

Configuration of Advanced Traffic Management Systems

Richard R. Dye

**Maryland State Highway
Administration**



- Maryland compared to Florida
- The CHART Advanced Traffic Management System
- Configuration Management of CHART

Florida / Maryland Comparison

(US DOT - BTS)

Maryland Fast Facts 2000

- **Transportation System Extent**
 - All public roads: 30,494 miles
Interstate: 481 miles
Road bridges: 4,963
Class I railroad trackage: 835 miles
Inland waterways: 532 miles
Public use airports: 35 (4 certificated for air carrier operations)¹
- **Vehicles and Conveyances**
 - Automobiles registered: 2.6 million
Light trucks registered: 1.2 million
Heavy trucks registered: 15,000
Buses registered: 12,000
Motorcycles registered: 49,000
Rail transit systems: 1 commuter rail, 1 heavy rail (subway), 1 light rail
Numbered boats: 208,000

Florida Fast Facts 2000

- **Transportation System Extent**
 - All public roads: 116,649 miles
Interstate: 1,471 miles
Road bridges: 11,182
Class I railroad trackage: 1,895 miles
Inland waterways: 1,540 miles
Public use airports: 126 (31 certificated for air carrier operations)¹
- **Vehicles and Conveyances**
 - Automobiles registered: 7.4 million
Light trucks registered: 3.6 million
Heavy trucks registered: 71,000
Buses registered: 45,000
Motorcycles registered: 255,000
Rail transit systems: 1 commuter rail, 1 heavy rail (subway), 2 automated guideway
Numbered boats: 841,000



Florida / Maryland Comparison

(US DOT - BTS)

- **Geographic**

- Land area: 9,775 sq. miles (rank: 42)
Percent of land area owned by federal government: 2.64 (rank: 35)
Persons per square mile: 541.8 (rank: 5)
Highest point: Backbone Mountain (3,360 ft.)
Lowest point: Atlantic Ocean (0 ft.)

- **Political Subdivisions**

- Counties: 23
Municipal governments: 1563
Congressional districts: 8

- **Demographic**

- Population: 5,296,486 (rank: 19)
Percent urban population: 812 (rank: 13)

- **Geographic**

- Land area: 53,927 sq. miles (rank: 26)
Percent of land area owned by federal government: 8.84 (rank: 18)
Persons per square mile: 296.4 (rank: 8)
Highest point: Section 30, Township 6 North, Range 20 West, Walton County (345 ft.)
Lowest point: Atlantic Ocean (0 ft.)

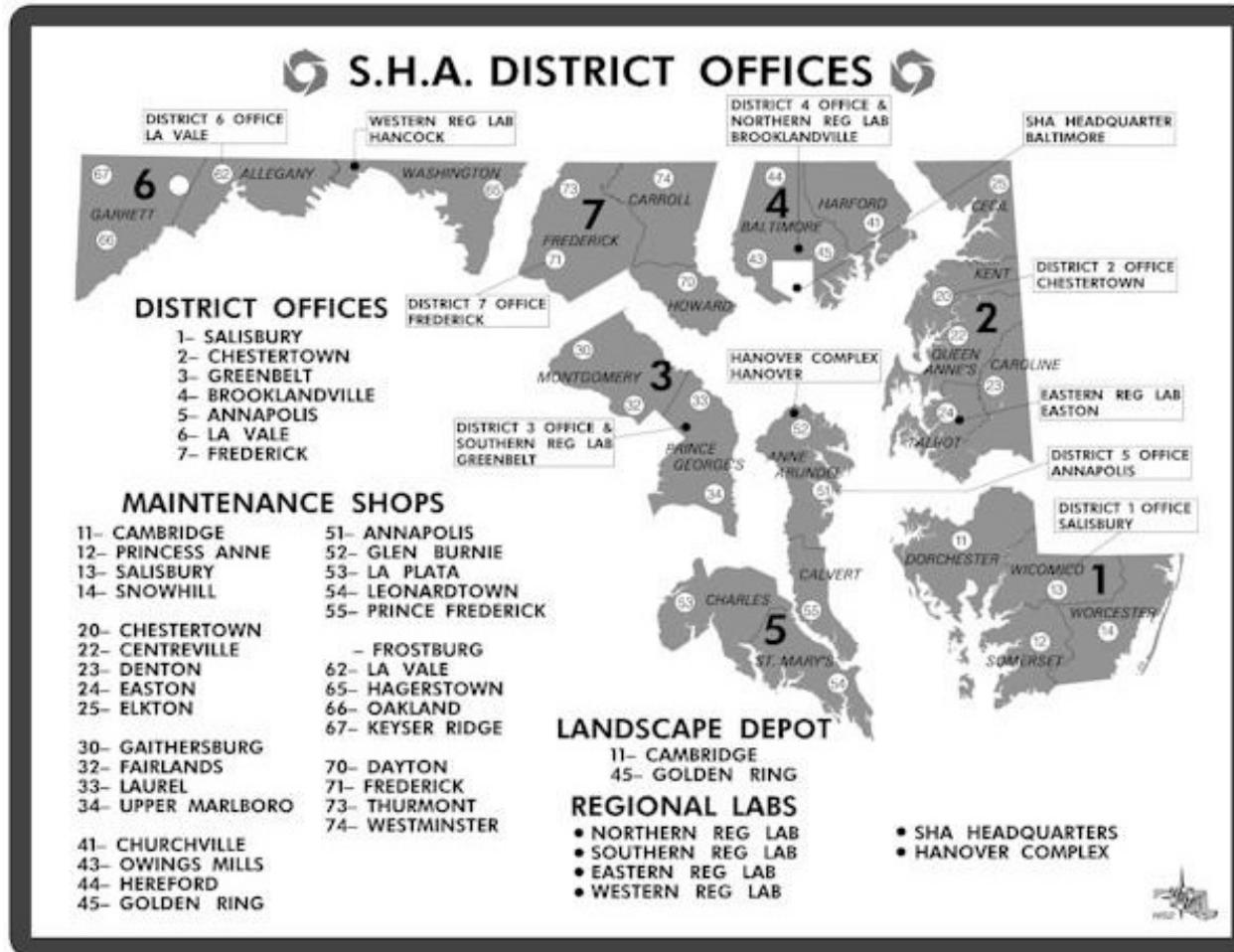
- **Political Subdivisions**

- Counties: 67
Municipal governments: 3943
Congressional districts: 25

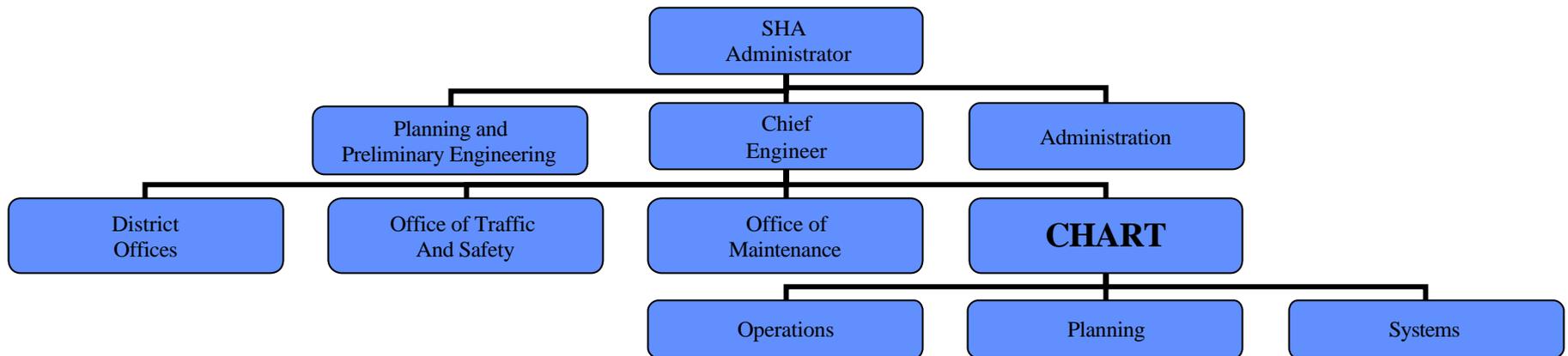
- **Demographic**

- Population: 15,982,378 (rank: 4)
Percent urban population: 852 (rank: 8)

Maryland District Offices



Maryland SHA Organization

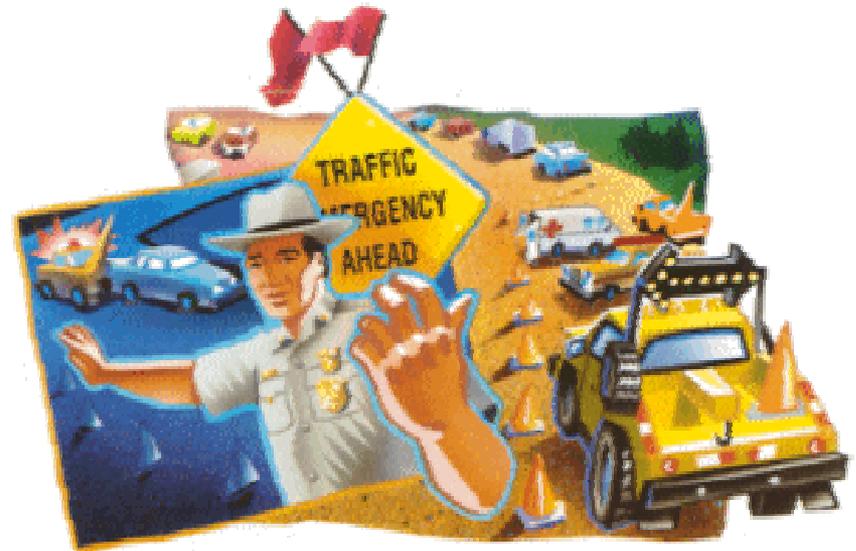


This partial organization chart shows the SHA's organization only as it relates to the CHART program



CHART Grew From Reach the Beach

- 1988
 - State Highway
 - State Police
- 1995
 - Statewide Operations Center
 - 2 Remote Traffic Operations Centers
 - MdTA AOC

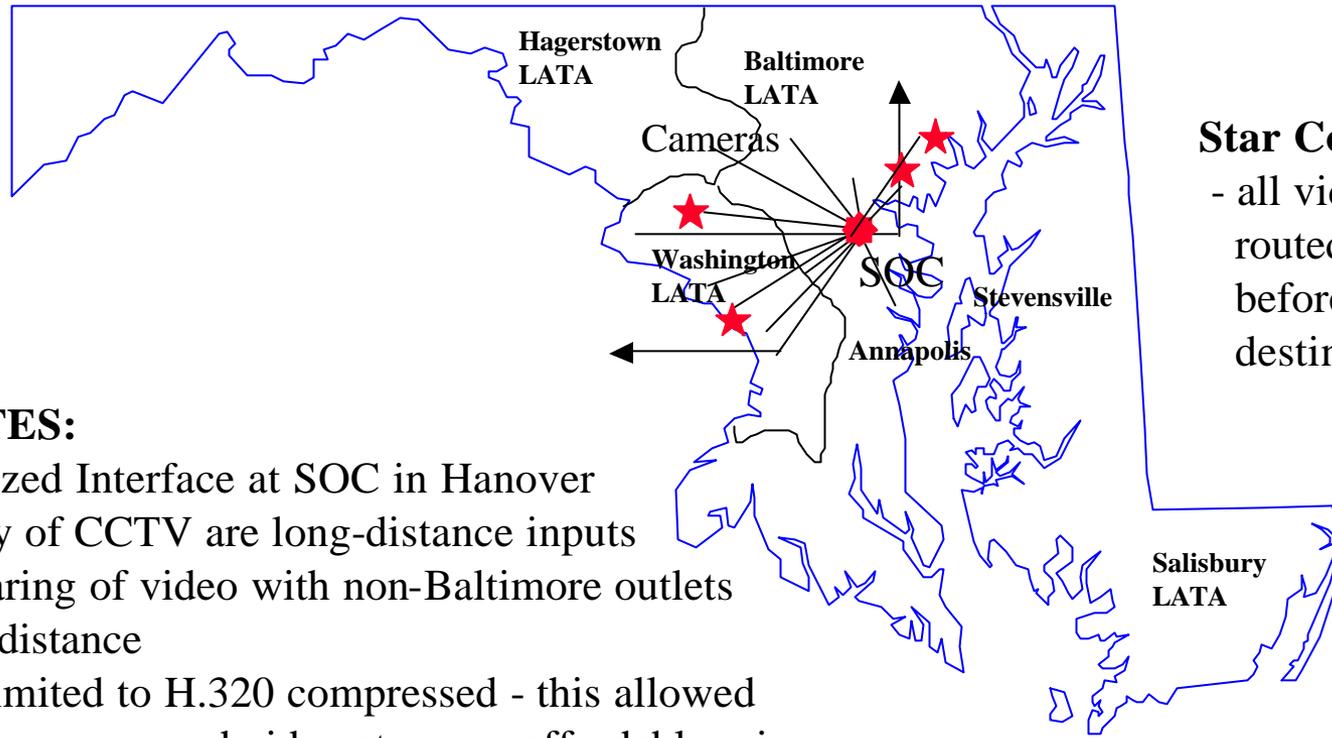


- 9 Centralized CODECs at SOC
- 2 CODECs at each TOC
- 2 CODECs at MDTA AOC
- 2 CODECs at Montgomery County TOC



Because of the original CODECs chosen, a video signal could only be seen at one of these locations at a time.

ORIGINAL CHART INTERFACE FOR VIDEO



Star Configuration

- all video and data routed to SOC before any other destination

ATTRIBUTES:

- Centralized Interface at SOC in Hanover
- Majority of CCTV are long-distance inputs
- Any sharing of video with non-Baltimore outlets is long distance
- Video limited to H.320 compressed - this allowed 15 frame per second video at a very affordable price

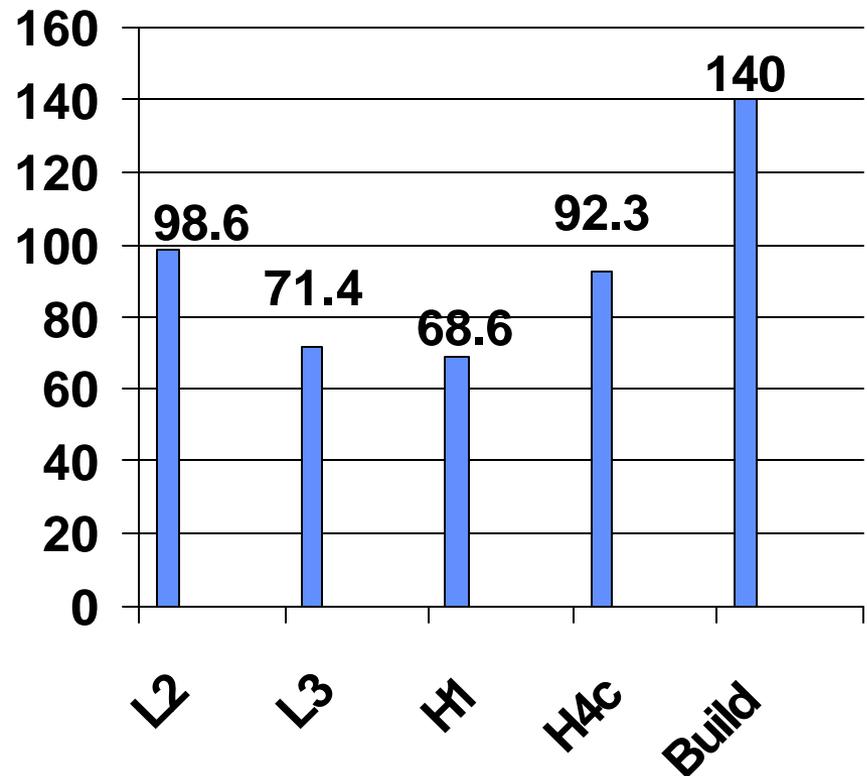
CODEC = Video Coder/decoder



CHART Telecommunications Study

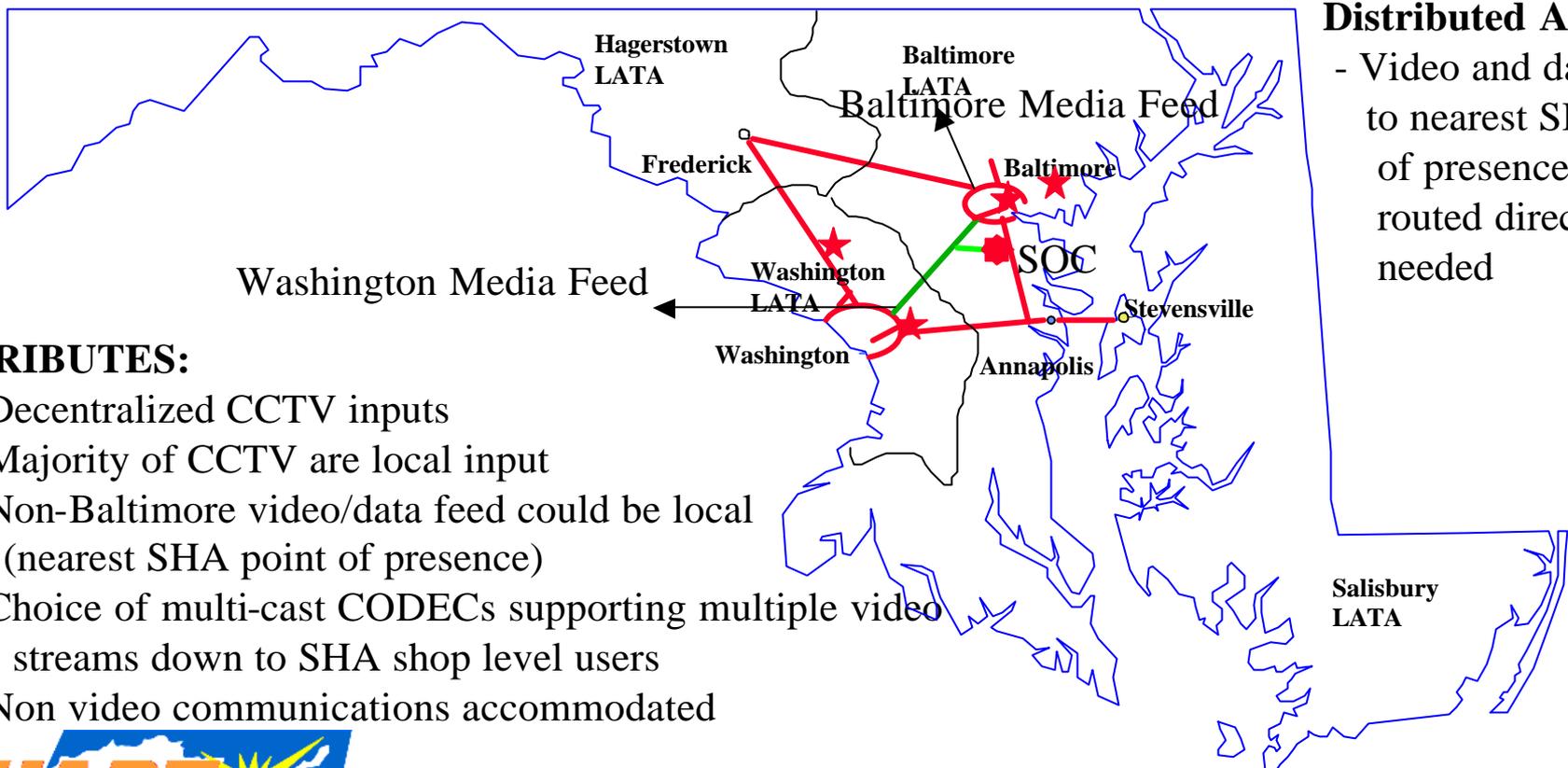
- L2 - A centralized network of leased circuits
- L3 - A decentralized network of leased circuits
- H1 - A hybrid using resource sharing fiber and leased circuits
- H4c - A hybrid with private fiber installed in the metro areas
- Build - Private fiber installed in the ROW for the complete ITS coverage area

(Millions \$)



Multi-cast Video CODECs at SOC, TOCs, AOC and Montgomery County TMC. These will allow simultaneous sharing of video.

TELECOMMUNICATIONS STUDY RECOMMENDED NETWORK



Distributed Architecture

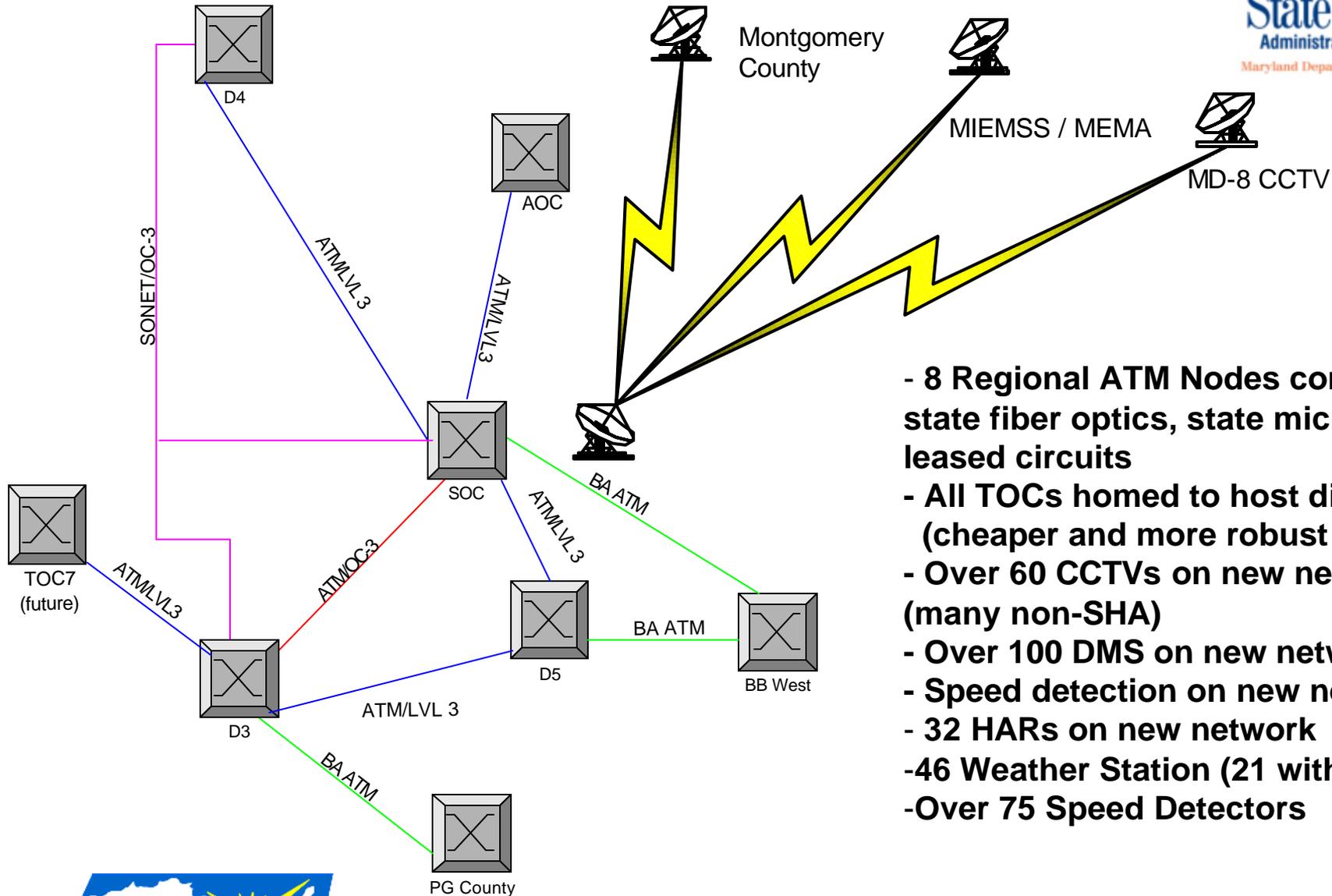
- Video and data routed to nearest SHA point of presence and then routed directly where needed

ATTRIBUTES:

- Decentralized CCTV inputs
- Majority of CCTV are local input
- Non-Baltimore video/data feed could be local (nearest SHA point of presence)
- Choice of multi-cast CODECs supporting multiple video streams down to SHA shop level users
- Non video communications accommodated



Maryland State Highway Administration



- 8 Regional ATM Nodes connected by state fiber optics, state microwave and leased circuits
- All TOCs homed to host districts (cheaper and more robust network)
- Over 60 CCTVs on new network (many non-SHA)
- Over 100 DMS on new network
- Speed detection on new network
- 32 HARs on new network
- 46 Weather Station (21 with CCTV)
- Over 75 Speed Detectors



- Incorporates existing traffic management and emergency operations systems into a single interface.
- Future – will provide this information to other jurisdictions in a “CHART Lite,” web-based platform

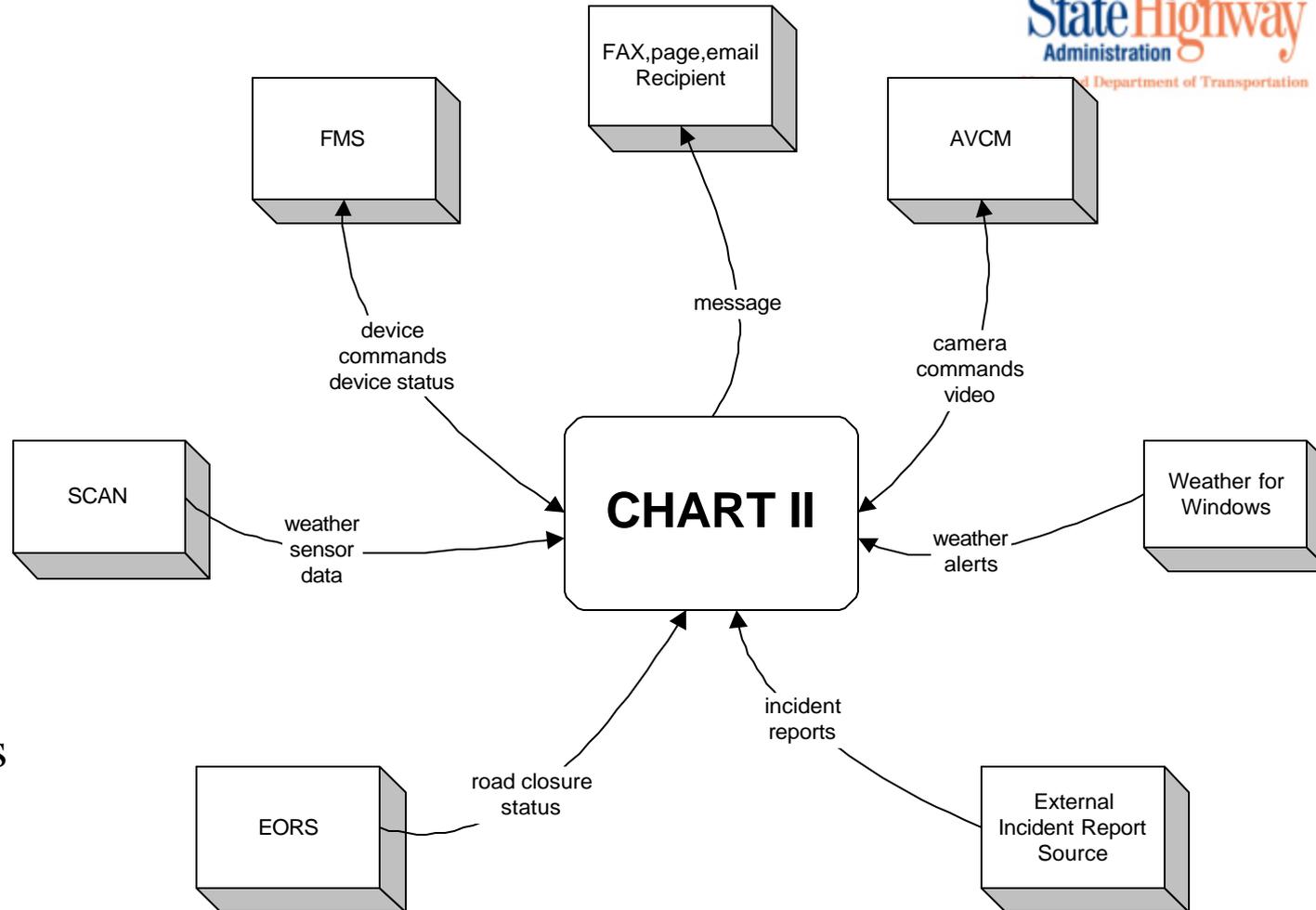


CHART ATMS

- Designed to Interact with other Modals / Jurisdictions
- Business Area Architecture & Requirements Development began in Fall 1998

CHART I

- The first statewide ATMS in the US
- Was NOT designed to grow beyond original 4 TOCs
- Proprietary code was not well documented
- Non-integrated systems required operators to move among several machines to perform necessary functions...NO time for “traffic management”

THE NATURE OF SOFTWARE

“Unfortunately, software development does not progress in accordance with the rather simple rules that govern most functions. That is why software projects run beyond delivery dates by many months; overrun budgets, often significantly; and are even canceled about one-quarter of the time. Consequently, you need help to find your way through this thicket.” —[Putnam and Myers, 1996]

“Studies have shown that for every six new large-scale software systems that are put into operation, two others are canceled. The average software development project overshoots its schedule by half; larger projects generally do worse. And some three-quarters of all large systems are ‘operating failures,’ that either do not function as intended or are not used at all ... 55 percent of the projects cost more than expected, 68 percent overran their schedules, and 88 percent had to be substantially redesigned.” —[Gibbs, 1994]

“The odds of a large [software] project finishing on time are close to zero. The odds of a large project being canceled are an even-money bet.”

— [McConnell, 1996, page 81]

Design Competition

- A detailed functional description of the desired traffic management system was sent to 2, major defense software developers
- Responses and additions to the RFP, were requested as well as a working prototype and a detail of the firm's internal systems development process.

Design Configuration Management

- Original RFP called for:
 - In parallel with the development of requirements, MDSHA personnel will establish a CHART working group (CWG). This group will include representatives from state, county, and city agencies both within the State of Maryland and neighboring jurisdictions who are likely to be impacted by the operation of the CHART system and who may have a desire to cooperate.
- A subset of this CWG still meets monthly



Requirements Development

- 1997 – 1998 multiple visioning sessions were held between the State Highway Administration and other potential stake-holders, including:
 - Toll Authority, airport authorities, port authorities, city and county Departments of Public Works, federal, state and local police departments, neighboring states and the District of Columbia
- These results were published in a comprehensive Business Area Architecture

CHART Business Objectives

- **CHART is intended to be a state-wide traffic management system**, not limited to one or two specific corridors of high traffic volumes, but expandable to cover the entire state as funds, resources, and roadside equipment become available to support traffic management.
- **CHART is intended to be a coordination focal point**, able to identify incidents, congestion, construction and road closures; and then able to direct the resources from various agencies, as necessary, to respond to recurring and non-recurring congestion and emergencies. It should also manage traffic flow with traveler advisories and signal controls, and coordinate or aid in the cleanup and clearance of obstructions.
- **CHART is intended to be an information provider**, providing real-time traffic flow and road condition information to travelers and the media broadcasters, as well as providing real-time and archived data to other state agencies and local, regional, inter-state, and private sector partners.
- **CHART is intended to be a 7 day per week, 24 hours per day operation** with the system performing internal processing and status checks to detect failed system components and resetting or reconfiguring itself where appropriate, or notifying operators and/or maintenance staff where necessary for service.



Standards

- The CHART II system has been designed to be as compliant as was possible at the time (1999) with ITS national standards. The system design utilized draft standards in the three areas of:
 - data storage
 - center to center communications
 - field communications

Standards

- “In the area of data storage, the team is utilizing the Traffic Management Data Dictionary (TMDD) to define attributes stored in the database. The TMDD contains the national ITS standard data definitions for data elements. Any data elements that exist in the TMDD that are needed by the application use the TMDD definitions. Additional attributes that are needed to implement the CHART II system requirements are added to these standard table definitions.”

Source: CHART II System Architecture 9/5/2000



Standards

- “In the area of center to center communications, the CHART II system design utilizes CORBA for transactions between software components. CORBA has been chosen as one of two approved methods of communication between ITS software components by the NTCIP Center to Center committee. The design team has referenced the burgeoning object model that is currently being developed by the Center to Center committee, but has found that it has not yet defined system interfaces. Thus, the CHART II system design has been developed to separate standard interfaces from those that are clearly CHART II system specific. Furthermore, the CHART II team has submitted its current interface definitions and designs to the Center to Center committee as a potential starting place for standard interface definitions.”

Source: CHART II System Architecture 9/5/2000



Standards

- “The CHART II system will use CORBA as the basis for all external interfaces for near real time data exchange. For interfaces involving the exchange of non-real time data the standard of choice is the Extensible Markup Language (XML). XML is a markup language for documents containing structured information. Numerous applications as well as most web browsers already have XML support built-in.”

Standards

- “In the area of field communications, the CHART II system design is consistent with current national standards. This design supports the addition of NTCIP compliant devices through the addition of NTCIP device protocol handlers.”
Source: CHART II System Architecture 9/5/2000
- A separate contractor has developed a driver based upon published NTCIP standards and published CHART Design documents.



User Access Control

- User access control in the CHART II system is based on four basic principles:
 - users
 - system functions
 - functional rights and roles
 - shared resources

Principles of User Access Control

- A role is a collection of functional rights. It allows an administrator to grant a user the correct set of functional rights that reflect a particular position within the organization.
- Users are then assigned the necessary rights to fill that position by simply granting them the appropriate role.

Principles of User Access Control

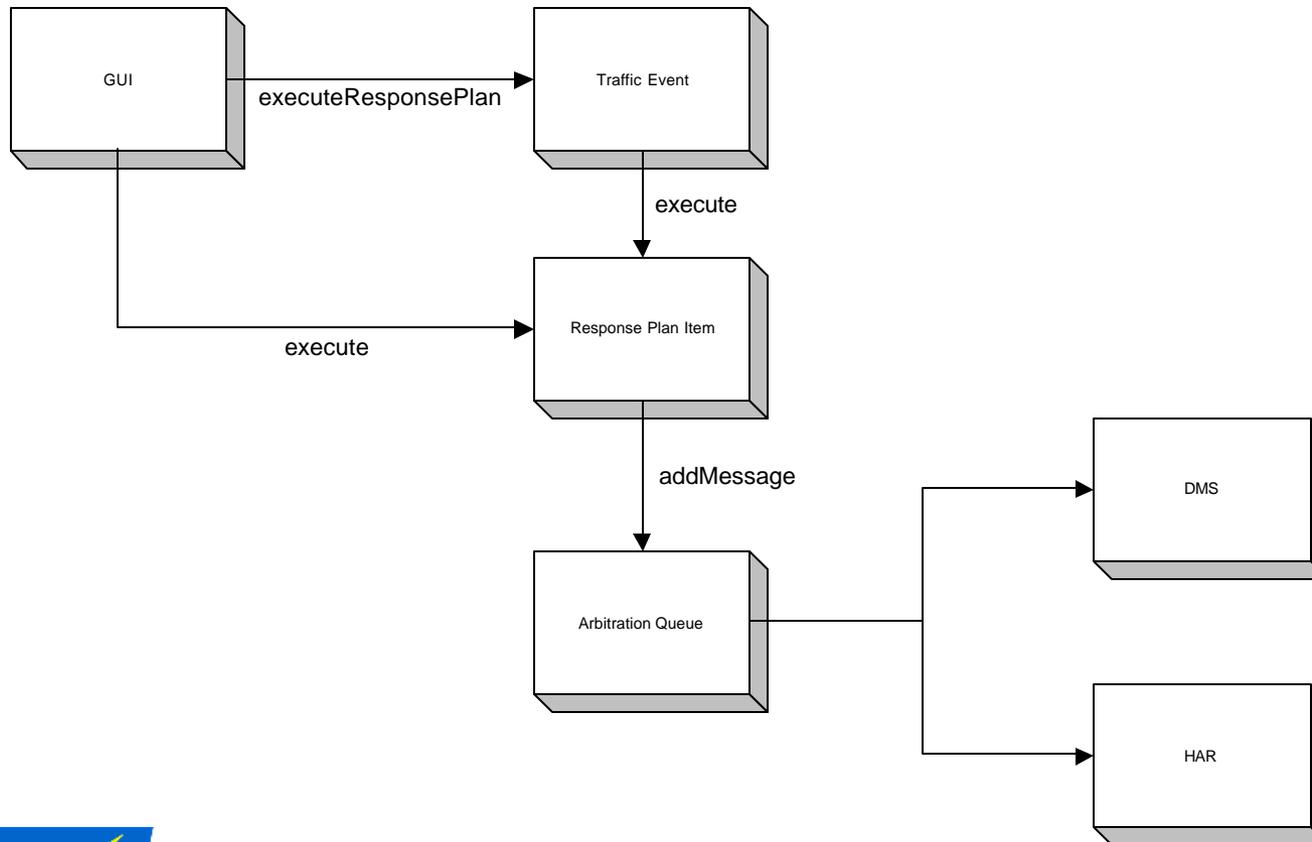
- A shared resource is a resource in the CHART II system that is owned by a particular organization.
- Administrators can allow a role to use resources owned by one organization and prohibit control of resources owned by another.

Device Control

- CHART II system design enforces the business rule that an operator may only set the message on a device in response to a traffic event, except for maintenance activities.

Device Control

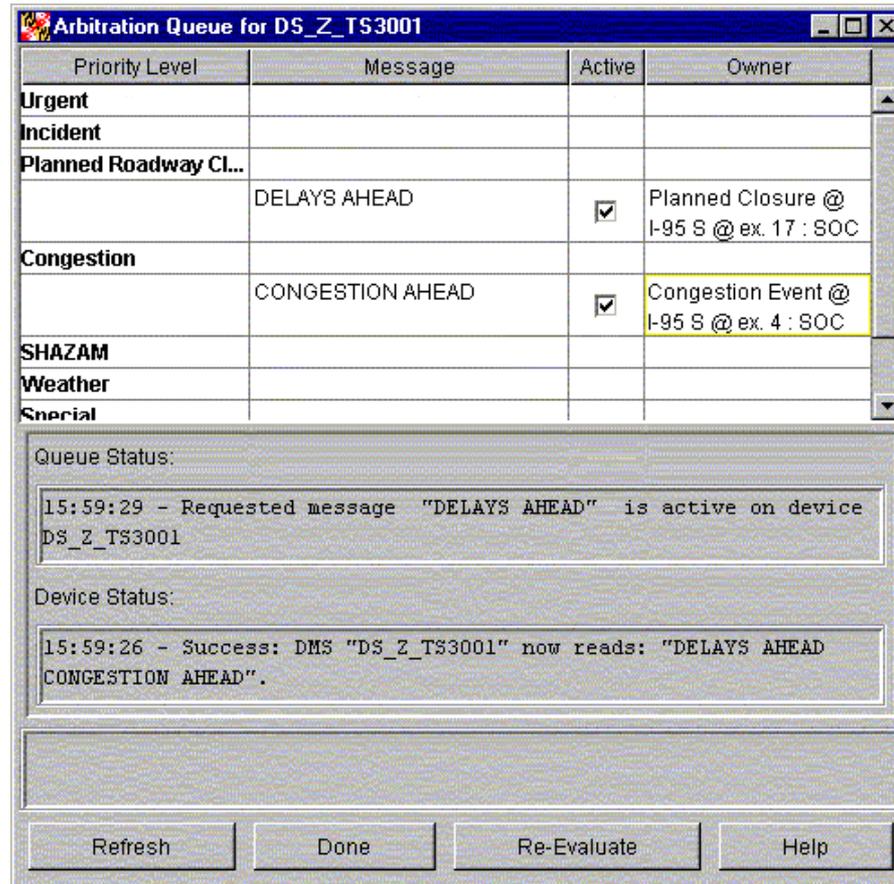
The following diagram shows how devices are controlled in CHART II.



Device Control

- The CHART II system maintains a traffic event object for each roadway event that has been opened.
- Each event has a response plan that may contain several response plan items.
- Each response plan item simply contains a reference to the arbitration queue for a particular DMS and the message that should be sent to that device when the response plan item is executed.
- The system removes active messages from devices when the traffic event that the message was set in response to is closed.

Arbitration Queue



The screenshot shows a software window titled "Arbitration Queue for DS_Z_TS3001". It contains a table with columns for Priority Level, Message, Active, and Owner. Below the table are sections for Queue Status and Device Status, and a row of buttons at the bottom.

Priority Level	Message	Active	Owner
Urgent			
Incident			
Planned Roadway Cl...			
	DELAYS AHEAD	<input checked="" type="checkbox"/>	Planned Closure @ I-95 S @ ex. 17 : SOC
Congestion			
	CONGESTION AHEAD	<input checked="" type="checkbox"/>	Congestion Event @ I-95 S @ ex. 4 : SOC
SHAZAM			
Weather			
Special			

Queue Status:

```
15:59:29 - Requested message "DELAYS AHEAD" is active on device DS_Z_TS3001
```

Device Status:

```
15:59:26 - Success: DMS "DS_Z_TS3001" now reads: "DELAYS AHEAD CONGESTION AHEAD".
```

Buttons: Refresh, Done, Re-Evaluate, Help

DMS Control

- The system facilitates controlling Dynamic Message Signs (DMS) located throughout the state.
- These signs allow for customized traffic messages to be displayed to the motoring public.
- DMSs are located at fixed positions throughout the state and are also deployed on mobile trailers that can be transported to locations where they are needed, including scenes of traffic incidents.

Events

- The usage of events introduces the concept that device activation can only take place if an event is opened.
 - Unlike earlier versions of CHART, a DMS in this release may not be activated unless they are attached to an open event or are in maintenance mode.
 - This extra step will allow for better record keeping and statistical analysis as well as simplify intra-TOC use of scarce field resources.
 - Operators are responsible for correctly classifying and recording problems in their proper event type.



Opening an Event

The screenshot shows the 'System Navigator' window with a tree view on the left containing folders like 'Libraries', 'Plans', 'Dictionaries', 'DMS', and 'Events'. The 'Events' folder is selected, and a context menu is open over it. The menu items include 'New Action Event', 'New Congestion Event', 'New Disabled Vehicle Event', 'New Incident', 'New Planned Roadway Closure', 'New Safety Message Event', 'New Special Event', 'New Weather Service Event', 'Edit Displayed Properties', 'Add Navigator Search System Filter', 'Add Navigator System Folder', 'Add Navigator Search User Filter', 'Add Navigator User Folder', 'Add Traffic Event System Filter', and 'Add Traffic Event User Filter'.

Description	Open	OpCtr	Type	County/St...	Source	Location
▲ Action Event ...	<input checked="" type="checkbox"/>	SOC	Action Event	Prince Ge...	CCTV	oilhkiy
▲ Action Event ...	<input checked="" type="checkbox"/>	SOC	Action Event	Calvert Co...	Local Police	Test
■ Congestion Ev...	<input checked="" type="checkbox"/>	UNKNOWN	Congestio...	Allegany C...	CCTV	i-495
■ New Action Event	<input checked="" type="checkbox"/>	UNKNOWN	Disabled V...	Anne Arun...	CHART Unit	432
■ New Congestion Event	<input checked="" type="checkbox"/>	UNKNOWN	Disabled V...	Baltimore ...	Local Police	Location 2
■ New Disabled Vehicle Event	<input checked="" type="checkbox"/>	UNKNOWN	Incident	Baltimore ...	CHART Unit	95
■ New Incident	<input checked="" type="checkbox"/>	UNKNOWN	Incident		CHART Unit	a
■ New Planned Roadway Closure	<input checked="" type="checkbox"/>	UNKNOWN	Incident	Montgome...	Local Police	I-495

Types of Events

- There are eight types of events available in the CHART II system:
 - Action Event
 - Congestion Event
 - Disabled Vehicle Event
 - Incident Event
 - Planned Roadway Closure Event
 - Safety Message Event
 - Special Event
 - Weather Event

Action Event

- An Action Event shall be recorded for any off roadway activity that causes the Operator to take action.
 - Example:
Dispatching a signal technician or maintenance crew for a stop sign down.

Congestion Event

- A Congestion Event shall be recorded recorded for any recurring or non-recurring congestion.

Disabled Vehicle Event

- A Disabled Vehicle Event shall be opened to record each Disabled Vehicle not in the travel lanes.

Incident Event

- An Incident Event shall be opened for any problem blocking the roadway or accident off the roadway.
 - Examples
 - Debris in roadway
 - Disabled vehicles in the roadway
 - Damage to overhead structure that blocks lanes
 - Accidents

Planned Roadway Closure Event

- A Planned Roadway Closure Event shall be entered for each roadwork project. This event interfaces with a statewide permits system but may be used without a pre-entered Permit as a starting point.

Safety Message Event

- A Safety Message Event shall be entered when a public service message or plan of messages needs to be activated.
 - Example
 - To activate Holiday messages or Wipers On messages a Safety Message Event must be opened first.

Special Event

- A Special Event shall be opened to allow activation of any Stadium or large Event Plans.

Weather Event

- A Weather Event shall be opened to record any closures due to weather events.
 - Examples:
 - Roadways washed away by flooding
 - High water
 - Rockslide
 - Ozone

Dictionaries

- CHART II R1B2 has both an accepted words and a banned words dictionary.
- Only administrators have privileges to view or modify either dictionary.
- Operators discover banned words when attempting to enter a banned word on a device. The device will not send a message to a device if it contains a banned word.

CHART on the Web

Coordinated Highways Action Response Team

Home | [Local Traveler Information](#) | [Interactive Mapping](#) | [Maryland Weather](#) | [Lane Closures](#)

Navigation

- Home
- What's New
- Local Traveler Information
- Winter Storm Information
- Reading Room
- Contacts and Directions
- Links
- Feedback

CHART System

- CHART Overview
- CHART Subsystems
- Traffic Monitoring
- Incident Management
- Traffic Management
- Traveler Information
- Glossary of ITS Terms

Local Weather Conditions

- NWS East Coast Satellite
- Current Conditions
- Hourly Round Up
- State Forecast
- State Watches
- State Warnings
- Special Report
- Public Report
- Summary Report

Overview | **Traffic** | **Roadway Weather** | **Video and Camera** | **Help**

Welcome to the CHART Web Mapping section. The map interface allows users to view current traffic and emergency road conditions from across the state. There are three different map tabs to choose from: Traffic, Roadway Weather, and Video and Cameras.

You may select a map section by clicking on the appropriate tab along the top or just click on the MD state map in your desired area or you may choose a pre-defined area from the picklist below the blue Maryland state map.

No Snow emergency counties

■ Snow Emergency

Select area:

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Disclaimer:



CHART on the Web

Coordinated Highways Action Response Team

Home | Local Traveler Information | Interactive Mapping | Maryland Weather | Lane Closures

Navigation: Home, What's New, Local Traveler Information, Winter Storm Information, Reading Room, Contacts and Directions, Links, Feedback

CHART System: CHART Overview, CHART Subsystems, Traffic Monitoring, Incident Management, Traffic Management, Traveler Information, Glossary of ITS Terms

Local Weather Conditions: NWS East Coast Satellite, Current Conditions, Hourly Round Up, State Forecast, State Watches, State Warnings, Special Report, Public Report, Summary Report

Map Navigation: Overview, Traffic, Roadway Weather, Video and Camera, Help

Roadway Weather Information System Sensor

Location	US - 50 @ Table Rock Rd
Last Update	10/31/01 12:10:40 PM
Air Temperature	60.9F
Dew Point	28F
Relative Humidity	29%
Wind Speed	5 mph
Gust Speed	9 mph
Wind Direction	W
Visibility	
Precipitation Type	None
Pavement Temperature	85.1F to 85.1F

Legend: Snow Emergency Plan, Road Way Information System Sensors (RWIS): Currently Reporting, Not Reporting, Weather Road Closure, Maryland Weather

Text Version: [Weather Road Closure](#), [Maryland Weather](#), [Weather Station Data](#)

Please allow map window to loading map image before a mouse clicks and selections

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CHART on the Web

The screenshot displays the CHART web application interface. At the top, a blue banner reads "Coordinated Highways Action Response Team". Below this is a navigation menu with tabs for "Overview", "Traffic", "Roadway Weather", "Video and Camera", and "Help". The main content area features a map of Maryland with various highway routes (I-70, I-270, I-495, I-95, I-83, I-695) and markers for weather road closures, video cameras, and camera snapshots. A legend on the right side of the map explains these symbols. Below the map, there is a "Live Traffic Cameras - Microsoft Intern..." window showing a "Video Feed" of a highway interchange with the text "I-83 AT I-83 JFX I-695 EAST VIEW". The interface also includes a sidebar with "Navigation" and "CHART System" links, and a footer with contact information for chartmaster@sha.state.md.us.



CHART on the Web

The screenshot displays the CHART web application interface. At the top, a blue banner reads "Coordinated Highways Action Response Team". Below this is a navigation menu with tabs for "Overview", "Traffic", "Roadway Weather", "Video and Camera", and "Help". The "Traffic" tab is active, showing a map of Maryland with various roadways color-coded by speed sensor data. A legend on the right side of the map provides a key for the colors: red for 0-30 mph, orange for 30-50 mph, green for > 50 mph, and grey for "No Report". It also includes a symbol for "Weather Road Closure". The map shows major highways like I-95, I-70, and I-83, along with local roads and city names like Baltimore, Frederick, and Montgomery. A sidebar on the left contains a "Navigation" menu with links like "Home", "What's New", and "Local Traveler Information", and a "CHART System" menu with links like "CHART Overview" and "Traffic Monitoring". At the bottom of the map window, there is a contact email address: chartmaster@sha.state.md.us.



CHART on the Web

Coordinated Highways Action Response Team

[Home](#) | [Local Traveler Information](#) | [Interactive Mapping](#) | [Maryland Weather](#) | [Lane Closures](#)

Navigation

[Home](#)
[What's New](#)
[Local Traveler Information](#)
[Winter Storm Information](#)
[Homeland Security](#)
[Reading Room](#)
[Contacts and Directions](#)
[Links](#)
[Feedback](#)

CHART System

[CHART Overview](#)
[CHART Subsystems](#)
[Traffic Monitoring](#)
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[Traveler Information](#)
[Glossary of ITS Terms](#)

Local Weather Condition

[NWS East Coast Satellite](#)
[Current Conditions](#)
[Hourly Round Up](#)
[State Forecast](#)
[State Watches](#)
[State Warnings](#)
[Special Report](#)
[Public Report](#)
[Summary Report](#)

Traffic Events

This data will automatically refresh every thirty seconds.

Type	Location	Direction	Details
Incident (Collision)	Baltimore County [I-695 AT EXIT 18 MD 26 LIBERTY RD]	Outer Loop	2 vehicles involved. Outer Loop shoulder closed. 4 of 4 Outer Loop lanes closed. Created: 9/11/2003 5:51:28 AM by TOC4.
	...H AVE TO US 1]	East/West	All lanes open. Created: 9/9/2003 2:12:53 PM by TOC3.
		None	All lanes open. Created: 9/10/2003 2:47:43 PM by SOC.

Live Traffic Cameras - Microsoft Intern...

Video Feed

▶ ⏪ ⏩

Help with video

Which direction is this camera facing

Internet

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CHART on the Web

CHART On The Web - Microsoft Internet Explorer

Live Traffic Cameras - Microsoft Intern...

Video Feed

T-695 AT I TRFRTV RD

Help with video

Which direction is this camera facing

Integrated Highways Action Response Team

[Information](#) | [Interactive Mapping](#) | [Maryland Weather](#) | [Lane Closures](#)

[Roadway Weather](#) | [Video & Camera](#) | [Message Signs](#)

Legend

Select area: Go

Balto.-Wash.-Fred. Triangle

[Overview](#) [Help](#)

Dynamic Message Sign:

- Online with Message
- Online without Message
- Offline

Text Version

[Dynamic Message Sign](#)

Please allow map window to finish loading map image before additional mouse clicks and selections.

CHART System

- [CHART Overview](#)
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666, 199, 154, 60

Internet

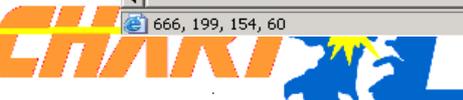
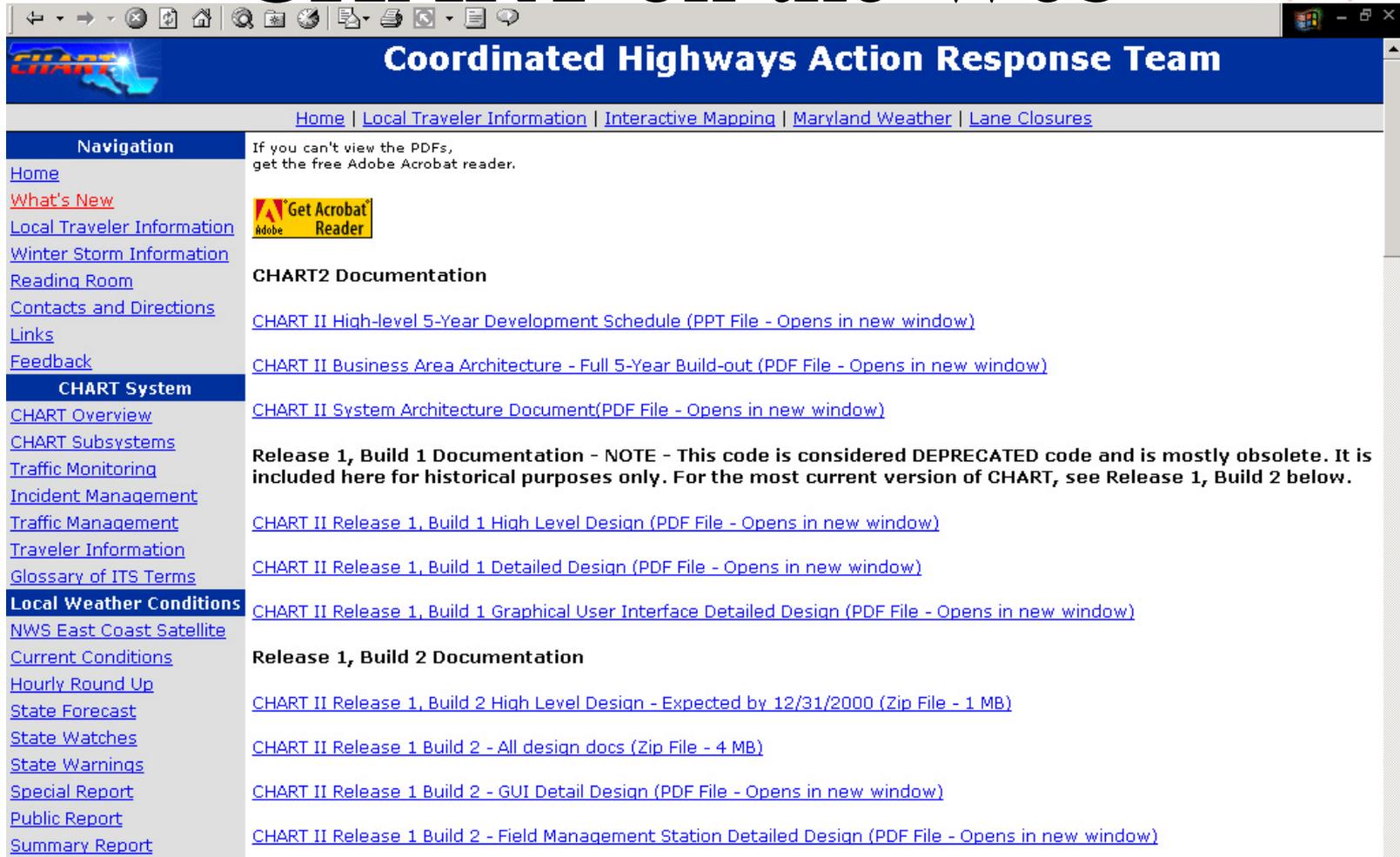


CHART on the Web



The screenshot shows a web browser window displaying the CHART website. The browser's address bar is empty, and the page title is "Coordinated Highways Action Response Team". The website has a blue header with the CHART logo and navigation links: Home, Local Traveler Information, Interactive Mapping, Maryland Weather, and Lane Closures. A left sidebar contains a "Navigation" menu with links to Home, What's New, Local Traveler Information, Winter Storm Information, Reading Room, Contacts and Directions, Links, and Feedback. Below this is a "CHART System" menu with links to CHART Overview, CHART Subsystems, Traffic Monitoring, Incident Management, Traffic Management, Traveler Information, and Glossary of ITS Terms. The "Local Weather Conditions" menu includes links to NWS East Coast Satellite, Current Conditions, Hourly Round Up, State Forecast, State Watches, State Warnings, Special Report, Public Report, and Summary Report. The main content area features a message about PDF viewing, an Adobe Acrobat Reader download button, and sections for "CHART2 Documentation" and "Release 1, Build 2 Documentation", each with several links to documents and design files.

Coordinated Highways Action Response Team

Home | [Local Traveler Information](#) | [Interactive Mapping](#) | [Maryland Weather](#) | [Lane Closures](#)

Navigation

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If you can't view the PDFs, get the free Adobe Acrobat reader.



CHART2 Documentation

- [CHART II High-level 5-Year Development Schedule \(PPT File - Opens in new window\)](#)
- [CHART II Business Area Architecture - Full 5-Year Build-out \(PDF File - Opens in new window\)](#)
- [CHART II System Architecture Document\(PDF File - Opens in new window\)](#)

Release 1, Build 1 Documentation - NOTE - This code is considered DEPRECATED code and is mostly obsolete. It is included here for historical purposes only. For the most current version of CHART, see Release 1, Build 2 below.

- [CHART II Release 1, Build 1 High Level Design \(PDF File - Opens in new window\)](#)
- [CHART II Release 1, Build 1 Detailed Design \(PDF File - Opens in new window\)](#)
- [CHART II Release 1, Build 1 Graphical User Interface Detailed Design \(PDF File - Opens in new window\)](#)

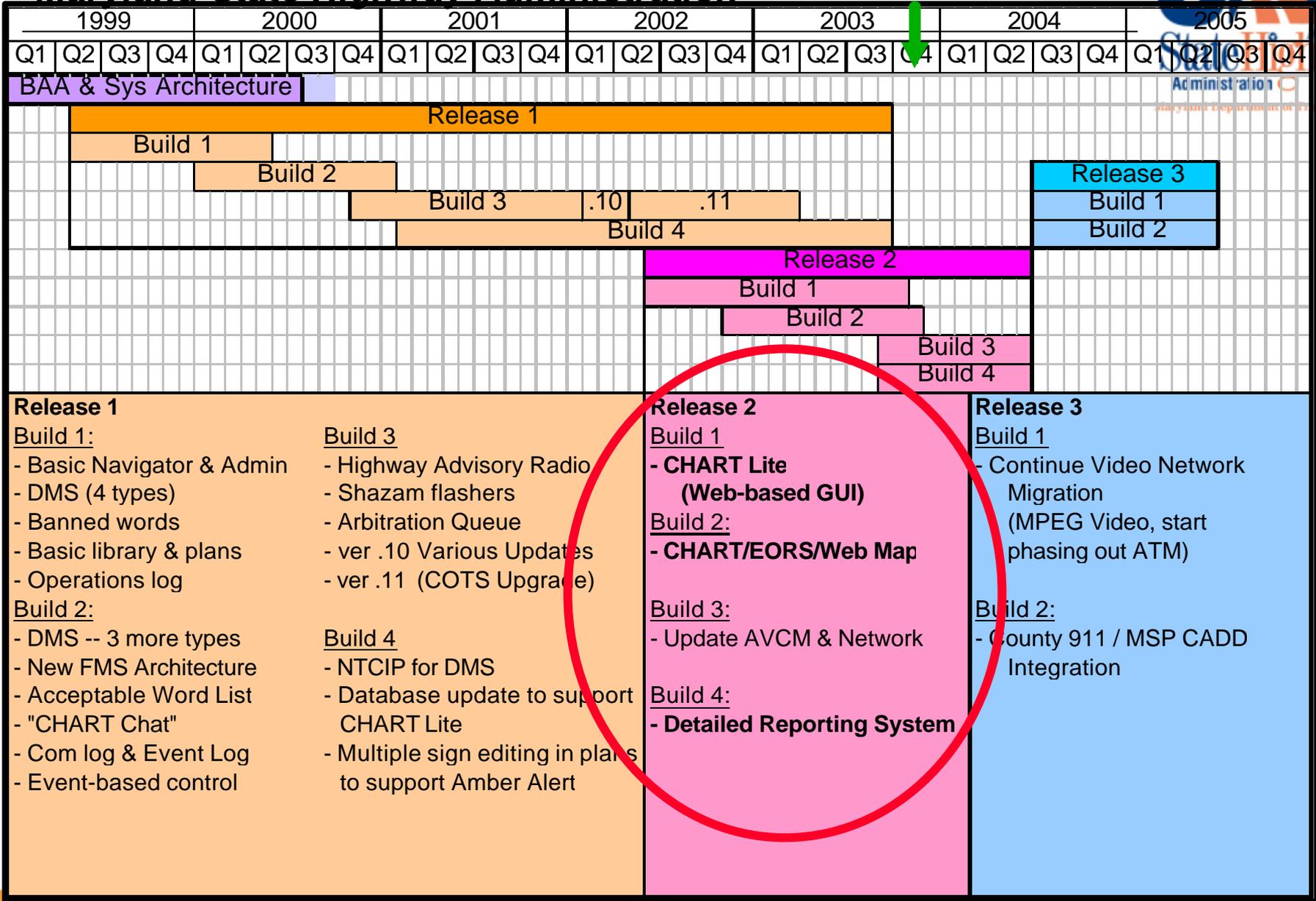
Release 1, Build 2 Documentation

- [CHART II Release 1, Build 2 High Level Design - Expected by 12/31/2000 \(Zip File - 1 MB\)](#)
- [CHART II Release 1 Build 2 - All design docs \(Zip File - 4 MB\)](#)
- [CHART II Release 1 Build 2 - GUI Detail Design \(PDF File - Opens in new window\)](#)
- [CHART II Release 1 Build 2 - Field Management Station Detailed Design \(PDF File - Opens in new window\)](#)



Multi-year Deployment Schedule

Maryland State Highway Administration



Event Reports

System Time	Log Entry	Author	Source	Center
11/17/03 15:38:41	Traffic Event 'Incident @ N/B I-95 X-47[Other]' opened	Irineker	Other (Unspecified)	TOC4
11/17/03 15:38:41	Location set to 'N/B I-95 X-47'	Irineker	Other (Unspecified)	TOC4
11/17/03 15:38:41	Source set to 'State Police (R)'	Irineker	Other (Unspecified)	TOC4
11/17/03 15:38:41	Direction set to 'North'	Irineker	Other (Unspecified)	TOC4
11/17/03 15:38:41	County/state set to 'Baltimore County'	Irineker	Other (Unspecified)	TOC4
11/17/03 15:38:45	Incident type changed to 'Collision, Property Damage'	Irineker	Other (Unspecified)	TOC4
11/17/03 15:38:45	Traffic event name changed from 'Incident @ N/B I-95 X-47[Other]' to 'Incident @ N/B I-95 X-47[Collision, Property Damage]'	Irineker	Other (Unspecified)	TOC4
11/17/03 15:38:47	Road conditions set to 'Dry'	Irineker	Other (Unspecified)	TOC4
11/17/03 15:39:03	CHART Unit 9401' participation added	Irineker	Other (Unspecified)	TOC4
11/17/03 15:39:06	CHART Unit 9401' notified flag set to 'true'	Irineker	Other (Unspecified)	TOC4
11/17/03 15:39:49	Incident type changed to 'Collision, Personal Injury'	Irineker	Other (Unspecified)	TOC4
11/17/03 15:39:49	Traffic event name changed from 'Incident @ N/B I-95 X-47[Collision, Property Damage]' to 'Incident @ N/B I-95 X-47[Collision, Personal Injury]'	Irineker	Other (Unspecified)	TOC4
11/17/03 15:39:55	Incident vehicle data set: ; Trailors - 1	Irineker	Other (Unspecified)	TOC4
11/17/03 15:40:44	Incident vehicle data set: ; Trailors - 1, Trailors Overturned - 1	Irineker	Other (Unspecified)	TOC4
11/17/03 15:41:00	Incident vehicle data set: Cars - 1; Trailors - 1, Trailors Overturned - 1	Irineker	Other (Unspecified)	TOC4
11/17/03 15:41:08	State Police' participation added	Irineker	Other (Unspecified)	TOC4
11/17/03 15:41:09	State Police' responded to event flag set to 'true'	Irineker	Other (Unspecified)	TOC4
11/17/03 15:41:17	Fireboard' participation added	Irineker	Other (Unspecified)	TOC4
11/17/03 15:41:29	Lane configuration changed to '4 lanes each direction with shoulders'. Current configuration: SB: LS-Open, L1-Open, L2-Open, L3-Open, L4-Open, RS-Open; NB: LS-Closed, L1-Open, L2-Open, L3-Open, L4-Open, RS-Open	Irineker	Other (Unspecified)	TOC4
11/17/03 15:41:29	Lane state description changed to '4 lanes each direction with shoulders on both sides'	Irineker	Other (Unspecified)	TOC4
11/17/03 15:41:43	BOTH VEHICLES IN CENTER MEDIAN	Irineker	Other (Unspecified)	TOC4
11/17/03 15:41:56	Location changed to 'N/B I-95 PAST X-47'	Irineker	Other (Unspecified)	TOC4
11/17/03 15:41:57	Traffic event name changed from 'Incident @ N/B I-95 X-47[Collision, Personal Injury]' to 'Incident @ N/B I-95 PAST X-47[Collision, Personal Injury]'	Irineker	Other (Unspecified)	TOC4
11/17/03 15:43:12	ENTRAPMENT	Irineker	Other (Unspecified)	TOC4



Maryland State Highway Administration CHART Lite



Operations Center Report - CHART - Microsoft Internet Explorer

CHART

Back | Forward | Refresh | Home | Paging | Traffic Events | Help | Logout

Operations Center Report For 'SOC'

[All Open Events and Devices With Active Messages In System](#)
[View Shift Handoff Report](#)

Open Traffic Events

Event Description / Location	Direction	Event Type	County / State	Lane Closures	Vehicles
Incident @ MD RTE. 66 ATT CHEWSVILLE[Other] MD RTE. 66 ATT CHEWSVILLE	East/West	Incident (Other)	Washington County	2 of 2 westbound travel lanes closed. 2 westbound shoulder lanes closed. 2 of 2 eastbound travel lanes closed. 2 eastbound shoulder lanes closed.	
Incident @ MD 7 @ MAIN/DELAWARE AVE[Emergency Roadwork] MD 7 @ MAIN/DELAWARE AVE	East/West	Incident (Emergency Roadwork)	Cecil County	2 of 2 westbound travel lanes closed. 2 westbound shoulder lanes closed. 2 of 2 eastbound travel lanes closed. 2 eastbound shoulder lanes closed.	
Planned Closure @ US 40 (MEADOW RUN BRIDGE) DO NOT DELETE US 40 (MEADOW RUN BRIDGE) DO NOT DELETE	East/West	Planned Closure	Garrett County	2 of 2 westbound travel lanes closed. 1 westbound shoulder lane closed. 2 of 2 eastbound travel lanes closed. 1 eastbound shoulder lane closed.	
Planned Closure @ MD 450 W/B>47TH AND 46TH 8P-10P R/LNS MD 450 W/B>47TH AND 46TH 8P-10P R/LNS	West	Planned Closure	Prince George's County	2 of 4 westbound travel lanes closed. 1 westbound shoulder lane closed.	
Planned Closure @ US 50 AT BAY BRIDGE (THRU 11/26) US 50 AT BAY BRIDGE (THRU 11/26)	West	Planned Closure	Queen Anne's County	1 of 3 westbound travel lanes closed.	
HAR devices in use:				197 198 199 297 298 299 996 P HAR	
Action Event @ MD 458 @ BROOKS [Signal] MD 458 @ BROOKS	None	Action Event	Prince George's County		
Action Event @ MD 253 @ LONDONTOWN/STEPNEY [Signal] MD 253 @ LONDONTOWN/STEPNEY	None	Action Event	Anne Arundel County		
Action Event @ MD 27 BETWEEN MOUNT PELTER & BOND ST MD 27 BETWEEN MOUNT PELTER & BOND ST	South	Action Event	Carroll County		



CHART Map



CHART Mapping - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Media Print Mail

Address: http://170.93.51.74/chartmap/

Traffic Road Work Video/Camera CHART Devices EORS Other

View Display Help

DMS at I-95 S, at Chesaco Ave (prior to I-95/I-895 Split) (818)

Comm Mode: ONLINE

Status: OK

LANES DIVIDE AHEAD

I-95 PAST I-895

ALL LANES THROUGH

Events		Legend	
All Open Events			
Location	County	Dir	OpCtr
MD RTE. 66 ATT CHEWSVILLE	Washington	E/W	SOC
MD 183 PRIOR TO 62ND AVE	PG	S	SOC
MD 7 @ MAIN/DELAWARE AVE	Calcl	E/W	SOC
US 48 (MEADOW RUN BRIDGE) ...	Garrett	E/W	SOC
US 50 AT BAY BRIDGE (THRU ...)	QA	W	SOC
I-95 PAST I-895 NEW TRAFF ...	Balto City	S	AOC
I-95 CR RAMP FROM MD 150 ...	Balto City	N	AOC
U.S. 50 BAY BRIDGE/AV LAN ...	QA	W	AOC
MD 174 RAMP OFF I-97 THR ...	AA	S	SOC
MD 175 AT RIDGE RD	AA	W	SOC
MD 193 - CUNNINGHAM DR TO ...	PG	E	SOC
MD 492 W/B-47TH AND 6TH ...	PG	W	SOC
BWI Parking	AA	None	HAA BWI
RT 272 AT RT 273	Calcl	S	SOC
MD 528 @ 427TH ST.	Worcester	None	SOC
SMALLWOOD DR @ ST CHARLES ...	Charles	None	SOC
ST CHARLES PKWY @ ST MARK ...	Charles	None	SOC
ST CHARLES PKWY @ ST THOM ...	Charles	None	SOC
GREEN SPRING AVE AT GREEN ...	Baltimore	N/S	SOC

0 3.53mi

1: 454797 GO Active Tool: Identify

Longitude: -76.517; Latitude: 39.344; X: 441399; Y: 186387

Map Center: 49200, 169100

Internet



Partners

Transportation Management

Highway Maintenance

Law Enforcement

- Statewide Operations Center
- Washington DC Traffic Center
- Baltimore Traffic Operations Center
- Annapolis Traffic Operations Center
- Bay Bridge Traffic Operations Center
- Authority Operations Center
- Montgomery County Traffic Center
- Ravens Traffic Operations Center
- Redskins Traffic Operations Center
- Prince George's County Traffic Center
- BWI Airport Operations
- Virginia Department of Transportation
- Northern Smart Traffic Center

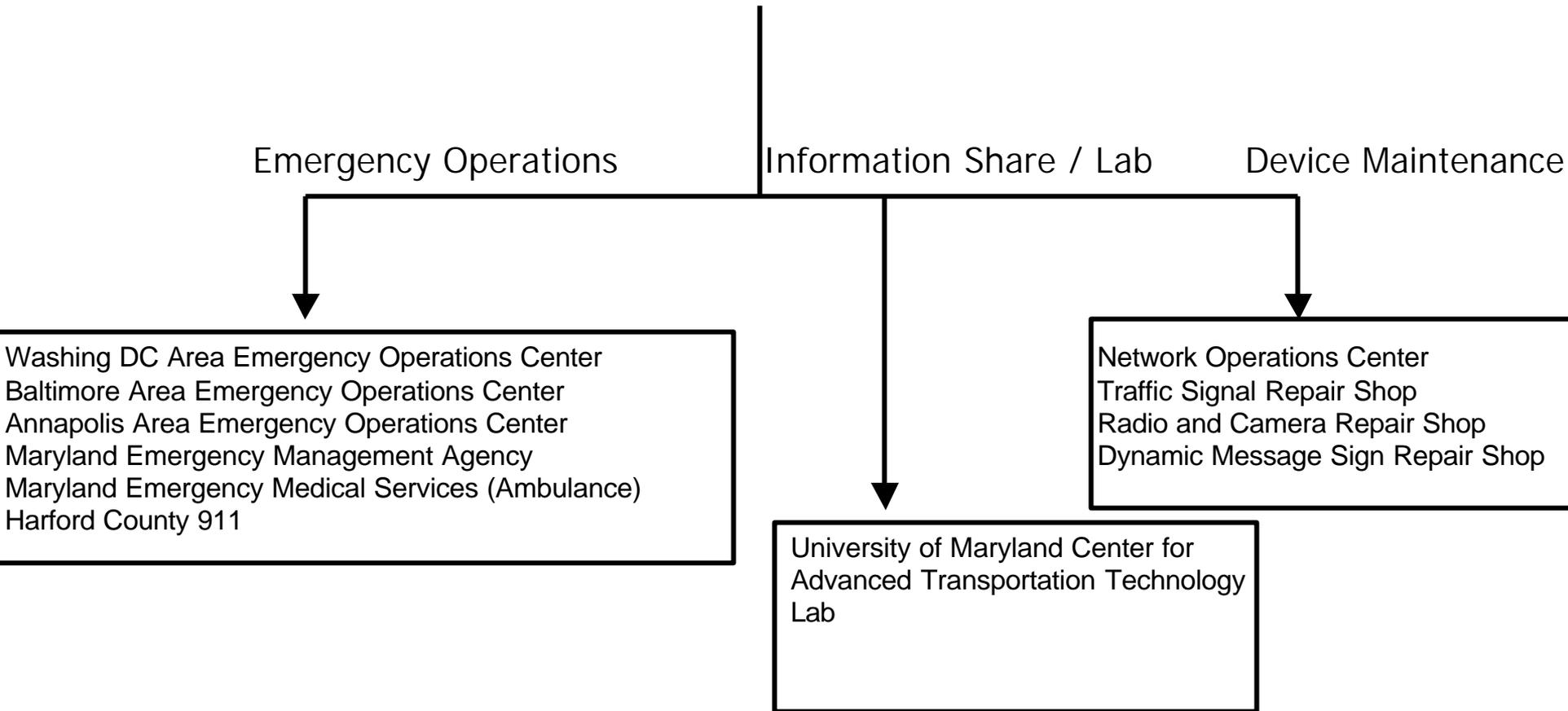
- Baltimore County Police
- Maryland State Police Barracks - Annapolis
- Maryland State Police Barracks - Rockville
- Maryland State Police Barracks - Forestville
- Maryland State Police Barracks - Golden Ring
- Maryland State Police Barracks - College Park
- Maryland State Police Barracks - Waterloo
- Maryland State Police Barracks - Glen Burnie
- US Park Police (Greenbelt)

- Dayton Shop
- Owings Mills Shop
- Laurel Shop
- Fairland Shop
- Annapolis Shop
- Gaithersburg Shop
- Golden Ring Shop
- Upper Marlborough Shop

Current Users of CHART



Partners (Continued)



Current Users of CHART



Future Partners

Baltimore City Police / 911
Baltimore City Public Works
Baltimore City Fire Department Operations
District of Columbia Traffic Management Center*
Hereford Highway Maintenance Shop
Anne Arundel County 911 PSAP *

* Currently funding their own workstation and circuit



Operational / Administrative Coordination

- CHART Board (Meets Monthly)
 - Chaired by SHA Chief Engineer (originally SHA Administrator)
 - Each District Engineer with CHART Responsibilities
 - Director, SHA Office of Traffic and Safety
 - Director, SHA Office of Maintenance
 - MdTA (Toll) Representative
 - State Police Representative (Lieutenant or Sergeant)
 - SHA CFO
 - MDOT CIO
 - University of Maryland



Planning Coordination

- Technical Working Group
 - Originally organized to coordinate functional design
 - Continues to meet monthly to coordinate each agency's build-out
 - Consists of division-chief level representatives of software, communications / network, engineering design and construction inspection personnel

Development Coordination

- The principal elements of effective change management are:
 - Identifying the documents, system components, and other items to be controlled
 - Placing items under control at the appropriate time
 - Using formal methods to propose and authorize changes, to request authorization to deviate from configuration control requirements, and to document technical problems
 - Establishing formal mechanisms for evaluating and tracking changes and problems from identification through resolution and closure

CHART II System Requirements Specification Release 1 Build 2

- **Document # M361-RS-002R1**
- **This document was delivered after the Response to RFP was finalized and was updated after local joint application development sessions had occurred.**
- **It is updated after each software build**

CHART II System Requirements Specification Release 1 Build 2

3.7.2.1 Event Management This section presents general requirements related to the management of events.			246
3.7.2.1.1 <i>The system shall store identifying information with each event.</i>	1	2	268
3.7.2.1.1.1 <i>The system shall store the Date/time with each event entry.</i>	1	2	269
3.7.2.1.1.1.1 The system shall store the system date/time of the creation of the entry.	1	2	735
3.7.2.1.1.1.2 The system shall store the operator entered date/time for an entry (defaults to system date/time).	1	2	736
3.7.2.1.1.2 <i>The system shall store the source Workstation Identifier (if applicable) with each event entry.</i>	1	2	270

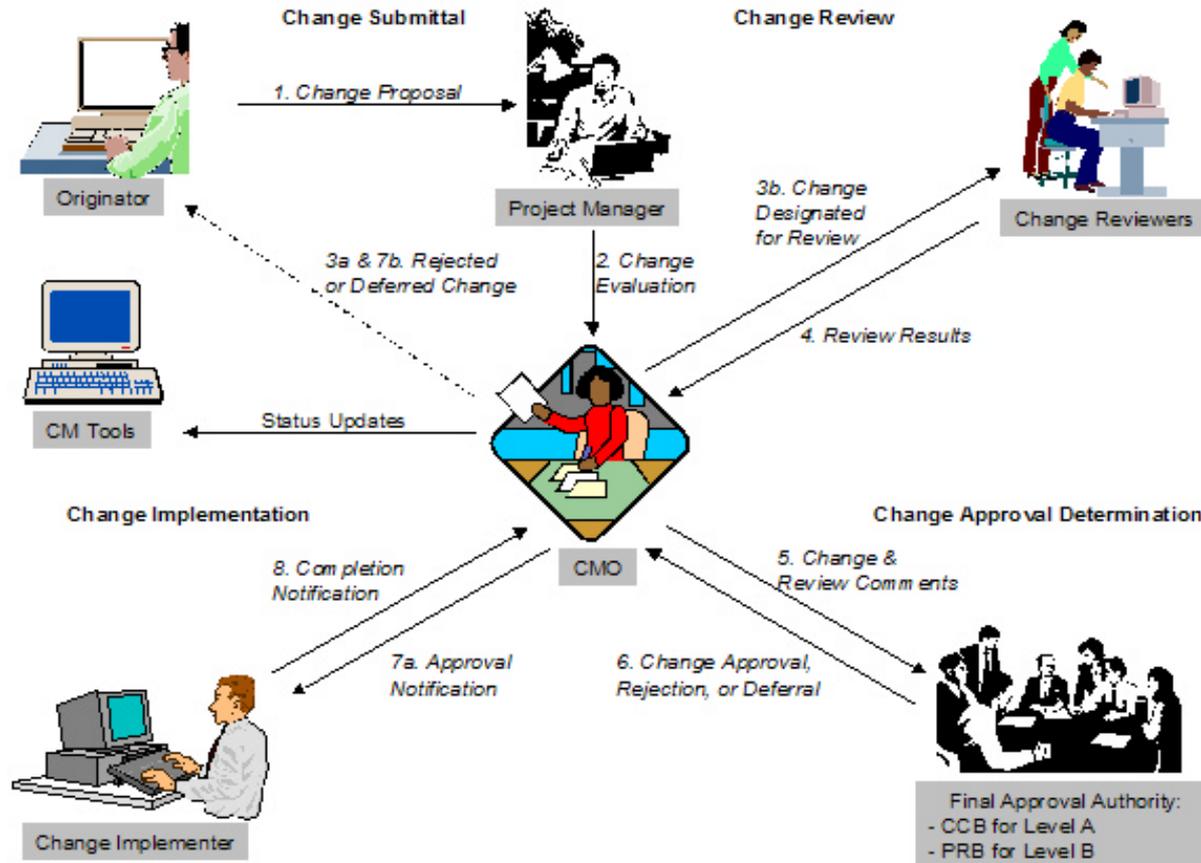


CHART II Project Master Plan

Appendix G

- **Configuration Management Plan**
- **Document #M361-MP-001GR3**
- **Many of the following slides come directly from this required, early contractual delivery**

Development Coordination



Development Coordination

Level	Controlled CIs	Change Reviewers	Approval Authority
A	<ul style="list-style-type: none"> ➤ CHART II Requirements ➤ CHART II Design Documents ➤ Acceptance Documents ➤ Transition Plan ➤ Operational system components ➤ Interface Control Documents ➤ Other items as specified by MDSHA Project Manager 	<ul style="list-style-type: none"> ➤ Affected software managers ➤ Task Manager 	CHART II CCB (see Section 2.3)
B	<ul style="list-style-type: none"> ➤ Development baseline items ➤ Other items as specified by MDSHA Project Manager 	<ul style="list-style-type: none"> ➤ Affected software managers 	CHART II PRB (see Section 2.4)

Development Coordination

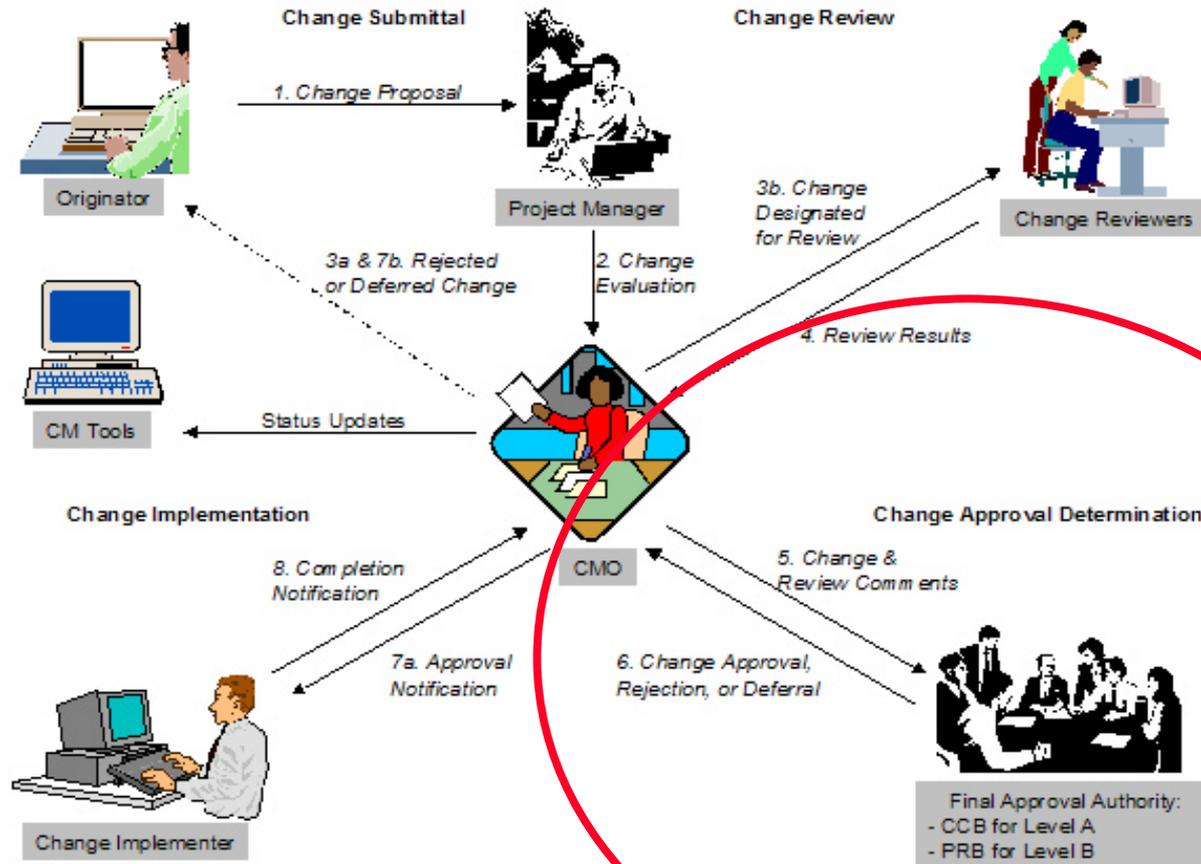
- **Change Priorities**

- **A priority level is assigned to each proposed change so that the proper resources are applied according to the criticality for project success. The change originator assigns the priority, which may be modified during the review/approval process.**

Development Coordination

Priority	Criticality	Characteristics
1 Very High	Major deficiency, error, or issue that merits immediate attention until resolved	Any one of the following is true: <ul style="list-style-type: none"> ➤ Critical system functionality is inhibited ➤ Testing cannot proceed in the affected functional area(s) ➤ Continuation of the situation jeopardizes the project schedule
2 High	Major deficiency, error, or issue that requires immediate attention as soon as all Very High items are resolved	Any one of the following is true: <ul style="list-style-type: none"> ➤ Major system functionality is inhibited, but system is not inoperable ➤ Testing can proceed in affected functional area(s) but with restrictions ➤ Continuation of the situation may jeopardize the project schedule
3 Medium	Deficiency, error, or issue that requires resolution but not immediate attention	All of the following are true: <ul style="list-style-type: none"> ➤ System functionality is somewhat affected, but an acceptable workaround has been identified ➤ Testing can proceed in affected functional area(s) with few or no restrictions ➤ The situation has little or no impact on operational use ➤ Continuation of the situation does not impact the project schedule
4 Low	Minor deficiency, error, or issue that should be resolved but may be postponed	All of the following are true: <ul style="list-style-type: none"> ➤ System functionality is not affected ➤ Testing is not impacted ➤ The situation (though an irritation or distraction) does not impact operational use ➤ Continuation of the situation does not impact the project schedule

Development Coordination



Development Coordination

- The CHART II Configuration Control Board (CCB) functions and responsibilities are as follows:
 - Establishes CHART II CM policy and associated processes and procedures
 - Approves and controls the CHART II CM Plan
 - Establishes and controls project baselines
 - Reviews and assesses the impact of baseline changes
 - Coordinates with external CCBs on the review and approval of changes that involve interfaces with external systems
 - Reviews and determines the disposition of requests for deviation from or waiver of project CM requirements as delineated in this plan

Development Coordination

- The CCB is chaired by the MDSHA CHART II Project Manager, who has final approval authority on all CCB issues. Voting board members are:
 - MDSHA CHART functional area managers (who are also responsible for ensuring that the proper user communities are represented at workshops and work sessions)
 - University of Maryland representative
 - Federal Highway Administration (FHWA) representative*
- Non-voting members, who provide technical background information, impact analysis, and resulting recommendations, are:
 - CSC CHART II Task Manager
 - PB Farradyne, Inc. (PBFi) Development Manager
 - Independent Validation and Verification (IV&V) agent
 - The CHART II CM Office (CMO) CMO may attends CCB meetings and provides support

* Due to Federal guidelines became non-voting



Development Coordination

- **CHART II Level B Problem Review Board**
- The Task Manager will establish and chair a Problem Review Board (PRB) for Level B changes. Members will include, at a minimum,
 - the CHART II CMO
 - QA representative
 - System Test Manager
 - Development Manager
 - Database Designer
 - CHART IV&V
- The PRB will meet as often as necessary to resolve all pending Level B problems, which will be tracked to closure by the CMO. The CMO will also take minutes and distribute them to board members.

Development Coordination

- The economic downturn of 2001 has affected the Consolidated Transportation Plan (CTP) budget for CHART software development
- The detailed Business Area Architecture, CHART II System Requirements Specification, and CHART Configuration management Plan makes it easier to pick and choose high-level requirements and bid them out to multiple vendors

Development Coordination

- The CHART II Configuration Control Board (CCB) functions and responsibilities have evolved to a combination of:
 - MDOT multi-modal Network CCB
 - Monthly CHART Board review
 - Yearly review by outside agency with statutory oversight for state government software development (Maryland Department of Budget and Management)
- Current builds are smaller in scope, but larger in multi-agency complexity



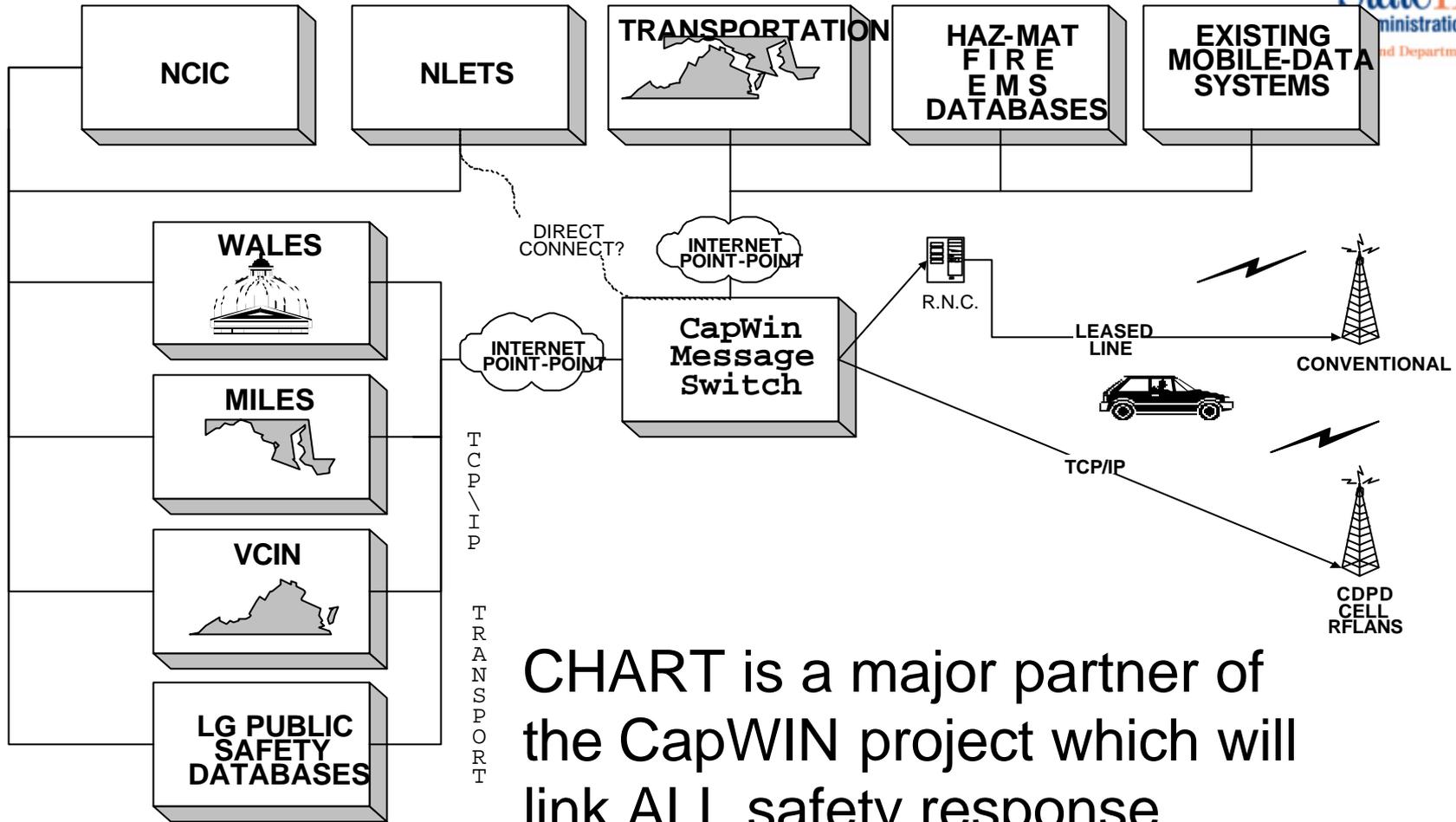
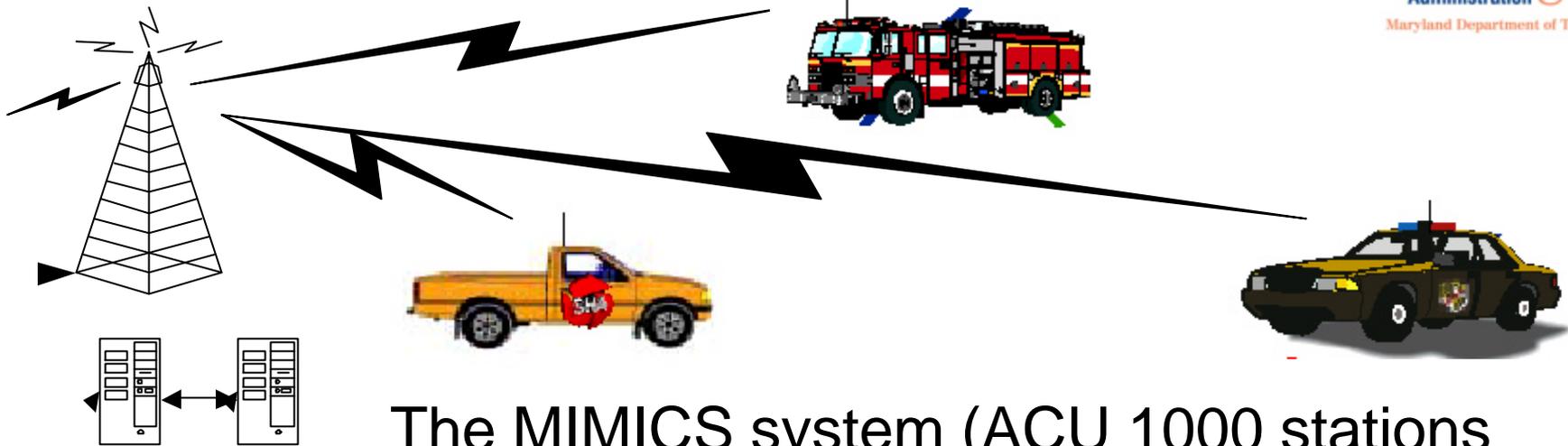


CHART is a major partner of the CapWIN project which will link ALL safety response agencies in the Washington D.C. region



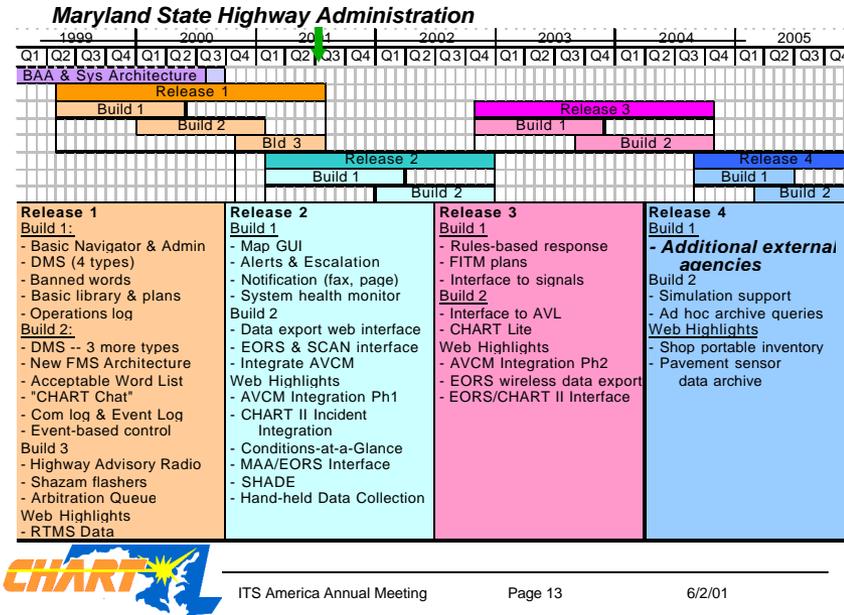


The MIMICS system (ACU 1000 stations that allows sharing of radio traffic at the base-station level) is being evaluated for installation at many CHART workstation locations.

What Have We Learned?

Schedules are great, but.....

- Government getting good at balancing technical, risk, and economic issues in their planning
- Interagency groups are forming to jointly develop systems
- But once planning is complete and deliverables start to flow...EVERYBODY WANTS EVERYTHING NOW!!



What's Around the Corner?

Changes are coming in design disclosure

- To meet FOIA and to encourage collaboration, all CHART designs documents have been posted to the web
- More intra-agency, security sensitive data is now riding this network
- How to share design while tracking where design goes?



What's Around the Corner?

- Many high-value “targets” are currently monitored by DOTs for traffic management purposes
- Who else will start receiving this video?
- Will video be routinely recorded?
- If not routinely, which cameras will be recorded and under what circumstances?

