

**National Institute of Standards and Technology (NIST)  
in cooperation with  
Centrum dopravního výzkumu, v.v.i. (CDV)**

**Workshop on Intelligent Transportation Systems (ITS)**

**Prague, Czech Republic  
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# **ITS Equipment Standards in the United States**

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***PILLAR* CONSULTING, INC**

# ITS Equipment Standards in the United States

**NEMA TS 2 Standard**

**NEMA TS 4 Standard**

**ATC Standards**

## **NEMA TS 2 Standard 2003 (1998, 1992)**

- **Designed for safety and reduced liability**
- **Defines the minimum hardware and functional characteristics for traffic controllers**
- **Hardware requirements for cabinet components**
- **Environmental and power requirements**
- **Interchangeability of cabinet components across vendors**
- **Shelf mounted**

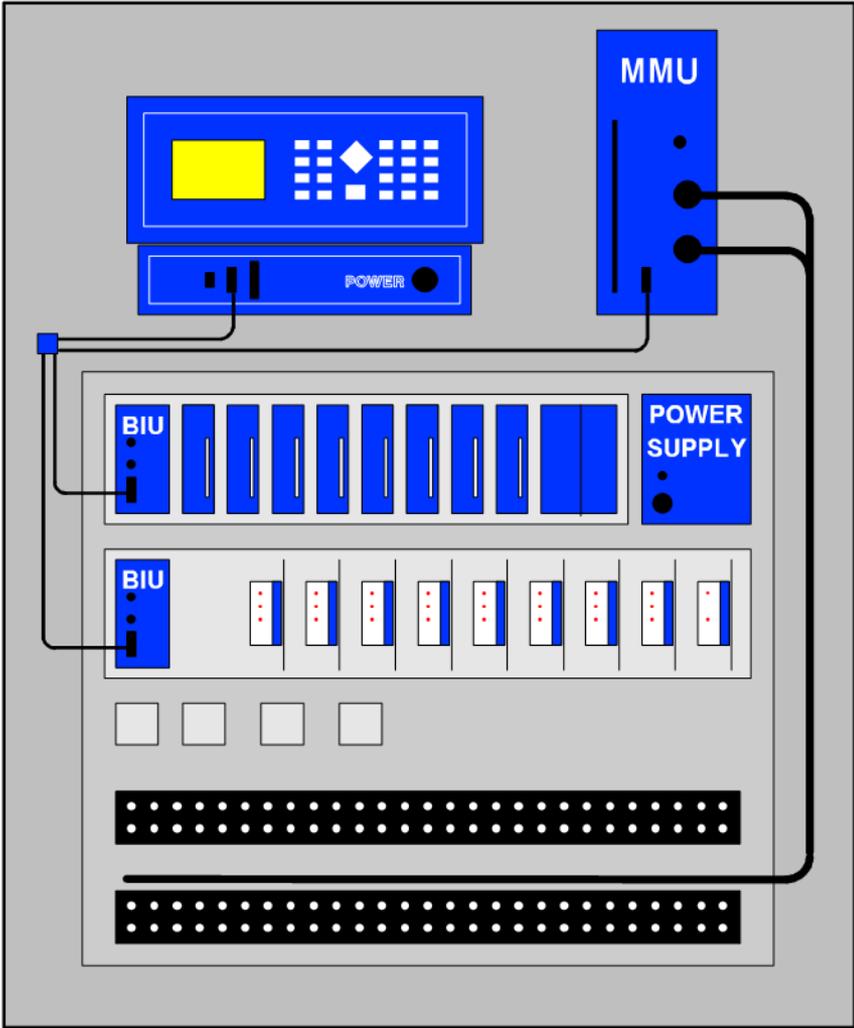
## **NEMA TS 2 Standard 2003 (1998, 1992)**

- **Synchronous Data Link Control (SDLC) serial data communications between cabinet components**
- **National Transportation Communications for ITS Protocol (NTCIP) requirements**
- **Migration options for users of TS 1 Standard**
- **Variety of cabinet dimensions**
- **Historically, controller software provided by traffic controller manufacturer**

# NEMA TS 2 Cabinet Components

- **Traffic Controller**
- **Malfunction Management Unit (MMU)**
- **Bus Interface Unit (BIU)**
  - **Terminals & Facilities BIUs**
  - **Detectors BIUs**
- **Power Supply**
- **Loop Detectors**
- **Load Switches**

# TS 2 Type 1 Cabinet Architecture



# NEMA TS 2 Type 1 Cabinet



# ITS Equipment Standards in the United States

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## NEMA TS 4 Standard

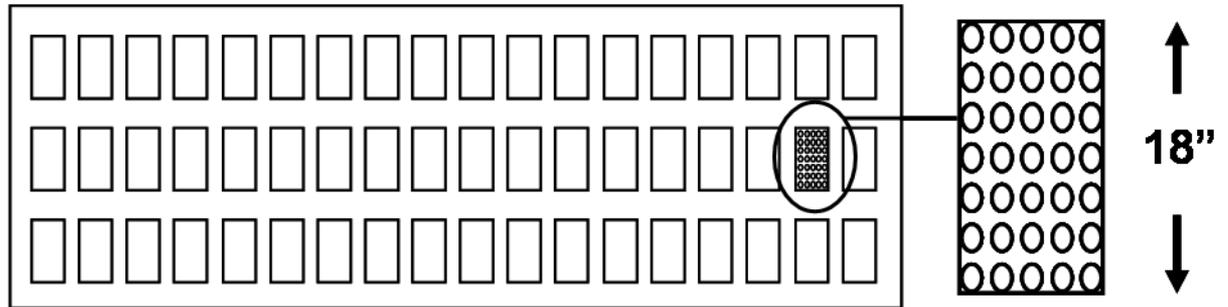
- Provides safe, dependable, functional and easily maintained Dynamic Message Sign (DMS) equipment
- Defines the minimum hardware and functional characteristics of DMSs
- Mandatory and optional conformance requirements
- Focus on existing technologies currently in use

# NEMA TS 4 Standard

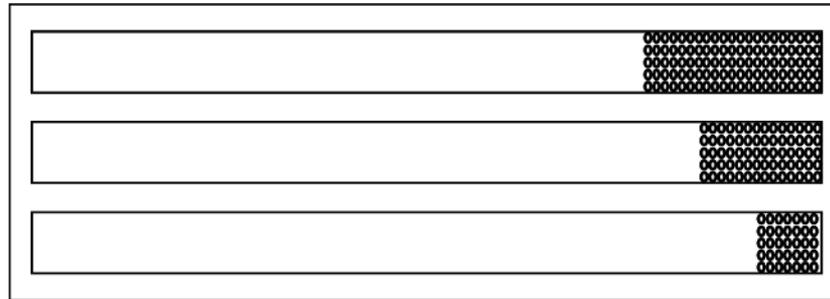
- **Predominantly addresses Variable Message Signs (VMS)**
  - **Character Matrix Signs**
  - **Line Matrix Signs**
  - **Full Matrix Signs**
- **Changeable Message Signs (CMS) and Blankout Signs (BOS) to be addressed in future versions**

# Types of VMS Sign Displays

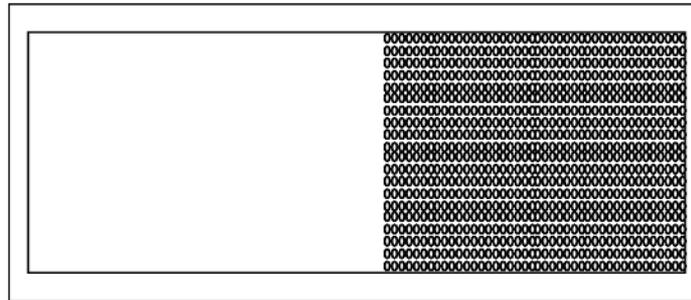
**Character  
Matrix  
Sign**



**Line  
Matrix  
Sign**



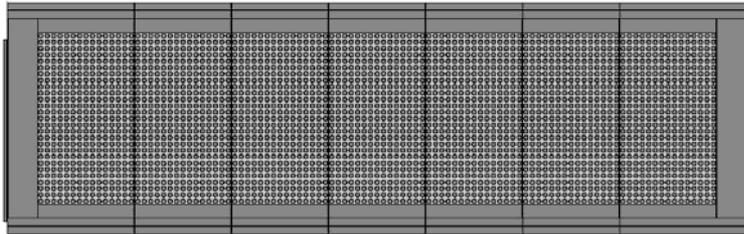
**Full  
Matrix  
Sign**



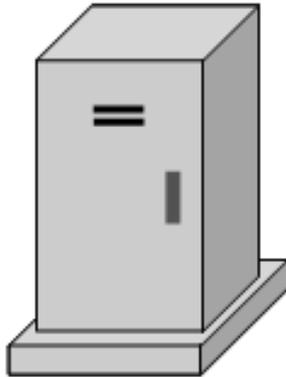
# NEMA TS 4 Standard Requirements

- **Environmental**
- **Mechanical Construction**
- **Controller/Sign Interface**
- **Display Properties**
- **Optical Components**
- **DMS Controller Cabinet**
- **Electronics & Electrical**
- **Performance Monitoring**
- **Power**
- **Conformance**
- **Documentation**

# Major Units of DMS Equipment



- **Display Module**
- **Drivers**
- **Environmental Sensors and Controls**
- **Power Supplies**



- **Sign Controller**
- **Communications Module**
- **Environmental Sensors and Controls**
- **Power Supplies**

# Variable Message Signs



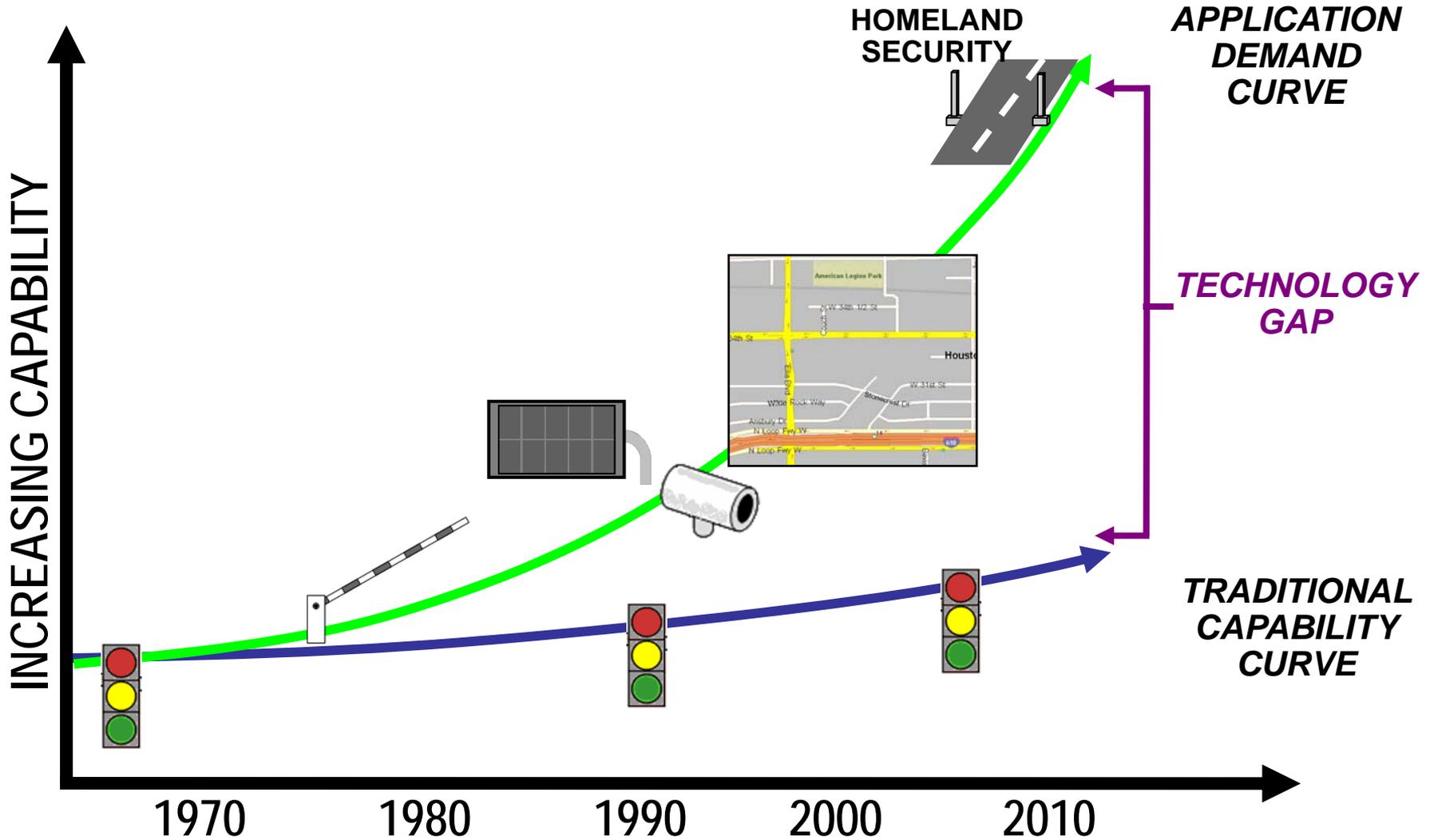
# ITS Equipment Standards in the United States

**NEMA TS 2 Standard**

**NEMA TS 4 Standard**

**ATC Standards**

# ATC Standards



# ATC Standards

- **ATC Joint Committee oversight group made up of SDO representatives**
  - **ITE**
  - **NEMA**
  - **AASHTO**
- **Working groups to create and maintain standards**
  - **Cabinet**
  - **Controller**
  - **API**

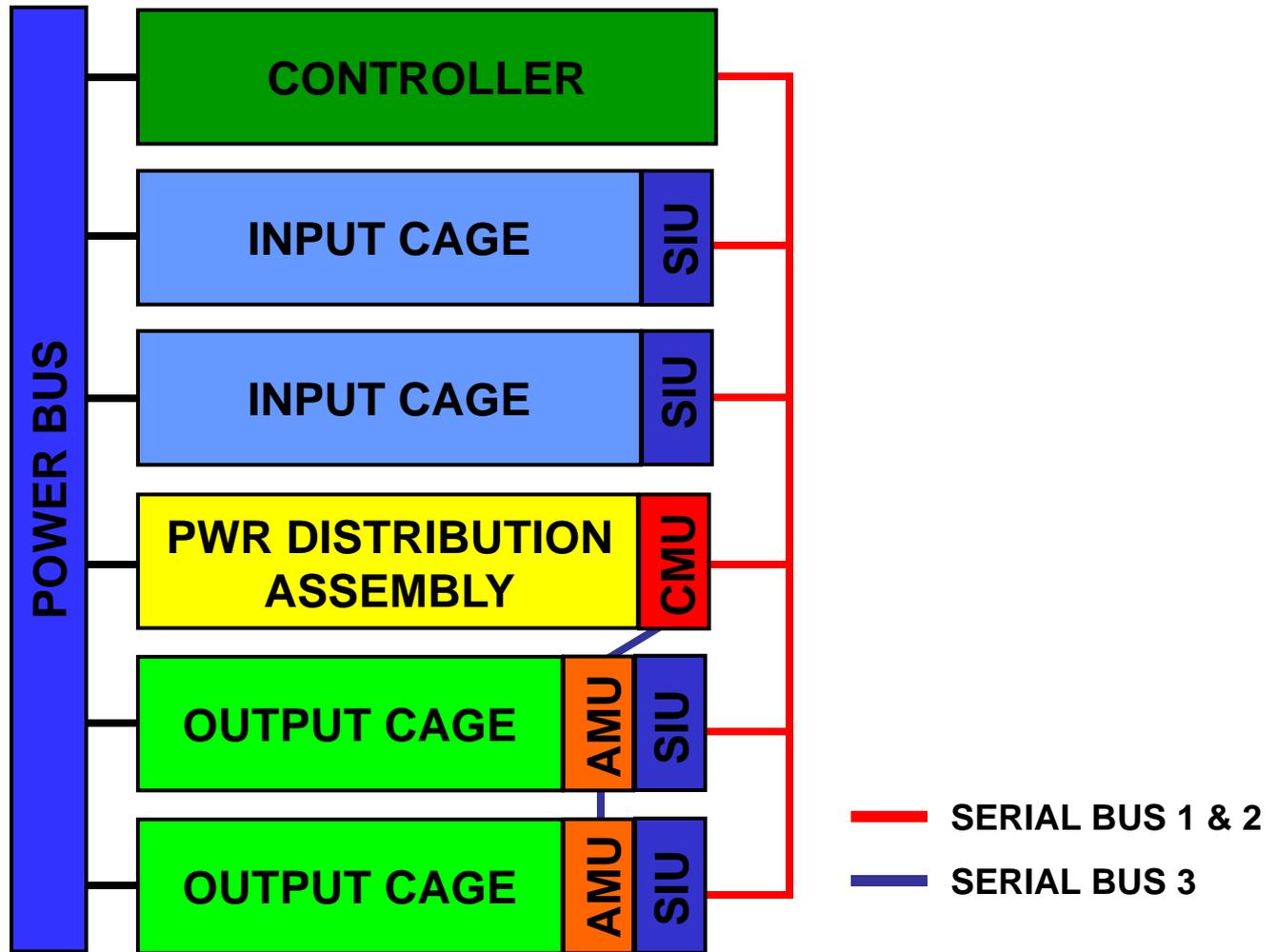
# ATC Standards

- **Open Architecture**
- **Modular**
- **Multi-process / Multi-application**
- **Grow with technology**
- **General purpose computing platform for the transportation community (“PC-like” concepts)**

# ATC Standards

- **Intelligent Transportation Systems (ITS) Cabinet Standard**
- **ATC Controller Standard**
- **ATC Application Programming Interface (API) Standard**

# ITS Cabinet Standard



# ITS Cabinet Standard



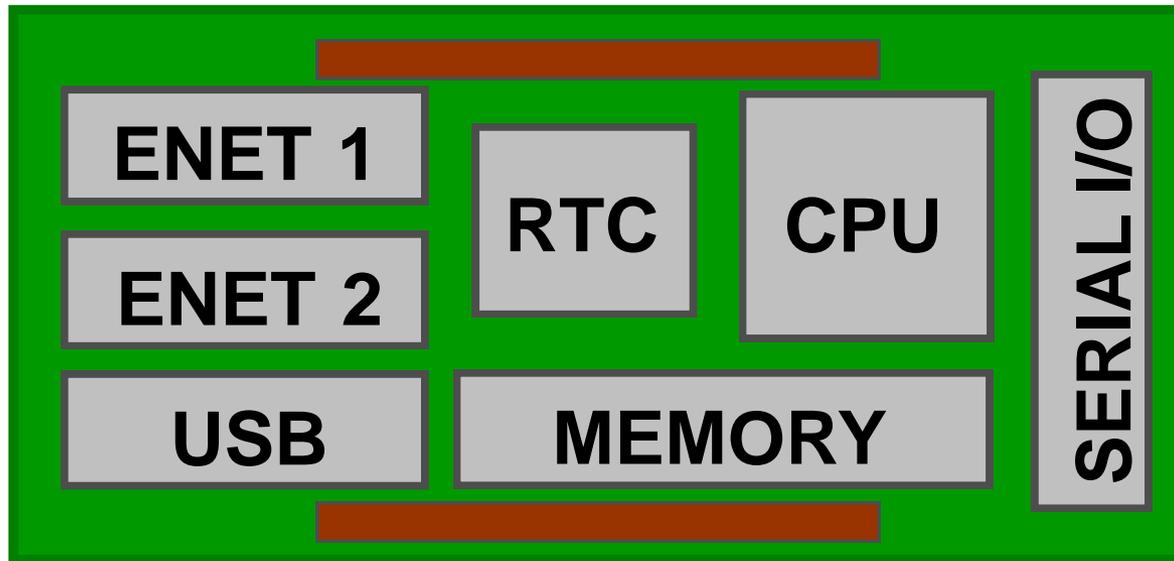
# ATC Controller Standard

- **ATC Controller Standard 5.2b centers around an “*engine board*” concept**
- **Computational capabilities that can grow with technology**
- **Must run Linux operating system**
- **Works with the ATC API software**

## ATC Controller Standard

- **Engine board is a building block for new ATC architectures**
- **Future controllers can be any size and shape**
- **Third party application software will run on ATC controllers regardless of manufacturer**
- **Multiple application programs will run simultaneously**

# ATC Controller Standard

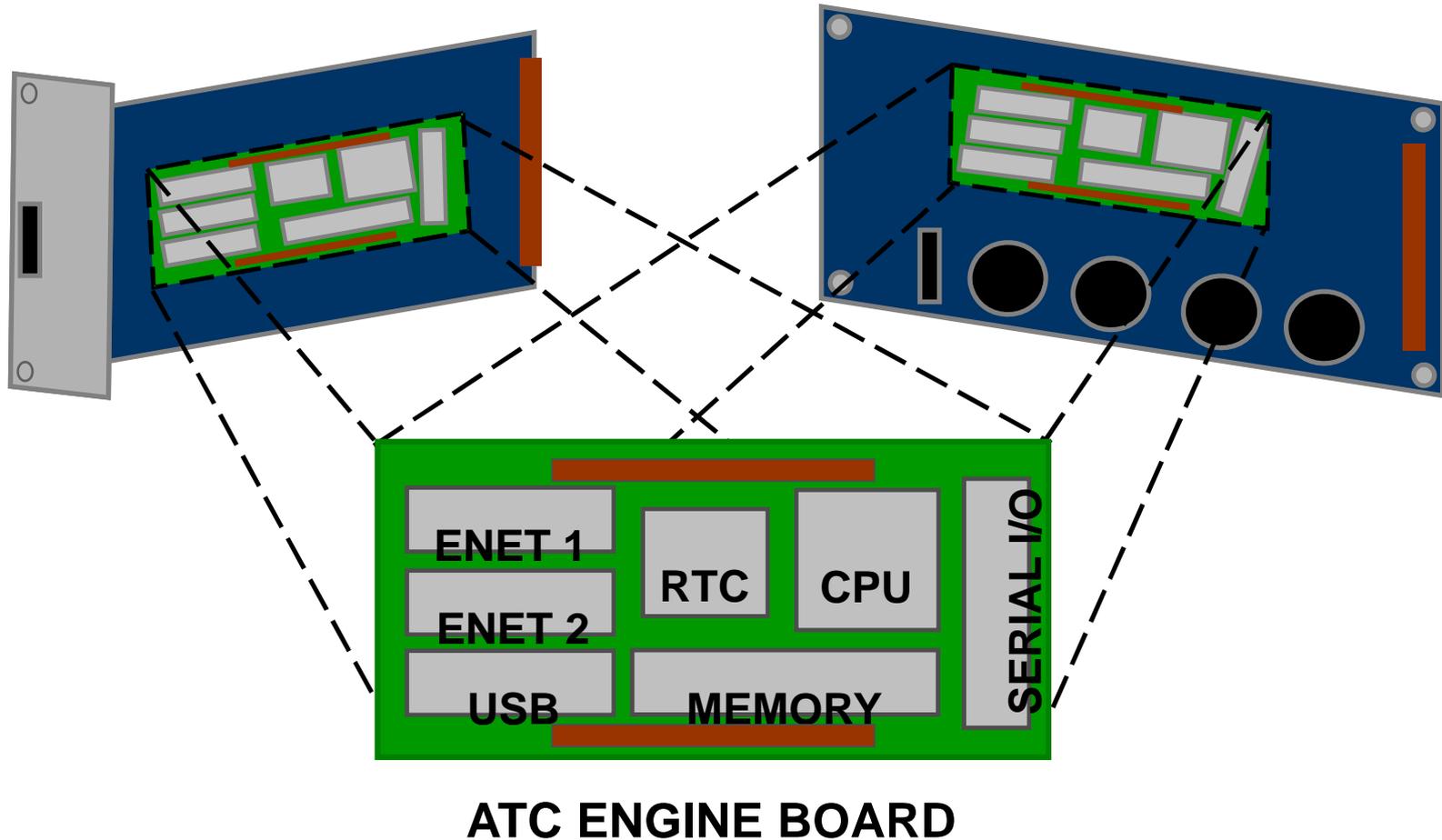


**ATC ENGINE BOARD**

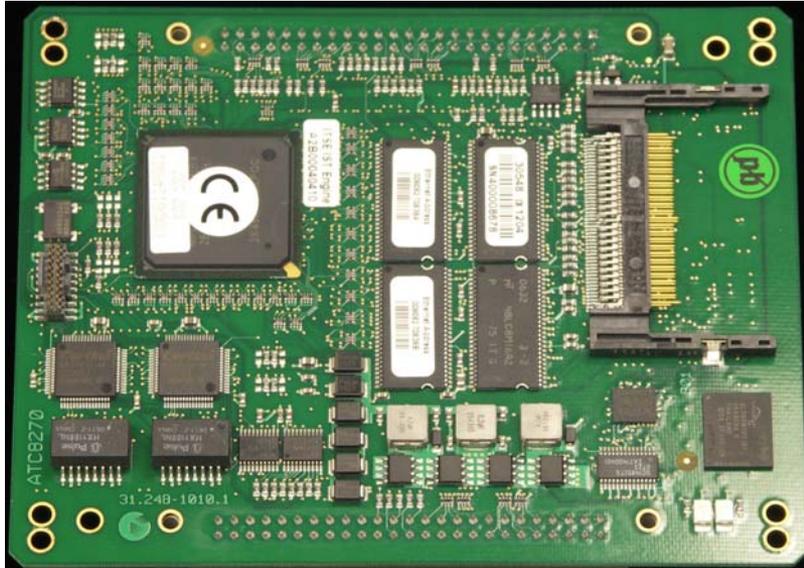
# ATC Controller Standard

2070 HOST MODULE

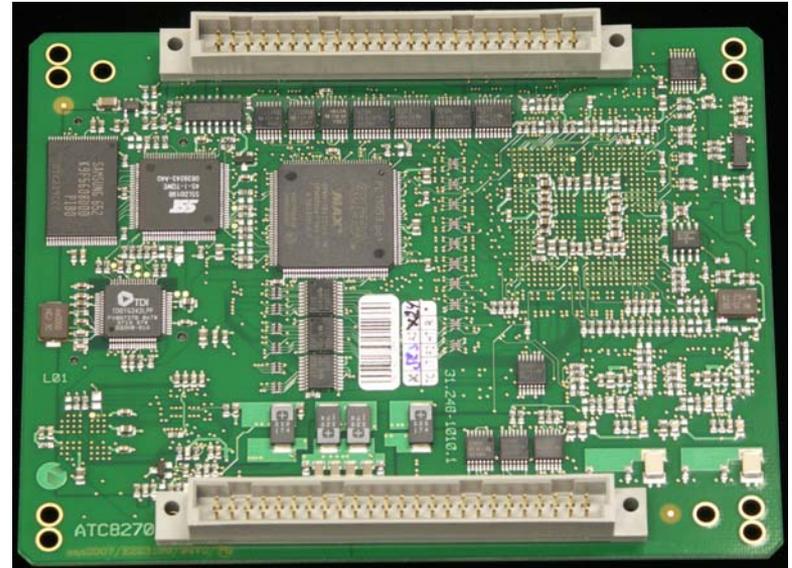
NEMA HOST MODULE



# ATC Engine Board

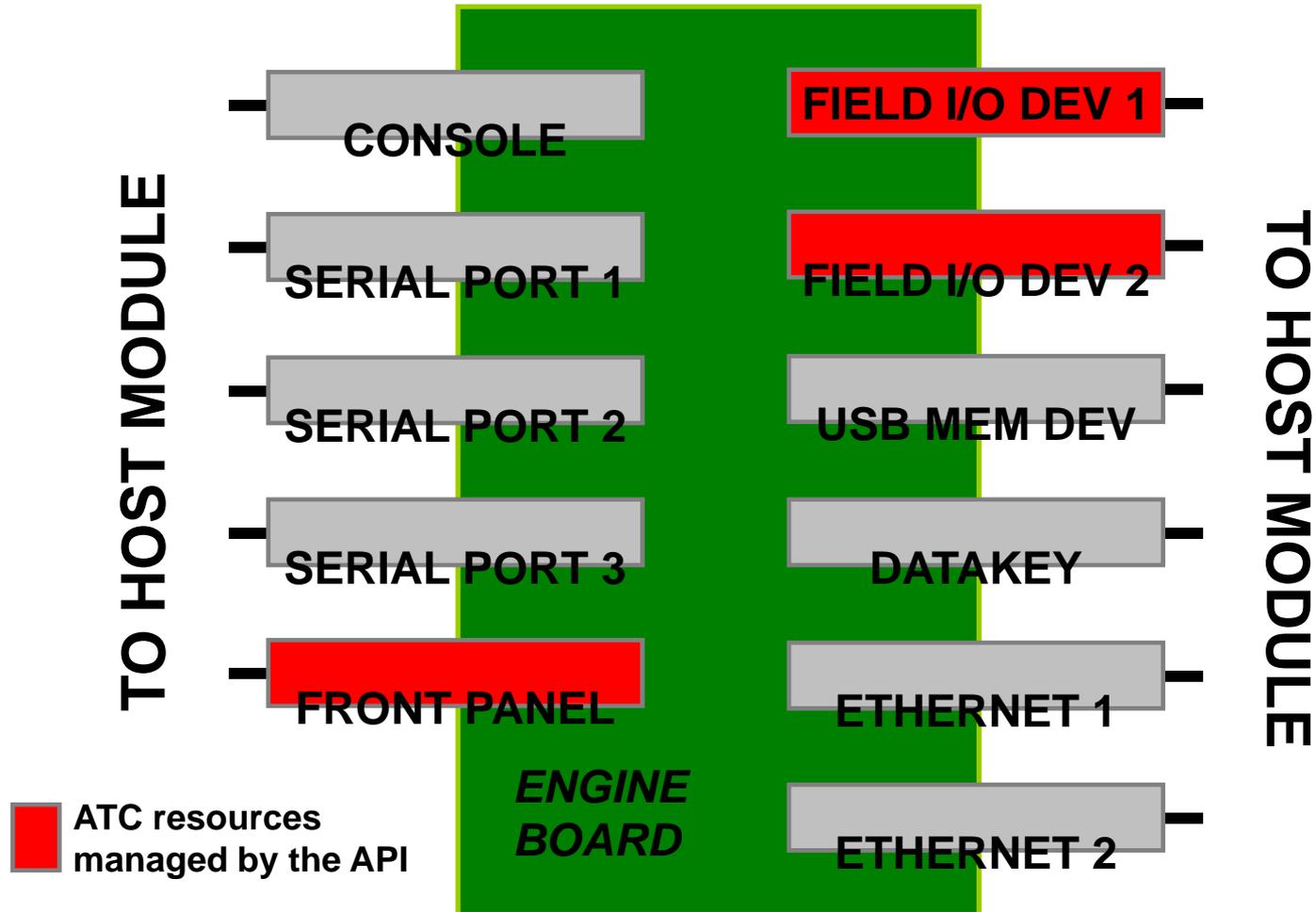


**Top View**



**Bottom View**

# ATC Controller Standard



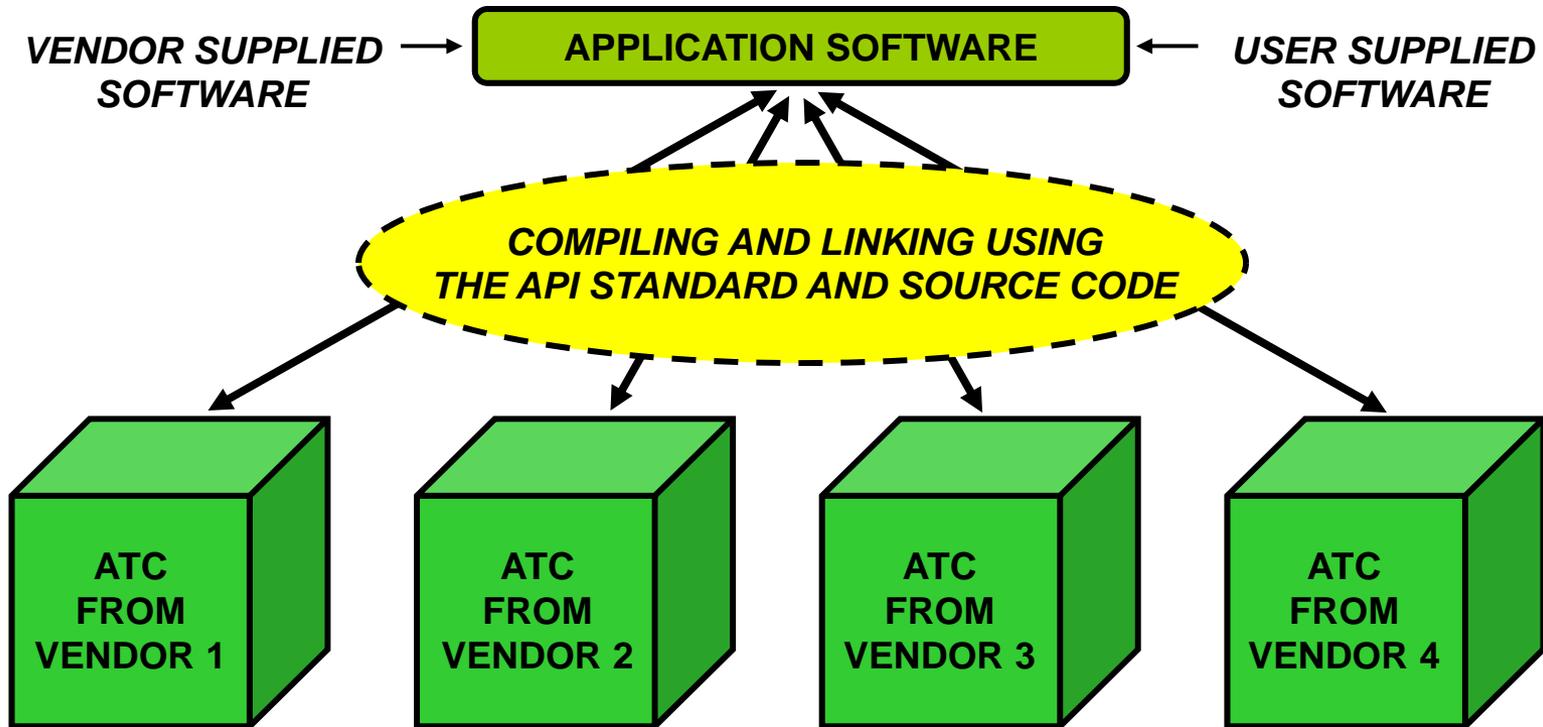
# ATC API Standard

- **Universal interface between application programs and ATC hardware**
- **Built on subset of Linux open architecture Operating System**
- **Functions written in C for controller devices and multiple application management**

## ATC API Standard

- **Allows software to be written that can operate on any ATC regardless of manufacturer**
- **Supports multiple software applications on a single controller**
- **Creates a broader software market**
- **Completes many of the goals of the ATC program**

# ATC API Standard



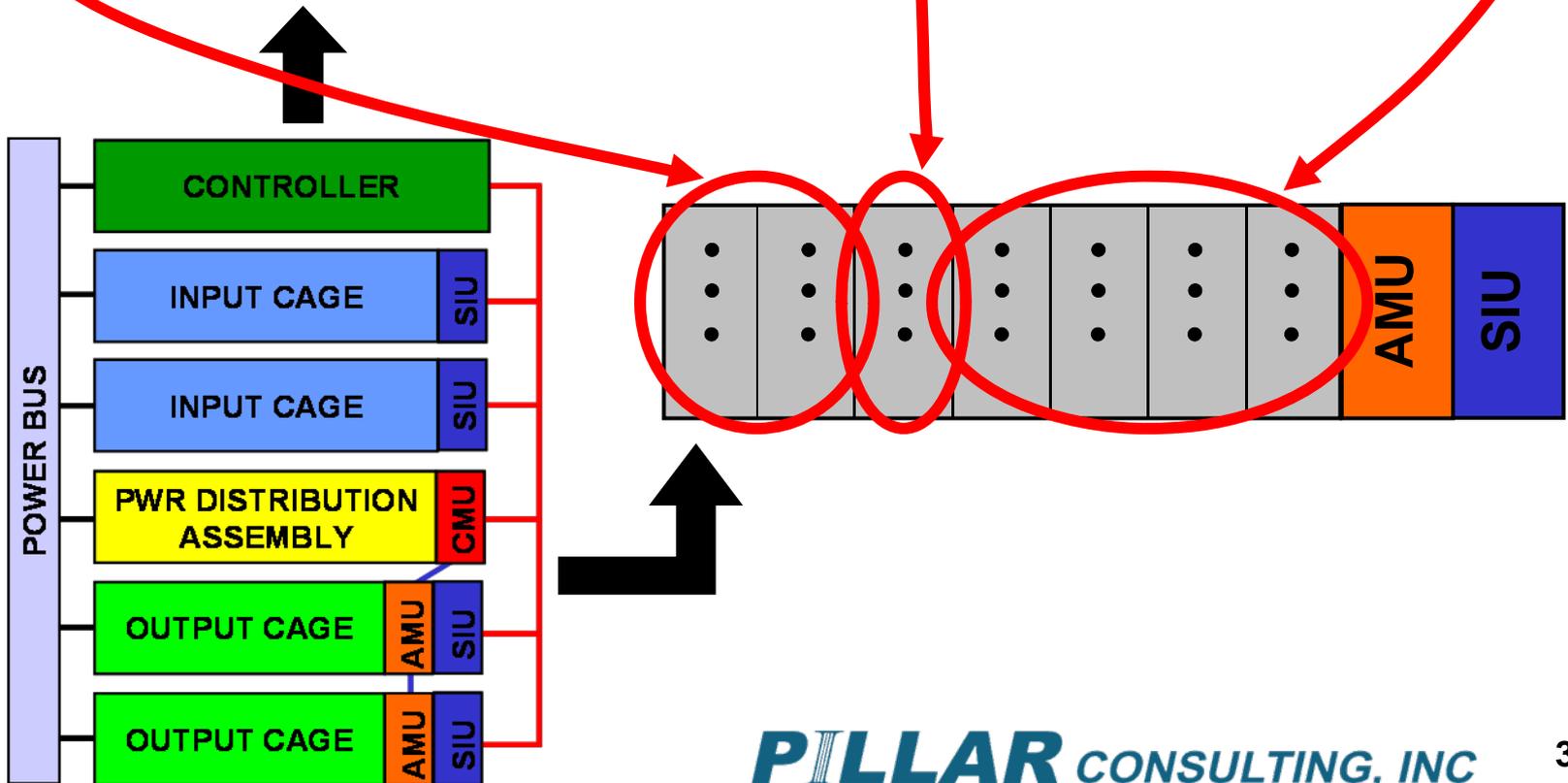
# ATC API Standard



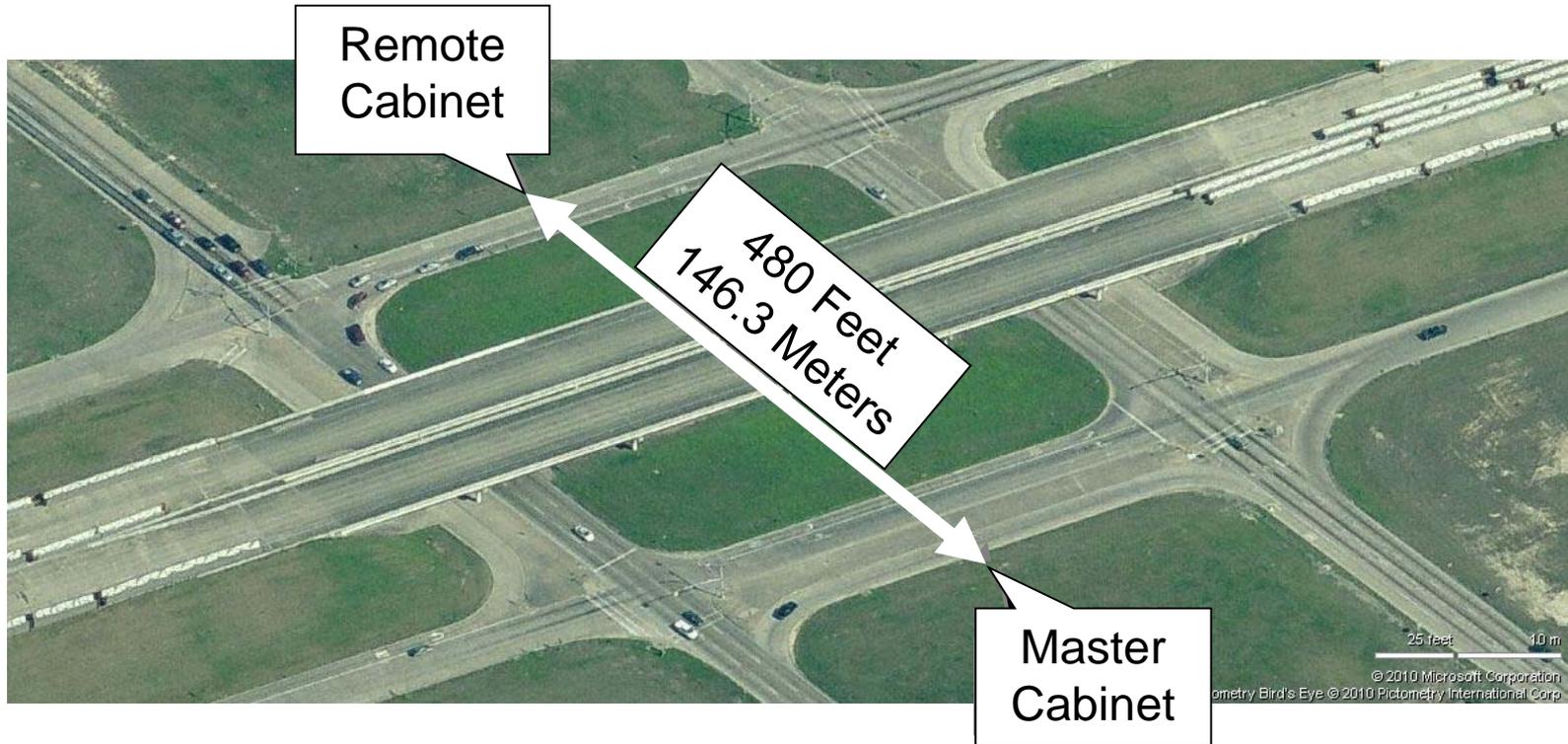
```
FRONT PANEL MANAGER VER 1.00
SELECT WINDOW: 0-F          SET DEFAULT: *,0-F
0 Camera Control           1 * Signal Program
2 Radiation Detect         3
4                           5
6                           7
8                           9
[ MORE - UP/DN ARROW ]    [ CONFIG INFO - NEXT ]
```

# ATC API Standard

```
FRONT PANEL MANAGER VER 1.00
SELECT WINDOW: 0-F      SET DEFAULT: *,0-F
0 Camera Control       1 * Signal Program
2 Radiation Detect     3
4
6
8
[MORE - UP/DN ARROW]  [CONFIG INFO - NEXT]
```



# Harris County Distributed Cabinet Application: Multiple Intersection Control



# Harris County Distributed Cabinet Application: Multiple Intersection Control



**Master Cabinet**

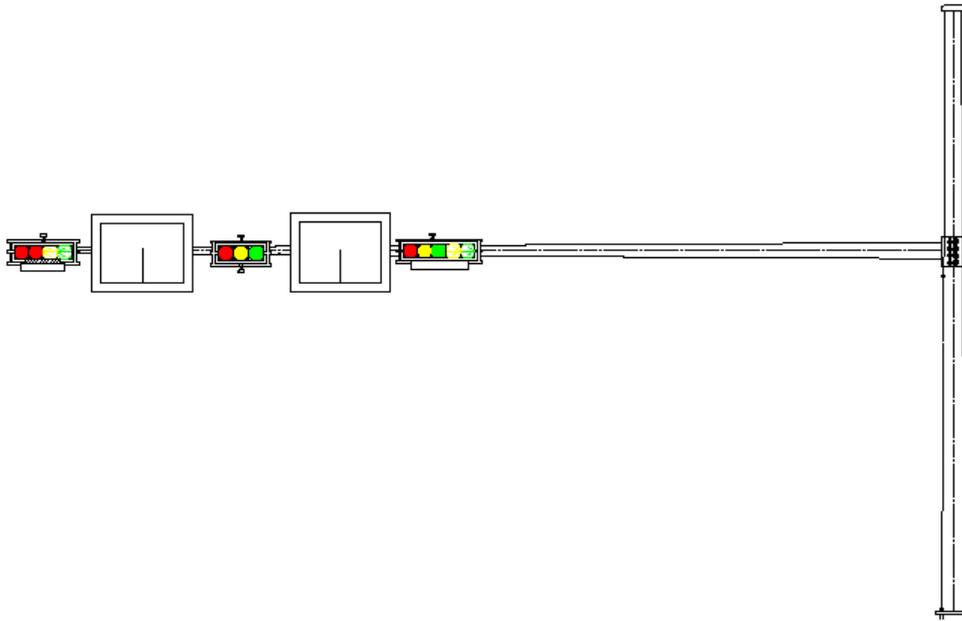


**View of Master and  
Remote Cabinet**



**Remote Cabinet**

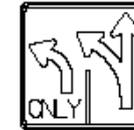
# Harris County Changeable Lane Assignment System (CLAS)



**Signal Head and Sign Elevation**



A



B



C



D



1



2



3



4



5

**Sign Sequences**



## References

- **National Electrical Manufacturers Association**  
<http://www.nema.org/stds/>
- **Advanced Transportation Controller (ATC) Standards**  
<http://www.ite.org/standards/>
- **United States Department of Transportation**  
<http://www.dot.gov/>

# Contact Information

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The screenshot shows the Pillar Consulting Inc. website. The header features the company logo and a list of core values: Integrity, Reliability, Consistency, and Character. A navigation menu includes links for Home, About Us, Engineering / Management, Transportation, Information Technology, and Contact Us. The main content area is divided into two columns. The left column, titled 'ARTICLES', features a featured article titled 'The ATC API and its Impact on the Operations and Management of Transportation Systems' with a 'More...' link and a 'A Concurrent' status indicator. The right column, titled 'HIGH TECHNOLOGY IN TRANSPORTATION', contains a paragraph about the company's capabilities and a list of services including Project Management, ATC, 2070 Controllers, NTCIP, and ATIS. A small image of a highway with cars is also present. At the bottom, there are links for logging into the ATC API Working Group and creating an account.

www.pillarinc.com

Integrity  
Reliability  
Consistency  
Character

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ARTICLES

The ATC API and its Impact on the Operations and Management of Transportation Systems  
The Advanced Transportation Controller (ATC) Standards provide for open architecture hardware and software platforms for a wide variety of Intelligent Transportation Systems (ITS). [More...](#)

A Concurrent

NEWS

01/10/05 New Website

HIGH TECHNOLOGY IN TRANSPORTATION

Pillar leverages its broad engineering and management capabilities to provide innovative solutions to the transportation industry. We work with both government agencies and private industry. Pillar is an integral player in the development of standards for the ATC, the NTCIP and the Caltrans Qualified Products List (QPL).

Transportation

- Project Management
- Advanced Transportation Controller (ATC)
- 2070 Controllers
- National Transportation Communications for ITS Protocol (NTCIP)
- Specification Development
- Equipment Qualification and Testing
- Standards Training
- Automated Incident Detection
- Automated Vehicle Location (AVL)
- Advanced Traveler Information Systems (ATIS)
- Member ITE and IEEE

Login To ATC API Working Group Page ([click here](#)) or Create Account ([click here](#))