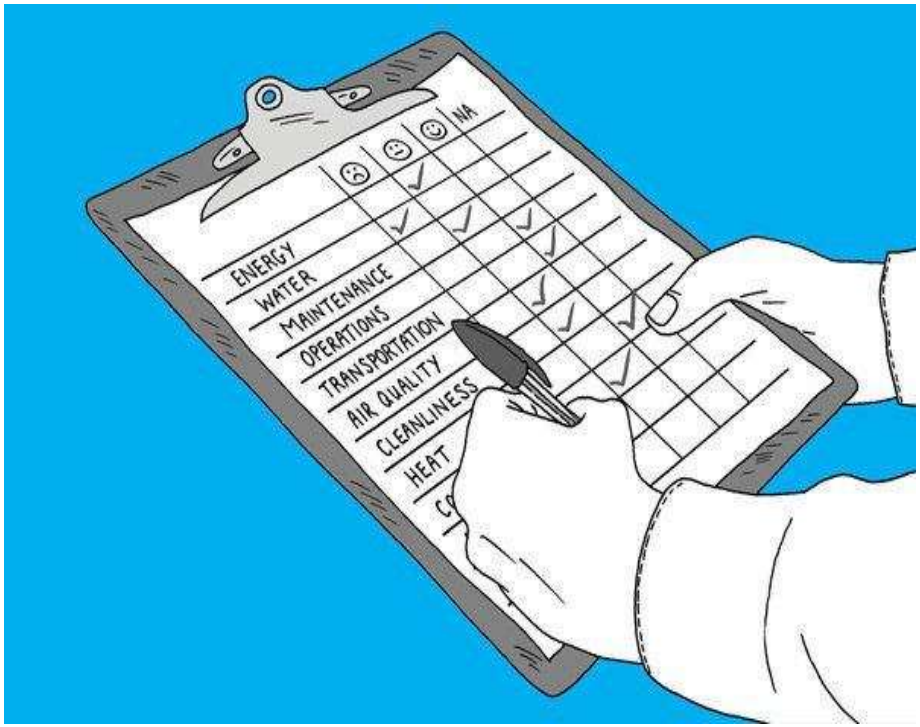
- Do the people doing NASA's work see their individual workplaces supporting/constraining them?

Seeking help within our organization

NASA occupational health experts analyzed their incident records for indications of ***Sick Building Syndrome:***

They found little correlation between complaints and building condition, but some with building age.

Post Occupancy Surveys?



+ *Learn from recent projects*
+ *Direct occupant input*
- *"Snapshot" of only a few assets*
- *Can't compare with most other buildings*

They serve their purpose, but don't help us link facilities broadly to peoples' health

Looking for help beyond NASA…

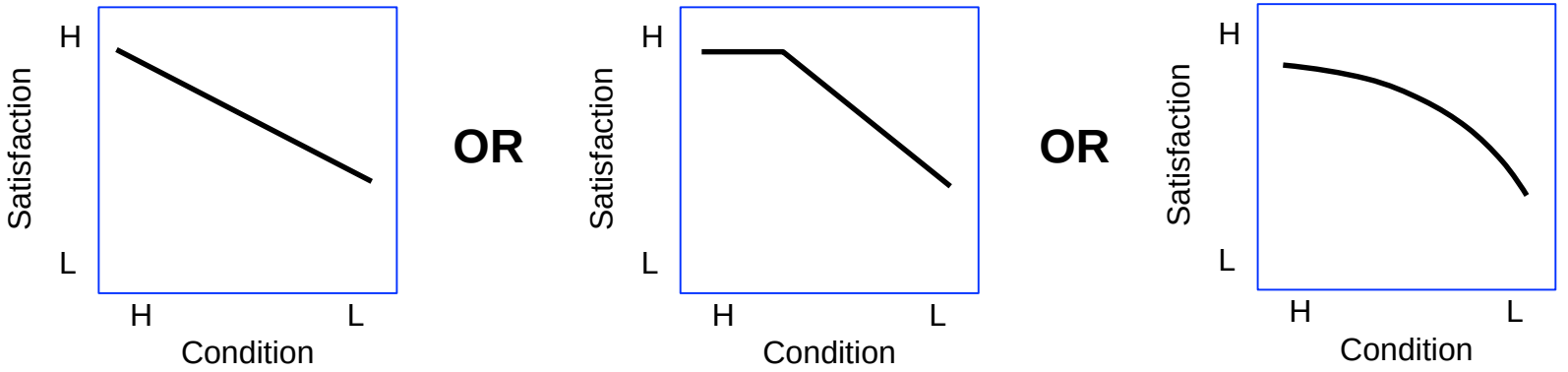
For civilian Feds, GSA's occupant survey is timely, tied to research, lets us compare with peers, and free!

Satisfaction and Building Condition

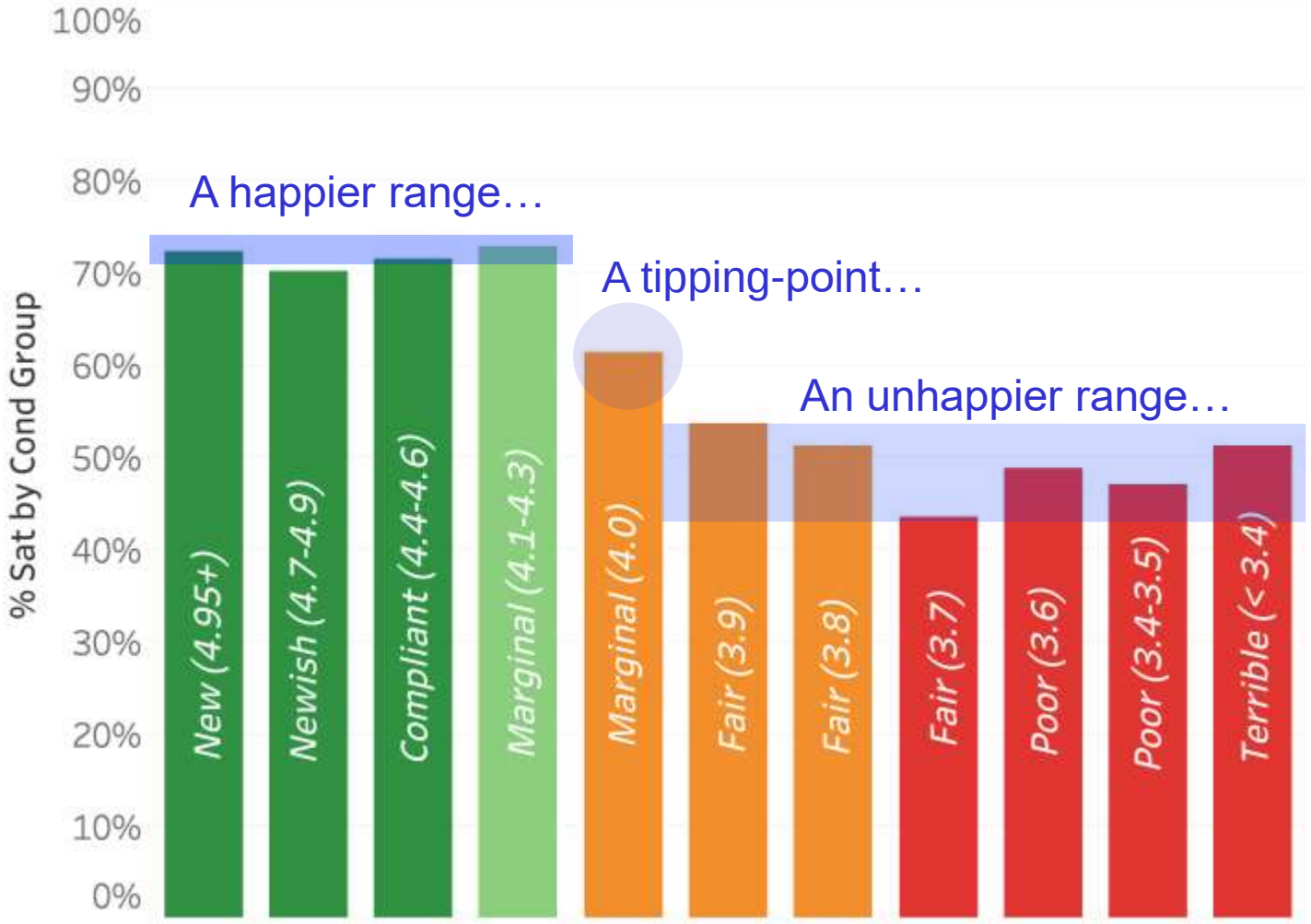
A value proposition for our industry:

Readiness → Satisfaction → Productivity

Degraded buildings certainly cost more for us to run, but do occupants judge degraded buildings as we do?



Building Condition and Satisfaction



So What? A "Neediest asset" approach to renewal may spend more and benefit our people less.

Workspace Configuration and Satisfaction

Private office layout

- More initial fit-out
- More costly operations
- More frequent reno
- More sf/occupant

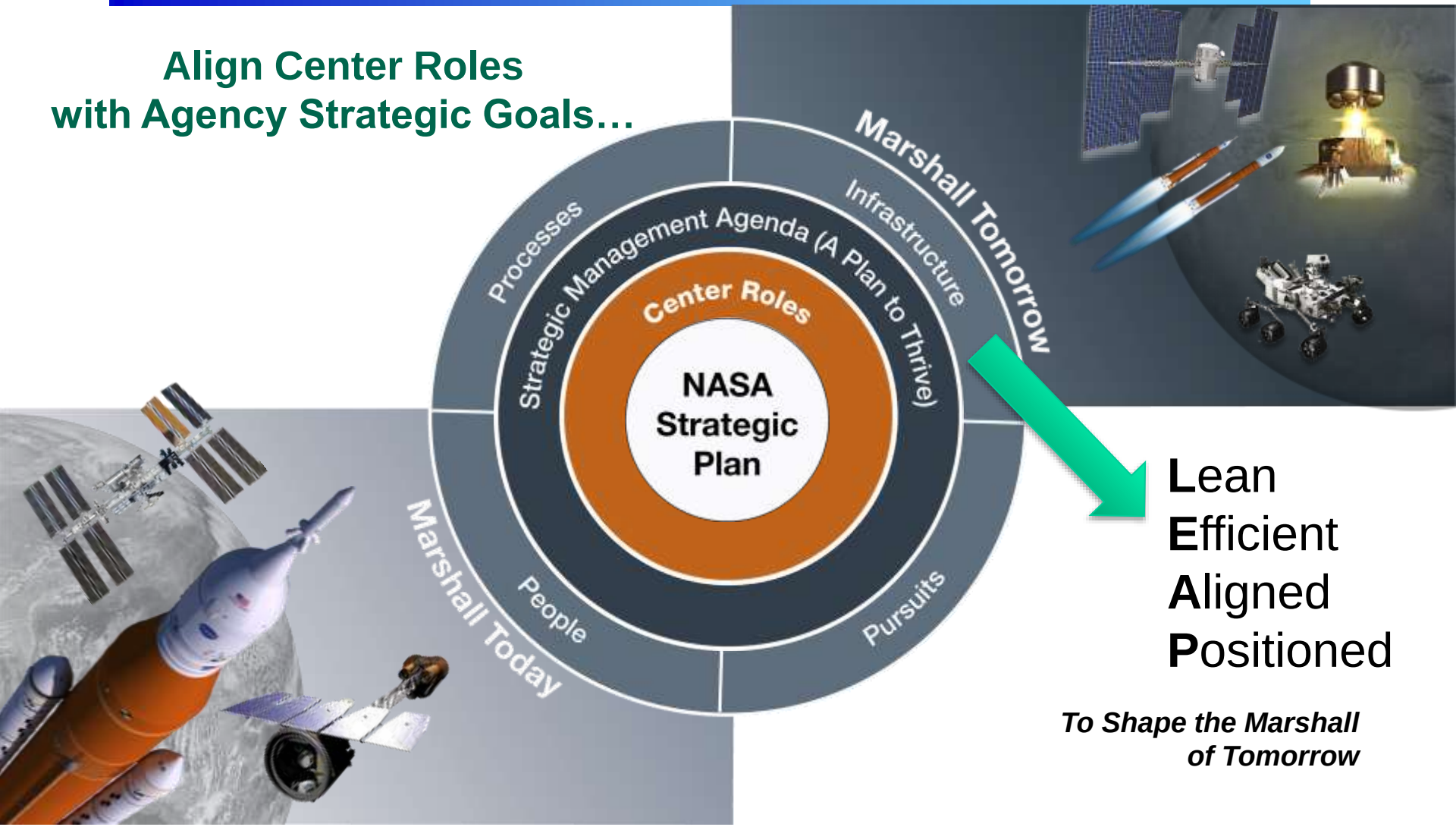
Open office layout

- Less initial fit-out
- Less costly operations
- Less frequent reno
- Fewer sf/occupant

…so is it wise to invest extra for private offices?
NASA's occupant data shows no extra satisfaction!

Using occupant health research locally

Align Center Roles with Agency Strategic Goals…



Lean
Efficient
Aligned
Positioned

To Shape the Marshall of Tomorrow

A NASA installation application

NASA's Marshall Space Flight Center evaluates each asset in five dimensions in developing a 20-year facilities master plan:

- Support to Agency Goals/Primary Center Roles/Core Products
- Importance to those products/hard to replace?
- Asset Readiness
- How occupants perceive the facility
- Impact of the Facility on Agency goals

Learning Objectives:

A “Total Cost of Ownership” approach to facility stewardship involves mission/people factors

Actionable science based research is needed (and available)

Facility professionals need compelling stories supported by credible internal data for management to pay attention

BACKUP

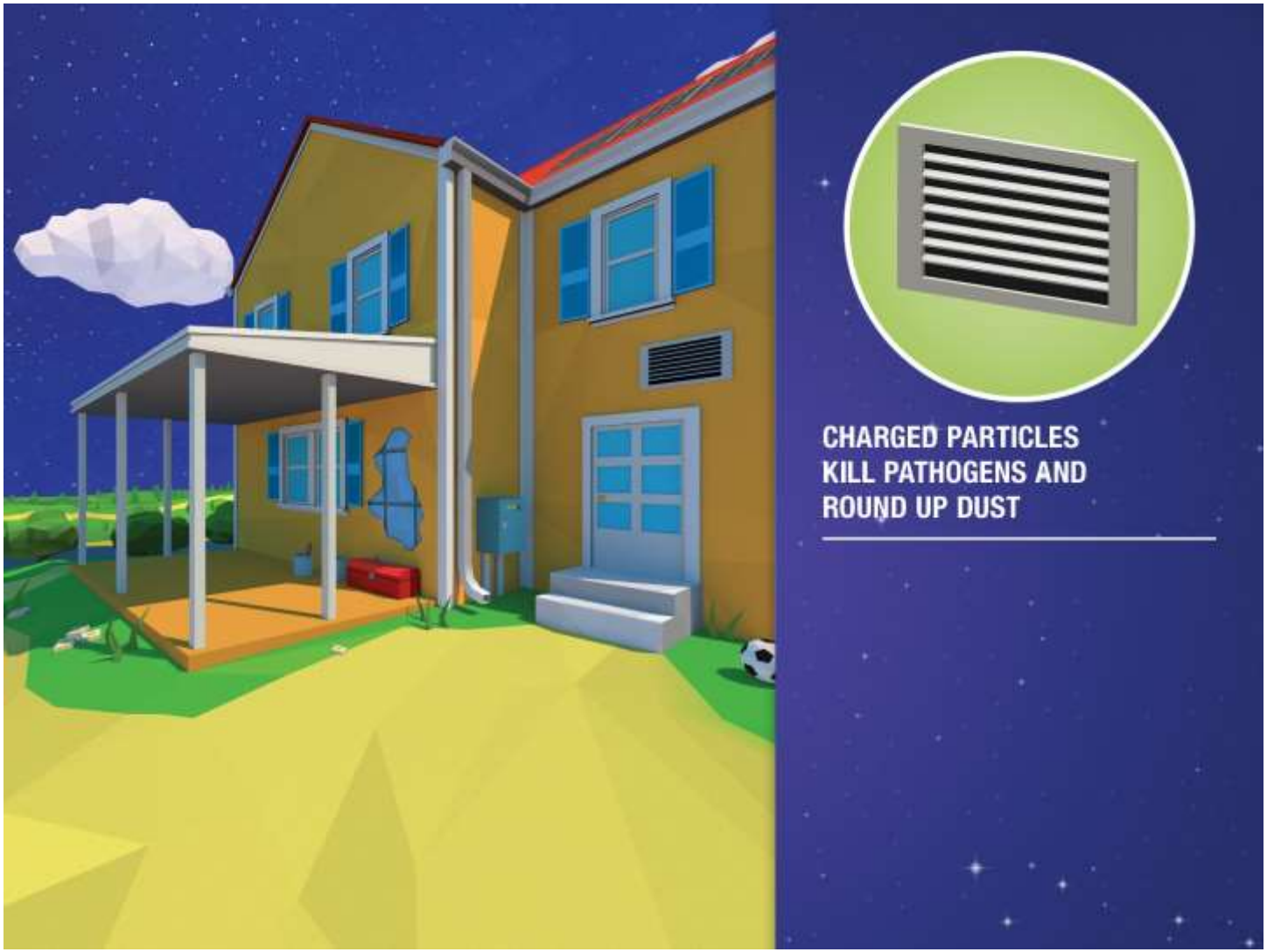
Building to Code & Standards vs Building for Health

- Under Sustainable guidelines, NASA building to ASHRAE 189
- Healthy building research takes years to translate into building code and Unified Facilities Guide Specifications.
- Construction cost analyses often dominate Total Cost of Ownership, although Congress shows signs of changing.
- Still, Total Cost of Ownership skirts health and productivity costs.

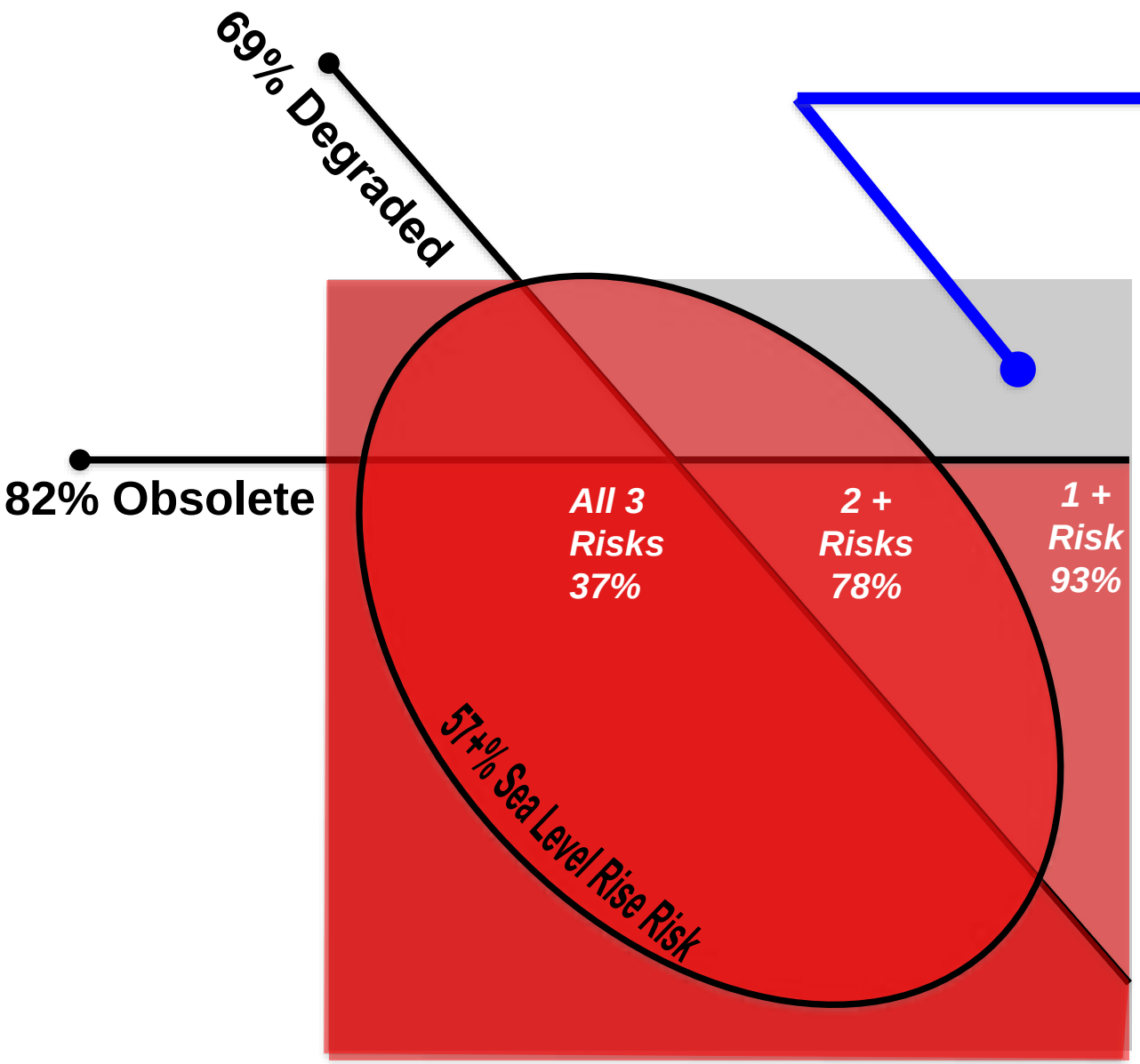
Healthy Buildings: A Program of the Harvard T.H. Chan School of Public Health

(https://forhealth.org/ 2/11/2019)

NASA Research Benefits Healthy Buildings



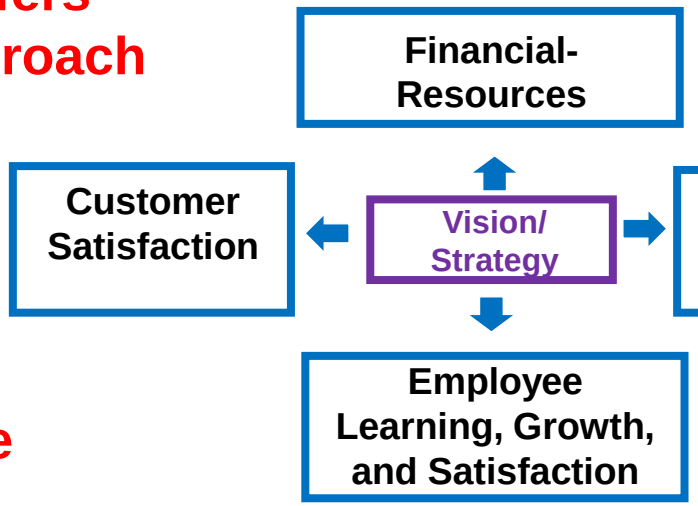
Risk and Readiness Problem



~7% of NASA assets are clear of these risks today…

Why the GSA Survey is important t

GSA Survey offers a standard approach – if everyone does their own survey, there is no basis for an enterprise wide Decision.



Standard metrics

Developed Process Specific metrics

Existing Federal metrics, such as the Employee Viewpoint Survey (EVS)

NASA Langley Research Center

Bureau Summary

National Aeronautics and Spac

Select Agency to Filter: National Aeronautics and Space Administration

Select Bureau to Filter: Langley Research Center

Legal Interest: Agency Owned

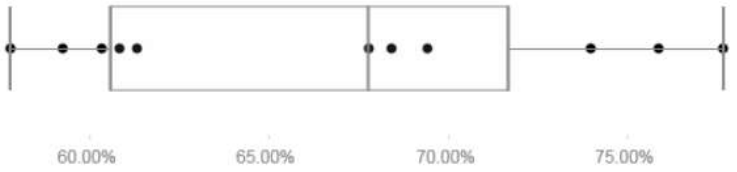
	2018 Value	change from 2017	3-year trend
Overall Satisfaction:	57.8%		57.8%
Response Count:	346		346

Satisfaction by Category

	Overall Satisfaction	% change from 2017	Government Wide Average
Overall Satisfaction	57.8%		56.7%
Condition of Facility	62.2%		65.7%
Quality of Cleanliness	72.7%		72.3%
Personal Workspace	62.8%		61.2%
Meeting Space	71.7%		60.6%
Security	76.8%		74.5%
Elevators	61.7%		58.8%

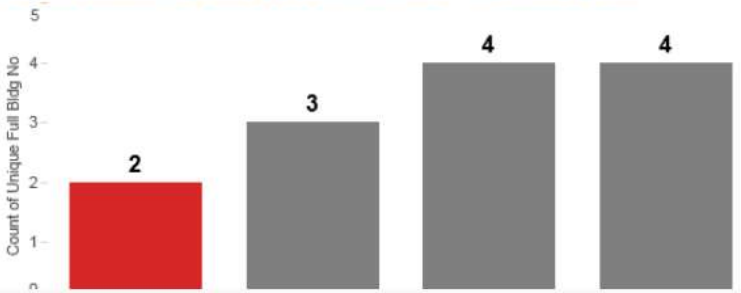
Satisfaction Compared to Other Agencies

(Click arrow to highlight selected Bureau) ▼



Buildings in Quartiles of Satisfaction

Navigate to Satisfaction by Building page to see more detail - 10 responses or greater



Improve Response Rates

Navigate to Satisfaction by Building page to see more detail

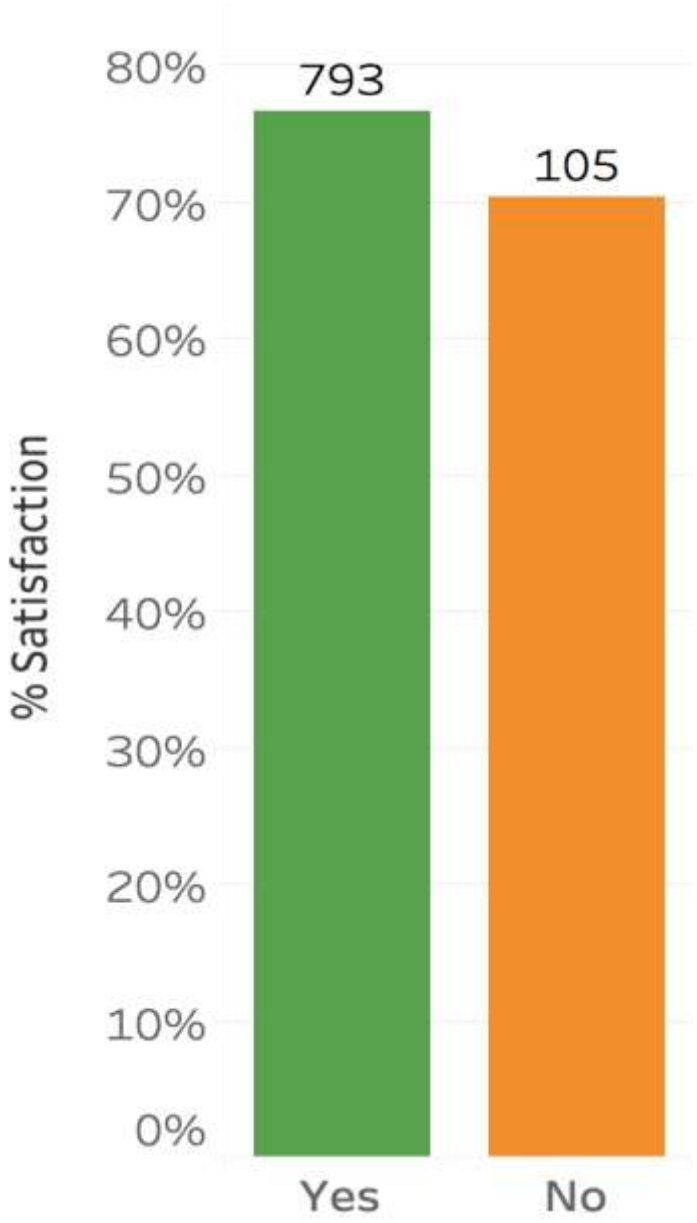
43 The number of buildings with low response counts (i.e. less than 10 responses)

Older Buildings: More Complaints

Potential Sick Building * Building Age Category Crosstabulation

			Building Age Category				
			>0 - <20 years	20 - <40 years	40 - <60 years	60+ years	Total
Potential Sick Building	No	Count	1436	1280	1772	803	5291
		% within Potential Sick Building	27.1%	24.2%	33.5%	15.2%	100.0%
	Yes	Count	15	36	180	48	279
		% within Potential Sick Building	5.4%	12.9%	64.5%	17.2%	100.0%
Total		Count	1451	1316	1952	851	5570
		% within Potential Sick Building	26.1%	23.6%	35.0%	15.3%	100.0%

Satisfaction and Sustainable Buildings



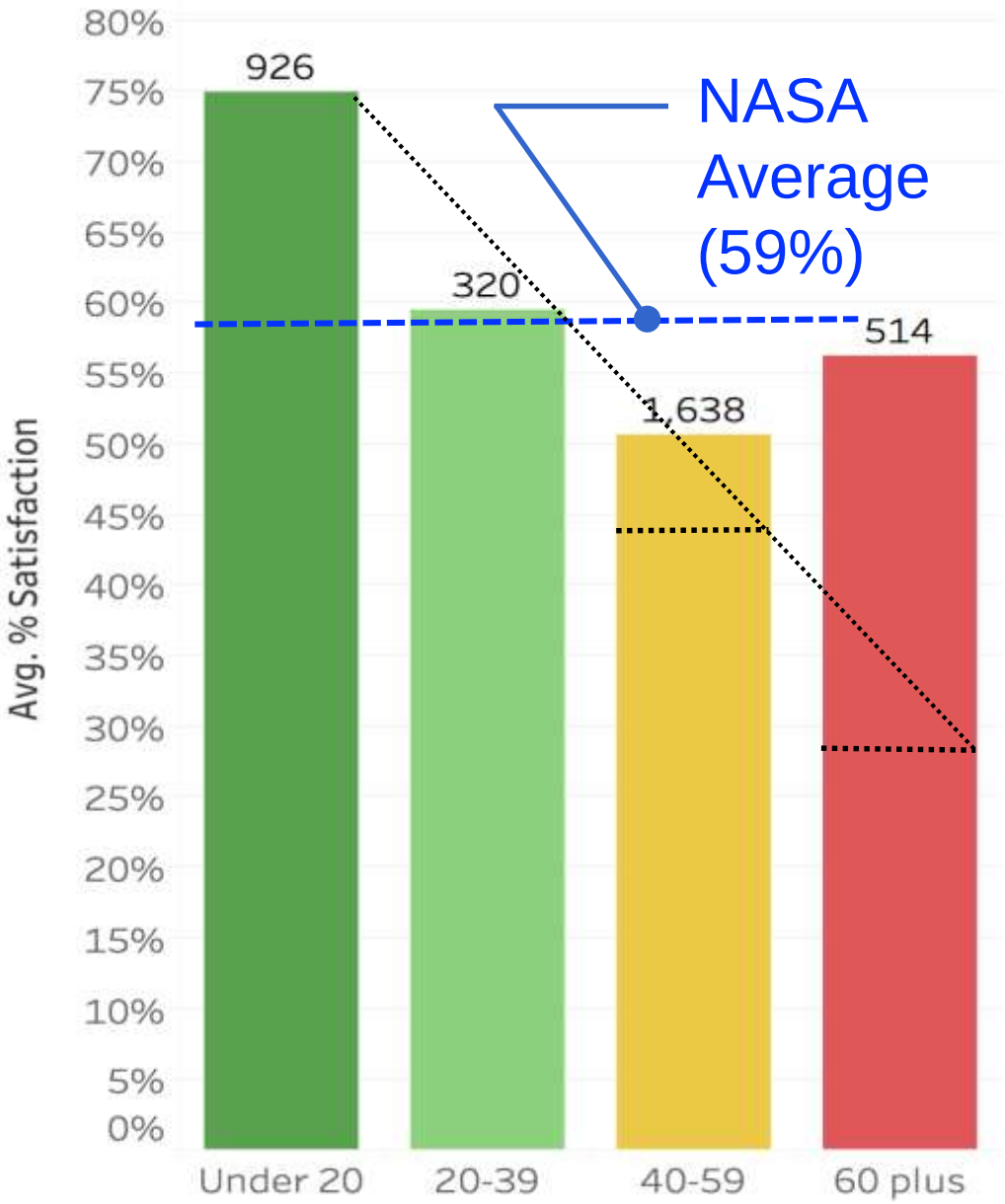
2016 Data

Occupant satisfaction in LEED-certified buildings exceeds other similar-age buildings (less-than-satisfactory responses > 25% greater for these).

Insight

Corroborates that striving for sustainable buildings has a positive impact on occupants

Satisfaction and Building Obsolescence



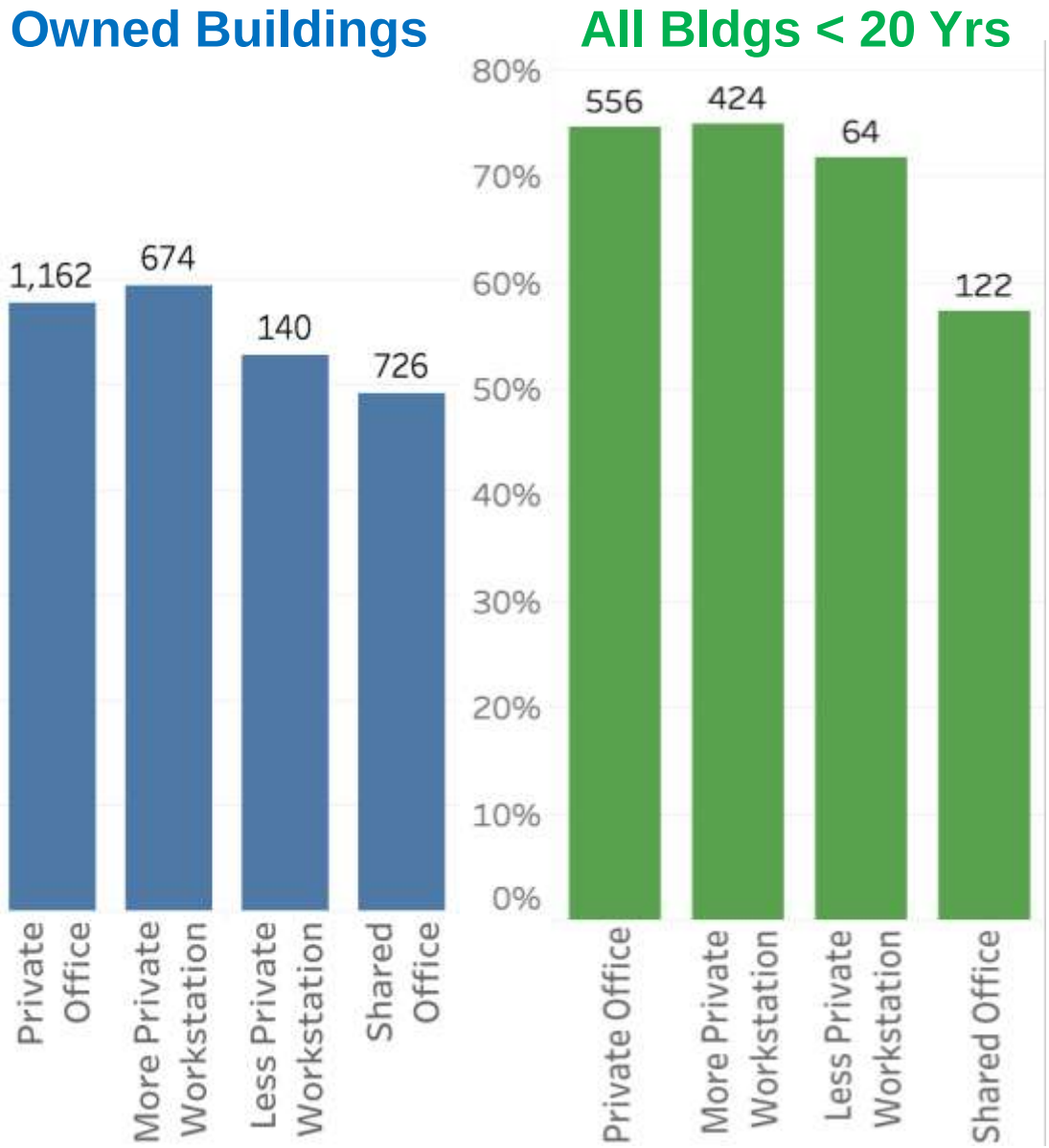
2016 Data

Employees in NASA's owned buildings from the past 20 years rate their workspace far better than those in older buildings.

Insight

Corroborates that relying on many older NASA buildings may already impede occupant productivity

Satisfaction and Workspace Configuration



2016 Data

NASA employees rate open systems workstations as well as private offices.

Insight

Survey responses do not confirm that private offices are more satisfying than open workstations!