



People Helping People Build a Safer World™

Development and Implementation of Automated Code Compliance Checking



Energy Codes 2007

July 24 – 27 • Pittsburgh, Pennsylvania

SMARTcodes ™

David Conover

July 25, 2007



ICC

SMARTcodes ™

Project Goal

Automate code compliance checking for the I-Codes and Federal, state and locally adopted versions of those codes leading to....

.... enhanced communication, knowledge and collaboration

.... more complete code complying designs

.... more timely and accurate design acceptance and approval

.... improved building safety and performance

.... reduced construction costs

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 **INTERNATIONAL
CODE COUNCIL®**

Current Process

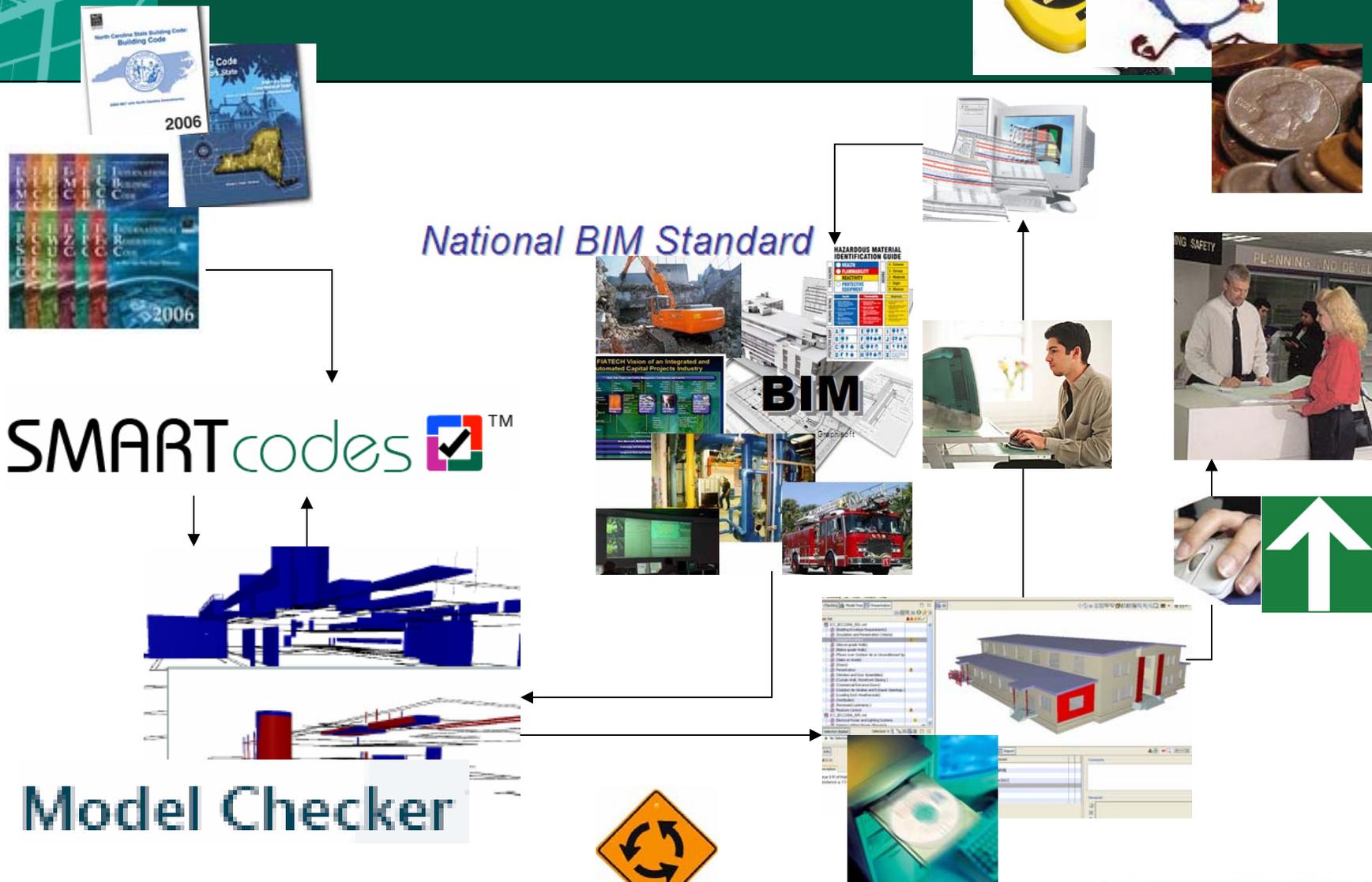
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16				
21	22	23				
28	29	30				



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Future Process



SMARTcodes 

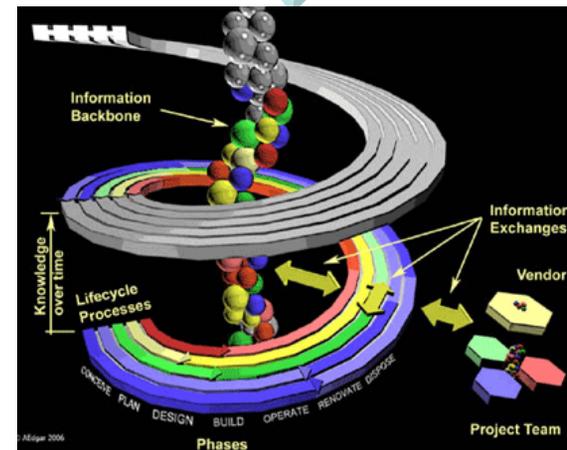
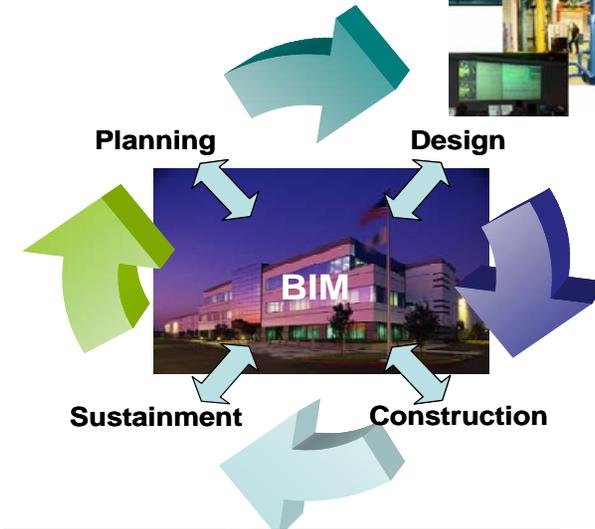
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Building Information Model



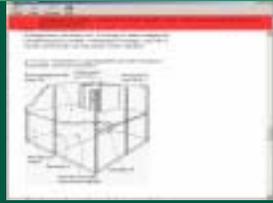
Physical and functional characteristics of a building (data) in digital format

- *... a shared knowledge source or database of intelligent information about a facility*
- *... stays with the building forever and is enhanced over time*
- *... can be seamlessly maintained and used by all*



Interoperability

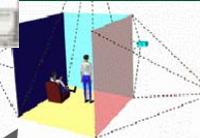
**Codes
Standards,
Regulations ...**



BIM software
Arch, Struct, Eng Services
Civ Eng



VRML
Visualisation
3D models



Knowledge databases
Company
External



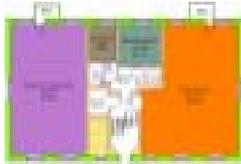
Functional description
Functions
Calculations
Requirements
Constraints



Reuse
Refurbishment
Demolition
Reconstruction



FM
Renting, sale and use
Maintenance
Warranty

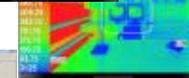
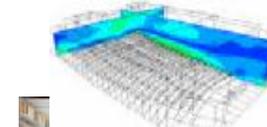
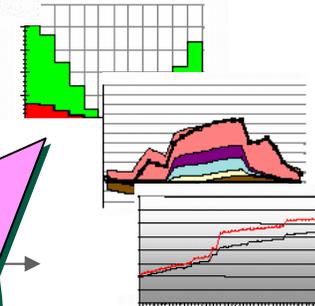


IFC

BIM

IFC

Simulation
Comfort
Air, heating
Lifecycle costs
Light and sound
Insulation
Use
Fire
Environmental impact
Life expectancy



Description
Inc cost estimates



4D
Schedules
Logistics



Sourcing
Product databases
Price databases

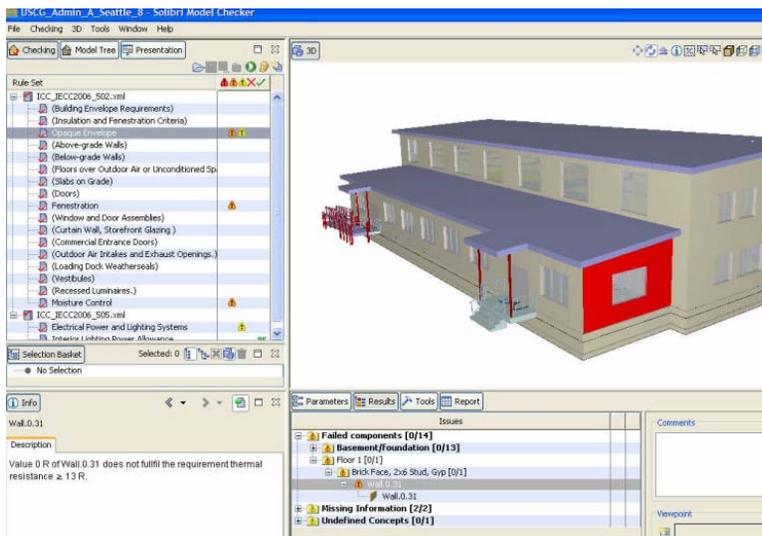


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Model Checking Software

Software tools that can read a BIM and provide any number of different types of output related to the building and its systems as represented in the BIM



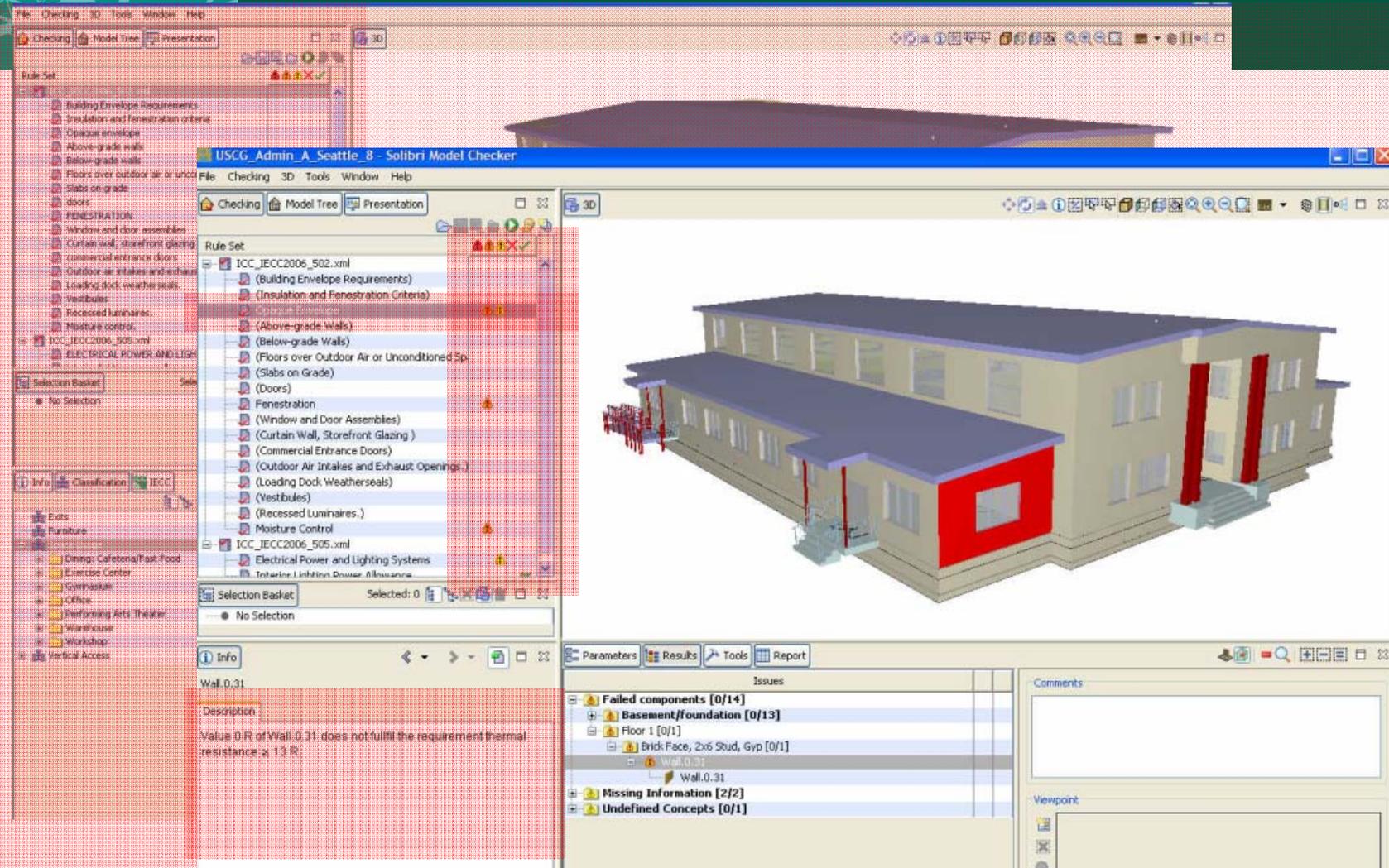
SMARTcodes  TM

Codes, rules and regulations in a format that allows them to be applied by model checking software to identify conflicts between the BIM and the codes, rules and regulations

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Automated Code Compliance Checking



Manual Code Search



Envelope Components

Check all components that apply to your building.

Roof

- Insulated entirely above deck
- Metal building
- Attic and other

Above grade walls (more than 15% above grade)

- Mass wall
 - Include the following in my SmartCode
 - ESR-1525 Evaluation Subject: CELBLOX Insulating Concrete Forms (ICFs)
 - ASTM C 90: Standard Specification for Loadbearing Concrete Masonry Units
 - ICC Code commentary section 502.2.3 Above-grade wa
- Metal building
- Metal framed 2 of 4 documents selected
- Wood framed and other
- Below grade walls (at least 85% below grade)

Floor

- Mass floor

Code preview
Table 502.2(1) Building Envelope Requirements: Opaque Assemblies


Certified Products Directory Search
<< Back

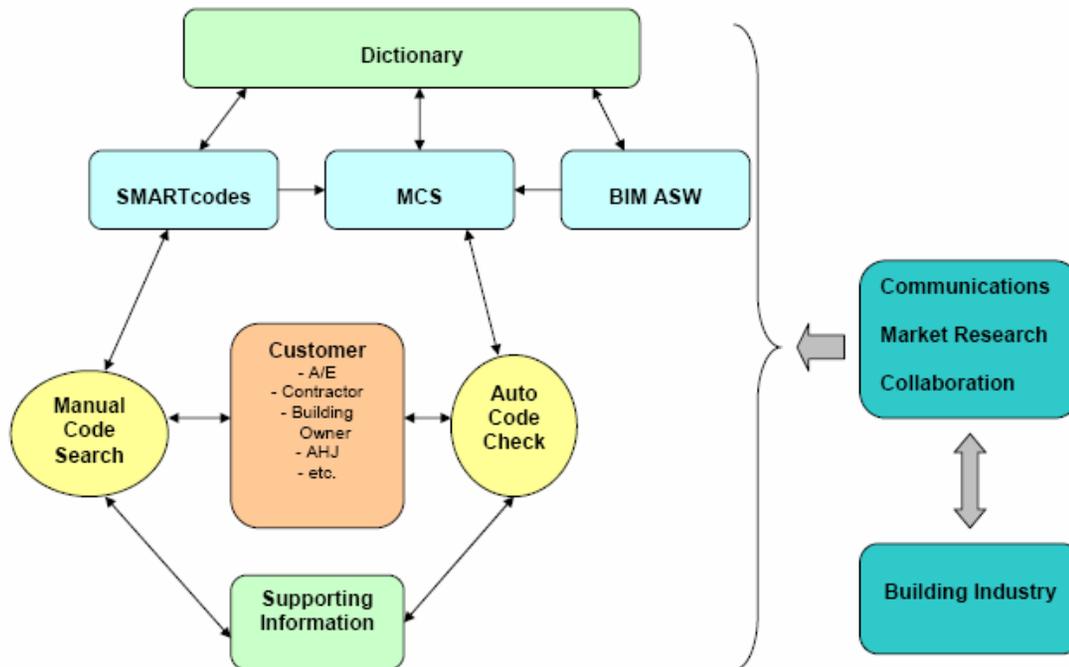
Manufacturer: Advanced Glazing Systems, LLC

Window Manufacturer	Model Number	Framing	U-factor	SHGC
Advanced Glazing Systems, LLC	102-CWU Curtain Wall	Aluminum	0.50	0.40
Advanced Glazing Systems, LLC	102-CWU Window Wall	Aluminum	0.50	0.40
Harmon, Inc.	502-SUU Curtain Wall	Aluminum	0.50	0.45
Metric Metals	112-TWA Curtain Wall	Aluminum	0.60	0.40

[More >>](#)

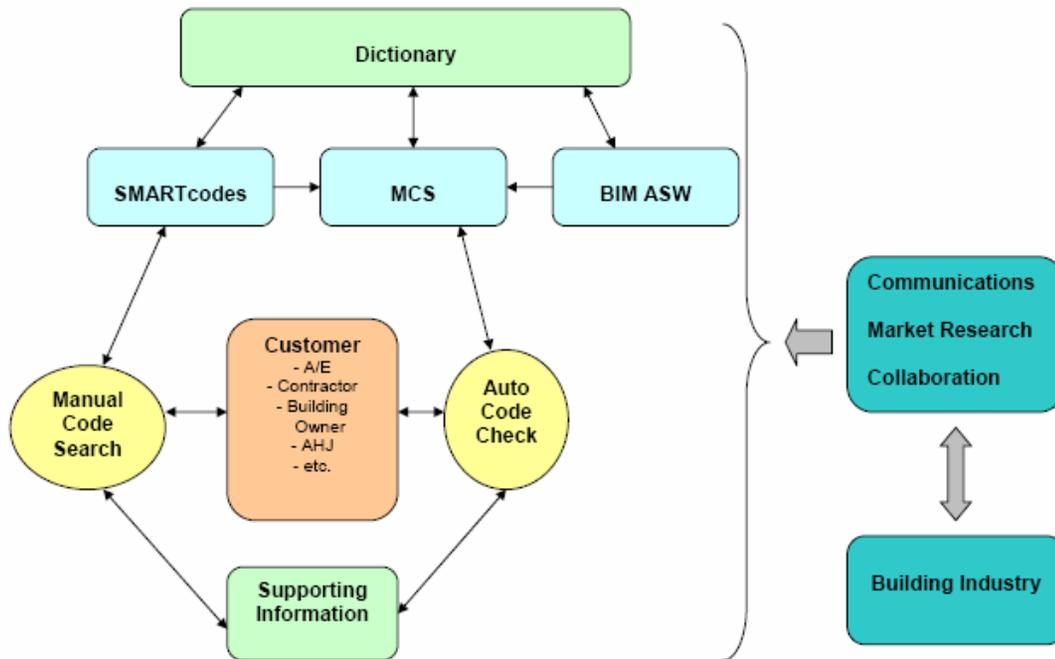
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buildingSMART
Next >>

Project Overview



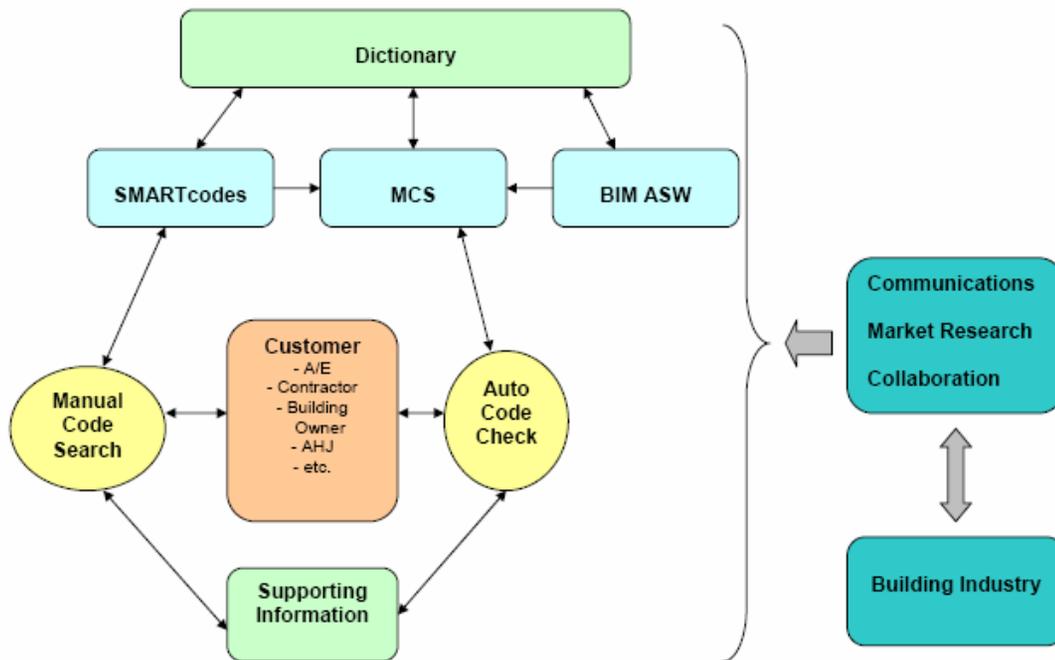
- Dictionary – details associated with terms, properties and values that provide a basis for communication between SMARTcodes, MCS and BIM
- SMARTcodes – A process and software for making codes and other criteria “smart”
- MCS and BIM ASW – Availability of software that can apply SMARTcodes and can provide for “code checkable” BIMs

Project Overview



- **BIM Gallery – Availability of BIMs for real buildings for demonstration and testing/validation purposes**
- **Manual Code Search – Ability to address code questions directly in the absence of a BIM**
- **Data Drill Down – Availability of information relevant to the application of the codes**

Project Overview



- **Communications – Outreach to and a pipeline for input from the building industry**
- **Market Research – Facilitating market access to and use of SMARTcodes**
- **Collaboration – Identification of and collaboration with relevant stakeholders, organizations and interested parties**

ICC Achievements to Date

- ✓ *SMARTcodes builder (Windows based software to facilitate creation of SMARTcodes) - beta version complete and tested*
- ✓ *SMARTcodes protocol (instructions for making any document “smart”) - completed and validated*
- ✓ *IECC dictionary (terms, objects, properties critical for MCS, BIM and SC communication) - completed*
- ✓ *IECC SMARTcodes (key ICC IP) - drafted and “plug and play” with different MCS validated*

ICC Achievements to Date

- ✓ ***Successful collaboration with two MCS (critical to successful auto code checking) for their application and use of SMARTcodes***
- ✓ ***Communications with three BIM ASW companies (critical to successful auto code checking) and building relationships with them***
- ✓ ***Availability of multiple BIMs for application and use in demonstrations and testing***
- ✓ ***Enhanced communications and outreach – multiple articles, press coverage, presentations at national, state and local meetings***

ICC Achievements to Date

- ✓ *New efforts with administrative software entities – potential key portal to auto code checking through state and local plan review and permit management software*
- ✓ *SMARTcodes task group – continuing monthly web meetings with staff from federal, state and local agencies to guide the project*
- ✓ *Market research initiated – key to identifying customer/user interest and address making SMARTcodes available for use*



ICC Achievements to Date

- ✓ ***Collaboration – continuing and enhancing relationships with organizations and initiatives critical to project success***
- ✓ ***Project management – coordinated and effective project team implementing dynamic project management plan***

Key Short-Term Goals

- *Enhanced online live demonstration of auto code checking with multiple buildings and model checkers for IECC application throughout the US and beta test of manual code search and data drill down for IECC – 8/31*
- *Final SMARTcode builder and protocol and validate acceptability – 9/30*
- *Initiate work on other SMARTcodes and federal, state and local amendments to ICC Codes – 10/31*

Questions, Suggestions or Comments?

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