

Global  
Material  
Security



# Transportation – Security, Tracking, and Reporting System

U.S. Department of Energy  
National Nuclear Security  
Administration



# Why Develop T-STAR?



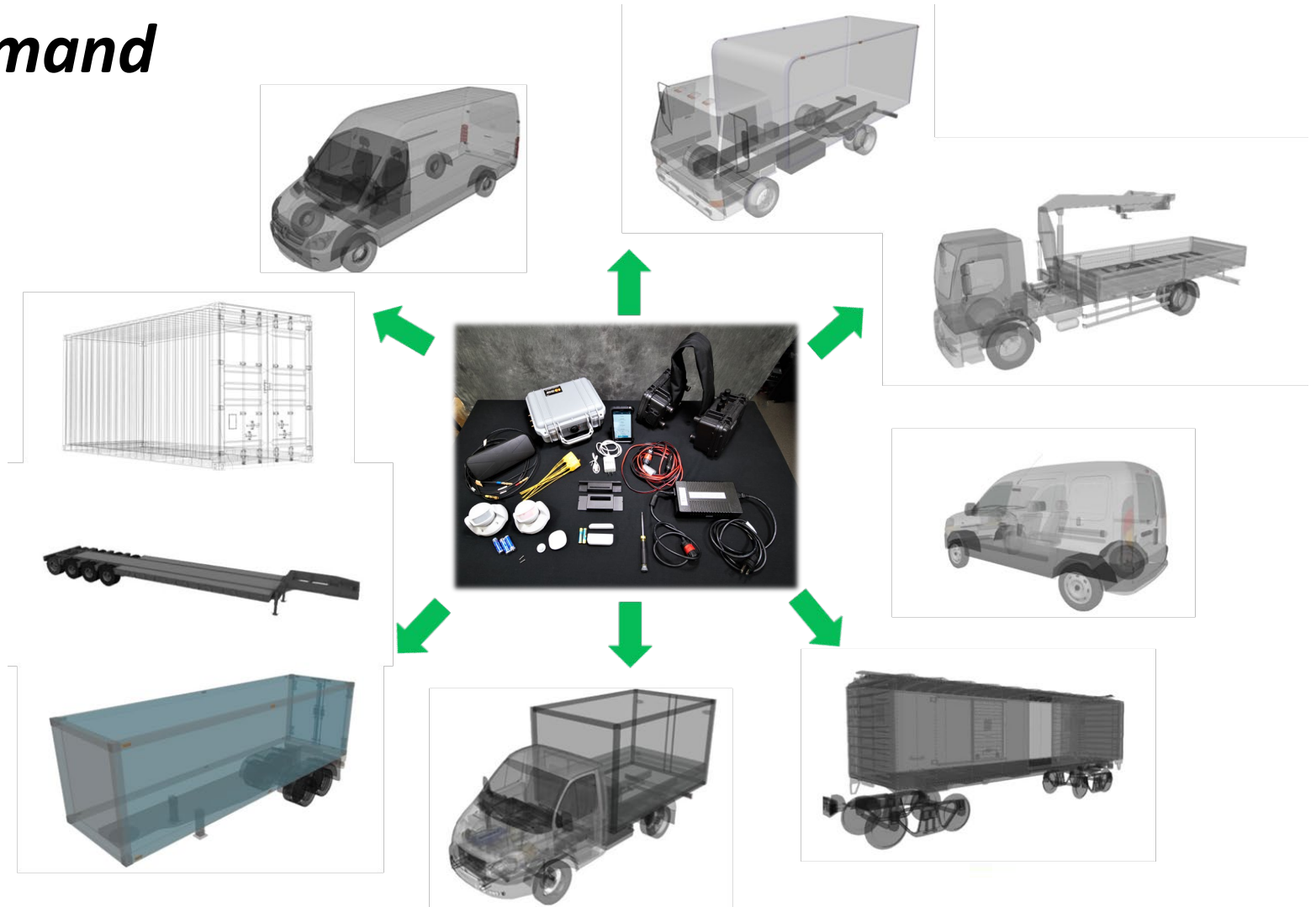
- Tracking technologies are not viable or required in many international locations
- Existing tracking technologies do not often provide detection and can be expensive to implement
- Developed to provide in transit visibility, detection (and assessment) capability to responsible parties
- Designed to overcome many barriers to deploying tracking systems capable of providing detection
- Designed to be flexible to allow use on a variety of conveyances used to transport radioactive material
- Designed to be inexpensive to maintain and easy to use

# Flexibility is Required



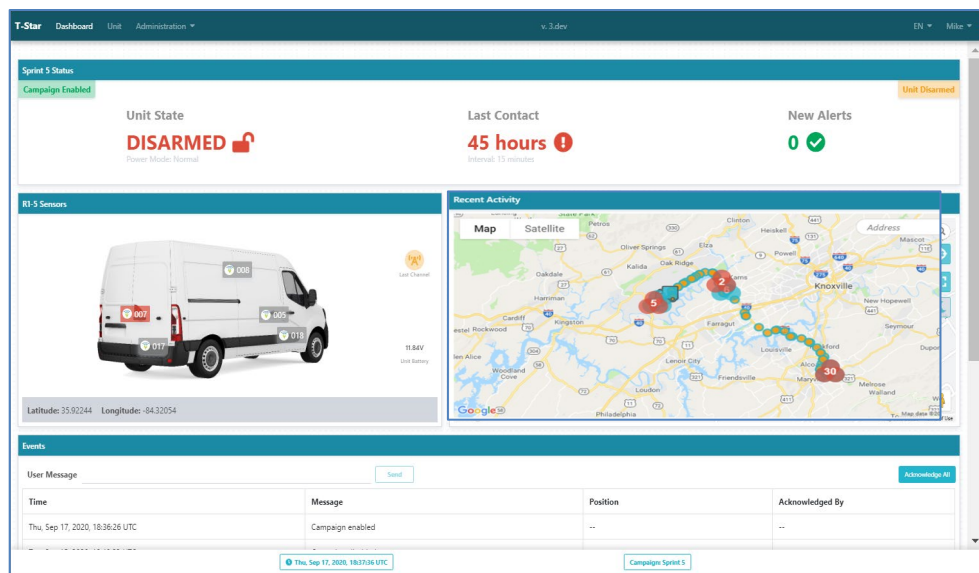
## *Deployment on Demand*

- Rail
- Box Truck
- Panel Van
- Sea/Land
- Flatbed
- Trailer
- Crane Truck





# What is T-STAR?



T-STAR Server and Website  
*Configuration, Monitoring, and Response*

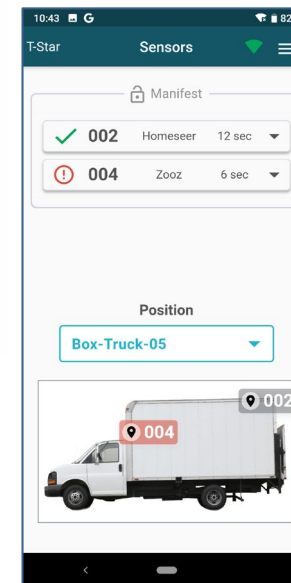
- Sensor nodes communicate with Control Unit using T-STAR's wireless network
- T-STAR Control Unit communicates with T-STAR Server via Cellular or Iridium satellite network
- T-STAR Website is hosted by the T-STAR server or on AWS Cloud and is accessible to desktop and mobile clients



Passive Infra-Red (PIR)  
*Detects Motion*



GPS, GSM,  
Iridium Antenna



Mobile App



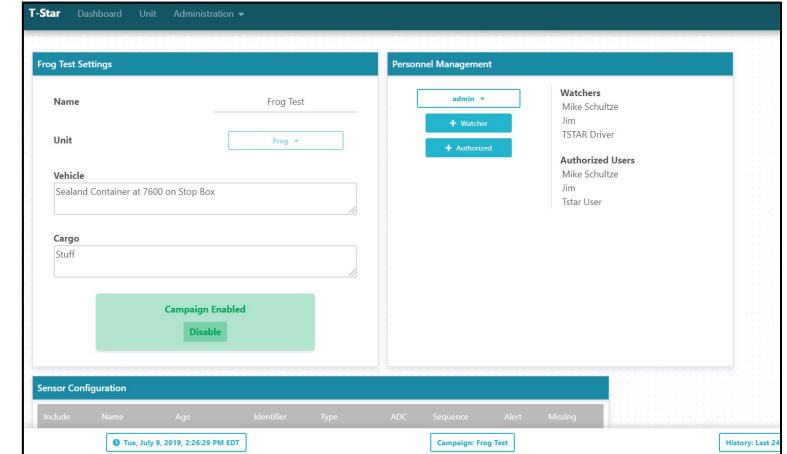
Magnetic Door Sensor  
*Detects Door Open/Close*



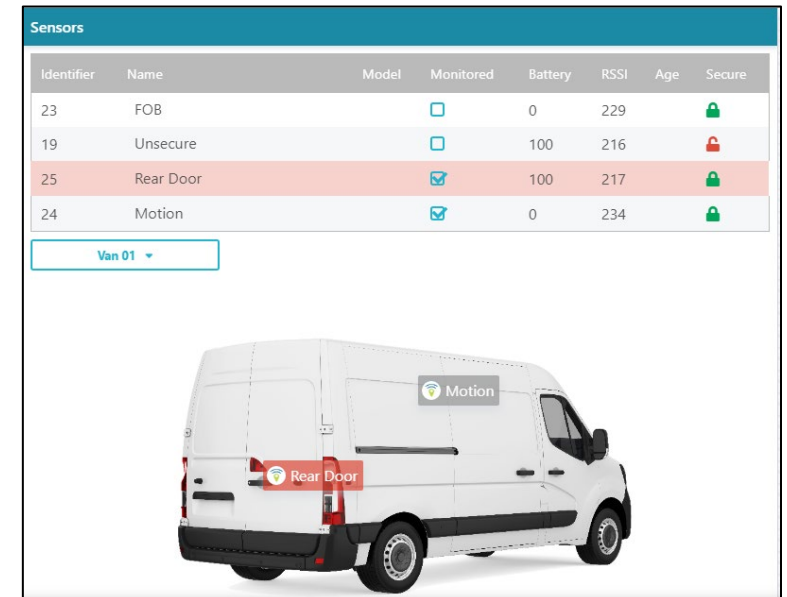
T-STAR Control Unit  
*Communications*

# Using T-STAR

- Setup transport “Campaign”
  - Security manager uses T-STAR website to configure a T-STAR control unit and sensors to be placed on the conveyance
  - Adds Users
    - Persons who can monitor the shipment
    - Persons who will receive alert notifications
- Install system and sensors on conveyance
- Operability testing of communications and sensors in conjunction with monitoring center



The screenshot shows the T-STAR web interface. The top navigation bar includes 'Dashboard', 'Unit', and 'Administration'. The main content area is divided into two panels. The left panel, titled 'Frog Test Settings', contains fields for 'Name' (Frog Test), 'Unit' (Frog), 'Vehicle' (Sealand Container at 7600 on Stop Box), and 'Cargo' (Stuff). Below these fields is a green button labeled 'Campaign Enabled' and a smaller 'Disable' button. The right panel, titled 'Personnel Management', has an 'admin' dropdown, '+ Watcher' and '+ Authorized' buttons, and lists 'Watchers' (Mike Schultze, Jim TSTAR Driver) and 'Authorized Users' (Mike Schultze, Jim Tstar User). At the bottom, there is a 'Sensor Configuration' section with a table of sensors and a 'History: Last 24' link.



The screenshot shows the 'Sensors' section of the T-STAR web interface. It features a table with sensor data and a 3D model of a white van with sensors indicated.

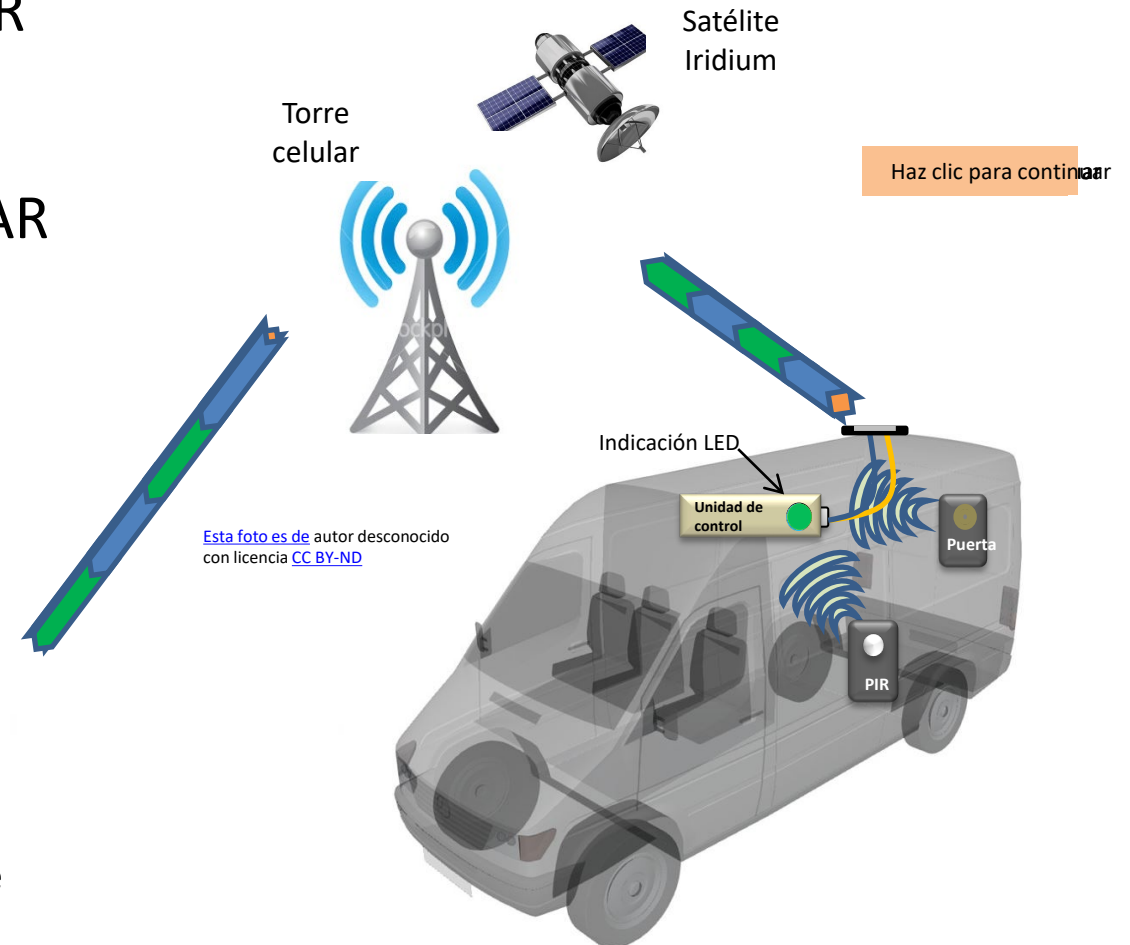
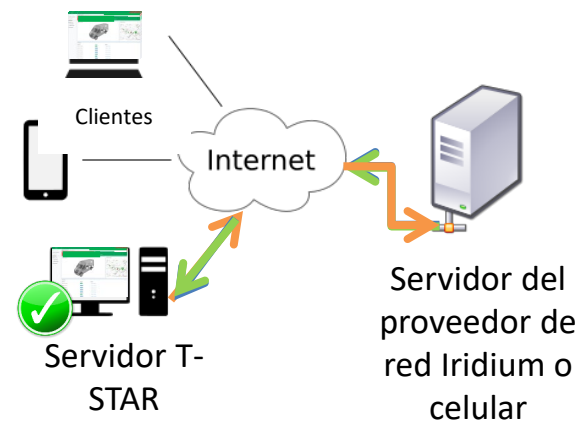
Identifier	Name	Model	Monitored	Battery	RSSI	Age	Secure
23	FOB		<input type="checkbox"/>	0	229		
19	Unsecure		<input type="checkbox"/>	100	216		
25	Rear Door		<input checked="" type="checkbox"/>	100	217		
24	Motion		<input checked="" type="checkbox"/>	0	234		

Below the table is a dropdown menu labeled 'Van 01'. At the bottom is a 3D model of a white van with a 'Motion' sensor icon on the side and a 'Rear Door' sensor icon on the back.



# How T-STAR is ARMED

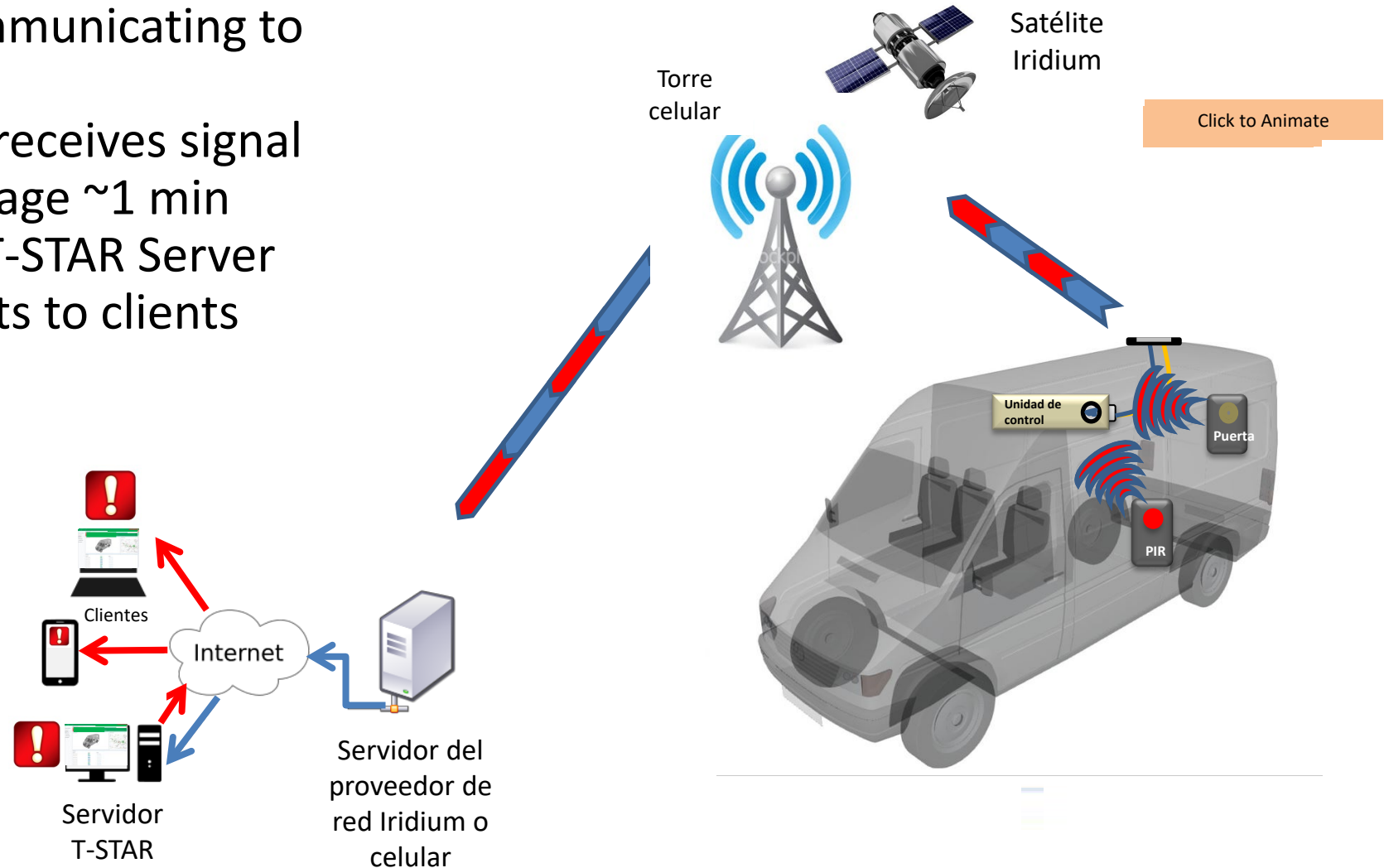
- T-STAR Control Unit Discovers Sensor Inventory
- T-STAR Control Unit Sends Inventory to T-STAR Server
- Sensor Inventory is Verified
- Confirmation/rejection message sent to T-STAR
- Driver arms the system using button or application
- Event notification sent that T-STAR is ARMED





# How T-STAR Alerts Work

- Normal state, nodes communicating to T-STAR
- Alarm triggered, T-STAR receives signal
- T-STAR sends Alert Message ~1 min
- Message is received on T-STAR Server
- T-STAR server sends alerts to clients







# Using T-STAR during Normal Operations

- Driver makes stop to pickup or unload
  - Driver contacts Security Manager
  - Security manager uses T-STAR website to Deactivate the Campaign and suspend alert notifications. Unit remains ARMED and Tracking.
  - Message sent to users that campaign has been Deactivated.
  - When complete, driver contacts Security Manager to Activate the Campaign
  - T-STAR is ARMED
- Driver is finished for the day
  - Driver contacts Security Manager
  - Security manager uses T-STAR website to Deactivate the Campaign and suspend alert notifications. Unit remains ARMED and Tracking.
  - If desired, Security manager uses T-STAR website to Shutdown the T-STAR remotely and power down the system.
- Driver cannot Deactivate or Disarm the system







- If disconnected (power, antenna, or no signal), an Alert message is generated by the server
- If sensor fails to report to T-STAR unit, an Alert is generated by the server that a sensor is not found
- Ability to Test user notification SMS and email when adding users
- History is stored and be recalled for reports and after-action review
- Multiple language support for both the Website and Alert Messages



- T-STAR User Interface (UI)
  - Dashboard
    - Monitor Status and Locations of Units
  - Campaigns
    - Setup
    - Authorized Users
    - Watchers
  - Geofences
  - Notifications
    - Alarms and Events communicated via email and SMS
  - User Roles
    - Administrators
    - Normal Users
    - Watcher
  - Units
    - T-STAR Head Unit (HU) and Sensors



- Works best in Google Chrome
  - Firefox is second choice
  - Safari works well on iPhone
  - Microsoft Edge
  - Hosted in Amazon cloud (AWS)
- Can be hosted on stand-alone server
- Google Maps
- SMS and Email notifications handled by Twilio and SendGrid

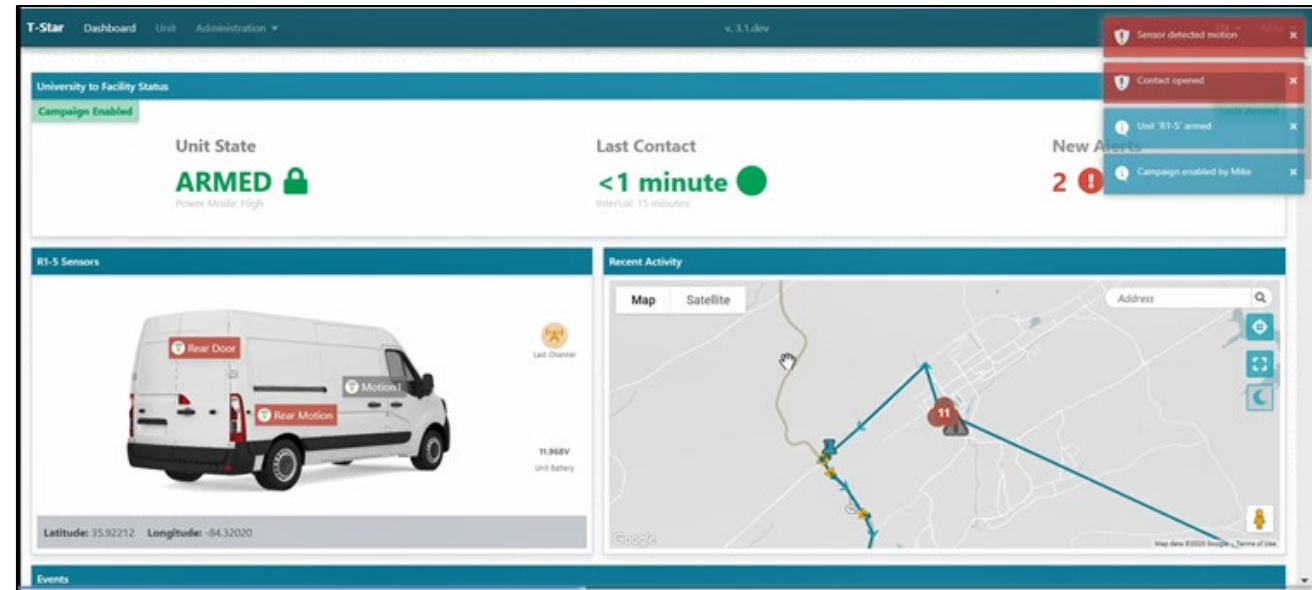
The screenshot shows a login form titled "T-Star". Below the title is the instruction "Sign in to start your session". The form contains two input fields: "Email" with an envelope icon and "Password" with a lock icon. A blue "Sign In" button is positioned below the password field.



# Dashboard



- Used to Monitor a T-STAR Campaign
  - Provides Status of System
    - System State (ARMED, DISARMED, etc.)
    - Reporting Intervals and how long since last report received
    - Alarms and Event Status
    - Assess and Acknowledge to dismiss Alerts
    - Communication status and availability
    - Battery Status Indicator
  - Cargo Configuration
    - Cargo and Sensor Configuration
    - Sensor Icons turn RED if in Alert
    - Case Tamper Indication
  - Maps
    - Show current location and location history
    - Alerts displayed on map as Alert icon
    - Zoom to current location
    - Google maps with satellite and StreetView
    - Displays Geofences defined in Campaign
  - History
    - Grid display of Alerts and Events
    - Filter to change time window to display events on Map and in the Grid
    - Assess and Acknowledge to dismiss Alerts





T-Star

Dashboard

Unit

Administration

v. 3.1.dev

University to Facility Status

Campaign Enabled

Unit State

ARMED

Power Mode: High

Last Contact

<1 minute

Interval: 15 minutes

New Alerts

2

Sensor detected motion

Contact opened

Unit "R1-5" armed

Campaign enabled by Mike

R1-5 Sensors

Rear Door

Motion1

Rear Motion

Last Channel

11.968V

Unit Battery

Latitude: 35.92212

Longitude: -84.32020

Recent Activity

Map

Satellite

Address

Map

Satellite

Address

Map data ©2020 Google

Terms of Use

Events

13



# Campaigns

- Method of organizing a shipment or multiple shipments with similar characteristics such as:
  - People knowledgeable about the shipment who need to administer or monitor the shipment
  - Cargo Configuration
  - Origin, Destination, Stopover Locations (Geofences)
  - Notifications
    - People or Organizations which will be notified of Alarms and Events
  - Units
    - T-STAR Head Unit (HU) and Sensor Configuration







T-Star

Dashboard

Unit

Administration

v. 3.4.2

R1-23 MTN Test Settings

Name

R1-23 MTN Test

Unit

R1-23

Vehicle

vehicle description

Cargo

cargo description

Campaign Enabled

Disable

Personnel Management

+

+ Watcher

+ Authorized

Watchers

Mike

Authorized Users

Mike

Sensor Configuration

Identifier	Name	Model	Monitored	Battery	RSSI	Age	Secure
9				0	255		
8				100	206		

Fence Management

Map

Map

Satellite

Address

Map

Satellite

Campaign Fences

None to display

Fence List

Fence 1

Home

Little River

Wed, Mar 3, 2021, 03:19:57 UTC

Campaign: R1-23 MTN Test



- Campaign Administrators
  - Set how often units are to report position information
  - Set countdown time until unit arms after code is entered on the keypad
  - Set type and number of sensors required by a Campaign
  - Select Cargo Configuration depiction to represent conveyance
  - Drag/Drop Sensor Icon to installation layout locations on cargo depiction
  - Rename Sensors to user friendly name for notifications.



# Units



T-StarDashboardUnitAdministrationv. 3.4.2ENMike

RI-23 Status

Last Low Bandwidth Update: 364 hours

Last High Bandwidth Update: 364 hours

General Status

Main Board

Board Version: ACTS TSTAR v1.0.0

Firmware Version: ReleaseWithConsole v0.2.4.0000

Latitude: 35.77358

Longitude: -83.92596

GPS Timestamp: Mon, Feb 15, 2021, 22:53:52 UTC

Position Overruns: 0

Event Overruns: 0

Modem Board

Last Reported State: ARM\_STATE\_DISARMED

WiFi: Disabled

Board Version: 3.0.0

Firmware Version: 0.7.22

Latitude: 35.77365

Longitude: -83.92588

GPS Timestamp: Mon, Feb 15, 2021, 22:53:57 UTC

Unit Serial: IMX6ee65ef190b1a31d4

Battery

Battery Voltage: 10.432V

Power Source: N/A

Sensors

Manifest

No Manifest Sensors

Unmonitored

NONE: 2

ZWave

ZWave Mode: ZWAVE\_MODE\_NORMAL

Communications

Cell

IMEI: 352254062853913

RSSI: 44

RSSI Update Count: 2

ICCID: 8934072579000571016

IP: 10.162.86.12

Modem Connected: 10.162.86.12

Status: ONLINE

Iridium

IMEI: 300434062036090

RSSI: 1

RSSI Update Count: 20

Modem Connected: true

Status: CONNECTED

Provisioning

Provisioning Info

Generated Timestamp: Wed, Jan 29, 2020, 16:06:35 UTC

Claimed Timestamp: Wed, Jan 29, 2020, 16:06:52 UTC

Identifier: 98

Counters

Unit Counter: 401590

Server Counter: 16294

Administration

Commands

Unit State

Arm: Disabled

WiFi

Enabled: Disabled

Checkin

15 minutes

Geofence Checkin

4 hours

Shutdown

Send

Unit Managers

admin

+ Manager

Managers

admin

Mike

Sensors

Identifier	Name	Model	Monitored	Battery	RSSI	Age	Secure
9			<input type="checkbox"/>	0	255		
8			<input type="checkbox"/>	100	206		

Van 01

Unit Position

MapSatelliteAddress

Last Command

id: 1430421

meta:

key id: 98

Unit Log

<< Start

Prev

Next

End >>

Last Checkin

id: 1430420

meta:

key id: 98





- People knowledgeable about the shipment who to administer or monitor the shipment
  - Administrators
    - Can see and administer ALL Campaigns
    - Can see and administer ALL Units
    - Can Add/Modify/Delete ALL Users
    - Can Assign Users to Roles
    - Can assess and dismiss any Alarms
  - Normal Users
    - Can see only those Campaigns they are assigned.
    - Cannot change Campaign or Unit values
    - Can assess and dismiss any Alarms for Campaigns they are assigned
  - Watchers
    - Users who want to be notified of alarms and events via email or SMS text message
    - Can be either Administrators or Normal Users

The screenshot displays the 'T-Star' Administration interface. The top navigation bar includes 'Dashboard', 'Unit', and 'Administration'. The 'General Settings' section for a user named 'tester' is shown. The user's description is 'T-STAR System Testing Account' and their primary email/username is 'tester\_account@nowhere.com'. Their role is set to 'Administrator'. Under 'Notification Methods', the email 'tester@tstar.com' is listed. The 'Allowed Notifications' section shows checkboxes for 'Email' and 'Phone', both of which are checked. The 'Notification Filter' is set to 'All' (radio button selected). An 'Update Password' button is visible at the bottom.

# T-STAR Operations

Global  
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Security

