

WebService

Status:

Host :

Port :

Tracks format:  
 tracks\_all  tracks

Tracks Filter:  
 Mature tracks only  
 Moving tracks only

# DMT's Restful Website Service

ACCESSING DMT'S RADARS USING A WEB SERVICES (REVISION 6)  
BILL HICKMAN

## **Description**

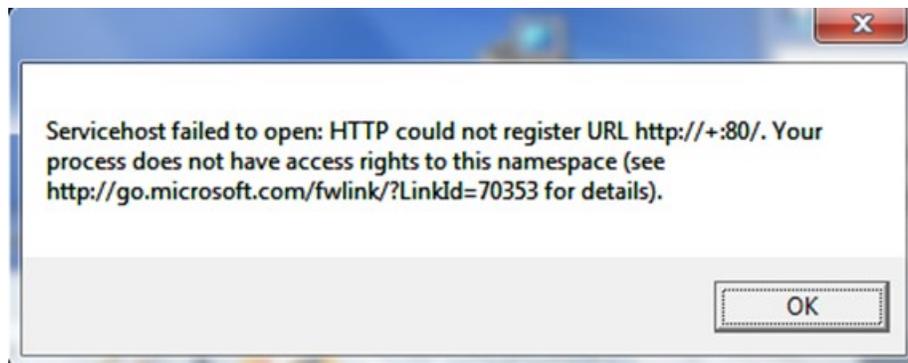
The DMT client software program<sup>1</sup> developed for operation with the DMT Radars implements a “Restful” website on the client’s host computer. This website provides a common HTTP REST<sup>2</sup> interface with nine endpoint function calls. This document provides a brief description of the website and its general operating procedures.

This revision extends earlier versions of this document by updating the format of the *Sweeps* endpoint to report sweep lines for all connected Radars. This change is implemented with *DMT Remote Client v2.50*.

## **Setup**

The *Restful WebSite* service is launched and controlled by the DMT client software program and operates continuously from the host computer while the client program is running. The *WebSite* monitors incoming http requests over the LAN on the host computer port selected by the user with the *WebService* control panel, and responds to nine separate endpoint requests to provide imagery and data on radar, AIS, and Blue force tracks detected by the DMT radars and by AIS/Blue force broadcast receivers.

The *WebSite* service should be setup and run from the “primary” DMT client computer operating from the command center. This client program must be started with the *Run as administrator* option selected. Otherwise, the *WebSite* initialization will fail and the following user alert will be displayed when attempting to start the service:



The Client program will then operate normally (minus the *WebSite* service) once this user alert is acknowledged. If the *WebSite* service is not running on the client program, then any external URI endpoint requests directed to the client host computer will be ignored.

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<sup>1</sup> *DMTRemClient.exe (Version 2.27 and later)*

<sup>2</sup> Representational State Transfer (REST) architectural style.

When the primary DMT client program is started with *Run as administrator* selected, the program starts and launches all “normal” client features, but does not launch the *WebSite* service automatically. The Start and Stop commands for this service are performed manually by the DMT Client operator with controls located on the *WebService* control panel described later.

## **Operation**

The *WebSite* service will respond to the following nine URIs:

### **Radar Vector Interface:**

```
http://<ipAddress>:<port>/Tracks3  
http://<ipAddress>:<port>/CorrTracks  
http://<ipAddress>:<port>/AISTracks  
http://<ipAddress>:<port>/BlueTracks  
http://<ipAddress>:<port>/Sweeps
```

### **Radar Imagery Interface:**

```
http://<ipAddress>:<port>/currentImage.png  
http://<ipAddress>:<port>/currentImageFull.png  
http://<ipAddress>:<port>/currentImage  
http://<ipAddress>:<port>/currentImageRev
```

Any user on the LAN containing the DMT client computer simply types one of these URIs in their browser, or automatically generates an HTTP GET request message, to access and view these reports, which are described in the following sections

## ***Radar Vector Interface***

The DMT client program processes track data from three separate input sources over the LAN: (1) Radar tracks from DMT radars, (2) AIS messages from the AIS receiver, and (3) Blue force track reports from the Raveon transponders. The client program will automatically match radar tracks with the current lists of AIS and Blue force tracks, and will tag the AIS or Blue force data to the matching Radar track.

## **Tracks Endpoint**

The *Tracks* endpoint is a report providing a complete<sup>4</sup> listing of all active radar tracks being managed by the DMT Client program at that point in time. Radar tracks remain active as long as they are being updated by the radars, and are “dropped” once they are no longer getting periodic updates.

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<sup>3</sup> Where <ipAddress>:<port> are the IPAddress of the host computer and the port number selected by the user in the *WebService* control panel.

<sup>4</sup> This listing will include either the complete list of radar tracks or be limited to only “mature” radar tracks depending on the selection on the *WebService* control panel described later.

Each time a radar track is updated, the Client program checks that track against the AIS and Blue tracks list to update the match information.

When the *Tracks* URI request is received by the Client computer's website, a *DMT Tracks Report* message is created and formatted as a JSON string, and returned as the endpoint response. The message contains the list of active radar tracks, with each track showing the radar reported position data and additional data for a matching AIS or Blue force track. If the radar track is not matched to an AIS or Blue force track, then the additional fields *ais:* and *blue:* will be blank.

The format for the *DMT Tracks Report* message is defined as follows:

DMT Tracks Report

```
{ "report_time": "(ISO8601 string)",  
  label5 : [list of Radar Track Report objects] }
```

Radar Track Report object

```
{ "track_id": "radar track number (string)",  
  "eff_time": "last update time (ISO8601 string)",  
  "latitude": "latitude (double)",  
  "longitude": "longitude (double)",  
  "course": "course degrees true (float)",  
  "speed": "speed knots (float)",  
  "move_state": "Moving or Stationary",  
  "age": "number of updates since track initiation (int)",  
  "ais": AIS Track Data object,  
  "blue": Blue Track Data object }
```

AIS Track Data object

```
{ "radar_match": "active or lost",  
  "ais_version": "reported AIS version (int)",  
  "eff_time": "last update time (ISO8601 string)",  
  "MMSI": "MMSI number (int)",  
  "IMO": "IMO number (int)",  
  "latitude": "latitude (double)",  
  "longitude": "longitude (double)",
```

---

<sup>5</sup> The placeholder *label* will either be the string "tracks" or "tracks\_all" depending on the selection on the *WebSite* panel as described later.

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```
"course": "course degrees true (float)" ,
"speed": "speed knots (float)" ,
"heading": "reported true heading (float)" ,
"nav_status": "navigation status (string)" ,
"ROT": "reported rate of turn (float)" ,
"rad_status": "radio status (string)" ,
"call_sign": "ship call sign (string)" ,
"name": "vessel name (string)" ,
"ship_type": "ship type indicator (string)" ,
"dimensions": { "bow": "meters (float)" , "stern": "meters (float)" ,
                "port": "meters (float)" , "stbd": "meters (float)" } ,
"draught": "meters (float)" ,
"destination": "destination (string)" ,
"ETA": "( ISO8601 string )" }
```

### Blue Track Data object

```
{ "radar_match": "active or lost" ,
  "id": "blue ID number (int)" ,
  "eff_time": "( ISO8601 string )" ,
  "latitude": " latitude (double)" ,
  "longitude": " longitude (double)" ,
  "course": "course degrees true (float)" ,
  "speed": "speed knots (float)" }
```

### Notes:

- (1) One *Radar Track Report* added to list for each active radar track
- (2) “ais” or “blue” fields included if radar track matches one of these, otherwise null
- (3) “move\_state” field indicates a stationary or moving radar track
- (4) “radar\_match” indicates match is currently active or previously active but now lost, and null entry means no match with radar track.

### **CorrTracks Endpoint**

The *CorrTracks* endpoint reports only the radar tracks that survive the *Track Correlation* filter on the DMT Client program. This filter is particularly useful in combining multiple radar tracks that are spawned from the same contact. This situation normally occurs when

- different radars are tracking the same contact , each reporting a separate track
- large targets (e.g., large ships) generate multiple tracks due to sheer size and to associated phenomena (wakes, etc.)

The DMT Client program normally operates with the **Track Correlation** filter ON to reduce/eliminate duplicate radar tracks from the same object, and to identify/report one track per real object.

Calling the *CorrTracks* endpoint generates a *DMT Tracks Report* message (as described earlier), that omits the duplicate tracks and reports only the radar track that best represents the real contact. The return message for this endpoint is identical (in format) to the *Tracks* return message, except that the *label* placeholder (“**tracks**” or “**tracks\_all**”) will be set to “**tracks\_corr**”. Note that if the Track Correlation filter in the DMT RemClient program is not ON, then this endpoint will return an empty message with no tracks.

### ***AISTracks Endpoint***

The *AISTracks* endpoint provides a list of all AIS Tracks being stored in the DMT Client program’s AIS Track List and displayed on the Client’s PPI Display.<sup>6</sup> This list is the result of all incoming AIS track reports received at the AIS receiver which are down sampled based on the *Display Filter* control settings on the *AIS Receiver* control box:

The screenshot shows the 'AIS Receiver' control panel with the following settings:

- Connect** button
- Tracks count: 0
- IPAdd: 127.0.0.1
- Port: 5001
- Record AIS Stream
- Correlation Gates:**
  - Separation: 200 m
  - Course Diff: 50 deg
- Display Filters:**
  - Min Spd kts: 5
  - Max Rng m: 10000
  - Ref Lat: 29.38421
  - Ref Lon: -94.88833
  - In Search Zone
  - PurgeTime (s): 60
  - Exclude Class B
- Hide** button

<sup>6</sup> Unlike the *Tracks* or *CorrTracks* endpoint messages which only report AIS or Blue Force tracks which match the radar track being reported.

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The *Min Spd kts* filter eliminates all AIS tracks with reported speeds less than the indicated value (5kts). The *Max Rng m* filter eliminates all AIS tracks located beyond the indicated distance in meters (10000) from the reference point.<sup>7</sup> The *In Search Zone* filter excludes AIS Tracks which are located outside the DMT Client's Search Zone. The *PurgeTime* filter removes AIS tracks from the AIS Track List which have not been updated for the indicated time interval in seconds (60). Finally, the *Exclude Class B* filter eliminates all Class B (small) boats.

When the *AISTracks* URI request is received by the Client computer's website, an *AISTracks Report* message is created, formatted as a JSON string, and returned as the endpoint response.

### AIS Tracks Report

```
{ "report_time": "(ISO8601 string)",  
  "tracks_AIS": [ list of AIS Track Data objects ] }
```

### BlueTracks Endpoint

The BlueTracks endpoint provides the current status information for each active blue force unit. The endpoint response for a *BlueTracks* URI request is to return a *Blue Tracks Report* message:

### Blue Tracks Report

```
{ "report_time": "(ISO8601 string)",  
  "tracks_Blue": [ list of Blue Track Data objects ] }
```

### Sweeps Endpoint

The Sweeps endpoint provides the key parameters for drawing the sweep lines for all Radars connected to the DMT Remote Client hosting the *WebService*. The endpoint response for a *Sweeps* URI is to return a *Sweeps Report* message:

### Sweeps Report

```
{ "report_time": "(ISO8601 string)",  
  "sweepList": [ list of SweepData objects ] }
```

### SweepData object

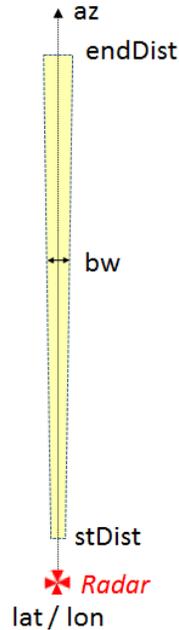
```
{ "_radar": "Radar number (int)",  
  "az": "azimuth °T(float)",  
  "stDist": "start distance meters (float)",  
  "endDist": "end distance meters (float)",  
  "bw": "beam width ° (float)",
```

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<sup>7</sup> The reference point (Ref Lat/RefLon) should be selected as the center of the geographic area of interest.

```
"lat": " latitude (double)",
"lon": " longitude ( double ) " }
```

The sweep data parameters define the azimuth in degrees true of the radar sweep (*az*), the beam width (*bw*), the starting and ending points of the sweep coverage area (*stDist*, *endDist*), and the radar latitude/longitude (*lat*, *lon*), illustrated as follows:



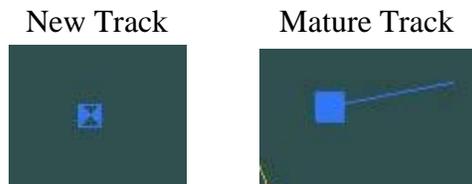
### Radar Imagery Interface

#### currentImage.png Endpoint

The information provided with this endpoint is a snapshot picture of the track symbols being displayed on the DMT Client display. It also shows the radar sweeps for all active radars. The image is a .png file that shows these plotted items on a transparent background.

The track symbols that may be contained in the image file are illustrated next.

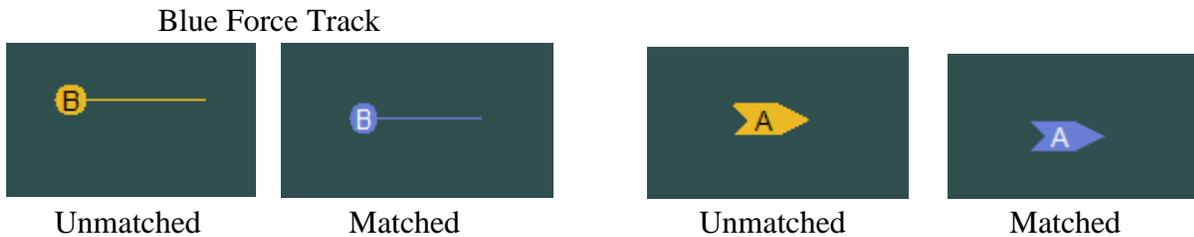
#### Radar Tracks:



Radar track symbols are displayed for radar tracks that are not matched with an existing AIS or Blue force track. Radar tracks that are so matched are hidden. A *New Track* symbol is shown for

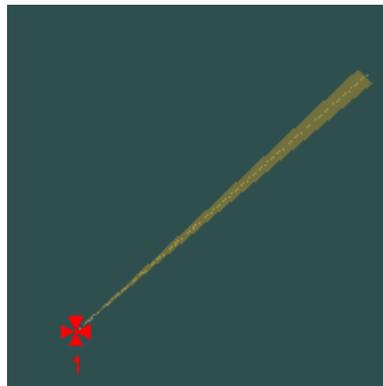
radar tracks with age < mature age. Otherwise, a *Mature Track* symbol is shown as a filled rectangle with vector indicating the course direction and length proportional to track’s speed. Note that the color of the Radar Track symbol is user selectable and may not be blue as illustrated here.

Blue/AIS Tracks:



Unmatched Blue force tracks are plotted as a filled gold circle with inscribed letter “B” and a vector indicating course and speed. Blue tracks that become matched with a radar track will change fill color to blue and cause the matching rada track to be hidden. Unmatched AIS tracks are shown with above gold symbol, and will change to blue fill when matched with a radar track.

Radar Sweeps: The radar symbols and sweep lines for both radars will appear as follows:



***currentImageFull.png Endpoint***

This endpoint returns a snapshot image of the DMT Client’s display. This image differs from the *currentImage.png* endpoint image in that it provides a full duplicate image of the plot being viewed on the primary DMT Client machine, which includes the current background map and all active symbols and icons. This endpoint was developed to support a new Client display repeater program<sup>8</sup> used to provide a remote terminal for viewing the primary Client’s current display.

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<sup>8</sup> Refers to the DMTClientRepeater v1.0 program.

### ***currentImage Endpoint***

This endpoint provides the geospatial coordinates for the plot image passed with the *currentImage.png* and *currentImageFull.png* endpoints using a GeoJSON formatted message as follows:

```
{ "image_url": "http://10.0.8.147:5000/currentImage.png",  
  "geometry": { "type": "polygon" ,  
                "coordinates": [[ [A1,B1],[A2,B2],  
                                   [A3,B3],[A4,B4],[A1,B1]] ] } }
```

where the coordinate pairs [AN, BN] are the latitude and longitude values for the Nth corner of the polygon (plot), and the entry **10.0.8.147:5000** is the **IPAddress:Port** for the *WebSite* service as selected by the user as described later.

### ***currentImageRev Endpoint***

This endpoint provides an alternate format for specifying the geospatial coordinates for the plot image endpoint messages. This format takes advantage of the fact that the earlier image endpoints (\*.png) will pass a rectangular image with aspect ratio of either 16:9 or 4:3. The JSON response message here provides the latitude values for the top and bottom edges, the longitude values for the left and right edges and the plot's aspect ratio as follows:

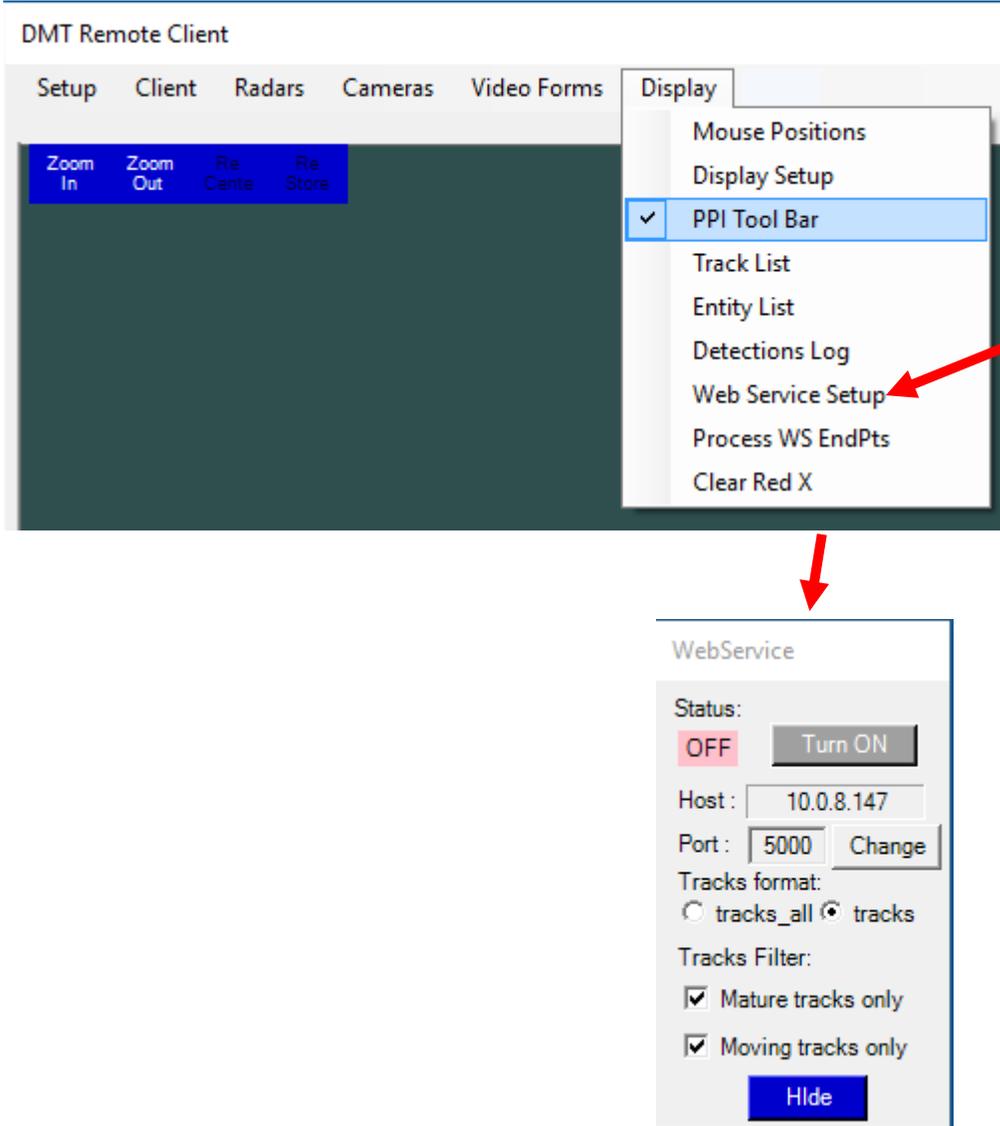
```
{ "East":Elon, "North":Nlat, "Ratio":AR, "South":Slat, "West":Wlon }
```

where:

- Elon = right edge longitude (double)
- Nlat = top edge latitude (double)
- AR = plot aspect ratio (float) : (16 : 9) => 0.5625 or (4 : 3) => 0.75
- Slat = bottom edge latitude (double)
- Wlon = left edge longitude (double)

### ***WebService Control Panel***

All WebSite control functions are managed with the *WebService* control panel which is accessed from the DMT Client's display menu as follows:



The *WebSite* URI (IPaddress:Port) is indicated with the settings on the control panel. The IPaddress listed in the *Host* box is automatically set to the host computer's current IPV4 address on the LAN. The user may then select a port number with the *Port* box control.

At startup for the Client program, the last port entry made and saved by the user is restored automatically. (If no previous port selection is stored or no settings file is found for the client program, then the port value is set to 80). At this point, the *WebSite* service is not active and the control panel will appear as shown above.

Before starting the *WebSite* service, the user must verify or change several filters that are present on the control panel, which are described next.

*Tracks Format Options:* As mentioned earlier, the *Tracks* endpoint message will show one of two possible labels as “tracks\_all” or “tracks.” The reason for a choice here is to support legacy users as well as new users of the *Tracks* endpoint message where each expects a different label to appear. The user must select the desired label to appear in the endpoint message by clicking on the appropriate option with the *Tracks Format* controls.

*Tracks Filters:* The DMT client program provides two track filters which allow the user to limit the radar tracks reported in the *Radar Vector* and *Radar Imagery* interfaces. Both filters are intended to remove tracks which may not be desired by the website user.

The first filter removes developing (immature) radar tracks until that track is considered to be “formed” and stable. These tracks are labeled as “mature” tracks by the DMT radar tracker module, and are so marked by the tracker once a minimum number of updates are obtained on that track.

This feature is a key false alarm mitigator for the DMT radar, allowing the detection threshold to be low enough to detect weak targets but requiring multiple updates to be seen on that track before it is considered a real (mature) track.

If the *Mature tracks only* filter is not active, then every detection reported by the radar will be reported with the *Tracks* endpoint. The recommended setting (active) will eliminate spurious contacts and ensure that only well-formed radar tracks are reported. Note again that the *CorrTracks* endpoint reports only one radar track per actual contact.

The second filter removes stationary radar tracks from being reported. The DMT radar tracker module marks all tracks as stationary until a track has moved some minimum distance from its initial detection location. These stationary tracks (ships at anchor, etc.) may not be of interest to the website user and may be eliminated from reports by activating this filter.

Note that the *Mature tracks only* and *Moving tracks only* filters are active (checked) by default. The user can de-select either filter at any time by accessing this dialog box and unchecking the appropriate filter.

After verifying the *WebSite* URI and filter settings on the *WebService* control panel, the user will then need to start the *WebSite* service by clicking the *Turn On* button. The *Status* window at the top of the control panel will then show **ON** when the *WebSite* service is started. At this point the *WebSite* service is active with no further user actions required. At any time the user may stop the service by clicking on the *Turn Off* button. The service may be started and stopped as many times as desired by the DMT Client user.