# Communicating facility limitations: Lab design and beyond

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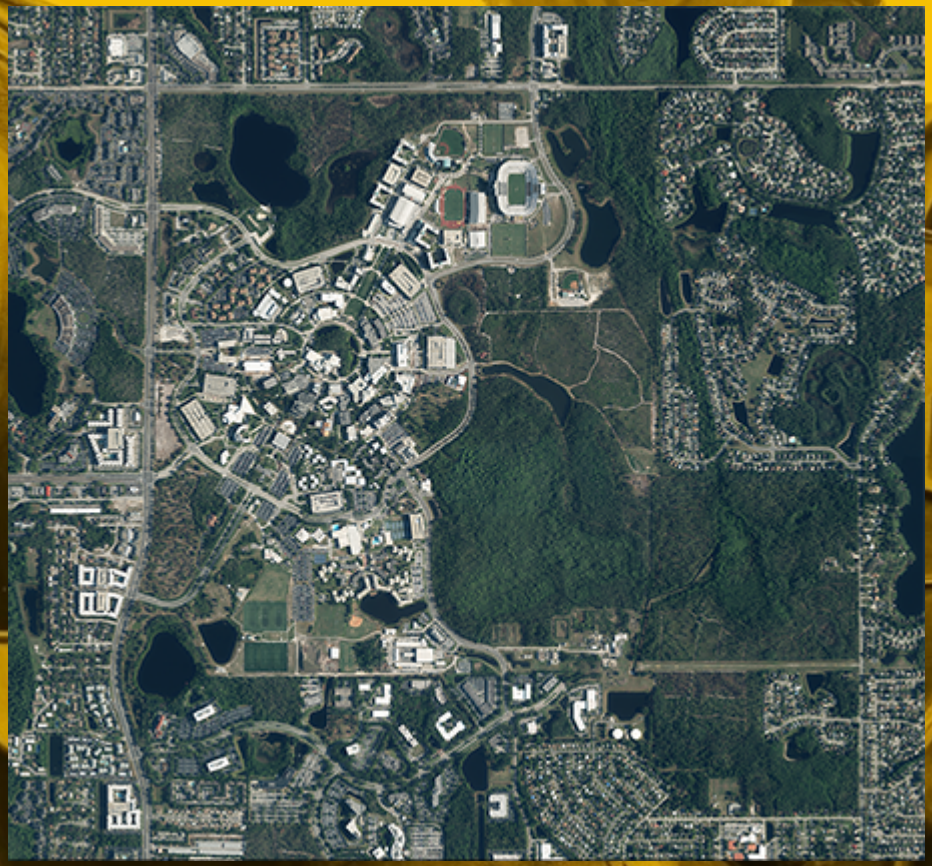
UCF

# A little bit about UCF…




ESTABLISHED
1963
FIRST CLASSES
1968
In 1968, UCF had 15 structures on Main Campus.
Today, UCF operates or manages 309 facilities in more than 25 locations; a semiconductor fab facility in Kissimmee (BRIDG), and Arecibo Observatory in Puerto Rico.
January 2019
Data source: UCF Fact Book and 2018-2019 Common Data Set
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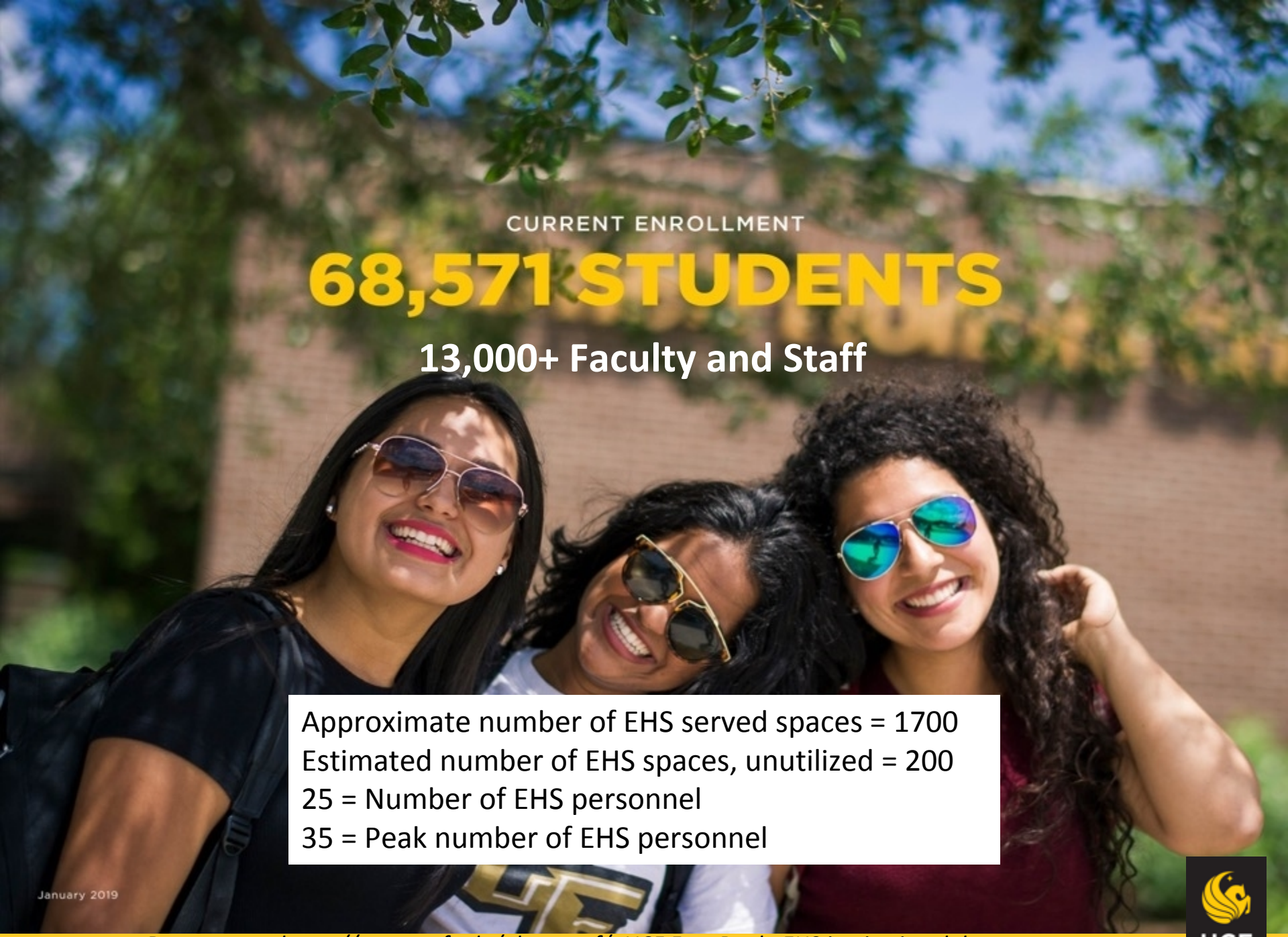


Approximate number of EHS served spaces = 1700
Estimated number of EHS spaces, unutilized = 200
25 = Number of EHS personnel
35 = Peak number of EHS personnel

*Data source: https://www.ucf.edu/about-ucf/; UCF Fact Book; EHS institutional data*

Deciphering the rules and regulations that govern space use can be overwhelming. As researchers and staff travel to new institutions or different states, it is often difficult to anticipate what activities are allowable.

To encourage safe practices, reduce frustration, and eliminate perceived research hurdles at the University of Central Florida (UCF), the Department of Environmental Health and Safety (EHS) has implemented a new tool to communicate space and infrastructure limitations. Additionally, in partnership with UCF Space Planning, Analysis, and Administration (SPAA), EHS has begun to develop common language descriptions for space and engineering controls to allow informed decisions about assignment and use of available space.

# Project

- Background
- Building Assessments
- Institutional Common Language
- Future
  - Communicating to other campus stakeholders


# 50+ years of growth

… renovations and technological advancement.

# UCF opened in 1968…

Between 1968 and 1974, when some of UCF's laboratories were constructed, Florida Building Code was not well defined.

- Many of UCF's buildings during this time period were built to Standard Building Code (SBC)
  - Southern Building Code Congress International (SBCCI)
  - The last SBC was published in 1999
- In 1974, Florida adopted a state minimum building code. Local governments could choose from four model codes, amend codes, and enforce local codes as desired.

# Statewide Standards

In response to events stemming from Hurricane Andrew (August 24,1992), and record insurance losses, a more regulated Florida Building Code was enacted by the Florida Legislature in 1998.

This revised code became effective on March 1, 2002.

- In Florida, NFPA standards were incorporated into code in the 1980s.

# UCF Construction Standards

Prior to creation of in-house standards, UCF followed Florida Board of Regent's guidelines.

For the past ten years, UCF has published a guiding document:

- *UCF Design, Construction, and Renovation Standards*
  - The standards are evaluated and revised regularly through committee and stakeholder recommendations.

# What does that mean at UCF?

| New Structures Built | Date of Construction |
|---|---|
| 24 | 1974 and before |
| 158 | Between 1975 and 2002 |
| 52 | From 2003 to 2010 |
| 42 | After 2010 |
| **309+** | **TOTAL** |

| New Structures with Hazardous Material/Process/Waste | Date of Construction |
|---|---|
| 9 | 1974 and before |
| 45 | Between 1975 and 2002 |
| 22 | From 2003 to 2010 |
| 13 | After 2010 |
| **Approx. 90** | **TOTAL** |

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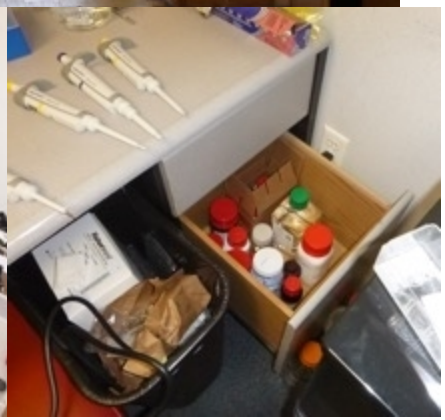
# What prompted this project?

## Repurposing of spaces



## Incidents and Accidents

*Sources: Univ. of Kentucky presentation, UCF EHS Inspections, and Honolulu FD photos from March 2016*

# New Technology and Growth


*Sources: Glowforge, MakerBot, UCF BRIDG Fab Facility, and Arecibo*

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# Facility Design Limits

# Recognizing Deficiencies

In addition to annual State Fire Marshal inspections, a robust EHS inspection program was established in 2011.

Through two years of this process, UCF developed a list of facilities that had significant issues with current code compliance. Including:

- Electrical outlets near water (inadequate GFI)
- Needed laser barriers, hazard signs, and warning lighting
- Distance of travel to emergency equipment
  - Eye wash and emergency shower
  - Egress
- Ventilation required (for current use)

Some issues are easy to document and fix (GFI, laser barriers and additional signage), while others require relocation of processes, significant engineering and funding.

# As codes and standards evolve

**What was once installed…**

**… must be retrofitted**

*Source: UCF EHS Inspections*

# Facilities – Status Check

In 2013, based upon items identified during lab inspections, an engineering assessment of buildings deemed “high-risk” was undertaken to determine code compliance of construction and renovations.

- For some early buildings, design documents do not clearly specify which codes or standards were used as a guide for construction.
- An absence of digital plans makes verification of structural changes and renovations time-consuming.

To eliminate bias, an independent third party was hired for this project. The firm chosen also helped to accelerate prioritization of renovation needs and determination of project costs.

# Improving Institutional Knowledge

- An engineering firm was chosen to assist UCF with the physical surveys of research and teaching laboratories
- After a first pass through one building, the assessment criteria was adjusted to achieve the desired answers
- To determine how to best proceed with capital expenditures, the firm was asked to compare the facilities to:
  - “As built” information from the design plans
  - Current codes:
    - FBC and NFPA
      - including control zone designation and chemical storage
    - Ventilation (NFPA and ASHRAE 110)

# Maintaining Institutional Knowledge

- The outcome of the study generated full reports for three buildings:
  - Digital plans including cabinetry and outlets
  - A spreadsheet was developed that tabulated information about known laboratory spaces, including:
    - Control area (as built)
    - Flooring material
    - NFPA classification as constructed per design
    - NFPA 45 2015 classification
      - as used and constructed
- The fields in the spreadsheet were to become a required dataset for all new laboratory construction

At the same time,

# Lessons were learned…

In newly occupied facilities, spills and wear from processes result in damaged lab flooring and costly repairs.

UCF EHS and FP&C collaborated to develop more robust flooring standards for areas with hazardous materials or processes. (2016)

*Source: UCF EHS Inspections*

# Update of UCF Standards

## Language was incorporated into the standards to define:

**High Hazard Area Flooring (General Laboratory, Shop and Hazardous Liquid Storage and Use Area Flooring)**

1. Flooring must be non-pervious, one piece, and liquid tight, with covings or equivalent methods to ensure spills cannot seep underneath adjacent walls and cabinetry. This can be achieved by use of epoxy-coated concrete slab, linoleum, or sealed/treated concrete. Flooring must meet or exceed ASTM F 925 for the materials commonly used in proposed research space. Carpet, tiles (including VCT) and plank materials are not acceptable. All flooring penetrations for the area must be sealed to prevent spills from seeping to the floors below.
2. Areas with heavy equipment require flooring that can withstand the load without damage, penetration, or indentation.
3. BSL3 labs require monolithic, non-pervious floors that are easily decontaminated.
4. Areas with cryogen use (dewars, magnetic facilities, etc.), washrooms that contain sterilization facilities, high-temperature equipment areas, and/or welding, brazing, or glass-blowing activities must be able to withstand extreme temperatures without damage.

**LEVEL A - LABORATORIES**

**Acoustical Ceilings**

Ceiling designs with acoustic ceiling tile sizes other than 24" x 24" must be approved by the Director of Facilities Planning and Construction.

**Concrete Flooring**

1. Painted concrete is prohibited.
2. Flooring must be non-pervious, one piece, and liquid tight, with covings or equivalent methods to ensure spills cannot seep underneath adjacent walls and cabinetry. This can be achieved by use of an epoxy-coated concrete slab, linoleum, or sealed/treated concrete. Flooring must meet or exceed ASTM F 925 for materials commonly used in proposed research space.

**Carpeting**

Carpet, tiles (including VCT), and plank materials are prohibited.

**Painting and Coating**

All flooring penetrations for the area must be sealed to prevent spills from seeping to the floors below. Flooring choices must be reviewed by UCF Environmental Health & Safety (EH&S) for approval. Areas with heavy equipment require flooring that can withstand equipment load without damage, penetration, or indentation. High hazard area flooring: BSL3 labs require monolithic, nonpervious floors that are easily decontaminated. Areas with cryogen use (dewars, magnetic facilities, etc.), washrooms that contain sterilization facilities, high-temperature equipment areas, and/or welding, brazing, and glass-blowing activities must be able to withstand the extreme temperatures without damage.

# UCF Lab Flooring

Flooring must now meet or exceed ASTM F 925

Two different grades of epoxy floor are prescribed to meet projected space use (and growth):

- Type 1 for general laboratory
- Type 2 for more severe chemical use labs
  - Applies to all rooms with fume hoods
  - An industrial-type flooring utilizing Type 1 as a substrate and a second layer that increases chemical resistance

# Status of Findings

With information from studies of 3 core scientific buildings, UCF has:

- Completed some renovations during scheduled maintenance activities, including:
  - HVAC retrofit included change of lab ventilation from return-air plenum to single-pass air
  - Replacement of fume hoods and air-handling fans no longer operating to specifications
- As new spaces were built, relocation of faculty to suitable research spaces

EHS and FP&C are regrouping to document which findings have been addressed through renovation projects or relocation of process

# Common Language

# Language Differences

- Facilities Design
  - Florida Building Code, NFPA, UCF Standards
- Environmental Health and Safety
  - NFPA, AIHA, OSHA, ASRAE
- Institutional
  - U.S. Department of Education
    - Facilities Inventory and Classification Manual (FICM)

      U.S. Department of Education, National Center for Education Statistics. (2006). *Postsecondary Education Facilities Inventory and Classification Manual (FICM): 2006 Edition* (NCES 2006-160). U.S. Department of Education. Washington, DC: National Center for Education Statistics.
- Colloquial

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# Meaning and Definitions

## "Is this room a lab?"

| Facilities Design | Environmental Health and Safety | Institutional | Colloquial |
|---|---|---|---|
| FBC, NFPA, UCF Standards | NFPA, AIHA, OSHA, ASHRAE | FICM | Hiring |
| Does it meet codes and standards? | Does it meet safety needs for processes? | Is this teaching or research? | Which rooms are unoccupied/ underutilized? |
| Construction and Code Compliance | What activities and materials are going to be used?<br><br>Teaching, Research, Lab, Shop, Studio, Clinical, Maintenance, etc. | What is the educational mission of the room? | What type of work does the PI perform? Are any of those rooms available? |

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# What are the room use types?

- NFPA 45 (class A, B, C, D), NFPA 55
  - Negative pressure spaces
- NFPA 318 (class 100, 1000, etc.)
  - Positive pressure spaces
- FICM Facilities Classifications
  - 100 Classroom
  - 200 Laboratory
    - Including Class, Open, Research/Nonclass
  - 300 Office
  - 500 Special Use
    - Such as clinic, field building, animal facilities, greenhouse
  - 700 Support
    - Shop, Vehicle, Hazardous Materials Storage

# Comparison of data

- UCF EHS inspection findings and hazardous materials inventory are recorded in a database
  - Each room inspected, or found during inspection, is added to the database
  - Originally, EHS used FICM codes, but that became problematic
- SPAA has a separate database (Archibus) that lists all buildings/rooms occupied by UCF and includes the FICM codes
  - In this dataset, computer labs and language labs are also listed as labs
  - Incidental testing and use (instrument labs) are also labs

# Creating Definitions

Spaces with hazardous materials or processes can include:

- NFPA 45 labs, compliant with current code
- Labs designed with unknown code
- Cleanrooms and other positive pressure lab spaces
- Incidental testing spaces
  - with and without fume hoods and/or EWES
- Mechanical chases
- Shops with dust collection
- Shops with fume ventilation
  - photo processing, print making, machine shops
- Garages (including engine test facilities)
- Outbuildings
  - With and without approved chemical storage

# Combining Information

- One challenge has been finding a suitable space in the SPAA database to record the newly created definitions.
  - The FICM codes must be maintained for institutional reporting purposes
  - The newly created codes will be used for space programming
- Positioning in the database will occur after SPAA returns from the Archibus Conference in April 2019. Possibilities:
  - Dropdown below FICM codes
  - Unused field that can be used to hold a numerical code that refers to construction types

# Communicating to Stakeholders

# Next Steps:

Upon completion of the EHS and SPAA institutional language effort:

- Facility use limitations will be communicated to space users
  - PI's responsible for activities should know space capabilities
    - Anticipate that processes will require additional funding
  - Deans and Chairs should be aware of all assigned space to guide informed faculty assignments and acquisition of new equipment

Scale x Excellence = Impact

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# What to communicate:

- To faculty:
  - Hazardous materials approved for use and storage
    - Storage limits (flammable liquids/solids; toxic gases, etc.)
  - Ventilation
    - Air changes per hour, fume hood rates
    - Toxic gas storage
  - Building resources allocated
    - Power, Nitrogen, Air, Vacuum, etc.
  - Flooring and sanitary piping compatibilities (incompatibilities)
- To Deans and Chairs:
  - Summary of all spaces and buildings assigned

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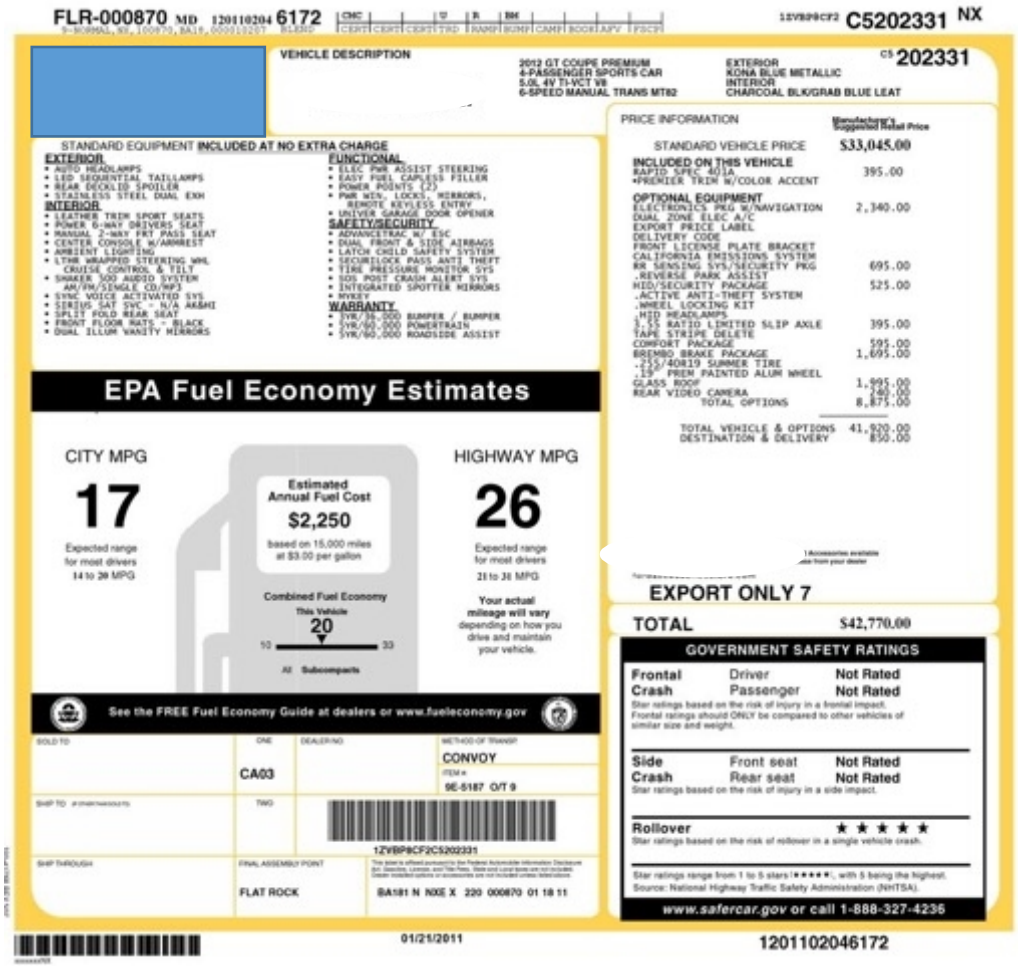
# Effective Data Communication

- Understandable
- Accessible
- Memorable
- Concise



# Thank you!

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