



**Approved by the Tactical Operations  
Committee December 2016**

# **Improving Graphical Temporary Flight Restrictions in the National Airspace System**

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*A Report of the Tactical Operations Committee in Response to  
Tasking from the Federal Aviation Administration*

*December 2016*

# Improving Graphical TFRs in the NAS

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## Executive Summary

This report provides a comprehensive set of recommendations from the RTCA Tactical Operations Committee to the FAA focused on problems with Temporary Flight Restrictions in the National Airspace System. While TFRs are less than 1% of total NOTAMs, pilots view them as one of the most significant NOTAM categories. The consequences of not complying with a TFR include compromising safety of flight, criminal/certificate/administrative penalties and, in some cases, the use of deadly force.

Pilots today regularly utilize technology to depict TFRs in a graphical format, enhancing pilot situational awareness while avoiding TFRs. Driven by this increased use of TFR graphics, stakeholders have identified a series of gaps with the FAA's current processes and technologies for creating and distributing TFRs. Among the myriad of issues, graphics are not always available and sometimes erroneous. NOTAM TFR text remains the only legal source of TFR location information but is often lengthy, not user-friendly and difficult for pilots to understand. Additionally, there is no definitive source of information for when sporting event TFRs are active.

These issues, and others, prevent pilots from fully trusting and embracing their automation tools in planning for TFRs. Instead, pilots continue to call and receive phone-based latitude and longitude information about TFRs, limiting the automation benefits to pilots and driving up cost for the FAA.

The TOC conducted a comprehensive evaluation of TFRs and submit the following recommendations that address all categories and life cycle of TFRs. Recommendations in this report focus on:

- The process and tools for origination of TFR NOTAMs and transmission of these to industry;
- Ensuring availability of graphically formatted TFRs to pilots that are legal for navigation and span all operational scenarios, including TFR NOTAMs for planning, receiving TFR information in flight as well as on charts, when appropriate;
- Addressing the graphical TFR needs of key air traffic users, including Air Traffic Control and Flight Service Stations;
- Simplifying and clarifying the textual format of TFR NOTAMs;
- How to improve education of the wide array of aviation stakeholders impacted by TFRs.

Each year the FAA Air Traffic Organization (ATO) identifies its top five safety concerns, and for FY2017 two "top 5" issues are focused on NOTAMs. Safety concerns for NOTAMs include a lack of centralized oversight requiring NOTAM originators determine and cancel NOTAMs for conditions no longer present in the NAS and validate/verify information related to NOTAMs. All of these concerns apply to the TFR subcategory of NOTAMs. The recommendations in this report highlight a similar, broad set of needs for improved oversight of TFRs, validation and verification of information as well as some incorporation of TFRs into permanent publications. The TOC is optimistic that this TFR-focused report, along with the ATO emphasis on NOTAMs in its top 5 safety list, will lead to meaningful improvements in the process and tools for generation of TFRs.

Finally, based on language contained within the current FAA Reauthorization (Sec 2209 a1C), there appears to be an opportunity for wide-spread proliferation of TFRs that could have an adverse effect on the operation of both manned and unmanned aircraft. Specifically, the language referring to "Amusement parks" and "Other locations that warrant such restrictions" is vague and open to wide interpretation by those seeking to create TFRs. The FAA should work with industry to develop implementation guidelines for congressional language on new TFRs in order to avoid creating a patchwork of TFRs across the country that could have a negative impact on aviation.

### Executive Summary of Recommendations in TOC Graphical TFR Report

Category	Sub Category	TOC TFR Recommendations
FAA Charting (VFR Sectional/ TAC)	Long Term TFRs	<ol style="list-style-type: none"> <li>1. Long-term TFRs should be charted on Sectional and Terminal Area Charts.</li> <li>2. Long-term TFRs should be identified using standardized criteria.</li> <li>3. The FAA should retain the issuance process for long-term TFR NOTAMs, regardless of part-time or full-time activation, even after that TFR NOTAM has been charted.</li> </ol>
	Sporting Event TFRs	<ol style="list-style-type: none"> <li>4. The FAA depiction is adequate and the FAA should sustain their sporting venue charting effort.</li> </ol>
	Charting Specifications	<ol style="list-style-type: none"> <li>5. The FAA should standardize the charting requirement documents for TFRs to ensure consistency and to reduce pilot confusion.</li> <li>6. The FAA should modernize the Sectional and Terminal Area Chart production process to achieve a 56 day charting cycle.</li> </ol>
TFR Origination	Standardized Entry Method	<ol style="list-style-type: none"> <li>7. Any tools the FAA utilizes to generate TFR NOTAMs should produce a standard output.</li> <li>8. Any new or existing TFR NOTAM entry tool should, in general, tightly constrain the use of freeform text and not allow its use for the geographic definition. The use of dropdown menus should be maximized to ensure consistent output.</li> <li>9. TFR NOTAM templates should be centrally managed electronically for all users.</li> <li>10. The TFR submission tool should render its output in a format recommended by industry - AIXM 5.X with GML</li> <li>11. The TFR submission tool should provide a graphical depiction of the impacted area to all affected ATC agencies.</li> </ol>
	TFR NOTAM Oversight (text and graphic)	<ol style="list-style-type: none"> <li>12. The FAA should designate a 24x7 operational office with the authority to review, reissue, or cancel any TFR in real-time, prior to its broadcast, to ensure: (a) accurate graphical depiction and (b) conformance with NOTAM policy and FAA orders.</li> <li>13. The automation tool utilized for TFR NOTAM submission should produce and display an electronic graphical depiction for each TFR containing a clearly defined geographical area and include a required user verification step where the affected geographical area is verified to be accurate/correct.</li> </ol>

Transmission to Industry	Digital with AIXM/GML	14. The FAA should provide TFR NOTAMs in AIXM/GML digital format.
	Standard and Authoritative Method of Machine to Machine TFR Transmission	15. Authoritative TFR NOTAM data should be provided in AIXM 5.X with GML over multiple nodes in SWIM. 16. The FAA must ensure that the SWIM onboarding process is efficient/timely for all approved “partners”. 17. Legacy Esri shapefiles of each TFR should remain available.
	Format of GML Portrayal Script	18. Prototype testing of GML Portrayals Scripts by the FAA and multiple vendors should be done and circulated to investigate 1) the range of graphical interpretations of AIXM data and 2) the interoperability of SLD/SE portrayal scripts for AIXM.
	Notification Process for Changes	19. The FAA should communicate changes to TFR NOTAM policy to industry.
Graphics Availability and Electronic Presentation	FAA TFR Graphical Website – Human to Machine	20. The FAA should sunset their graphical TFR website. The electronic depictions (graphics) for all TFRs and Special Use Airspace (SUA) should be provided simultaneously with the text for public consumption via the FAA's NOTAM Search website ( <a href="https://notams.aim.faa.gov/notamSearch/">https://notams.aim.faa.gov/notamSearch/</a> ). 21. Changes should be made in NOTAM Search to improve consumption of TFR information. 22. Each TFR should have a stand-alone graphic (a static image with the option of either a Sectional or Low Altitude Enroute chart background), with textual comments on the graphic. 23. The FAA should have a standard for displaying TFR overlay graphics on its website. 24. Dissemination of the Notices to Airmen Publication (NTAP) should include the previously available HTML option to make it easier for operators to access this information, and all information in the NTAP should be available in NOTAM Search.
	Disclaimer for FAA Produced Online Graphic	25. After adding TFR graphics to NOTAM Search, the disclaimer should explicitly state that TFR graphics can be relied upon for navigation. 26. The FAA should explicitly state that the TFR graphic is equal to the NOTAM’s geographical textual description.
	Sporting Event Blanket TFR	27. For each sporting event venue, the FAA should graphically display on NOTAM Search the lateral and vertical dimensions, along with valid times. The locations for projected sporting event TFRs should also be displayed.
	Accuracy of FAA TFR Depictions Provided Online	28. All TFR graphics being displayed should have a correctly oriented chart.
	Industry Standard for Electronic Depiction	29. The FAA should establish industry standards for electronic depiction of TFRs by tasking the appropriate groups, contractors and/or committees.

FSS and ATC	Availability for FSS and ATC	<p>30. The FAA should ensure controller automation (ERAM, STARS) can visually display TFRs on the controller scope.</p> <p>31. The FAA should implement ERAM/STARS enhancement that allows the drawing of a TFR on one scope and pushing it to another.</p> <p>32. Controller guidance regarding coordination with a TFR proponent, such as firefighting agencies and pilots, should be clarified to better detail responsibilities and how “by ATC authorization” should be employed.</p> <p>33. Interpretation of TFR restrictions and what ATC can authorize should be standardized among facilities.</p> <p>34. The FAA should depict sporting event venues with over 30,000 seats on ATC radar maps.</p> <p>35. The FAA should depict long-term TFRs on ATC radar maps.</p>
	Briefing NOTAM Order Changes	<p>36. There should be a clear communication process to brief changes of NOTAM policy to ATC positions that create TFR NOTAMs prior to implementation, and there should be sufficient time to allow technical requirements for parsing to be updated.</p>
	Standard Manner of Providing Graphic to Specialists	<p>37. The FAA should make sporting event venues and their 3 NM radius lateral rings available on controller charts.</p>
Textual Format		<p>38. The FAA should standardize the language and format of TFR NOTAMs to facilitate the effective transfer of critical information to pilots.</p> <p>39. The FAA should restructure the TFR NOTAM format to be consistent across all types to allow pilots to have a standardized reading pattern and improve the understanding of restrictions.</p> <p>40. The FAA should remove from the NOTAM, to the extent possible, all extraneous information and publish that information elsewhere or at the end of the NOTAM.</p> <p>41. The FAA should ensure automated plain language interpretation for all TFRs can be accomplished.</p> <p>42. The cut out or exception area language should be published in a standardized format.</p> <p>43. The FAA should expand their NOTAM issuance policy to allow TFR NOTAMs to be published seven days ahead of the activation time, instead of the usual three days, when the information is available.</p> <p>44. The FAA should publish a single standard for the latitude/longitude format that can be stated in a TFR NOTAM.</p>
FIS-B Uplink	Range of Transmission	<p>45. The FAA should increase the FIS-B radio station look ahead range for the NOTAM-TFRs.</p>
	FIS-B Text	<p>46. The FAA should task the appropriate committee (e.g., SC-206 SG-5) to investigate undoing the change to the FIS-B radio stations that truncates uplinked NOTAM-TFR text records.</p>
	Graphic Legality	<p>47. The FAA should evaluate the use of FIS-B NOTAM-TFR graphics to meet regulatory requirements for navigation and operational use in the cockpit.</p>



## Introduction

The Federal Aviation Administration (FAA) issues Temporary Flight Restrictions (TFR) pursuant to Title 14, Code of Federal Regulations, Part 91, General Operating and Flight Rules, and Part 99, Security Control of Air Traffic. A TFR is an airspace prohibition implemented for a specified area of airspace, on a temporary basis, in order to provide protection to persons or property in the air or on the ground. TFRs are issued via the Notice to Airmen (NOTAM) System.

In recent years, users of the National Airspace System (NAS) have increasingly utilized graphical depictions of TFRs resulting in multiple user issues regarding the issuance of TFRs. A series of high profile problems with TFRs<sup>1</sup> resulting in pilot violations galvanized industry concern on the issue.

In response to this stakeholder concern, the FAA requested the RTCA Tactical Operations Committee (TOC) to perform a task to provide the FAA with recommendations on three subjects:

- Task 1: Use broader expertise and data to clarify and validate issues associated with TFRs and recommend solutions.
- Task 2: Recommend policy regarding an online authoritative source for TFR content and use of TFR information for flight planning purposes.
- Task 3: Develop an associated set of business rules around what can be disseminated; to whom the data should be disseminated; standardization of the format; graphical depiction; and means of dissemination.

The TOC established the Graphical TFR Task Group (membership noted in Appendix A) which drafted the recommendations in this report.

## Background

There were approximately 1.8 million NOTAMs issued in 2015, while about 3,700 TFR NOTAMs were issued between July 2015 and June 2016. While TFRs represent a small percentage of total NOTAMs, there are a number of reasons why pilots view TFRs as one of the most significant NOTAMs. First, there are serious consequences for not complying, including criminal, certificate and administrative penalties. For certain TFRs, aircraft may even be intercepted and deadly force may be used. Additionally, many TFRs advise pilots of hazards that they would prefer to avoid.

The following list comprises the different types of TFR NOTAMs that may be issued:

- 91.137(a)(1): Surface Hazard
- 91.137(a)(2): Disaster Relief
- 91.137(a)(3): Air Congestion (Special Event)
- 91.138: National Disaster Areas in Hawaii

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<sup>1</sup> August 2015 South Carolina VIP VPOTUS TFR, Fall 2015 New York VIP Pope TFR, February 2016 Los Angeles VIP POTUS TFR

- 91.139: Emergency Air Traffic Rules
- 91.141: Proximity of the President and Other Parties (referred to as VIP)
- 91.143: Space Flight Operations
- 91.144: High Barometric Pressure Conditions
- 91.145: Special Events
- 99.7: National Security

The following count of TFR NOTAMs by month demonstrates that Hazards, VIP and Security NOTAMs make up the largest number of TFRs. Wildfire TFRs have a direct relationship with the severity of fire season and average around 650 per year over the past seven years. Security NOTAMs have averaged about 1,600 per year from CY2013 to 2015:

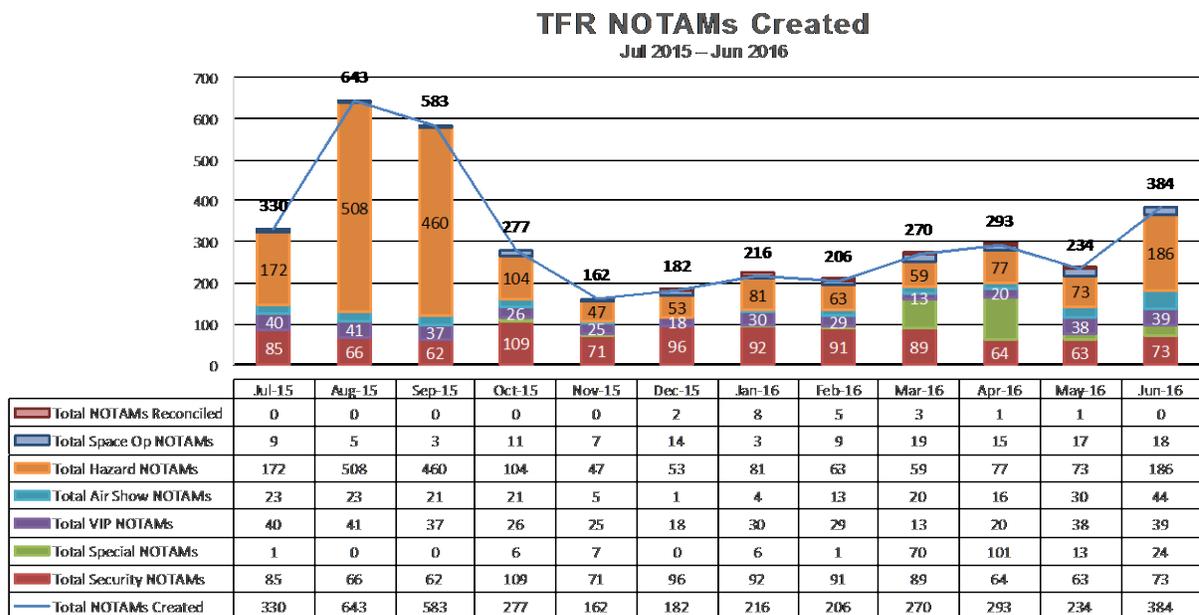


Figure 1 Count of NOTAMs by Category by Month (Source: US NOTAM System)

Pilots have increasingly utilized technology to depict TFRs in graphical format. A 2016 survey of a random sample of active pilots in the Aircraft Owners and Pilots Association (AOPA) suggested that 82% use an Electronic Flight Bag (EFB) frequently or always in the cockpit. The survey determined that pilots generally avoid TFRs laterally by looking at a graphic. Though graphics are currently only advisory in nature, they play an important role for pilots as TFR NOTAMs often contain lengthy and complex text.

The increased use of graphics has had a positive impact on reducing TFR violators who are deemed Targets of Interest (TOI). In 2003, the number of TOIs averaged over 230 per month. However, between 2013 and 2015 the number of targets decreased dramatically to just 218 per year. A key factor in reducing TOIs has been improved pilot situational awareness due to EFBs and graphical depictions.

Despite the reduction in TOIs, there has been a prevalence of high profile TFR violations due to erroneous information being provided to pilots. The errors include incorrect TFR graphics, graphics failing to be generated, inability to provide plain language interpretations of the NOTAM, and errors within the NOTAM texts themselves. These errors are largely the result of FAA's poor quality assurance of TFRs and the use of inadequate production tools. Correcting these issues is critical to empowering pilots and allowing them to trust the advanced technology available to them, which should, in turn, enable a greater reduction in TOIs.

## Methodology

The Graphical TFR Task Group was created by compiling a team of subject matter experts from industry representing general and business aviation, flight planning, information service providers, equipment providers, TFR originators and multiple organizations within the FAA. TFRs have been identified previously in the industry as a critical issue and excellent work has already been done. The Task Group studied the work of multiple groups including the RTCA Special Committee 206 (Aeronautical Information and Meteorological Data Link Services) 2013 TFR issues report, a 2005 Volpe study, a 2011 Integrated Communication Navigation and Surveillance (ICNS) Conference presentation on graphical data link and multiple NASA Aviation Safety Reporting System (ASRS) compilations. Additionally, the group compiled case studies of issues associated with Graphical TFRs. Through examination of case studies, review of previous work and group discussion, the Task Group developed a recommendation report comprised of defined TFR issues and recommendations.

## FAA Charting (VFR Sectional/TAC)

### Long Term TFRs

<b>Recommendation 1. Long-term TFRs should be charted on Sectional and Terminal Area Charts.</b>
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The FAA does not have standardized criteria for determining when a TFR should be depicted on a Sectional or Terminal Area Chart (TAC). Several TFRs of lengthy duration, specifically Kennedy Space Center, Camp David, and Washington D.C., have been charted for years while in 2016, the Disney Land and Disney World TFRs were added to their geographically affiliated chart. Charting TFR airspace has been shown to increase awareness and compliance. The most notable impact has been the reduction in the incursion rate occurring in the Washington D.C. area.

The 2005 Volpe study on TFRs noted the benefits of having long-term TFRs charted as it increases awareness of the restrictions within an area thereby increasing compliance. Charting this airspace also increases comprehension of the NOTAM and reduces the opportunity for an incursion. Human factors dictate that a visual depiction enhances awareness and vastly reduces loss of information in translating large sections of text into an avoidance area along a pilot's route of flight.

The VFR pilots who choose not to talk to air traffic control are the target audience for this intervention as they are the individuals most likely to violate a TFR unknowingly. Sectional and Terminal Area Charts are the primary resource for VFR navigation and are therefore the most important resources on which TFRs could be charted.

**Recommendation 2. Long-term TFRs should be identified using standardized criteria.**

In order for a TFR to be designated ‘long-term’ and charted, it should first meet certain criteria. Most TFRs last a limited amount of time so few will need to be charted. Recommended criteria for identifying long-term TFRs include the following:

1. It will be necessary to issue a TFR for this airspace in the foreseeable future.
  - A. Foreseeable future is considered to be at least two sectional chart cycles or 12 months.
2. The flight restriction will be consistently defined with the same lateral limits.
3. Flight restrictions will impact the airspace:
  - A. At least 30 separate days of the year; or
  - B. The airspace is subject to routine TFR issuance (i.e., Camp David, Kennedy Space Center).

Certain metroplex areas, such as Los Angeles and New York, are frequently impacted by VIP TFRs that encompass all of the Class B airspace. There is no benefit to charting VIP TFRs for these expansive areas as they are impacted inconsistently despite possibly meeting the 30 day per year threshold.

Exceptions dictate that the FAA discuss the projected TFR need and long-term plan with the TFR proponent prior to charting the TFR area. It is also important that the TFR proponent be engaged by the FAA regularly to ensure the TFR need is understood and that changes are optimally aligned with the VFR charting cycle.

The committee determined that the following TFRs not currently published on charts meet the proposed criteria for charting:

- Andersen Air Force Base – Radiation area (example, FDC 6/5131)
- Beale Air Force Base – Unmanned Aircraft area (example, FDC 6/3017)
- Corpus Christi Naval Air Station – Unmanned Aircraft area (example, FDC 6/2539)
- Dallas, Texas – Former President Bush (example, FDC 9/2934)
- Grand Forks Air Force Base – Unmanned Aircraft area (example, FDC 6/3025)
- Kilauea, Hawaii – Volcano (example, FDC 5/7637)
- Libby Army Airfield – Unmanned Aircraft area (example, FDC 6/4292)
- Vieques, Puerto Rico – Naval Training Range unexploded ordinance area (example, FDC 6/1484)
- Wilmington, Delaware – Vice President Biden (example, FDC 9/3124)<sup>2</sup>

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<sup>2</sup> The TFR for Vice President Biden is expected to be cancelled in January 2017. A new TFR for VP Pence in Indiana is expected to replace it.

## Case study

Two examples are presented below. These airspaces have had countless TFRs issued over multiple years for unmanned aircraft operations with the same lateral and vertical limits always being restricted. The multiple complicated shapes, defined by latitude/longitude points and arcs, are difficult for pilots to interpret.

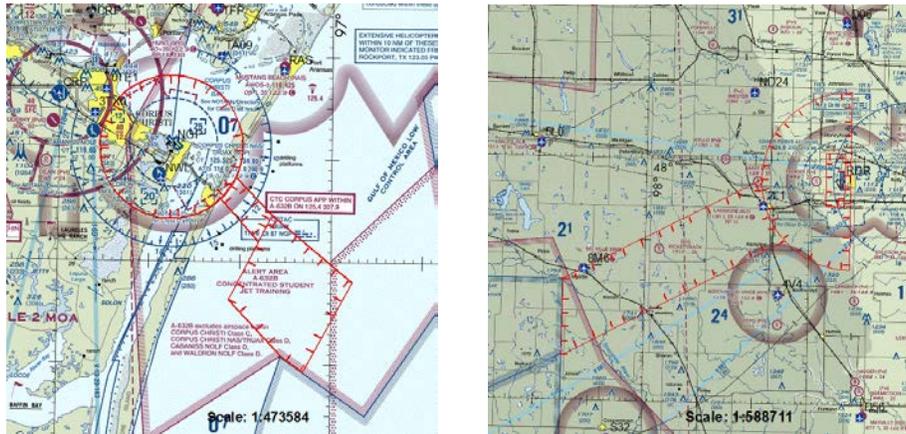


Figure 2 Examples of areas considered to be long-term TFRs and worthy of being charted: Corpus Christi Naval Air Station (left) and Grand Forks Air Force Base (right)

**Recommendation 3. The FAA should retain the issuance process for long-term TFR NOTAMs, regardless of part-time or full-time activation, even after that TFR NOTAM has been charted.**

Maintaining the existing NOTAM process for charted TFRs is important for ensuring pilot awareness, facilitating electronic depiction of the impacted area by automation, and ensuring that operators who do not use FAA products have access to the information in a standardized manner. Continuing to utilize the NOTAM process will ensure that those TFRs which are charted, but have irregular schedules, continue to be briefed to pilots by Flight Service specialists.

## Sporting Event TFRs

**Recommendation 4. The FAA depiction is adequate and the FAA should sustain their sporting venue charting effort.**

Until this year, the FAA had not depicted all venues impacted by the sporting event blanket TFR on Sectional or Terminal Area Charts. Failing to chart these locations and uniquely depict them as a location impacted by the blanket TFR increases the chance for unintentional non-compliance. The committee agreed that charting the area impacted 3NM (nautical mile) radius around sporting event TFR locations was not preferred, as these areas are inactive a majority of the time. Their depiction could create the falsehood of a constant 3NM radius restriction around stadiums.

The FAA has begun charting all venues impacted by the blanket sporting event TFR (30,000+ seats) with the symbol below:

The STADIUM, RACEWAY, etc. naming would accompany the diamond symbol at the actual location that the TFR is predicated upon.

## Charting Specifications

**Recommendation 5. The FAA should standardize the charting requirement documents for TFRs to ensure consistency and to reduce pilot confusion.**

The FAA does not have a standard charting specification for TFRs on Sectional or Terminal Area Charts. The following areas are currently charted: Disney Land and Disney World, Kennedy Space Center, Washington D.C., and Camp David. Each location has a different depiction method. Standardizing the symbology will improve pilot recognition, facilitate knowledge retention and allow uniform guidance.



*Figure 3 Unique charting depictions for areas governed by a TFR. From left to right, the Kennedy Space Center, Washington DC and Camp David.*

Additionally, the applicable TFR altitude restrictions are not being charted. Depicting the altitude floor and ceiling, such as how it is depicted for Class C airspace, would provide further dimensional information to the restriction and improve a pilots ability to comply with the restriction.

The following depiction standards for Sectional and Terminal Area Charts are suggested:

1. Utilize Disney Land/Disney World charting standard (embraces Volpe recommendation; similar to Part 93 areas).
2. Depict TFR altitude floor and ceiling in MSL similar to Class C airspace (Volpe recommendation).
3. Sustain the TFR note inclusion with a reminder for the pilot to check NOTAMs.
4. For multiple TFRs in the same area, or multiple areas within the same TFR, delineate the different areas and provide the altitude floor and ceiling for each area. We recommend utilizing the same solid blue line used for the boundary to define the different individual areas.
5. If a long-term TFR area has inconsistent altitude restrictions but consistent lateral dimensions (e.g., Grand Forks AFB), do not depict the altitudes on the chart, but include within the TFR a note stating that impacted altitudes vary and to check NOTAMs.

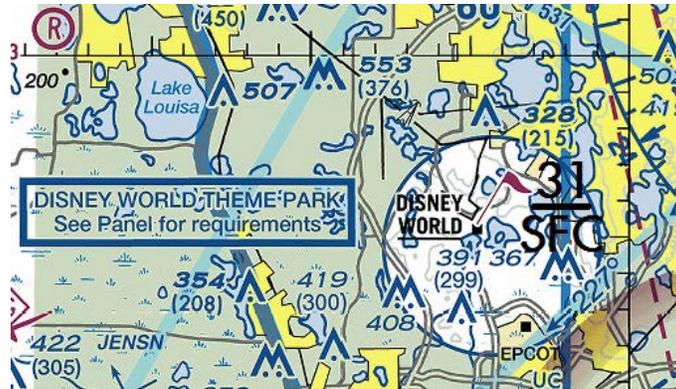


Figure 4 Disney World depicted on a sectional chart with a mock-up of how altitude information may be included

**Recommendation 6. The FAA should modernize the Sectional and Terminal Area Chart production process to achieve a 56 day charting cycle.**

The FAA should transition to automated, electronic chart production for Sectional and Terminal Area Charts as soon as possible to allow for reduced time between publication cycles. Reducing the amount of time between publication cycles would better facilitate the charting of TFRs and the ability to conduct “data driven” charting. Using automation would allow FAA Sectional and Terminal Area Charts to be layered so that users, at their discretion, could turn on and off certain charting symbology which would facilitate reductions in chart clutter near TFR areas.

## TFR Origination

### Standardized Entry Method

**Recommendation 7. Any tools the FAA utilizes to generate TFR NOTAMs should produce a standard output.**

Given the many FAA TFR NOTAM entry applications used by assorted departments (System Operations Security, Air Traffic Control, Flight Service Stations, National Inter-agency Fire Center, etc.), and their inconsistencies in output when compared, the FAA should transition to defining a standard output for TFR NOTAMs and ensure that all TFR NOTAM entry tool across all organizations provide this output.

The FAA should strive to employ tools that:

- Minimize the opportunity for entry errors by incorporating logic rules and data dropdowns, while minimizing free text;
- Allow read-only, joint viewing of candidate TFRs among different FAA facilities such as ARTCC’s, TRACONS and departments as well as among different tools;
- Enable an effective and streamlined path to ensure all TFR originators are utilizing consistent templates and language and those not authorized to issue a TFR should only be provided read-only access;

- Standardize the different programs as much as possible to ensure changes to NOTAM policy and format are implemented consistently<sup>3</sup>;
- Include a preview option for the impacted area.

### Case Study 1

The following TFR NOTAM (FDC 6/4117) was entered via the NOTAM Entry System (NES) by the local air traffic control facility. However, it included an extra space after “SOUTH DAKOTA..” and the state name was fully spelled out rather than using the standard two letter state code (i.e., SD). These formatting errors originated with the entry specialist and prevented the downstream automation from generating a graphic or plain language interpretation.

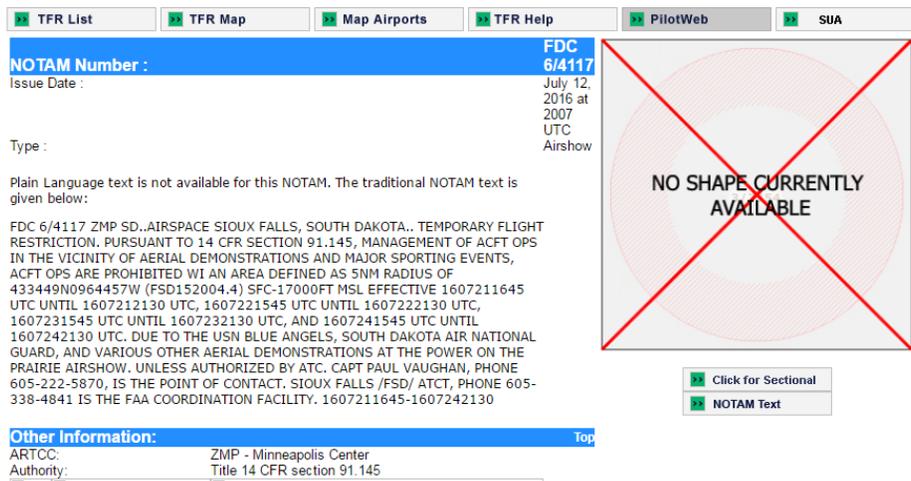


Figure 5 Entry Error Case Study #1

### Case Study 2

The TFR NOTAM below (FDC 6/0558) was generated with an incorrectly formatted NAVAID reference location. The text included a NAVAID name (MUSTANG), type (VORTAC), ident (/FMG/), radial bearing (142 DEGREE RADIAL) and distance (38NM), using an older, previously used format that was no longer recognized. These errors prevented the downstream automation from generating a graphic or plain language interpretation.

<sup>3</sup> The group recognizes that for some TFRs there may be unique cases where adding text-based pertinent information to a TFR may be necessary to further explain the situation impacting the airspace, i.e., “freeform.”

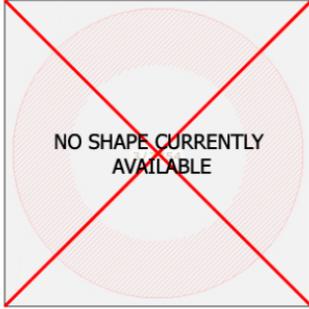
**NOTAM Number :** FDC 6/0558  
**Issue Date :** July 22, 2016 at 1559 UTC  
**Type :** Space Operations

Plain Language text is not available for this NOTAM. The traditional NOTAM text is given below:

FDC 6/0558 ZOA NV..AIRSPACE ARTESIA FLAT, NV..TEMPORARY FLIGHT RESTRICTIONS WI AREA DEFINED AS 1.5NM RADIUS OF 385610N119211500W OR THE MUSTANG VORTAC /FMG/ 142 DEGREE RADIAL AT 38NM SFC-17957FT DUE TO ROCKET LAUNCH ACTIVITY PURSUANT TO 14 CFR SECTION 91.143. WAYNE HUBBARD/ ROCKETRY ORGANIZATION OF NORTHERN NEVADA 775-901-1834 IS IN CHARGE OF THE OPERATION. OAKLAND AIR ROUTE TRAFFIC CONTROL CENTER /ZOA/ TELEPHONE 510-745-3331 IS THE FAA COORDINATION FACILITY. 1607231600-1607242100EST

**Other Information:** [Top](#)

**ARTCC:** ZOA - Oakland Center  
**Point of Contact:** ROCKETRY ORGANIZATION OF NORTHERN NEVADA  
 Telephone 775-901-1834  
**Authority:** Title 14 CFR section 91.143



**Click for Sectional**  
**NOTAM Text**

Figure 6 Entry Error Case Study #2

### Case Study 3

The following examples compare two TFRs that were issued for the same airspace. The TFR depicted on the left, FDC 6/8302, was formatted improperly and, as a result, had language that did not comply with NOTAM policy. As a result, the TFR did not provide a graphical depiction. Conversely, the properly formatted TFR for the same area (on the right; FDC 6/9530) contained a graphic depiction as the issuer utilized proper language/formatting. Such graphical depiction errors may be avoided if the FAA ensures standardization of input.

**TFR List** | **TFR Map** | **Map Airports** | **TFR Help** | **Print/View** | **SSA**

**NOTAM Number :** FDC 6/8302  
**Issue Date :** May 03, 2016 at 1852 UTC  
**Type :** Space Operations

Main Language text is not available for this NOTAM. The traditional NOTAM text is given below:

FDC 6/8302 ZMA FL..AIRSPACE KENNEDY SPACE CENTER, FL..TEMPORARY FLIGHT RESTRICTIONS KENNEDY SPACE CENTER SPACE OPERATIONS AREA PURSUANT TO SECTION 91.143 OF THE CODE OF FEDERAL REGULATIONS (CFR 91.143). PILOT OPERATIONS CONDUCTED BY FAA CERTIFICATED PILOTS OR CONDUCTED IN ACT OF U.S. REGISTRY ARE PROHIBITED AT ANY ALTITUDE IN THE SECTOR, WI AN AREA DEFINED AS 285116N04219W TO 290730N0300W THENCE CLOCKWISE VIA A 30 NAUTICAL MILE ARC CENTERED AT 283700N0447W TO 281330N03469W TO 282501N03029W TO 282501N03759W TO 283501N04449W TO 283212N043499W TO 283501N04910W TO 284920N050449W TO 285116N04714W TO 285116N04219W. MIAMI CENTER, PHONE 305-716-1589, IS THE COORDINATING FAA FACILITY AND MAY BE CONTACTED FOR THE CURRENT STATUS OF ANY AIRSPACE ASSOCIATED WITH LAUNCH OPERATIONS. THIS AREA ENCOMPASSES R2033, R2033, R2034 AND PORTIONS OF W497A, W136F, W137F AND W137G. ADDITIONAL WARNING AND RESTRICTED AREAS WILL BE ACTIVE IN CONJUNCTION WITH THE OPERATIONS. PILOTS SHALL CONSULT ALL NOTAMS REGARDING THIS OPERATION. 1605060446-1605060758

**Other Information:** [Top](#)

**ARTCC:** ZMA - Miami Center  
**Authority:** Title 14 CFR section 91.143

**NOTAM** | **FDC 6/9530 Download shapefiles**

**Number :** FDC 6/9530  
**Issue Date :** May 05, 2016 at 1326 UTC  
**Location :** KENNEDY SPACE CENTER, Florida  
**Beginning Date and Time :** May 07, 2016 at 0448 UTC  
**Ending Date and Time :** May 07, 2016 at 0750 UTC  
**Reason for NOTAM :** Space Operations Area  
**Type :** Space Operations  
**Replaced NOTAM(s) :** N/A  
**Plats May Contact :** MIAMI (ZMA) ARTCC: 305-716-1589

**Jump To:** [Affected Areas](#) | [Operating Restrictions and Requirements](#) | [Other Information](#)

**Affected Area(s)** [Top](#)

**Airspace Definition:**  
 Region bounded by:

From:	Latitude:	Longitude:	FSD:
MM ARC Centered on	290730°N	80°300°W	
To:	291370°N	80°2647°W	
To:	291130°N	80°1600°W	
To:	292018°N	80°3629°W	
To:	292521°N	80°3759°W	
To:	292501°N	80°4144°W	
To:	293121°N	80°3369°W	
To:	293851°N	80°4701°W	
To:	294910°N	80°5044°W	
To:	295116°N	80°4714°W	
To:	295116°N	80°4219°W	

**Altitude:** From the surface up to Unlimited  
**Effective Dates:**  
 From May 07, 2016 at 0448 UTC  
 To May 07, 2016 at 0750 UTC

**Operating Restrictions and Requirements** [Top](#)

No pilots may operate an aircraft in the areas covered by this NOTAM (except as described).

THIS AREA ENCOMPASSES R2033, R2033, R2034 AND PORTIONS OF W497A, W136A, AND W136C. ADDITIONAL WARNING AND RESTRICTED AREAS WILL BE ACTIVE IN CONJUNCTION WITH THE OPERATIONS. PILOTS SHALL CONSULT ALL NOTAMS REGARDING THIS OPERATION.

**Other Information:** [Top](#)

**ARTCC:** ZMA - Miami Center  
**Authority:** Title 14 CFR section 91.143

Figure 7 Entry Error Case Study #3

TFR Builder and the NAS Integrated Status Insight System (NISIS) will begin submitting TFR NOTAMs via NOTAM Origination Service (NOS) by February 2017. The planned transition to Federal NOTAM System (FNS) will retire several tools, including NOTAM Entry System (NES), from being used for TFR NOTAM submission.

Each existing tool has its own nuances that can prevent TFR graphics from being produced:

- If the originator of a TFR NOTAM does not utilize the TFR Builder Application to submit the TFR NOTAM, no graphical depiction will be displayed on the FAA's TFR website (tfr.faa.gov). An exception to this statement exists for HAZARD TFRs. The TFR parser (not TFR Builder Application) will only parse depictions for properly formatted HAZARD TFRs.
- When no graphical depiction is provided, this can be an indication that the TFR was submitted through a separate application such as NES. The NES is slated to be replaced by eNOTAM II (ENII), on transition to the FNS, which may sustain the existing issues. All other types of TFRs, which were not created using the TFR Builder Application, will be displayed with the original NOTAM text only.
- NISIS currently does not support any graphical depiction of TFRs.
- Certain tools (mainly NES) allow the entry of TFR NOTAMs using templates which are not updated per policy changes that can result in parsing/graphical rendering errors (i.e., use of WITHIN vs WI; space between a number and the NM acronym; use of tenths in coordinate sets).

**Recommendation 8. Any new or existing TFR NOTAM entry tool should, in general, tightly constrain the use of freeform text and not allow its use for the geographic definition. The use of dropdown menus should be maximized to ensure consistent output.**

The elimination of freeform plain text when creating TFR NOTAMs, to the maximum extent possible, in favor of tailored dropdown menu selections will significantly reduce both the impediments incurred downstream and the errors associated with parsing freeform text. While dropdowns do minimize the potential for entry error, the FAA could allow some flexibility within the tool to ensure effective textual communication of the impacted area (i.e., the closest city in relation to a TFR should not be constrained to a dropdown menu unless it could contain all charted cities). Also, the FAA should consider allowing the use of nautical mile distance and direction from a prominent city if a TFR is located in a rural area (example “50NM NE of Spokane, WA”).

**Recommendation 9. TFR NOTAM templates should be centrally managed electronically for all users.**

Similar to what is currently employed in NOTAM Manager, any update(s) to NOTAM templates should be uniformly and automatically pushed out to all TFR entry tools rather than allowing each individual creator to manually update their own templates. This will serve to ensure consistency of the output.

#### Case Study

Below on the left is the current NES template for a candidate TFR, and on the right is the TFR template from JO 7930.2Q. There are considerable differences between the two including the portrayal of times and acronyms. There is considerable variation between the originator’s NES TFR candidate and the template represented in FAAO 7930.2. This has led to the candidate TFR being rejected after receiving manual edit(s) as well as mapping errors where the TFR graphical depictions are created.

**Draft NOTAM Preview**

Work Number: 16-012437      Work State: Initial draft

Return to Draft    TFRMAP    Print

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!FDC Y/NNNN ZLA CA..AIRSPACE 12 NM SE OF PALMDALE, CA..TEMPORARY
FLIGHT RESTRICTIONS WI AN AREA DEFINED AS 5 NM RADIUS OF
342344N/1175506W (PALMDALE VORTAC FMD139015.9) SFC-11800FT . TO
PROVIDE A SAFE ENVIRONMENT FOR FIRE FIGHTING. PURSUANT TO 14 CFR
SECTION 91.137(A) (2) TEMPORARY FLIGHT RESTRICTIONS ARE IN EFFECT,
ANGELES NATIONAL FOREST TELEPHONE      OR FREQ 119.7250/THE
SMOKEY BEAR FIRE IS IN CHARGE OF THE OPERATION. TBA IS THE FAA
COORDINATION FACILITY. EFFECTIVE 1609122200 UTC UNTIL 1610011433
UTC.
1609122200-1610011433EST
AA
16-012437
AUTHOR: JULIE STEWART/JS/FS-RAL/
MANAGER: BRANDELL PATTERSON/FS-RAL/
TIL 1610011433
AUTHOR COMMENTS: THIS IS A NEW TFR. IMPACTS VR 1257 JIK VR 1265 E:F
FOR QUESTIONS, PLEASE CONTACT JULIE STEWART AT      ARTCC
- PLEASE INPUT THE FAA COORDINATING FACILITY AS WE DO NOT HAVE THAT
SCREEN IN OUR NES.
USNOF COMMENTS:

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*!FDC y/nnnn ZLC MT..AIRSPACE MISSOULA, MT..TEMPORARY FLIGHT RESTRICTIONS PURSUANT TO TITLE 14 CFR SECTION 91.137(a)(2) WI AN AREA DEFINED AS 3NM RADIUS OF 465422N1135521W (3NM RADIUS OF MS0076008.6NM) SFC-10000FT MSL EFFECTIVE 1402271900 UTC (1400 LOCAL 2/27/14) UNTIL 1402280200 UTC (2100 LOCAL 2/27/14) FIRE FIGHTING AIRCRAFT OPS. MONTANA DNRC MISSOULA DISPATCH TELEPHONE 406-829-7070 OR FREQ 133.20/WEST RIVERSIDE FIRE IS IN CHARGE OF THE OPERATION. SALT LAKE/ZLC/ARTCC TELEPHONE 801-320-2560 IS THE FAA COORDINATION FACILITY...*

Figure 8 TFR Template Differences

**Recommendation 10. The TFR submission tool should render its output in a format recommended by industry - AIXM 5.X with GML<sup>4</sup>**

The Aeronautical Information Exchange Model (AIXM) was designed/developed via collaboration between the FAA and EuroControl to enable the provision of aeronautical information, within the scope of Aeronautical Information Services (AIS), in a digital format. AIXM version 5.1, which is based on the Open Geospatial Consortium (OGC) Geography Markup Language (GML) and is one of the schemas applicable to the aeronautical domain, introduced the concept of digital NOTAMs. ICAO's recommended format for output data is AIXM with GML and this group recommends any new or existing TFR authoring tool provide data in the ICAO suggested format.

**Recommendation 11. The TFR submission tool should provide a graphical depiction of the impacted area to all affected ATC agencies.**

Existing TFR submission tools, such as NES, do not have the graphic communication capabilities necessary to allow effective display/coordination of a candidate TFR between a proponent (i.e., the US Forest Service or the Bureau of Land Management) and impacted air traffic control facilities. For example, TFRs in southern California that are submitted to Los Angeles Air Route Traffic Control Center (ARTCC) need to also be coordinated with the Southern California ("SoCal") Terminal Radar Approach Control Facility (TRACON). NES currently does not have the ability to share a candidate TFR with any FAA organization outside of an ARTCC. The ability to provide a single accurate graphic across all affected FAA offices is key to an effective discussion of a candidate TFR.

<sup>4</sup> AIXM 5.1 is the most current version of AIXM. Over time, the most current standard for AIXM will change.

## TFR NOTAM Oversight (text and graphic)

**Recommendation 12. The FAA should designate a 24x7 operational office with the authority to review, reissue, or cancel any TFR in real-time, prior to its broadcast, to ensure: (a) accurate graphical depiction and (b) conformance with NOTAM policy and FAA orders.**

Standardization and consistency among all TFR producers is critical for an accurate graphical depiction. However, oversight and verification are vital to ensure they are rendered accurately and effectively while meeting FAA requirements. Some FAA offices responsible for issuing TFR NOTAMs, such as the Service Centers, do not have real-time oversight and may only conduct monthly audits. There is no single FAA office reviewing each TFR to ensure compliance with policy. The FAA's TFR website is staffed by contract support only during business hours. This website is often the only indicator of an issue with a TFR NOTAM's format. However, the staff provides only IT support and does not deal with content/format issues.

Some TFRs are submitted with textual language which is not per NOTAM policy (which could be from outdated templates) resulting in either no graphic or an erroneous graphic being generated. Often these are either planned TFRs or from proponents who rarely request TFRs and do not understand the process. In addition, these proponents generally do not have access to either TFR Builder or NOTAM Entry System.

The recommended office should be staffed 24 hours per day to incur minimal delay in the broadcast of submitted TFRs since they often contain information critical to safety and/or security.

Firefighting TFRs are a prime example of TFR candidates that are screened with effective oversight by the local ARTCCs. Today, these TFRs are published with minimal delay, and a 24x7 office should not slow down the speed with which firefighting TFRs are disseminated.

Depending on the Code of Federal Regulations (CFR) that the TFR NOTAM is issued under, the listed FAA Coordinating Facility may be different from the office with the authority to cancel or reissue the TFR. For this reason, the proposed office should serve as a second independent point of contact with the authority to reissue or cancel TFRs. Finally, this proposed office should also have responsibility of alerting the originator/proponent of a TFR NOTAM if the need to reissue or cancel a TFR arises since many originators track their own requested TFRs based on the original FDC NOTAM number.

The United States NOTAM Office (USNOF) does not have the authority to cancel or modify a TFR issued by any line of business in the FAA. While this is an issue which holds true for all NOTAM types (Distant, FDC, DOD), the authority to cancel or reissue TFR NOTAMs should be available, but tightly controlled by knowledgeable personnel within the FAA. For example, the ability to cancel a VIP TFR should be handled differently than other TFRs.

### Case Study 1

The USNOF only looks at NOTAM formatting and does not look at compliance with other policies such as FAAO 7400.2. Several TFR NOTAMs (example FDC 6/9379) were edited by the US NOTAM office in the summer of 2016 with the following language in the reason section for the TFR: “TO PROVIDE A SAFE ENVIRONMENT FOR FFR ACFT OPS.” The contraction “FFR” is not in accordance with NOTAM or ICAO policy which confused automation and prevented a correct plain language interpretation of the NOTAM from being created. The correct language is “TO PROVIDE A SAFE ENVIRONMENT FOR FIRE FIGHTING.” It was determined that the FAA’s contraction guidance was erroneously updated to include FFR as a valid ICAO contraction. FFR was not in the NOTAM Entry System (NES) and this was a manual edit by the US NOTAM Office specialists. The firefighting agencies did not recognize this acronym and do not use it.

### Case Study 2

TFR NOTAMs are sometimes issued as a “catch-all” for activities that do not actually warrant a TFR. The TFR below was erroneously issued for a Controlled Firing Area in Indianapolis ARTCC airspace. The issuing facility was unable to modify or cancel the NOTAM as the individual responsible for its creation had gone home for the weekend. The USNOF does not have the authority to cancel all types of TFRs and the organization tasked with oversight, the Service Center, only works between the hours of 9am-5pm.

FDC 6/1305 ZID IN..AIRSPACE TERRE HAUTE, IN..TEMPORARY FLIGHT RESTRICTIONS CONTROLLED FIRING AREA WI AREA DEFINED AS 1 NM RADIUS OF 385143N864840W (1 NM RADIUS OF OOM 211 DEGREE RADIAL AT 19 NM.) SFC-16500FT. PURSUANT TO 14 CFR SECTION 91.137(A)(1) TEMPORARY FLIGHT RESTRICTIONS ARE IN EFFECT FOR AN AIRBORNE HAZARD AT BLUE SKIES **CONTROLLED FIRING AREA(CFA)** IN R3404, ELECTROMAGNETIC EMISSIONS REMAIN. **AVOIDANCE ADVISED.** NAVAL SURFACE WARFARE CENTER IS IN CHARGE OF ON SCENE EMERGENCY RESPONSE ACTIVITY 812-854-5259. INDIANAPOLIS ARTCC /ZID/ TELEPHONE 317-247-2243 IS THE FAA COORDINATION FACILITY. 1601082300-1601090700

*Figure 9 Controlled Firing Area TFR*

### Case Study 3

The following TFR was reissued several times which amounted to over a year of constant activation. It was issued in relation to disposal of unexploded ordinance. An FAA investigation determined, however, that the hazard was too low to warrant a TFR and a Controlled Firing Area, which does not even require a NOTAM, would be the most applicable type of airspace<sup>5</sup>. It should be noted that similar TFRs were issued for the identical airspace back in 2003 which also caused many months of unnecessary flight restrictions.

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<sup>5</sup> Recurrent training on NOTAM Policy should include what does and does not qualify as a TFR NOTAM, such as Controlled Firing Areas.

!FDC 6/1032 ZFW TX..AIRSPACE TEXARKANA, TX..TEMPORARY FLIGHT RESTRICTIONS WI AN AREA DEFINED AS 2 NM RADIUS OF 332553N0941445W (TEXARKANA VORTAC TXK233010.0) SFC-2000FT AGL EXPLOSIVE DEMOLITION. PURSUANT TO 14 CFR SECTION 91.137(A)(1) TEMPORARY FLIGHT RESTRICTIONS ARE IN EFFECT. ONLY RELIEF AIRCRAFT OPERATIONS UNDER DIRECTION OF UXO/MATRIX ENVIRONMENTAL SVCS,PATRICK SAVEALL ARE AUTHORIZED IN THE AIRSPACE. UXO/MATRIX ENVIRONMENTAL SVCS,PATRICK SAVEALL TELEPHONE 870-490-2747 IS IN CHARGE OF ON SCENE EMERGENCY RESPONSE ACTIVITY. FORT WORTH /ZFW/ ARTCC TELEPHONE 817-858-7503 IS THE FAA COORDINATION FACILITY. EFFECTIVE 1602081130 UTC UNTIL 1603102230 UTC DLY 1130-2230 MON-THUR,EXCLUDING HOLIDAYS. 1602091130-1603102230

*Figure 10 TFR Reissued Multiple Times*

**Recommendation 13. The automation tool utilized for TFR NOTAM submission should produce and display an electronic graphical depiction for each TFR containing a clearly defined geographical area and include a required user verification step where the affected geographical area is verified to be accurate/correct.**

Currently a graphical depiction is not a required accompaniment of TFR NOTAMs. The TFR representations that are available from the FAA come with a robust disclaimer to contact Flight Service for an official briefing. The adage “a picture is worth a thousand words” could not be a truer statement when it comes to the safety benefits of providing a graphical depiction for each TFR NOTAM. FDC NOTAMs are often verbose, making the location of the actual impacted airspace and its three dimensional spatial orientation difficult to visualize.

Preview graphics that resemble the final product are not provided in most TFR authoring tools which prevents the submitter from verifying: (a) that the proposed area is correct, and (b) that the resulting graphic for pilots is correct. Improperly formatted text can lead to automation failing to provide any graphic or result in an erroneous depiction.

Validation of a graphic, if one can be created for the TFR, could be accomplished by overlaying the TFR graphic on an aeronautical chart display enabling verification of accurate depiction before allowing the TFR to be submitted.

The Volpe study offered recommendations on this topic and justification as to why the graphic is effective at increasing pilot awareness and at increasing compliance. The reduction in TOIs in the last few years is directly related to the availability of TFR graphical depictions on electronic charts in the cockpit via EFBs and various websites. Many TFRs are related to hazardous activity, so displaying TFRs also provides a safety benefit.

## Transmission to Industry

### Digital with AIXM/GML

**Recommendation 14. The FAA should provide TFR NOTAMs in AIXM/GML digital format.**

The FAA needs to provide TFR NOTAMs in AIXM digital format for consistency and accuracy as this is the industry accepted standard. The FAA should be able to provide TFR NOTAMs in other formats, if deemed more beneficial, as technology evolves.

AIXM is the aeronautical information data exchange model created via a collaboration between the FAA and EuroControl to enable the provision of aeronautical information in digital format. A majority of NOTAMs, including TFRs, are currently being created digitally and provided in AIXM 5.1 format via the FAA's FNS over SWIM. It is recommended that GML (geographical) data be included as part of a digital NOTAM in AIXM to facilitate the accurate graphical overlay depiction of TFRs. This is tentatively slated for late 2016 to accommodate "simple" (single point and radius) TFRs. TFR NOTAMs consisting of freeform text, which normally include complicated VIP TFRs, will be included at a later time.

The benefits of AIXM/GML include the following:

- AIXM is the internationally accepted standard for the exchange of aviation data with readily available validation suites;
- GML uses internationally accepted WGS84 coordinate format and is an XML grammar for expressing geographical features.

### Standard and Authoritative Method of Machine-to-Machine TFR Transmission

**Recommendation 15. Authoritative TFR NOTAM data should be provided in AIXM 5.X with GML over multiple nodes in SWIM.**

Today, there is a lack of standardization as to how TFR NOTAM files are transmitted to/ingested by industry which can result in discrepancies. The NOTAM Distribution Service (NDS) should be the authoritative source of TFR NOTAMs from the FAA with FNS via SWIM being the "warehouse" for obtaining TFR NOTAM data.

The FAA currently provides TFR NOTAMs in XML and AIXM 5.1 digital formats along with Esri shapefiles via their TFR website. They also now offer TFR NOTAMs in AIXM 5.1 format via SWIM but with no GML data. Certain vendors (e.g., Leidos) also make TFRs available to third parties. There have been reports of TFRs not being provided (missing) via the normal stream by some vendors for unknown reasons. There have also been reports of shapefiles not being removed from the FAA website after a TFR has expired. The FAA must fully support and recognize an authoritative method for disseminating TFR NOTAMs to all users/vendors. Data accessed via this authoritative process should not have any FAA provided disclaimers or restrictions limiting their operational use.



**Recommendation 16. The FAA must ensure that the SWIM onboarding process is efficient/timely for all approved “partners”.**

Given the FAA plans to disseminate machine-to-machine NOTAMs exclusively via SWIM, the process for onboarding to SWIM needs to be improved. Currently the process is time consuming (averaging 6-9 months) and frustrating for users to develop coding due to a test environment which is not regularly updated with adequate data. Access to the production environment is completely prohibited until a user can prove their ability to connect/authenticate in multiple environments and failover to backup ports without "hanging" on a previous firewall connection and disrupting the flow of data to others. These steps are all necessary but take time and seem to be strongly enforced at the expense of data accuracy and completeness.

**Recommendation 17. Legacy Esri shapefiles of each TFR should remain available.**

Esri shapefiles are critical for some operators to depict TFRs. Not all operators are expected to utilize AIXM/GML in the future, so these shapefiles should remain available until the FAA determines they are not used by operators.

## Format of GML Portrayal Script

**Recommendation 18. Prototype testing of GML Portrayals Scripts by the FAA and multiple vendors should be done and circulated to investigate 1) the range of graphical interpretations of AIXM data and 2) the interoperability of SLD/SE portrayal scripts for AIXM.**

Scripts for creating graphical depictions of GML/AIXM data should be based on open standards. The Open Geospatial Consortium (OGC) SLD/SE Portrayal standards provide the basis for GML Portrayal Scripts. There is a need for vendor input on GML Portrayal scripts and whether it should be generic, specific, etc. The script would allow for standardization of TFR portrayal among vendors.

The proposed TFR portrayal scripts should be circulated among stakeholders for feedback, such as at the Aeronautical Charting Forum and Air Transportation Information Exchange Conference (ATIEC) and the OGC Aviation Domain Working Group. Vendors should be encouraged to utilize the end product, given it is a standard developed to make TFR graphics more effective for pilots.

## Notification Process for Changes

**Recommendation 19. The FAA should communicate changes to TFR NOTAM policy to industry.**

As parsing will continue to be relied on by many vendors, it is important that the FAA communicates TFR NOTAM text changes to affected government agencies, industry and FAA field facilities prior to implementation and with enough notice for dissemination of that information to occur. For example, a change to the format for Hazardous Inflight Weather Advisory System (HIWAS) NOTAMs led to a parsing error that resulted in ERIDS not displaying any HIWAS NOTAMs, an issue which was not caught for several months.

Currently, the FAA lacks a standardized process for alerting industry and other agencies of changes to the TFR system, even though parsing can be heavily impacted by a change to the text which is governed under FAAO 7930.2. Outreach suggestions include SWIM NOTAM subscribers, flight planning vendors, FAA field facilities, and a notice published to the FAA’s external data website.

Case Study 1

An example of a parsing issue is the depiction on certain avionics of ADS-B/GPS interference event NOTAMs as TFRs when provided via FIS-B. The variability in the language of some TFR NOTAMs led to issues like this due to the automation being programmed with relaxed parameters to account for that variation.

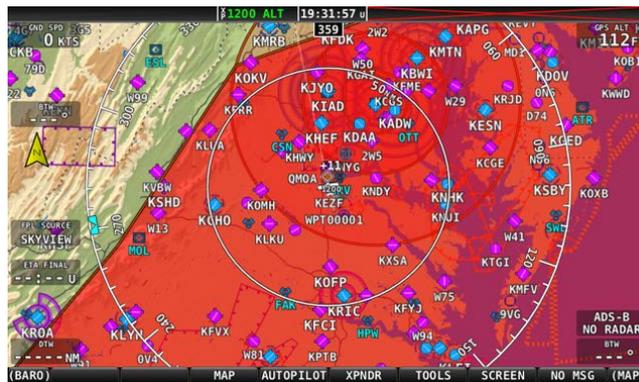


Figure 12 Sample Parsing Depiction Error

Case Study 2

Parsing issues have also appeared on the FAA’s graphical TFR website and subsequently on third party vendor sites. The example below (FDC 6/0909) shows a special notice for interference testing that appeared on the FAA’s website (left picture), despite it not being a TFR, and then on ForeFlight’s (right picture) and SkyVector’s systems.

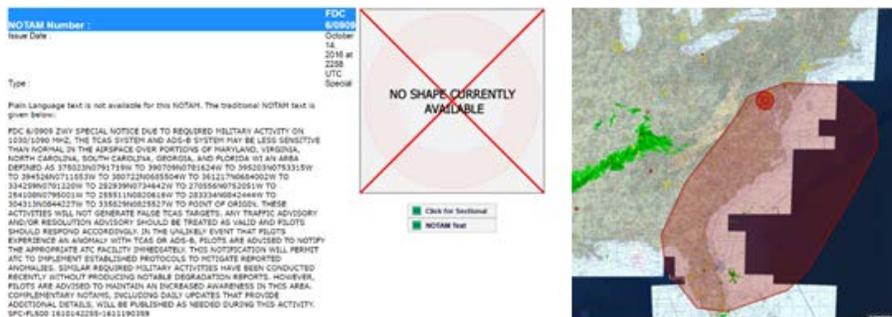


Figure 13 Interference Testing Erroneously Depicted as a TFR

# Graphics Availability and Electronic Presentation

## FAA TFR Graphical Website – Human to Machine

**Recommendation 20.** The FAA should sunset their graphical TFR website. The electronic depictions (graphics) for all TFRs and Special Use Airspace (SUA) should be provided simultaneously with the text for public consumption via the FAA's NOTAM Search website (<https://notams.aim.faa.gov/notamSearch/>).

Currently, NOTAMs are available in various places:

1. NOTAM Search provides all NOTAMs in textual form.
2. The FAA Graphic TFR website provides most TFRs graphically.
3. The FAA's SUA website provides all SUA NOTAMs graphically.

This fragmentation across multiple websites reduces the effectiveness of dissemination resulting in pilot self-briefing errors with heightened potential to omit impactful information from preflight planning processes. As a result, the FAA should sunset their current Graphic TFR website once TFR graphics are incorporated into NOTAM Search. (However, assurances should be made to communicate the end-of-life date of the site and all associated files to all users).

Since the use of one source is ideal for all related aeronautical information, the FAA should also investigate the incorporation of the FAA's SUA web portal with NOTAM Search as soon as possible. Providing a graphical depiction of SUA NOTAMs and scheduled use airspace would be beneficial if provided alongside TFR graphic depictions.

The FAA's FNS NOTAM search website was launched in 2014 as a means for pilots to comprehensively search, filter, group, query and archive NOTAMs in a single location. TFR NOTAMs are currently available for retrieval via the website, however, no graphical depiction or plain language text is available. The inclusion of plain language text and graphics for TFRs, like those provided on the FAA TFR website, would enhance the completeness of the NOTAM search website and potentially preclude the need for both.

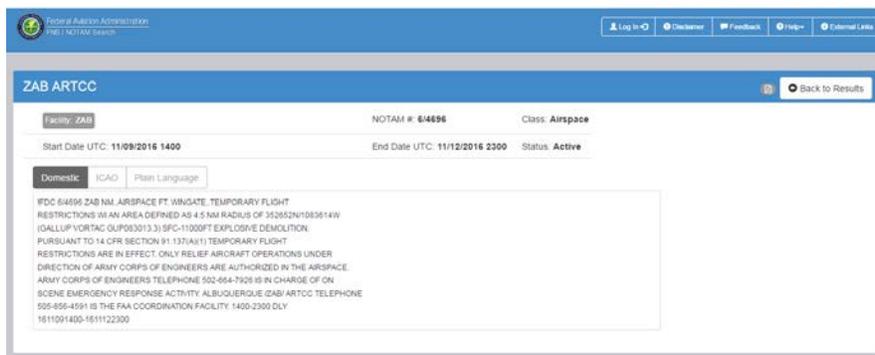


Figure 14 Example TFR NOTAM Text on NOTAM Search

The FAA’s graphical TFR website is over ten years old and lacks a modern interface and features that would be valuable to the pilot. Specifically, the FAA’s TFR website is not user-friendly or well integrated into the other resources pilots must access before flight. The map function, for example, is outdated and difficult to use, with a very limited pan/zoom function compared to modern products such as Google Earth or SkyVector.

### Case Study

This following TFR (FDC 6/7235) was issued correctly, however, the generation of a graphic took considerable time to become available:

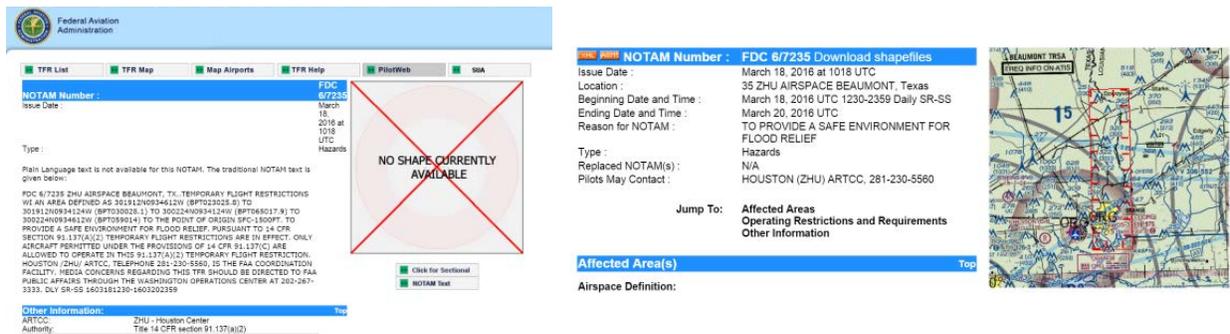


Figure 15 Long lag time for Graphic Availability

**Recommendation 21. Changes should be made in NOTAM Search to improve consumption of TFR information.**

If the FAA is to sunset its current graphic TFR website, the most logical location to migrate TFR information to would be the NOTAM Search site. For this to happen, the current site will need to be updated and improved.

The following is a list of specific recommendations for the updates to the NOTAM Search website:

1. The website must include the option to view a graphic (see below for static image recommendation) for each TFR NOTAM issued. It is recommended that an additional tab be added, specifically designated for TFRs, that would display all current TFRs on a map of the US.
2. The ability to overlay TFR graphics over various backgrounds should be provided. Specifically, Sectional chart, Terminal Area Chart, enroute low altitude chart, and street map backgrounds should be available. As some operators use the graphics for trip pre-planning to determine airport availability, the addition of a low-clutter background, emphasizing affected airports (with ICAO identifiers), is desired.
3. In addition to backgrounds, there should be the option to turn various layers on and off (i.e. NAVAIDs, airways, airports, etc), similar to what is currently done with FAA electronic charts.
4. All TFR graphic views should provide the ability to zoom in and out and to pan the map backgrounds, allowing the viewing of other TFRs in the area.
5. The website should include the option to view each TFR in the US graphically when using the route search function.



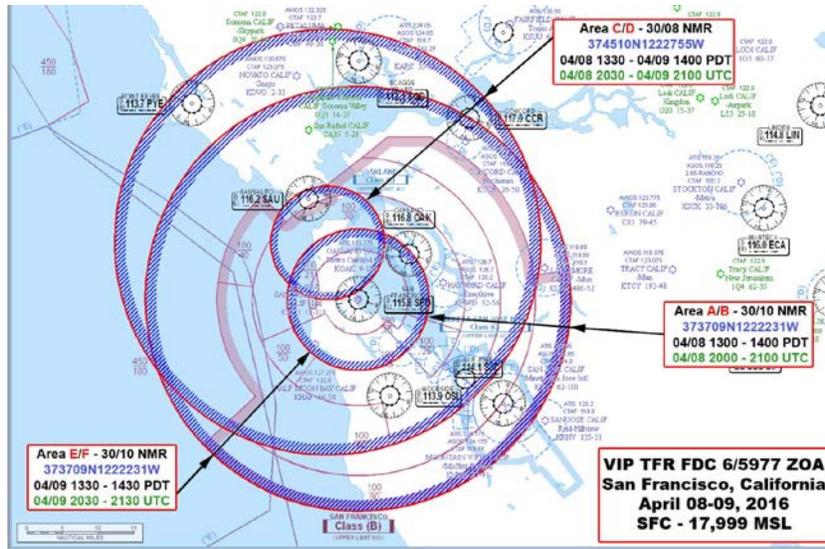


Figure 17 Super Bowl 2016 TFR Graphic

Currently, the FAA provides a depiction of the lateral dimensions of a TFR, but does not display the associated altitudes of the restriction. In addition, many TFRs have inner and outer rings, as well as airport exception areas, that have different associated altitudes. The FAA could increase pilot situational awareness by depicting the stratification that exists in these TFRs.

**Recommendation 23. The FAA should have a standard for displaying TFR overlay graphics on its website.**

The FAA should initiate a study to determine a standard for an electronic TFR overlay depiction that will be used for their website. Input should be sought from a variety of sources, including cartography, human factors, and industry professionals.

Based on the RTCA task group’s review of a number of electronic TFR overlay depictions, there are several suggestions for active, as well as proposed (scheduled) TFRs:

1. A red color for active TFR boundary outlines should be used.
2. A graphical indication of the area impacted by the TFR (some vendors use shading to show this), with a clear distinction between overlapping TFRs or overlapping rings contained in a single TFR.
3. A large, boldface black font, to indicate TFR floors and ceilings, should be used.
4. A “hover over” feature, that will display a plain language interpretation of the NOTAM, should be used.

For proposed or scheduled TFRs, the group suggests:

1. Orange for TFR boundary outline.
2. A graphical indication of the area impacted by the TFR (some vendors use shading to show this) and a clear distinction between overlapping TFRs or overlapping rings contained in a single TFR.
3. Bold, large black font with floor and ceiling of TFR.
4. Hover over feature should display plain language of the NOTAM.

Any FAA site that displays TFRs should include a legend with the standard display formats.

**Recommendation 24. Dissemination of the Notices to Airmen Publication (NTAP) should include the previously available HTML option to make it easier for operators to access this information, and all information in the NTAP should be available in NOTAM Search.**

The FAA routinely provides notices and additional information related to large TFR events (such as the Super Bowl) in the Notice to Airmen Publication (NTAP). Unfortunately, the NTAP is not a commonly known or easy to use resource for pilots and, as a result, the information it contains is not seen by most pilots. Previously, the NTAP was available in an HTML format and was simple to use. Today, however, it is available only as a PDF document which is hundreds of pages long. The FAA should revert back to the previous HTML availability of the NTAP. If the NTAP format cannot be improved, it should be sunset.

Additionally, the FAA should incorporate all notices, advisories, and other information that are currently provided in the NTAP into the NOTAM Search website. Each notice should then be linked to an airport so they can be found using a location search, similar to how the Letters to Airmen are available.

The NOTAM Search site should have a new tab developed to include other information pertinent to flight operations. One example of this information is Cold Temperature Restricted Airport procedures, which are included in the NTAP, but are pertinent to more than one specific airport. Another example of information that the FAA should post to this new tab is the GPS interference flight advisories, currently only provided on the FAAST webpage, which is another resource not commonly checked by pilots during preflight planning.

## Disclaimer for FAA Produced Online Graphic

**Recommendation 25. After adding TFR graphics to NOTAM Search, the disclaimer should explicitly state that TFR graphics can be relied upon for navigation.**

The current FAA graphical TFR website includes a disclaimer that reduces the value of the graphics, forcing more pilots to call Flight Service than would otherwise be necessary. When this happens, a Flight Service specialist must read the associated latitudes/longitudes to the pilot, who then must draw it themselves. This is time-consuming and can be imprecise.

Instead, a website with authoritative graphics that meet regulatory pre-flight requirements for pilots, is needed. This website should include a disclaimer that does not prevent pilots from using the graphics for navigation. The existing disclaimer for NOTAM Search allows pilots to trust the information they are accessing; however, it should explicitly state that TFR graphics can be used for navigation.

**Recommendation 26. The FAA should explicitly state that the TFR graphic is equal to the NOTAM's geographical textual description.**

Each unique TFR NOTAM's graphical depiction on NOTAM Search should include a note that the TFR graphic, and any information the FAA derives from that graphic, may be independently relied upon for avoiding the TFR and is equivalent to the geographical textual definition (location description) of the TFR, but that the NOTAM text must be consulted for reference to any further restrictions and definition.

### Sporting Event Blanket TFR

**Recommendation 27. For each sporting event venue, the FAA should graphically display on NOTAM Search the lateral and vertical dimensions, along with valid times. The locations for projected sporting event TFRs should also be displayed.**

Currently, sporting event TFRs are not displayed on the FAA Graphic TFR website. As a result, there is a need for a definitive source of information about sporting event TFRs, electronically providing graphic depictions showing the full dimensions of the TFR (i.e., 3NM radius, 3,000' AGL), along with valid times. Sporting event TFR information should be provided in the same location as all other TFRs.

### Accuracy of FAA TFR Depictions Provided Online

**Recommendation 28. All TFR graphics being displayed should have a correctly oriented chart.**

Currently, the FAA Graphic TFR website fails to correctly orient the display of TFR graphics overlaid on sectional charts. There are numerous examples of TFRs being overlaid "crooked" due to magnetic variation issues, most commonly involving TFRs in Alaska.

Additionally, the fix, radial, distance (FRD) definition of a TFR compared to its latitude/longitude definition can vary by a great enough distance to result in an inaccurate depiction. The fact that various available tools calculate TFR position differently may contribute to this problem. NES does provide a graphic showing the differences between the TFR with lat/long and the TFR with a FRD along with suggestions to correct the variation. Such capabilities may be leveraged to ensure all graphics are displayed correctly.

Regardless, these inaccurately displayed graphics impact a pilot's ability to use and interpret the graphics effectively. A standard TFR graphic presentation, which orients the chart in a correct and readable manner while also taking magnetic variation (difference between true and magnetic north) and differences between FRD versus latitude/longitude into account, should be provided. Also, location information that is included in the text of a TFR NOTAM must be considered as the authoritative definition for that TFR's geographical position - as such, it must be correct and in sync with the associated graphic.

#### Case Study 1

The examples below from Alaska show the Sectional charts skewed due to differences between magnetic and true north. The crooked charting makes interpreting the position of the TFR difficult for pilots.

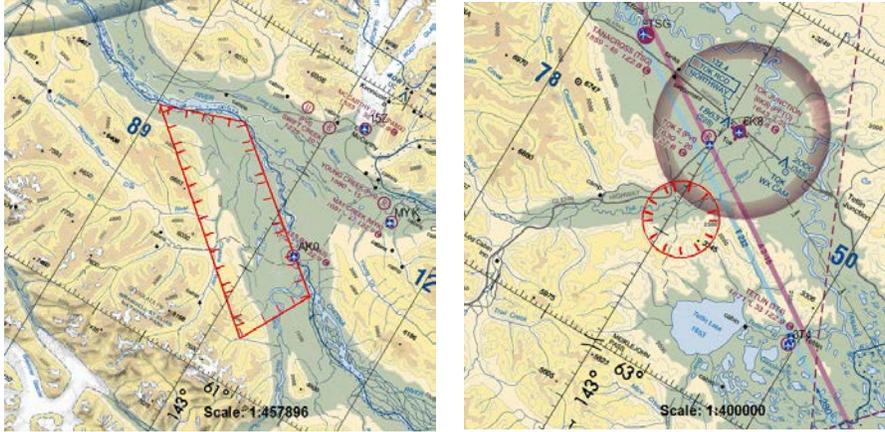


Figure 18 Firefighting TFRs in Alaska

## Case Study 2

These depictions on the FAA’s website show a discontinuity between the TFR’s position as calculated by latitude/longitude and by the FRD (example, FDC 6/8597 and 6/0231).



Figure 19 Discontinuity in TFR Position Based on Calculation Method

This issue has been documented in the past. Certain tools base the FRD on the lat/long or vice versa. A possible problem may be that different algorithms are being used to convert FRD to WGS84 lat/long. The FRD to lat/long conversion should be standardized. DO-229D Appendix L section L.6 includes an acceptable algorithm for converting FRD to WGS84 lat/long.

## Industry Standard for Electronic Depiction

**Recommendation 29. The FAA should establish industry standards for electronic depiction of TFRs by tasking the appropriate groups, contractors and/or committees.**

There is currently no requirement in the Minimum Operating Performance Standards (MOPS) for Flight Information Services Broadcast (FIS-B) with Universal Access Transceiver (DO-358) that dictates depiction requirements for TFRs beyond the availability of the graphics.

The avionics and application vendors that provide FIS-B use a variety of methods for depiction of TFRs on electronic displays. Additionally, many avionics and application vendors display both charted and non-charted TFRs for users.

Some of the current display variations include:

- Color coding of active versus scheduled TFRs;
- The type of shading inside of the impacted area(s);
- The method of depicting the impacted area(s) when the graphic is unavailable;
- The depictions of cutout/exception areas.

To eliminate confusion, there should be a standard that is consistent with the input received from ACF and ATIEC regarding the “format of GML portrayal script”. OGC Styled Layer Descriptor (SLD) defines an encoding to allow user-defined symbolization and coloring of GML. SLD addresses the need for users and software to be able to control the visual portrayal of the geospatial data. The FAA’s tasking should include, but not be limited to, investigating a standard for:

- TFR boundary color and shading;
- TFR boundary line thickness based on zoom level;
- Unique depiction of airports impacted by the overlying TFR.

Should the FAA elect to initiate further study on standards for TFR depiction as part of updating RTCA DO-358, the applicable NOTAM section in DO-358 is 2.2.4.3.5.

## FSS and ATC

### Availability for FSS and ATC

**Recommendation 30. The FAA should ensure controller automation (ERAM, STARS) can visually display TFRs on the controller scope.**

Providing a standardized and automated process for ATC to accurately depict TFRs on their scopes will reduce ATC workload and improve operational efficiency. The automation should be able to ingest AIXM/GML format to ensure consistency with the TFR depictions used by pilots. The TFR areas depicted on a controller’s scope can disagree with the graphic published in combination with the NOTAM due to the current need to manually draw the TFR.

There are issues of parsing and depiction depending on the automation tool employed. ERAM will not accept an incomplete polygon. ERAM is also limited to the 28 day cycle for depictions which is primarily an issue for long-term TFRs. Allowing for TFR drawings generated outside the 28 day cycle is critical for controller situational awareness. For those TFRs not mapped, ERAM can place a tag or anchor points and then the controller can draw lines to display it on the scope. Drawing feature is how CX depicts the TFR.

ATC may protect larger areas of airspace than necessary when the controller is forced to manually draw the TFR area on their scope. Manually drawing TFRs may remain an interim solution until an improved method can be made available. ERAM has tag and draw capabilities to depict circles and polygons on the glass, but it does not allow for arcs except by using a full circle and a line, resulting in scope clutter. Once an improved method is available, it should be incorporate into STARS as well.

TFMS is one automation tool that may be able to provide a graphical depiction of TFRs fairly quickly. However, TFMS is only available as a situational awareness tool and is not certified for traffic separation.

**Recommendation 31. The FAA should implement ERAM/STARS enhancement that allows the drawing of a TFR on one scope and pushing it to another.**

The draw function in ERAM can accurately depict TFRs including arcs via the use of multiple short lines. The problem with this is the amount of time it takes to draw complex shapes. ERAM has addressed capacity issues that limited the number of map items (lines, circles) that could be displayed. There are other enhancements to the draw feature being explored by the ERAM working group, one of which is the capability to “PVD”(display) a drawing from one scope to another. A non-active sector/scope could draw the TFR and then push the drawing to the affected active sector. This avoids having a controller actively working traffic from having to create the drawing.

**Recommendation 32. Controller guidance regarding coordination with a TFR proponent, such as firefighting agencies and pilots, should be clarified to better detail responsibilities and how “by ATC authorization” should be employed.**

There should be additional guidance provided to the ARTCCs and TRACONs regarding how TFR non-participating aircraft transitions should take place. The coordination varies from facility to facility with some controllers failing to conduct effective coordination to ensure, in the cases of firefighting, the TFR proponent or the nonparticipating aircraft are not unnecessarily inconvenienced or put at risk. The coordination procedures need additional direction in the FAA orders.

**Recommendation 33. Interpretation of TFR restrictions and what ATC can authorize should be standardized among facilities.**

The FAA should identify a consistent authoritative source pilots and controllers can both use to ensure consistent interpretations of restrictions.

For example, discrepancies may exist between TSD depiction of airports that fall outside of a 91.141 inner ring, but then controllers find out the day of the TFR that the airport is impacted due to conflicting information. Another example includes the bisection of airports by TFRs and potential impact to operations based on landing/departing direction (towards center of TFR or away). In this type of example, a TSD would likely have the depiction manually placed on the display. The TSD, though, is for situational awareness only.

**Recommendation 34. The FAA should depict sporting event venues with over 30,000 seats on ATC radar maps.**

This would allow exact location of the venue to be depicted for controllers.

**Recommendation 35. The FAA should depict long-term TFRs on ATC radar maps.**

This requirement will ensure consistency between facilities and reduce the need for the manual creation of the restricted area.

ERIDS can fail to parse out a TFR depending on the NOTAM's format. ERIDS displays all NOTAMs for the area covered. If the NOTAM is valid, it will be displayed in ERIDS. If the NOTAM does not populate in ERIDS, the controller will not have the information to display the TFR. There are times when the TFR is in adjacent airspace and the controller may not have the TFR NOTAM in their ERIDS. However, controllers regularly deal with operational situations where a constraint near a sector impacts operations. In such situations, controllers regularly coordinate with each other.

## Briefing NOTAM Order Changes

**Recommendation 36. There should be a clear communication process to brief changes of NOTAM policy to ATC positions that create TFR NOTAMs prior to implementation, and there should be sufficient time to allow technical requirements for parsing to be updated.**

There is no mandatory briefing on NOTAM Order changes which can result in outdated TFR templates and NOTAM terms being utilized. ATC can submit an incorrect TFR NOTAM which can impact automation downstream and the automation's ability to create a graphic. The JO 7210.3 designates briefing requirements in para. 2-2-11; however, this order has no requirement that facility air traffic personnel who create and distribute TFR NOTAMs are verbally briefed on changes to JO 7930.2. Requiring a mandatory briefing would help ensure TFR originators are informed of current policy.

Controllers need to be aware of the nuances contained within FAA orders and how they can impact an indicated "FAA Coordinating Facility" that is listed in the FDC NOTAM. When the FAA makes significant changes, such as moving TFR coordination from the Operations Managers to the Flight Data desk, robust training and support should be provided.

### Case Study

The FAA was unable to provide a graphic or plain language interpretation for an avalanche TFR NOTAM issued by Anchorage ARTCC (FDC 6/1234) as the FAA's TFR parser only parses HAZARD TFRs with standard formats. The depiction on the right was provided by ForeFlight following the creation of their own graphic for the same NOTAM. Anchorage ARTCC used a template to enter this TFR via NES but had failed to update the language in the text to current policy requirements. The issue was the nonstandard language related to defining the location.

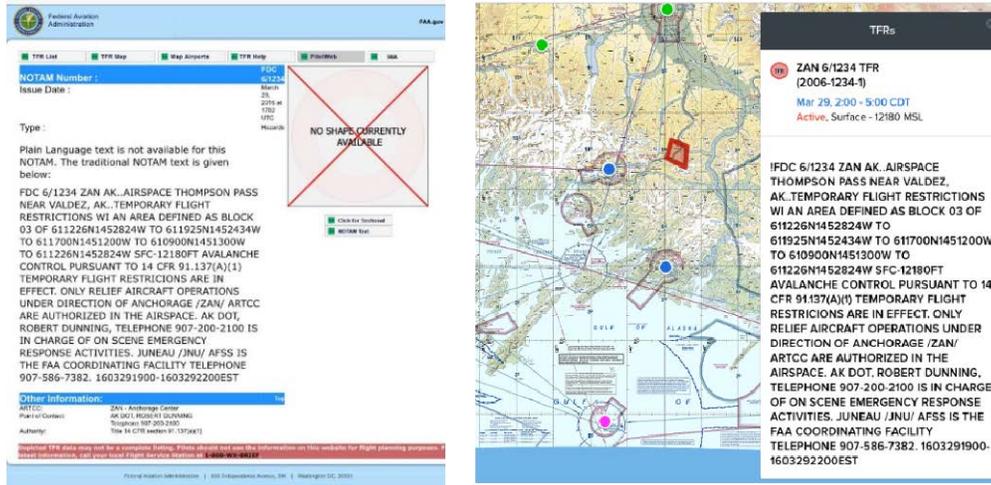


Figure 20 Avalanche TFR

## Standard Manner of Providing Graphic to Specialists

**Recommendation 37. The FAA should make sporting event venues and their 3NM radius lateral rings available on controller charts.**

The FAA should provide sporting event TFR locations on the controller chart as well as the 3NM rings associated with them. Below is a mockup of a controller chart with sporting event TFR locations depicted along with the 3NM circle restrictions.

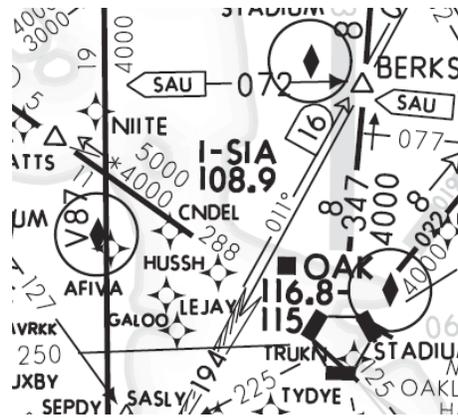


Figure 21 Controller Chart Mockup with Sporting Event TFR Location

There are inconsistencies among ATC and FSS facilities in regards to passing on TFR graphics to specialists. For example, OASIS allows Flight Service specialists to see a graphic but, given they are not always available, there is potential for missing this in briefings. This is similar to a pilot missing a TFR because there is no graphic provided. The FAA should make it mandatory that every ATC facility provide a TFR graphic to their controllers and allow the controllers to depict the impacted areas on their displays.

If an actual graphic depiction is consistently attached to the TFR data, that depiction could be distributed to ATC. An account has been provided by a committee member detailing a current practice of TFR circles and polygons being hand drawn on an applicable portion of a sectional chart. The "graphic" is then copied on a printer and placed at each affected sector desk.

## Textual Format

Many TFR NOTAMs contain over 1,000 words, have inconsistent organization, and will not be provided with an automated plain language interpretation because they are not standardized. The committee reviewed the 2005 Volpe study and supported many of its recommendations (listed below), pertaining to TFR NOTAM text. These recommendations primarily apply to FAR 91.141 and 99.7 TFRs.

Specifically the committee would duplicate multiple recommendations from the Volpe study as follows:

**Recommendation 38. The FAA should standardize the language and format of TFR NOTAMs to facilitate the effective transfer of critical information to pilots.**

This recommendation follows from one in the Volpe study that states: "Provide improved and standardized language and formatting of each NOTAM in briefing reports, arranging and emphasizing information so that relevant [TFR] NOTAMs are easier to find, and key information within the NOTAM is easier to understand."

**Recommendation 39. The FAA should restructure the TFR NOTAM format to be consistent across all types to allow pilots to have a standardized reading pattern and improve the understanding of restrictions.**

This is linked to another Volpe recommendation which says: "Break up the [TFR] NOTAM text. Reformat the text through arrangement emphasizing the location ensures pilots recognize the relevance of a NOTAM in relation to their flight when scanning through a preflight briefing report. Restructuring simplifies the ability to comprehend boundary information and assists in the ability to visualize the configuration of the [TFR] specifically the geometric arrangement of the restriction as it relates to the planned route of flight."

**Recommendation 40. The FAA should remove from the NOTAM, to the extent possible, all extraneous information and publish that information elsewhere or at the end of the NOTAM.**

Finally, this recommendation follows from one in the Volpe study which states: "'Legalese' language and other text not relevant to understanding the geographic location of the NOTAM should be eliminated or de-emphasized."

Recommendations made by the 2005 Volpe study were written after considerable research and analysis was conducted into why TFR violations occur and what effective interventions could be put in place to reduce the violation rate. Support for, and additions to, the recommendations discuss three important issues with the TFR NOTAM textual format:

- Arranging information to ensure understanding and clarity (seriation, etc.);
- Consistency of the NOTAM structure;
- Improving readability by either moving legal language to the end of the NOTAM, or no longer including it in the NOTAM and publishing it elsewhere, such as in the AIM or in the FARs.

The committee strongly agreed with the Volpe recommendations believing that legal considerations are negatively impacting safety and pilot compliance. The legal language requirements are running counter to the FAA’s goal of compliance and are frustrating to thousands of pilots who must read these NOTAMs to operate responsibly. The FAA should strive to present the critical information of TFRs effectively to pilots as, per the Volpe study, “it should be recognized that the reading conditions may be substantially suboptimal (e.g., done while in flight with poor lighting, turbulence, and other tasks competing for attention).”

The committee endorsed these recommendations with an understanding of the constraints to implementation currently in place. The constraints include:

- FAA and ICAO NOTAM policy, legal requirements, the Aeronautical Fixed Telecommunication Network standards, and United States Secret Service requirements;
- The need for language flexibility due to security reasons;
- Certain legal language that should be in the NOTAM if it is not in the CFR being cited;
- NOTAM constraints that may not be flexible, such as capital letters and a lack of paragraph breaks in the NOTAM block text.

### Case Study 1

The graphic below, courtesy of Jeppesen, shows the Pope’s visit to New York City at the same time as the UN General Assembly was taking place. Due to the complexity of the NOTAM and lack of standardized language, there was no graphic generated by the FAA TFR website while SkyVector, ForeFlight, and other vendors were unable to correctly depict the TFR until they made manual corrections (example, FDC 5/3614, 5/3619, etc.).



Figure 22 Pope’s 2015 New York Visit TFR



Many TFRs are lengthy due to the need to describe multiple, complicated restrictions. The restrictions may require non-standard language and follow an unusual format. These factors lead to the most impactful TFRs, generally those that apply to deadly force, not being easy to follow and impossible for automation to decipher. A consistent organization should be used to facilitate automation providing a plain language interpretation every time.

### Case Study

The TFR NOTAM below was issued for the nuclear summit taking place in Washington, DC. The NOTAM text is similar to the established SFRA/FRZ NOTAM. The dimensions and language match but there are variations in approved activities. As the language was nuanced and no graphic was provided, there was an increased chance it would be overlooked. This NOTAM was 1,400 words long, 8 parts, and had no plain language interpretation provided (example, FDC 6/6697).



Figure 25 DC Nuclear Summit TFR

**Recommendation 42. The cut out or exception area language should be published in a standardized format.**

Standardization of cut out area descriptions would facilitate automation correctly depicting these graphics.

The FAA can state in a TFR NOTAM specific areas that are not impacted by the TFR. Providing these exception areas is helpful and important to providing relief for aviators. However, it is common for the exception areas to be shown as part of the restricted area in the graphic or for the graphic not to be provided if the NOTAM has exception areas. The lack of standardized language describing these areas impacts automation and can be confusing to pilots.

### Case Study 1

The TFR below was issued for space flight operations and included several exception areas. The FAA's graphical site is unable to depict these areas so will either not show a graphic or will provide an erroneous graphic with no cut outs depicting the entire area as impacted. Pilots have come to trust graphics so depicting restrictions greater than what is stated in the NOTAM text can be detrimental to airport access and confusing for pilots.

FDC 6/6438 ZAB NM..AIRSPACE SIERRA BLANCA, NM.. TEMPORARY FLIGHT RESTRICTIONS ARE IN EFFECT WI AN AREA DEFINED AS 325600N1060400W TO 341200N1060400W TO 341200N1054400W TO 335700N1052700W TO 325600N1052700W TO POINT OF ORIGIN SFC TO FL239 **EXCLUDING 7.1NM RADIUS AROUND SIERRA BLANCA REGIONAL AIRPORT (SRR) AT 332800N1053200W SFC TO 14000FT MSL AND 3NM RADIUS AROUND LINCOLN STATION AIRPORT (NM25) AT 340700N1054000W SFC TO 1500FT AGL...**

*Figure 26 Space Flight TFR NOTAM Text with Exception Areas*

### Case Study 2

The graphic below, generated from the NOTAM above, was provided by ForeFlight and depicts a cutout on the north side and another on the east side of the restricted area. The exception areas were only effective up to certain altitudes, meaning there was no ability to show in two dimensions what the restricted area looked like. Failing to show a cut out can lead to pilot avoidance, unintended loss of access and a financial impact (example, 6/6438).



*Figure 27 Space Flight TFR with ForeFlight Graphic Showing Exception Areas*

### Case Study 3

In the example below, the web portal from Lockheed Martin, the FAA's Flight Service provider, failed to show the outer 30NM ring and the exclusion area for Addison Airport located within the TFR. ForeFlight, SkyVector, and the FAA's TFR page all depicted the TFR and cutout correctly (example, FDC 6/4068).

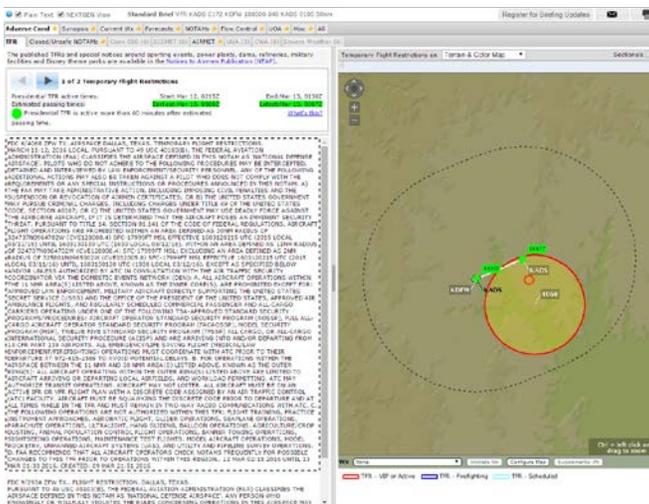


Figure 28 Dallas, TX Presidential TFR

### Case Study 4

In another example of cut outs not being displayed, Lockheed Martin was unable to correctly display a cutout provided for an airport in the Los Angeles area in association with a VIP TFR (below, left). The FAA's TFR site (below, right) did show the exclusion area depicted correctly (example, FDC 6/1610).

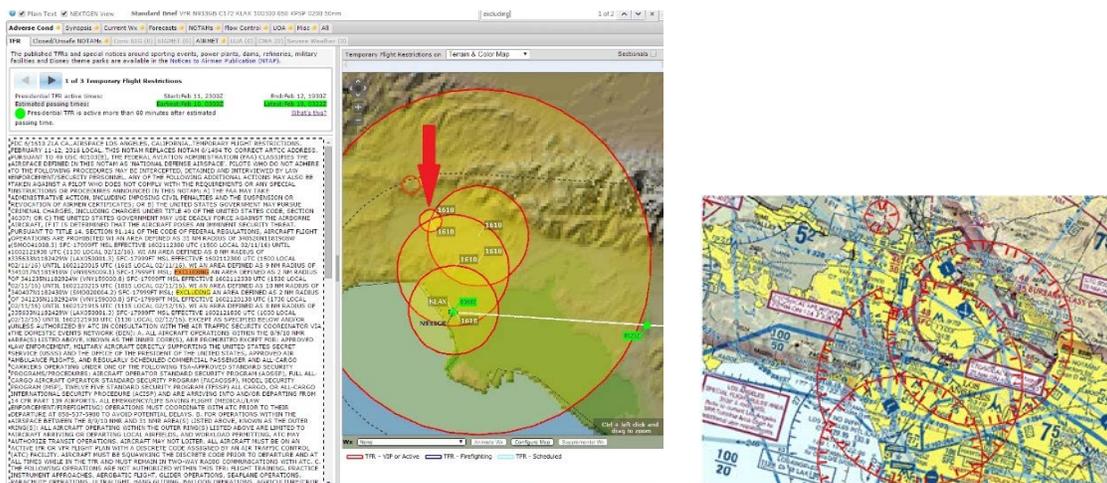


Figure 29 Lockheed Martin's Depiction of the Presidential TFR and the FAA's

**Recommendation 43. The FAA should expand their NOTAM issuance policy to allow TFR NOTAMs to be published seven days ahead of the activation time, instead of the usual three days, when the information is available.**

Providing seven days notice for upcoming TFRs improves the planning ability of operators while reducing the financial and operational impact of the restrictions. This recommendation mirrors one made in another report of the TOC focused on Airport Construction. Recommendation #25 of that effort states: “Provide flight operators with draft information on temporary and permanent obstruction impacts to IFR flight procedures earlier than the current 72 hours.” The request of commercial operators for obstruction NOTAM information 7 days in advance is similar to general and business aviation’s requests to have TFR information made available 7 days in advance when feasible.

**Recommendation 44. The FAA should publish a single standard for the latitude/longitude format that can be stated in a TFR NOTAM.**

There is variation in the way latitude/longitude is stated in TFR NOTAMs. Standardizing the format will improve the correct interpretation of the TFR’s geographical area. The committee determined degrees, minutes, seconds (example, 301912N0934124W) is the preferred industry standard.

## FIS-B Uplink

### Range of Transmission

**Recommendation 45. The FAA should increase the FIS-B radio station look ahead range for the NOTAM-TFRs.**

RTCA/DO-358 defines Look Ahead Range as the radius for which a given product is provided from a given radio station. The FIS-B radio stations use the look ahead range to geographically filter the set of NOTAMs that will be included in the FIS-B uplink. The Surveillance and Broadcast Services (SBS) Program Office’s Surveillance and Broadcast Services Description Document (SRT-047, Rev. 02 – November 15, 2013) defines the following NOTAM look ahead ranges:

- Low/Medium/High Tier Radios: 100NM
- Surface Radios: Not applicable, surface radios do not uplink any NOTAMs

Note that the 100NM NOTAM look ahead range is applicable to the text and graphic records for all FIS-B NOTAMs, which include NOTAM-TFR (Temporary Flight Restriction), NOTAM-FDC (Flight Data Center), and NOTAM-D (Distant). Also, the transmission interval for NOTAM-TFRs is 10 minutes; however, FIS-B radio stations alternate between transmitting the full text records and an empty NOTAM-TFR header, so it can take up to 20 minutes to initially acquire NOTAM-TFR text records. The existing limited look ahead range reduces the time available to the pilot to adjust to TFR changes routinely resulting in reception of a TFR with as little as 20 minutes prior notice to entering or landing within the TFR area.

- The FAA should increase the FIS-B radio station look ahead range for NOTAM-TFR text and graphic records to:

- High Altitude Tier Radios: 500NM
- Medium Altitude Tier Radios: 375NM
- Low Altitude Tier Radios: 250NM
- Surface Radios: 100NM

*Note: This recommendation is only applicable to the NOTAM-TFRs and not NOTAM-FDCs nor NOTAM-Ds.*

## FIS-B Text

**Recommendation 46. The FAA should task the appropriate committee (e.g., SC-206 SG-5) to investigate undoing the change to the FIS-B radio stations that truncates uplinked NOTAM-TFR text records.**

The FIS-B processor software in the FIS-B radio stations currently truncates NOTAM-TFR text records to 1,500 characters. When a NOTAM-TFR contains more than 1,500 characters the FIS-B processor software will uplink the first 1,492 characters of the original NOTAM-TFR text and use the remaining eight (8) characters to terminate the text record with “(INCMPL)”.

SC-206 SG-5 originally recommended that FIS-B NOTAM-TFR text records be truncated because reading and understanding thousands of characters of text from avionics display unit with limited screen real estate is not feasible/desirable and would distract the pilot from their primary task of operating the aircraft. The 1,500 character limit was determined through SC-206 SG-5 research that concluded that fewer than 10% of all NOTAM-TFR text records would require truncation. The truncation of long NOTAM-TFR text records also helped to ease the memory requirements for certificated avionics that implement FIS-B.

In order to support Recommendation 47, the FIS-B uplinked NOTAM-TFR text records should not be truncated. The FAA should task the appropriate committee (e.g., SC-206 SG-5) to investigate the technical feasibility (e.g., available FIS-B uplink bandwidth) and possible side-effects of undoing NOTAM-TFR text record truncation.

## Graphic Legality

**Recommendation 47. The FAA should evaluate the use of FIS-B NOTAM-TFR graphics to meet regulatory requirements for navigation and operational use in the cockpit.**

The FAA should task the appropriate committee (e.g., SC-206 SG-5) to evaluate the technical feasibility of utilizing the FIS-B ground system and uplink architecture to be an FAA approved source of NOTAM-TFR graphics. For example, can FAA AIXM/GML data for TFRs be correctly and completely translated into the graphic format used by FIS-B to uplink NOTAM-TFRs? It should be noted that the FIS-B radio stations are capable of uplinking a Current Report List (CRL) so avionics systems can indicate to the pilot if their FIS-B avionics have the complete set of NOTAM-TFRs or not.

Additionally, the FAA and the SBS Program Office should investigate making changes to policies and/or regulations that would allow pilots with certified FIS-B avionics systems to use the NOTAM-TFR graphics for navigation and operational use in the cockpit.

## Education

### Written Questions for Airmen

**Recommendation 48. The FAA should consider additional knowledge exam questions on TFRs that emphasize checking NOTAMs, comprehension of restrictions, avoidance, and the process of requesting ingress/egress permission.**

There is currently little emphasis on the importance of TFR awareness, avoidance, and understating when it comes to pilot testing. Introducing the topic of TFRs early in pilot training and testing is important to exposing the pilot, including UAS operators, to an important piece of the National Airspace System. This would apply to Dispatcher training as well. There are currently only two test questions on the topic and both fail to fully capture the substantial impact of TFRs on aviation operations:

Public figures are protected by...

- A) Special use airspace.
- B) Prohibited areas.
- C) Temporary flight restriction.

One of the purposes for issuing a Temporary Flight Restriction (TFR) is to...

- A) Announce Parachute Jump Areas.
- B) Protect public figures.
- C) Identify Airport Advisory Areas.

Testing all pilots on TFR awareness and avoidance best practices would be an effective way of ensuring that all types of pilots understand how they should interact with and operate around TFRs.

### Pilot Guidance

**Recommendation 49. The FAA should publicize the best practices for TFR awareness and avoidance in appropriate pilot guidance as well as in the Flight Instructor Refresher Course, pilot flight reviews, and in the FAA's WINGS program.**

The guidance provided to pilots regarding TFRs is limited and rarely goes beyond the statement of "remember to check NOTAMs." Publishing best practices for TFR awareness and avoidance would increase pilot knowledge around issue areas that are frequently mentioned in ASRS reports. The committee drafted the best practices listed below after looking at existing guidance and the issue areas identified in ASRS reports.

#### Preflight best practices:

- Pilots are encouraged to use online preflight resources, such as those provided by Flight Service, as they provide graphics for TFRs. The graphics can be used for operational purposes if there is no disclaimer stating otherwise.
- Pilots should check NOTAMs before every flight including short local flights.
- The FAA's online TFR graphical resource will provide a plain language explanation of a TFR NOTAM which can assist with understanding the area affected.
- With the increasing number of NOTAMs being published, pilots should utilize the FAA's NOTAM Search website as it allows filtering and sorting of NOTAMs.
- Pilots are reminded to read NOTAMs in their entirety as some TFRs may allow pilots to fly through the flight restriction should they request permission to do so and subsequently receive it.
- Pilots can reach Flight Service via telephone to be informed whether their route is clear of TFRs.
- Manually plotting a TFR on a chart can result in error. Pilots should provide a buffer between the depicted TFR boundary and their flight path as FAA cartographers are allowed a certain amount of leeway (relative accuracy) when plotting significant points, including VORs.
- TFRs are rarely charted, including those of long duration, so pilots should remain attentive for NOTAMs and possible changing conditions of TFRs. Long-term TFRs (e.g., Washington, DC) and short-term TFRs (e.g., firefighting) can have their requirements or duration change with little notice. Sporting event TFRs routinely have varying activation times due to issues like rain delays and overtime.
- Participating in the FAA's Safety Program Airmen Notification System (SPANS) is encouraged as it enables email notifications of TFRs in your area.

#### Inflight best practices:

- Pilots are encouraged to utilize VFR flight following as air traffic control will assist with TFR awareness and avoidance.
- Calling Flight Service via radio for updated flight conditions enroute is advisable; however, receiving VFR flight following from air traffic control is the best method to avoid a TFR incursion.
- It is best practice to monitor guard (121.5) as air traffic control DoD intercept aircraft will transmit on this frequency to pilots who may inadvertently enter a TFR.
- Utilizing an onboard navigator with a moving map that displays own-ship position is an effective way of maintaining situational awareness, particularly with regard to TFR proximity.
- It is important to understand how your Electronic Flight Bag or GPS moving map gets its TFR information and what its position accuracy is. Be aware of when your provider's TFR information is updated as some are not updated evenings or weekends. Be aware of FIS-B latency, processing time, and distance at which TFRs are uplinked. Understand your systems settings as it relates to depiction of TFRs and other airspace (TFRs may have to be manually selected to be depicted).



## Unmanned Aircraft Guidance

**Recommendation 51. The FAA should conduct additional outreach and education to unmanned aircraft remote pilots to ensure they understand their responsibility to avoid TFRs.**

Unmanned aircraft, whether commercial or recreational, are classified as aircraft by the FAA and subject to the restrictions stated in any TFR. The FAA should avoid unnecessarily increasing the length of TFR NOTAMs to explicitly call out remote pilots as being obligated to comply. Rather, education should be focused on training remote pilots to know that they must comply with all TFRs<sup>7</sup>. The FAA needs to emphasize this fact to ensure TFRs are complied with by one of the fastest growing sectors of aviation. The FAA should engage with industry to promote remote pilot education and TFR awareness.

**Recommendation 52. Law Enforcement Organizations (LEO) should be provided a single online resource for guidance on responding to intruder unmanned aircraft.**

The FAA should emphasize the resources available to Law Enforcement Organizations (LEO) that discuss reacting to noncompliant unmanned aircraft. The FAA should provide a single comprehensive website with all LEO guidance and contact information. The website URL with the guidance should be included in certain high risk NOTAMs (i.e., air show TFRs given the threat to the performers) and security sensitive TFRs (i.e., sporting event and VIP TFRs). Including the website link will not increase the NOTAM's length considerably and will be effective at highlighting the guidance available to LEOs.

## TFR Outreach and Communications

**Recommendation 53. The FAA should promote the importance of proactively engaging industry at all levels of TFR issuance and at all TFR issuing facilities.**

The FAA has different procedures for advertising TFRs depending on the type of the TFR (CFR issued under) and the event it relates to. The lack of a formalized process for TFR outreach to industry limits the opportunity for increasing awareness beyond the standard NOTAM system. For example, it should be standard practice for airports impacted by a pre-planned hazard TFR, such as gas venting scheduled in advance, to receive a phone call from the local air traffic control facility.

There is effective outreach with pilots, associations, and airports when it comes to large TFRs like the Super Bowl and political conventions. However, other large scale pre-planned TFRs are not always discussed with industry. The FAA should take advantage of joint FAA/industry forums, such as the National Customer Forum, as these are an effective avenue for alerting industry to events impacting the NAS. Discussion of these pre-planned events should occur in a timely manner to allow industry associations to conduct outreach to their members.

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<sup>7</sup> Addendums that provide additional guidance to the TFR, i.e., handouts, may be utilized to accomplish this

## Case Study

Eleven TFRs were issued for Indianapolis ARTCC with identical dimensions. The restrictions were published for altitudes from the surface to 10,000 feet MSL and each had a 2NM radius. These TFRs impacted several airways and overlaid an airport effectively closing it for the NOTAM's 12 hour duration. There was no outreach or warning to pilots or airports until the morning of the TFR's activation despite the FAA's 3-month lead time for the event. These NOTAMs impacted scheduled flights and access to airports, and thus had a significant financial impact. Alerting aviation associations, local pilots, airports, and FBOs to the TFRs would have lessened their impact by allowing preplanning. The TFRs were for gas venting, which is hazardous to pilots, so greater advertising would have been beneficial in increasing awareness and avoidance of the hazardous areas.

FDC 6/7080 ZID OH..AIRSPACE CIRCLEVILLE, OH. TEMPORARY FLIGHT RESTRICTIONS WI AN AREA DEFINED AS 2NM RADIUS OF 393946N0830552W (CIRCLEVILLE VOR XUB331010) SFC-10000FT MSL. FOR NATURAL GAS RELEASE PURSUANT TO 14 CFR SECTION 91.137 (A)(1) TEMPORARY FLIGHT RESTRICTIONS ARE IN EFFECT. ONLY AIRCRAFT OPERATIONS UNDER DIRECTION OF THE PROPONENT ARE AUTHORIZED IN THE AIRSPACE JENNIFER REAMS TELEPHONE 419-250-1730 IS IN CHARGE OF THE OPERATION. INDIANAPOLIS /ZID/ ARTCC TELEPHONE 317-247-2242 IS THE FAA COORDINATION FACILITY. 1607191100-1607192300

*Figure 30 Example of One of the Eleven TFRs Issued for Indianapolis ARTCC*

## **Additional TFR Considerations**

**Recommendation 54. The FAA should work with industry to develop implementation guidelines for congressional language on new TFRs in order to avoid creating a patchwork of TFRs across the country that could have a negative impact on aviation.**

Based on language contained within the current FAA Reauthorization (Sec 2209 a1C), there appears to be an opportunity for wide-spread proliferation of TFRs that could have an adverse effect on the operation of both manned and unmanned aircraft. Specifically, the language referring to "Amusement parks" and "Other locations that warrant such restrictions" is vague and open to wide interpretation by those seeking to create TFRs.

## Appendix A: Members of the Graphical TFR Task Group

### **Rune Duke, Aircraft Owners and Pilots Association (Co-Chair)**

Julie Stewart, Bureau of Land Management  
Dave Bear, Federal Aviation Administration  
Trish Gay, Federal Aviation Administration  
Talwyn Haley, Federal Aviation Administration  
Michael Helwig, Federal Aviation Administration  
Chris Henne, Federal Aviation Administration  
Brian Hint, Federal Aviation Administration  
Lynette Jamison, Federal Aviation Administration  
Scott Jerdan, Federal Aviation Administration  
Scott Leis, Federal Aviation Administration  
Bob McMullen, Federal Aviation Administration  
Chris Moody, Federal Aviation Administration  
Tiffany Narowski, Federal Aviation Administration  
Jim Perkins, Federal Aviation Administration  
Ajay Sawant, Federal Aviation Administration  
Matthew Thompson, Federal Aviation Administration  
Mark Tomicich, Federal Aviation Administration  
John Collins, Foreflight LLC  
Jeremy Holman, Garmin Ltd.  
Lauren Haertlein, General Aviation Manufacturers Association  
Paul Freeman, Harris Corporation

### **Jon Reisinger, Jeppesen (Co-Chair)**

Joe Daniele, Leidos  
Heather Rittiner, Leidos  
William L Geoghagan, National Air Traffic Controllers Association (NATCA)  
Jim McClay, National Business Aviation Association  
George Percivall, Open Geospatial Consortium (OGC)  
Trin Mitra, RTCA, Inc.  
Jim Mills, U.S. Air Force  
David von Rinteln, U.S. Air Force

# Appendix B: Tasking Letter



U.S. Department  
of Transportation

**Federal Aviation  
Administration**

Mission Support Services  
800 Independence Avenue, SW.  
Washington, DC 20591

March 29, 2016

Ms. Margaret T. Jenny  
President  
RTCA, Inc.  
1150 18th Street, NW  
Suite 910  
Washington, DC 20036

Dear Ms. Jenny:

The Federal Aviation Administration (FAA) issues temporary flight restrictions (TFR) pursuant to Title 14, Code of Federal Regulations, Part 91, General Operating and Flight Rules. A TFR is an airspace prohibition implemented for a specified amount of airspace, on a temporary basis, in order to provide protection to persons or property in the air or on the ground. TFRs are issued via the Notice to Airmen (NOTAM) System.

TFR NOTAMs are constructed according to guidance in FAA Order 7930.2, NOTAMS, and International Civil Aviation Organization agreements. The format used is rigid to ensure data can be interpreted and processed in the same manner for all NOTAMs. However, there are several issues which users have identified regarding the issuance of TFRs: the NOTAM text is not user-friendly; third party vendor automation often depicts graphical TFRs incorrectly; data provided by the FAA is not always suitable for Direct User Access Terminal Service vendors; and the FAA's website contains a disclaimer that it is not for flight planning purposes.

The FAA and users have identified several key areas that need to be addressed. These issues include, but may not be limited to:

- A need for a standard method for TFR data to be transmitted for the consistent development of TFR graphics, including a consistent format of TFR NOTAM text that will allow accurate graphical depictions;
- An online definitive (authoritative) source for all current TFRs and known future TFRs;
- The need to determine whether the disclaimer about TFR graphics can be removed from the FAA website allowing the information to be used for flight planning;
- The need to provide the TFRs' valid times, including sporting events, Presidential, and others;
- The need to reclassify, chart, or publish permanent TFRs including: the Washington Special Flight Rules Area, speed restrictions near Washington, D.C., and the Disney locations;
- Other possible methods to make the TFR NOTAM text more user-friendly.

As key stakeholders in this issue, I am asking for your assistance in clarifying the issues associated with TFR issuance and in developing solutions to improve the content and delivery of TFR information to aviation stakeholders.

The FAA requests that the TOC perform the following tasks and respond to the FAA with recommendations within 6 months:

**Task 1 - Use broader expertise and data to clarify and validate issues associated with TFRs and recommend solutions.**

**Task 2 - Recommend policy regarding an online authoritative source for TFR content and use of TFR information for flight planning purposes.**

**Task 3 – Develop an associated set of business rules around what can be disseminated; to whom the data should be disseminated; standardization of the format; graphical depiction; and means of dissemination.**

Completion of these tasks will provide the FAA with a clearer insight into what the industry values and help us to make better informed decisions moving forward. The FAA will provide subject matter experts as needed to support these tasks.

Sincerely,

A handwritten signature in black ink, appearing to read "E. Ray for".

Elizabeth L. Ray  
Vice President, Mission Support Services  
Air Traffic Organization