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Alternatives to Vieques

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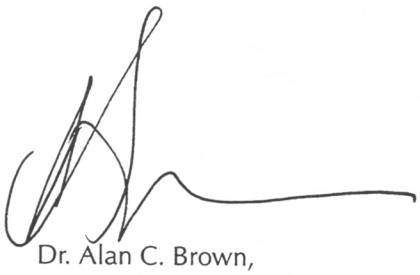

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Summary

Background

Military activity on the island of Vieques has recently become a contentious political issue, putting its future as a naval training facility in doubt. To prepare for the possibility that pre-deployment training will have to be conducted elsewhere in the future, the Secretary of the Navy tasked CNA to examine alternatives to Vieques that could be made available within approximately five years.

From the perspective of the naval training community, Vieques is a facility where ships, aircraft, air wings, battle groups, amphibious ready groups, marine expeditionary units, and many of the components that make up these larger units train at sea or in the field before they deploy. So our task was to find other ways that these forces can train (a) at sea or in the field (b) before they deploy. That largely rules out simulation, except as a means of augmenting at-sea training. It also rules out overseas ranges that cannot be accessed prior to deployment. And the five-year time horizon effectively rules out new range development. What we are left with is a collection of existing U.S. ranges that lie near the eastern seaboard, along the Gulf coast, or in the Caribbean. They need not be Navy ranges—access can be negotiated—and they need not be ideal—improvements can be made.

Results

We examined existing U.S. ranges as potential alternatives to Vieques and found two promising candidates. Neither candidate has all of the capabilities of Vieques, but each has a significant subset of those capabilities. The leading candidate is a collection of ranges accessible from the Virginia Capes operating area (VACAPES) that includes Camp Lejeune, the Dare County and Cherry Point ranges, and also Fort Bragg. The use of Fort Bragg for live bombing has yet to be negotiated, but it seems to be the final

piece of the puzzle. Aircraft will still not be able to fly end-to-end tactical strikes with live ordnance from VACAPES, but with appropriate negotiations that capability could be made available at the second candidate, Eglin Air Force Base. Eglin is not our leading candidate because there is no place in the vicinity to exercise the ARG/MEU. If Navy/Marine Corps integration is a top priority, then VACAPES is the better alternative; if strike operations is the top priority, then Eglin is the better alternative.

Recommendations

There is no need to choose between VACAPES and Eglin. We recommend pursuing both, because what looks like the better choice today may not look like the better choice five, ten, or twenty years down the road. Encroachment is a growing problem at almost all U.S. military ranges, so it seems only prudent not to become dependant on any single range or range complex.

To enable the Navy and Marine Corps to conduct future pre-deployment training in much the same way as it has been conducted at Vieques, we offer the following recommendations.

- Pursue an agreement with the Air Force for a) improved Navy access to Eglin for ATG training, b) relaxation of operating restrictions, and c) improvements to the target complex.
- Pursue an agreement with the U.S. Army that will enable the Navy to use Fort Bragg for live-ordnance ATG training.
- Defend the continued use of Pinecastle for live-ordnance ATG training. The Pinecastle facility is far from ideal, but it is currently the only range on the east coast where Navy aircraft train with the live ATG ordnance that they are asked to deliver in combat.
- Conduct NSFS training using the G-10 impact area at Camp Lejeune. Camp Lejeune have not been used for live-fire NSFS training since the mid 1970's, but there does not appear to be any good reason why such operations cannot be resumed.
- Develop an east-coast water-impact NSFS range, preferably in the vicinity of Camp Lejeune. The technology exists and

appears to be relatively inexpensive. Such a range could serve as an alternative to G-10 and would also be valuable insurance in the event that there are problems with conducting NSFS at G-10 that did not come to light during this study.

- Pursue agreements with nations in Europe and the Mediterranean basin for improved access to their training facilities. We also recommend that the U.S. Navy use these facilities regularly even if it is not always convenient, so that such use will be viewed as routine rather than as a response to U.S. domestic problems.

Introduction

Background

The island of Vieques has been an important tool for training Navy and Marine Corps forces for several decades. The U.S. Navy has had a presence on the island for at least 60 years. The Marine Corps began training there in the late 1940's and the U.S. Navy began using the eastern tip of the island for live-ordnance training in 1960. At present, the Navy owns approximately two thirds of the 33,000-acre island. The remainder of the island is home to approximately 9300 residents.

The Navy and Marine Corps use the facilities on Vieques to train combat forces in preparation for overseas deployment. Vieques has beaches where Marines can conduct amphibious landings, an inland area where they can conduct maneuvers, and a live-impact area where Marine artillery, Navy ships, and naval aircraft can employ live ordnance. The island is also situated in an area that places relatively few restrictions on how ships and aircraft can operate.

The relationship between the U.S. Navy and the residents of Vieques has been tumultuous over the years, and recent events have put the future of Vieques as an active training facility in doubt. The Navy and the Marine Corps have explained to Congress and to the American people how important Vieques is to military preparedness in hopes of overcoming the current opposition and resuming the use of Vieques to train combat forces. It remains to be seen, however, whether that argument will carry the day. While there is optimism in some quarters that the ongoing controversy will be resolved favorably, there is also the possibility that Vieques will cease to be available for Naval training.

Tasking

As the Navy comes to grips with the possibility that it may have to live without the training facilities at Vieques, it has begun thinking about long-term alternatives. To help inform his decision making on this subject, the Secretary of the Navy tasked CNA to examine alternative range options that could be made available to the fleet within approximately five years, based on how well they can accommodate the training that historically has been conducted at Vieques. The sponsor for the project has been the Deputy Chief of Naval Operations for Plans, Policy, and Operations (N3/N5).

Analytical approach

Our analytical approach is basically a three-step process. The first step is to analyze the training operations that are endangered by the potential loss of Vieques to determine what range attributes would be required to conduct those operations elsewhere. The second step is to survey existing and potential ranges to determine what range attributes could be made available. This step also includes a survey of alternative training technologies (e.g., simulation) to determine what role they can play. The third step is to compare the required range attributes from step one with the available range attributes from step two to identify the most promising Vieques alternatives. The specific methodologies for conducting these steps are described in the respective sections of this report.

Limitations of scope

We are looking for alternative sites that can accommodate the training operations that heretofore have been conducted at Vieques. We were not asked to assess the need for those training operations, nor were we asked to assess their effectiveness. Our objective was more modest. It was to determine how best to accommodate those exercises, or something approximating those exercises, in a world that does not include Vieques.

While it was our intent to consider all potential Vieques alternatives, it was impossible for a search for candidate ranges to be truly

exhaustive. The number of potential range sites is large, so it is entirely possible that some viable candidates were missed. On the other hand, we received inputs from many knowledgeable sources, so we believe it unlikely that a candidate range with significant promise escaped our attention.

We did not analyze all candidate ranges in equal detail. Our objective was to find the ranges or potential ranges that are most promising as Vieques alternatives. Candidate ranges that were clearly inferior to a competitor were eliminated from further consideration early in the process and consequently were not analyzed in detail.

We considered alternative training technologies such as simulation only as possible ways to compensate for shortcomings in physical ranges. Our focus was on alternative physical sites where the Vieques training operations could be conducted in the same way, or in nearly the same way, as they have been conducted in the past. The limited discussion of alternative training technologies does not mean that we think such systems are not useful. It only means that they are generally not good one-to-one substitutes for most of the live training exercises that have traditionally been conducted at Vieques.

Vieques training operations

Fallon/Pace Report

This project was motivated by concern that the loss of Vieques as a training facility will prevent the Navy and the Marine Corps from conducting specific, valuable training operations that historically have been conducted at Vieques. That concern was expressed to Congress and is articulated in [1], which has become known as the Fallon/Pace report.

Our guidance was to rely on the Fallon/Pace report to tell us what training operations are endangered by the loss of Vieques. The report describes several training operations that in the opinion of the Fallon/Pace authors cannot be conducted elsewhere, or cannot be conducted elsewhere with the same training value. We refer to these operations as NSFS, SACEX, ATG, and JTFEX. The remainder of this section briefly describes each of these four operations and summarizes the primary concerns that are expressed in the Fallon/Pace report.

- **Naval surface fire support (NSFS).** Navy ships are required to qualify in NSFS prior to deploying overseas, and the qualification process currently requires each ship to fire several rounds of live ordnance against land-based targets. Vieques is the only east-coast range where Navy ships are allowed to fire live ordnance.
- **Supporting arms coordination exercise (SACEX).** A SACEX exercises the coordination of supporting fires (NSFS, close air support, artillery, and mortars) before, during, and after an amphibious assault. Vieques is the only east-coast range where Navy ships are allowed to conduct NSFS in support of a SACEX using live ordnance.
- **Air-to-ground (ATG) strike training.** There are several ATG issues, but the ATG training operation that is at center stage is the end-to-end, magazine-to-target, live-ordnance strikes

against realistic targets. Vieques is the only east-coast range that accommodates high-altitude bombing of land-based targets.

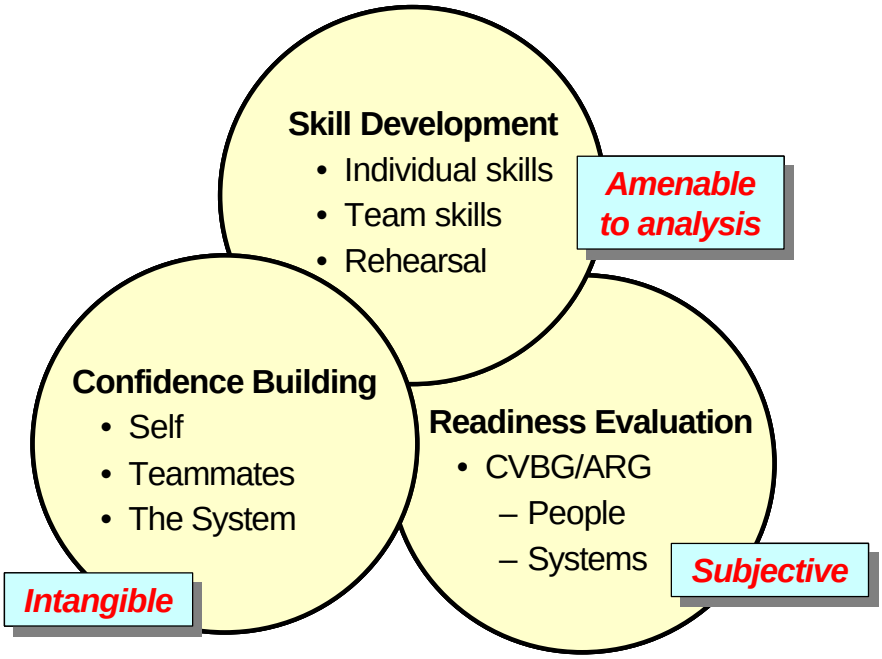
- **Joint Task Force exercise (JTFEX).** The JTFEX is a large-scale, multi-dimensional, joint and combined exercise that puts the naval forces into a stressful and realistic scenario where they must plan and conduct several diverse operations. Vieques is the only east-coast range complex where live NSFS firings against land-based targets and live high-altitude bombing of land-based targets can be included in such an exercise.

Objectives of fleet training exercises

We analyzed the objectives of the Vieques training operations to guide our thinking on what would constitute a legitimate alternative to Vieques. Discussions with people who design, execute, and participate in these exercises, as well as our own experience observing them, lead us to conclude that there are three primary objectives that are distinguishable, but not necessarily separable, as shown in Figure 1.

- **Skill development.** Fleet exercises provide a venue for developing war fighting skills at the individual and team levels, and for honing those skills under conditions that are as realistic as possible, consistent with safety, security, and other constraints.
- **Confidence building.** While rarely a stated exercise objective, confidence building was frequently raised by fleet trainers as justification for specific training evolutions, especially those that involve the employment of live ordnance.
- **Readiness evaluation.** The Navy certifies forces as ready to deploy based largely on the results of training exercises. The certification criteria have been codified at the unit level, but at the CVBG/ARG level, there are no clearly articulated criteria. The certification instead relies on the judgment of experienced observers.

Figure 1. Primary objectives of fleet training exercises



Based on the fact that important training objectives are intangible or subjective, we concluded that we could not make an analytical case for achieving those objectives through radically different means. Our analytical goal instead was to find alternative facilities where the same Vieques training operations can be conducted with as little compromise as possible.

Replacing Vieques capabilities

We were encouraged to analyze all possible alternatives to Vieques, but for practical reasons we had to establish some bounds within which we could focus our research. Three such bounds arise naturally from our tasking. Our interpretation of that tasking led us to focus on existing, physical ranges that lie within a few days steaming of east-coast ports. We also consider undeveloped sites, virtual ranges, and overseas facilities as back-up or supplemental ranges, but we do not believe that those options qualify as alternatives to Vieques.

- **Physical vice virtual ranges.** Vieques is a physical range where field training is conducted, so we looked primarily for other physical ranges that can accommodate the same or similar field training.
- **Existing vice undeveloped ranges.** Developing a new range in the U.S.—if it is even possible—will likely take a minimum of five to seven years, possibly much longer. Since our tasking was to look for alternatives that can be made available for Navy use within a five-year horizon, we looked primarily at ranges that already exist. Appendix A discusses the prospects for new range development in more detail.
- **Nearby vice overseas ranges.** The training facilities at Vieques are used during the IDTC to prepare combat forces for deployment. Consequently, we focused on training ranges in the western hemisphere.

Range survey

We compiled a list of candidate ranges based on three assumptions. First, we looked for candidate ranges that would be useful for training east-coast forces. That limited our search to the Atlantic Ocean, the Gulf of Mexico, the Caribbean Sea, or the Mediterranean Sea. Second, we looked for candidate ranges that are land-based; locations for at-sea ranges are abundant. Third, we looked for ranges that can accommodate one or more of the Vieques training operations: NSFS, SACEX, ATG, and JTFX.

Within the geographical areas described above, we collected information on Navy, Marine Corps, and other U.S. military training ranges; military RDT&E ranges; ranges controlled by other nations; and undeveloped or potential ranges.

Sources

Most of our range information came from the following sources:

- *Fleet Training Area/Range Directory*. Naval Warfare Assessment Station (NWAS); May 1998. This directory provides information on Navy and Marine Corps training ranges, including special-use airspace, associated non-instrumented surface and subsurface training areas, Research, Development, Test, and Evaluation (RDT&E) facilities and Air Training Command operating areas. Areas covered also include those that are regularly available for Navy/Marine units and are controlled by the United States Air Force (USAF), Air National Guard (ANG) and the North American Treaty Organization (NATO).

- *U.S. Navy and U.S. Marine Corps Range Information Web Site*. http://12.3.51.137/pubhtml/index.asp The CNO (N44) Range web site describes capabilities of U.S. Navy and U.S. Marine Corps air-to-ground ranges in the United States.

- *Sixth Fleet Mediterranean Exercise Manual (MEDEXMAN)*. COMSIXTHFLT Instruction C3500.3B. 24 February 1998.

This manual contains information on exercise areas, targets, and training facilities available to Sixth Fleet.

- *USAFE Instruction 13-212: Space, Missile, Command, and Control: Range Operations and Management.* 9 June 1999. Commander, US Air Forces in Europe (USAFE). This instruction includes operational and management information on air-to-ground and electronic warfare ranges regularly used by USAF units for training within the USAFE AOR.
- *AFWTF Instruction 3120.1M: Atlantic Fleet Weapons Training Facility Range Utilization Manual.* 28 September 1999. This instruction describes the training facilities at Vieques.
- *"The National Security Need for Vieques: A Study prepared for the Secretary of the Navy."* 15 July 1999. Commander U.S. Second Fleet and Commander U.S. Marine Corps Forces Atlantic. This study included a comparison of Vieques to 19 existing and "undeveloped" ranges on the U.S. east coast and in the Caribbean.
- *"Response to CMFL G-3 Questions on Vieques for Special OSD Panel."* II MEF G-3-FOPS Information Paper. 04 August 1999. This paper identified ranges used by Sixth Fleet for training in artillery, NSFS, and amphibious landing.
- We also collected data on potential ranges suggested by OPNAV and SECNAV. And, within the project's time constraints, we identified "undeveloped" ranges from a review of sea and air charts.

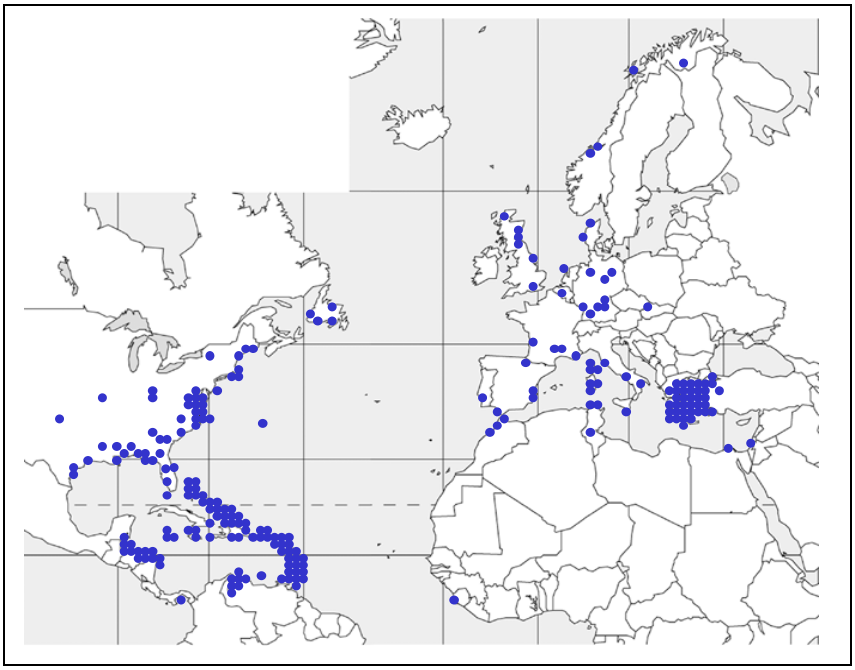
Caveats

As with any data collection effort, we had to work within certain constraints that may limit the accuracy or completeness of the database.

- Data currency. Some of our data come from documents that were compiled a few years ago or are currently being developed. The data may not always reflect current range capabilities. For ranges that were identified as serious candidates, we tried to confirm and supplement our source data with queries and interviews with appropriate personnel.

- Time constraints. We did not have the time necessary to collect all of the data that we would have liked to collect. As a result, we have varying levels of data on the 434 candidate ranges. Time constraints also limited our ability to look for undeveloped areas that could potentially be converted into ranges.

Figure 2. Geographic locations of candidate ranges



Database

The data collection effort produced a database of 434 candidate ranges, including 268 existing ranges and 166 "undeveloped" ranges. (The entire database is available separately.) Figure 2 shows where these ranges and potential ranges are located geographically. Note that some of the dots in the figure represent several of the individual ranges in the database. Appendix B contains a list of the candidate ranges that we investigated and also shows the kinds of information that are contained in the database.

Assessment methodology

This section describes how we evaluated each candidate range as a potential Vieques alternative. We start by developing a framework for making decisions among candidate ranges that have important characteristics that are not directly comparable. Next, we discuss how we handle the fact that some range characteristics can be improved. Finally, we describe the methodology that we used to evaluate specific candidate ranges.

Framework for trade-off decisions

We found it useful to treat the many disparate factors that characterize each candidate range as belonging to categories, within which comparisons are meaningful. This construct provides a framework for discussing what is otherwise a jumble of considerations and makes the trade-offs more explicit. Decision-making then becomes a process of deciding which categories are important and how the candidates compare within those categories. For this analysis, we characterized the candidate ranges using four categories—suitability, availability, risk, and cost.

- **Suitability.** Our first concern is the extent to which a candidate range can accommodate each specific training operation. Appendixes C through F discuss the characteristics that make a range suitable for NSFS, SACEX, ATG, and JTFEX training operations.
- **Availability.** We are also concerned about the reliability and predictability of access. Availability may be limited by natural phenomena, such as weather, or by the priorities of the range's owner.
- **Risk.** We are also concerned with threats to the long-term use of a range for its intended purpose. Such risks include:
  - **Non-development.** Proposals to develop a new range or to improve an existing range may not come to fruition.

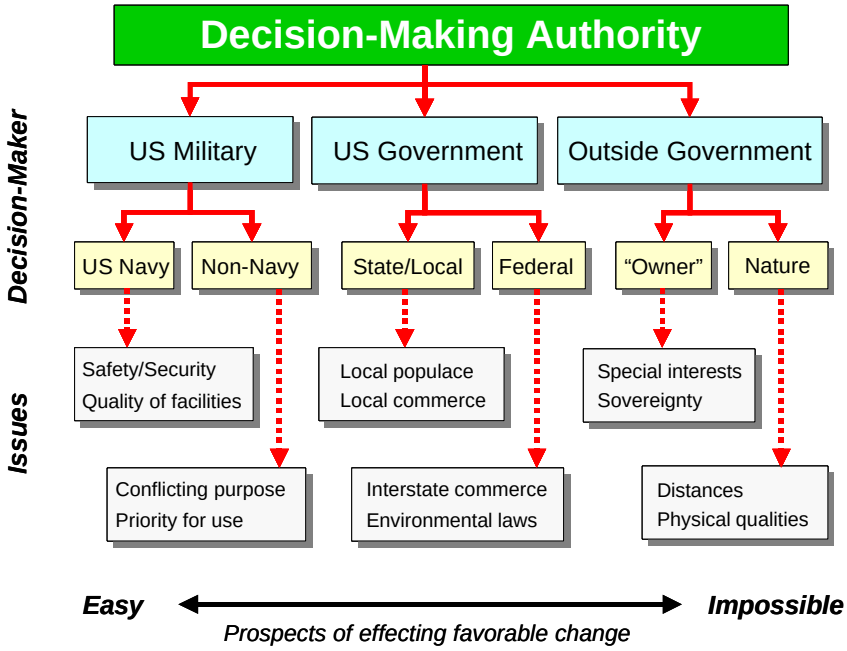
  - **Losing the range.** The range or its functionality may be lost due to a natural disaster or disputed sovereignty.
  - **Obsolescence.** We prefer a range that can handle future weapons and tactics, and will continue to be a solution far into the future.
  - **Incompatibility.** We prefer a solution that does not require major disruptions to the current tactical training system because such a solution is more likely to be accepted by the Fleet and because there are less likely to be unforeseen problems.
- **Cost.** We are also concerned with the up-front capital costs of establishing the range, the costs of maintaining and operating the range, and probably most important for our purposes, the opportunity costs that the Fleet must pay to use the range. The latter is typically expressed in days of steaming time.

Prospects for changing range characteristics

Two of the decision-making factors—suitability and availability—are subject to change. Almost any candidate range has shortcomings of one kind or another, but in some cases the Navy can take or initiate actions that will eliminate or reduce those problems. For the purposes of this analysis, we need some way to estimate—albeit roughly—the degree of difficulty that is associated with improving specific range attributes. We do that by identifying who has the relevant decision-making authority.

Figure 3 illustrates how decision-making authority spans a spectrum. On the left side of the figure, the Navy has considerable influence or leverage in negotiating a favorable arrangement. On the right side of the figure, the Navy has little or no influence. On the left side of the figure, the Navy can at least expect a reasonable decision that fairly considers its position. As we move to the right side of the figure, the decision-making process becomes increasingly arbitrary and unpredictable, and the Navy's needs become less relevant.

Figure 3. Prospects for improving existing ranges



For the purposes of this analysis, we assume that decisions that lie with the Navy or within the military establishment can be resolved in the Navy's favor. At the other extreme, we do not give serious consideration to physical actions such as building islands or dredging oceans that would require Herculean efforts or astronomical budgets. The remaining decisions, which lie outside the military establishment but within the realm of physical possibility, are assumed to be problematic. We do not dismiss such possibilities, but we want to be realistic by recognizing that a favorable resolution may be difficult to obtain.

Range assessment process

We followed a two-step process to identify the most-promising alternatives to Vieques. The first step was to apply the filters in Table 1 to eliminate candidate ranges that were clearly unsuitable or inferior to other candidates. For example, ranges not along the coast were dropped from the list of potential NSFS ranges. We actually did this in an iterative fashion, relaxing or tightening some

of the filters until we would up with a manageable number of candidate ranges for each training operation.

Table 1. Filters for identifying candidate ranges

Type of training	Minimum range characteristics
NSFS	On the coast
	Water depth > 35 feet within 12,000 yds of target
	Land-impact area
	Buffer zone (undeveloped area)
SACEX	Coastal location
	Assault beach
	Maneuver area >25 sq nm
	Water depth > 35 feet within 12,000 yds of target
	Land-impact area
	Buffer zone (undeveloped area)
ATG	Within 350 miles from the coast
	Land-impact area (live or inert)
	Altitude of at least 18,000' (for air-to-ground only)
	Altitude of at least 25,000' (for air-to-air tactics only)

Next, for each training operation, we assigned grades to each candidate range for suitability, availability, risk and cost. We chose to use the letters A, B, C and D to grade a candidate range in each area, much as a teacher would grade the performance of a student in different courses. The guidelines that we used for assigning these grades are:

A ➔ Little or no reason for compromise or concern

B ➔ Modest compromises or concerns

C ➔ Significant compromises or concerns

D ➔ Substantial concerns, possibly not viable

This grading method is a tool to help identify the most promising candidate ranges. It is admittedly subjective and imprecise, but that is the nature of the problem with which we are dealing. It is possible, for example, that reasonable people will disagree as to whether a particular range should have a suitability grade of B or C. It is less likely that one will argue for an A while the other argues for a D, and if that does occur there will at least be a common framework for discussion—both will agree that it is suitability rather than risk that is at issue.

Assessment of candidate ranges

This section presents the results of applying our assessment methodology to the candidate ranges. There are two tables for each Vieques training operation: NSFS, SACEX, ATG, and JTFEX.

- The first table shows the grades that were assigned for suitability, availability, risk, and cost. The analysis supporting our assessments and the reasons for assigning specific grades we discussed in Appendices C, D, E, and F for NSFS, SACEX, ATG and JTFEX, respectively
- The second table summarizes the results by putting the candidate ranges into one of four groups, where one parameter is the suitability grade and the other parameter is the lowest grade in the other three categories. To simplify the presentation, we use "good" to signify a grade of A or B and "poor" to signify a grade of C or D.

In the tables that follow, we assume that range improvements that are under control of the U.S. military (e.g., Navy, Air Force, DOD) can be made within the five-year time frame of interest. Our grades reflect those as yet unmade improvements. We assume that range improvements that are subject to approval by organizations outside of the military (e.g., FAA, EPA, State legislature) cannot be made in the time frame of interest. We will point out exceptions, where we have reason to believe that this assumption is invalid. Finally, even though we do not believe that foreign-controlled ranges should be considered legitimate Vieques alternatives, we include the most-promising ones in the following tables, if they can play a useful role within five years.

NSFS candidate ranges

Tables 2 and 3 show that Camp Lejeune is the most promising NSFS candidate. Camp Lejeune is not currently used for NSFS training, but there does not seem to be any good reason why it could not be. Navy ships have fired live ordnance into Camp Lejeune impact areas in the past, but the practice was discontinued in the 1970's. One

unresolved issue is the firing of high-explosive ordnance across the Intercoastal Waterway. The Marine Corps routinely closes the waterway for brief periods to fire inert ordnance (e.g., 155 mm artillery) from the beach towards inland targets, but at some point the Navy agreed[1] not to fire live ordnance across the waterway. If Navy ships are to use the G-10 impact area for live-ordnance training, that agreement will have to be revisited. A second issue is the fact that ships cannot get as close to the G-10 impact area as they can get to the Vieques target. That is probably not important, however, because the direct-fire counterbattery mission that requires a ship to get close is no longer considered tactically important. On the positive side, Camp Lejeune is close to Norfolk and is located among a complex of ranges where many aspects of pre-deployment training can be conducted. II MEF is currently exploring the possibility of using this range for NSFS.

Table 2. Grades for NSFS candidate ranges

Range Option	*Suitability*	*Availability*	*Risk*	*Cost*
Camp Lejeune (G-10)	A	A	B	A
VACAPES (water-impact)	B	A	B	A
Guantanamo Bay	B	A	D	B
Brunette Is. Newfoundland	A	C	C	B
La Orchilla Is. Venezuela	B	C	D	C
Capo Teulada Sardinia	A	D	C	A
Cape Wrath Scotland	A	C	B	C

1. This "agreement" is apparently an informal understanding between the Navy and the local Army Corps of Engineers command at Wilmington, NC.

Table 3. Summary for NSFS candidate ranges

Suitability \ Availability/Risk/Cost	*Poor*	*Good*
Poor		
Good	Other candidate ranges	Camp Lejeune (G-10) VACAPES (water-impact)

A water-impact range also meets most of the requirements, but a land-impact range is more desirable and more consistent with the current training philosophy. Most of the other candidate ranges have significant availability or risk problems. Some of them may be useful at certain times and under certain circumstances, but none is a serious alternative to Vieques.

SACEX candidate ranges

Tables 4 and 5 show that Camp Lejeune is the most promising SACEX candidate and the only one that is a serious alternative to Vieques. The other two candidates have significant limitations. Capo Teulada is suitable, but has availability and risk concerns. Guantanamo Bay has suitability problems as well as risk concerns.

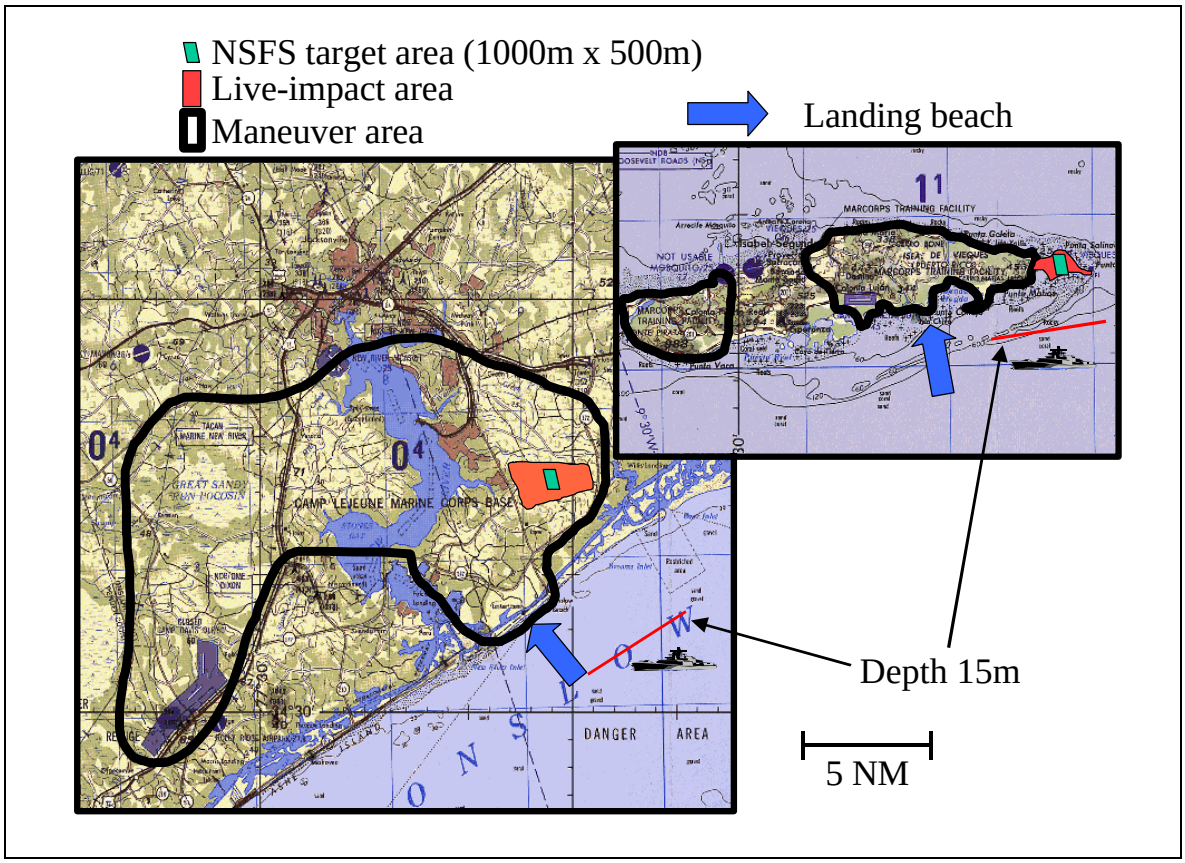
Table 4. Grades for SACEX candidate ranges

Range Option	*Suitability*	*Availability*	*Risk*	*Cost*
Camp Lejeune	A	A	A	A
Guantanamo Bay	D	A	D	B
Capo Teulada Sardinia	A	C	D	A

Table 5. Summary for SACEX candidate ranges

Suitability	Availability/Risk/Cost: Poor	Availability/Risk/Cost: Good
Poor	Guantanamo Bay	
Good	Capo Teulada	Camp Lejeune

Figure 4. Comparison of Camp Lejeune and Vieques for SACEX



Camp Lejeune is actually a very good site for a SACEX, and many such exercises have been conducted there in the past. The main advantage that Vieques has over Camp Lejeune is the ability to include live-fire NSFS in the exercise, but it appears that could be done at Camp Lejeune as well. Figure 4 compares the live-impact areas, landing beaches, and maneuvering areas for Camp Lejeune and Vieques. The size of the live-impact area is based on miss distances from observed NSFS live-fire training. The landing beaches at the two ranges are similar in size, but Camp Lejeune has a larger live-impact area and a much larger maneuvering area.

ATG candidate ranges

Tables 6 and 7 show that Eglin is the most promising ATG range candidate. It allows for tactical ingress, tactical operations in the target area, and the delivery of live ordnance. This assumes that appropriate access and relaxation of current test and evaluation range procedures can be negotiated with the Air Force to allow tactical ingress and tactical weapons release. The Cherry Point and Dare County ranges have similar tactical ingress capabilities, but live ordnance is not allowed. Neither Pinecastle nor Ft. Bragg is suitable by itself because they lack tactical approaches. Both allow live-ordnance, however, which complements the Cherry Point and Dare County range capabilities.

Table 6. Grades for ATG candidate ranges

Range Option	*Suitability*	*Availability*	*Risk*	*Cost*
Eglin AFB, FL	A	B	B	B
Cherry Point & Dare County ranges	D	A	A	A
Ft. Bragg, NC	C	A	A	A
Pinecastle, FL	C	B	C	A
Vliehors, Netherlands	A	C	D	C
Balikesir, Turkey	A	C	D	C

Table 7. Summary for ATG candidate ranges

Suitability \ *Availability/Risk/Cost*	*Poor*	*Good*
Poor	Pinecastle	Cherry Pt & Dare Co. Fort Bragg
Good	Vliehors Balikesir	Eglin AFB

JTFEX candidate ranges

Tables 8 and 9 show that the best choice for a JTFEX site is either VACAPES or Eglin. The Guantanamo Bay and Mediterranean options have excessive risk. Choosing between VACAPES and Eglin depends upon priorities. If conducting tactical and live ordnance ATG training in a single evolution is a higher priority than having a SACEX as part of the exercise, then Eglin is the better choice. If incorporating the Marine Corps into the exercise is a high priority and you are willing to separate the tactical and live-fire aspects of ATG training, then VACAPES is the better option. A better choice than either one, however, is both. That will provide additional flexibility to deal with future training priorities.

Table 8. Grades for JTFEX candidate ranges

Range Option	*Suitability*	*Availability*	*Risk*	*Cost*
VACAPES area	B	A	A	A
Eglin area	C	B	A	B
Guantanamo Bay area	D	A	D	B
Mediterranean	B	C	D	A

Table 9. Summary for JTFEX candidate ranges

		Availability/Risk/Cost	
		Poor	***Good***
Suitability	***Poor***	Guantanamo Bay area	Eglin area
	Good	Mediterranean	VACAPES area

Alternatives to Vieques

We agree with the Fallon/Pace report that there is no alternative site where the fleet can conduct all of the training operations that it used to conduct at Vieques, in exactly the same way as they were conducted at Vieques. But that is not the same as saying that there are no alternatives to Vieques. In fact, it appears that a combination of several existing ranges can accommodate the various Vieques training events, if improvements can be made in terms of providing the Navy with easier access and fewer restrictions.

East Coast options

The most desirable alternative to Vieques would be one that locates all of the required training facilities in one general area that is a short transit for most east-coast forces. We believe that there exists the potential for such a solution, albeit with some risk and some shortcomings. A potential east-coast solution that is accessible from the Virginia Capes (VACAPES) operating area includes the elements in Table 10.

In some ways this is a very conservative set of options, because nothing in the table is new and unprecedented. There is precedence in the Atlantic Fleet training process for:

- Conducting JTFEX (and its FLEETEX predecessor) in the VACAPES operating areas.
- Conducting NSFS into Camp Lejeune impact areas.
- Conducting SACEX at Camp Lejeune (with simulated NSFS).
- Conducting tactical ATG training with inert-ordnance into Cherry Point and Dare County ranges.
- Conducting live-ordnance ATG training into Pinecastle.

Table 10. VACAPES as an alternative to Vieques

Operation	*1st Choice*	*2nd Choice*	*3rd Choice*
JTFEX	VACAPES / W-72		
NSFS	Camp Lejeune (G-10)	Water-impact range	
SACEX	Camp Lejeune (NSFS into G-10)	Camp Lejeune (NSFS at water-impact range)	Camp Lejeune (simulated NSFS)
ATG (tactical)	Dare County & Cherry Point ranges		
ATG (live-ordnance)	Fort Bragg	Pinecastle	

Two elements in the matrix have not previously played a role in the training of east-coast naval forces—ATG training at Fort Bragg and NSFS qualification on a water-impact range—but even these operations have precedence of sorts. The Air Force has conducted ATG training at Fort Bragg and the Pacific Fleet sometimes qualifies ships in NSFS using a water-impact range.

The primary shortcoming of this alternative is the inability to combine tactical and live-fire aspects of ATG training in a single operation. The tactical ranges do not allow employment of live ordnance and the live-ordnance ranges cannot accommodate tactical maneuvering. It is conceivable that an initiative to solve this problem could be successful, but it is unlikely to happen any time soon.

Gulf Coast options

Eglin Air Force Base has many appealing attributes and probably could be converted into a first-rate ATG training range for naval aviation. There is plenty of sea room and air space for a battle group to conduct unfettered flight operations in the vicinity. Like Vieques

and unlike the east-coast ATG ranges, Eglin can accommodate both tactical and live-ordnance ATG operations. Since the intermediate-phase COMPTUEX focuses on carrier-based air operations and carrier/air wing integration, Eglin may be particularly well suited for that exercise. The transit distance to the Eglin area (which is roughly the same as to Vieques) is significantly greater than the transit distance to VACAPES, but ships need to spend time at sea anyway, so it may be worth the additional cost.

The main shortcoming of the Eglin area as an alternative to Vieques is the lack of an existing range where NSFS and a SACEX can be conducted. Nor does there appear to be any site that is particularly promising for the development of such a capability. The Gulf Coast is therefore less well suited for a JTFEX.

Caribbean options

Our search for Vieques alternatives in the Caribbean was not very productive. The only Caribbean facility that we found worth considering in any detail was Guantanamo Bay, Cuba. Unfortunately, Guantanamo Bay is quite limited in size and flexibility. It is physically possible to conduct an amphibious landing and to conduct NSFS and ATG training with live ordnance, but the quality of the training experience in all three cases would be severely limited by the physical dimensions of the facility. And, of course, overshadowing any physical considerations are the political considerations. It is not clear how Cuba and the rest of the world would react to a significant increase in U.S. military activity at Guantanamo Bay. It is quite possible that the U.S. government would not like to find out. But even if there were no qualms about using Guantanamo Bay for live-ordnance training today, the situation could change quickly in a post-Castro world. As with Vieques, there would be the risk that a Navy training facility could become a political football and be snatched away at an inopportune time.

Overseas options

There are several ranges in Europe and the Mediterranean where useful NSFS, ATG, and SACEX training can be conducted during

deployment. Some of these ranges are physically very appealing, but it is our opinion that they should not be viewed as potential substitutes for stateside, pre-deployment training facilities. There are two main reasons for this. The first reason is the political risk of relying on training facilities that belong to another nation. Regardless of how harmonious our international relations may be, access to those ranges will be subject to political winds and whims. It may well be that when tensions rise and access to those facilities is most needed that their availability will be most in doubt. The second reason is that relying on overseas ranges would be a significant break with the existing paradigm of pre-deployment training. The Navy would effectively be deploying forces before they are trained and certified as ready for deployment. It is possible that such a system could be made to work, but there is a great deal of organizational risk associated with such a monumental change to the current way of doing business.

As long as the Navy does not come to rely on foreign ranges, there is much to be gained from their use. Some of the facilities are superb, and they also give U.S. forces a more diverse training experience in terms of terrain and climate.

Summary

In our search for Vieques alternatives, we found no single training range that is superior in all respects. The best range for conducting a SACEX is on the east coast (Camp Lejeune), the best range for ATG training is on the Gulf Coast (Eglin), and the best NSFS ranges are overseas (Cape Wrath and Capo Teulada).

Overall, however, a VACAPES complex that includes Camp Lejeune, the Cherry Point and Dare County ranges, and also Fort Bragg is a promising alternative to Vieques. With improvements, the VACAPES complex could become comparable to Vieques in terms of the quality of tactical training it offers, while being superior to Vieques in two important ways—it is closer to Norfolk where most Atlantic Fleet forces are stationed and its future is less vulnerable to unfavorable political developments. VACAPES has one significant shortcoming in that it is not possible to exercise coordinated, tactical strikes and deliver live ordnance in a single training operation. That capability could be made available at Eglin,

however. So between the two complexes—VACAPES and Eglin—all of the Vieques training operations can be conducted, albeit not at the same time.

Appendix A: New range development

Many of the ranges that were under consideration for this study are prospective ranges. In other words, they are not ranges, but instead are parcels of land that conceivably could be converted into ranges. For the purposes of this study, it is important to understand the likelihood that such a parcel could be turned into a tactical training range within a few years. Most of our information on this subject has come from the Navy's Office of the General Counsel. Our analysis of this issue considers the process that must be followed to establish a new range, the Navy's track record in range development efforts, and the nature of the opposition that a range development proposal would likely generate.

The process

The Navy has to go through several steps to develop a new range. First, it has to locate an appropriate parcel of land, which could be public land or private land. If it is public land, they must negotiate a use permit or a land withdrawal with the appropriate federal department. If it is private land, they must negotiate a long-term lease with the owner. It is not clear how long these steps might take, but they will take some time.

Next, the Navy has to follow procedures described in the National Environmental Policy Act (NEPA) that involve studying alternatives and their consequences, and developing a proposal, which is then made available for public comment. We have been told that this second step should take approximately five years against normal opposition if no serious problems arise. NEPA requires an environmental impact statement (EIS), which takes about two years to prepare. It then takes roughly another three years to defend the proposal against a court challenge and subsequent appeals. If there are problems (e.g., a significant issue is not addressed in the EIS) the process can take considerably longer or the Navy can be enjoined from proceeding.

The final step, assuming that the court challenges are favorably resolved, is to develop the range for use, which will also take some time. All together, it is probably reasonable to assume that the end-to-end process will take a minimum of five years, and possibly much longer.

The historical record

The military services have not developed a new training range in over 40 years. Some ranges have been expanded or extended, and others have been reactivated, but the Navy has no recent experience developing a range where one has not previously existed. The focus recently has instead been on preserving the ranges that already exist. Some ranges have been lost, such as Kaho'olawe, and others are threatened, such as Pinecastle and BT-9.

The range expansion efforts that have been successful have been mostly in western desert areas where there are fewer encroachment issues and less opposition. These include the expansion of the Fallon Range Training Complex in Nevada, the Chocolate Mountains Gunnery Range in California, and the Barry M. Goldwater Range in Arizona. It may be quite a different matter to establish a range where one has not previously existed in the more densely populated coastal areas of the eastern United States. Even so, the process for effecting these expansions took quite a long time—eleven years in the case of Fallon—and required the military to make significant compromises. These efforts were also costly both in terms of dollars spent and political capital expended.

Likely opposition

It is reasonable to expect opposition to any new range development proposal from many different groups for many different reasons. Some of the opposition may be disingenuous or contrived, but there will also be opposition over legitimate concerns. Any military ranges will have an impact—often an undesirable impact—on the environment, the local economy, and the people who live in the area.

The Navy should not expect much support from the general electorate or from their political representatives. During World War

II and even during the Cold War, military preparedness was a national issue. That is not the case today. Instead, the citizenry is looking for a “peace dividend.” Under such conditions, it is less likely that any group of citizens will voluntarily bear the burden of a military training range for the greater good of the nation.

Any military training range—especially one where you can expend live ordnance—is going to disrupt the natural environment, and that in turn is going to generate opposition. The environmental concerns encompass three overlapping areas. One area of concern is the general protection of plants, animals, and ecosystems, with special emphasis on the protection of endangered or protected species and the habitat that they need to survive. Another area of concern is parks and natural areas, for recreation and enjoyment, and also for preservation. The third area of concern is pollution, particularly pollution of the air, water, soil, or aquifers that might endanger the health of current residents or future generations. Closely related to environmental concerns is a concern for sites that have historical or cultural significance to the nation or to any group that chooses to make it an issue.

Almost any range development effort in the East can expect to encounter opposition because the land in the proposal has commercial potential. The first problem is locating an appropriate parcel of land. Unlike the West where vast tracts of land are federally owned, most of the land in the East is privately owned. Also, unlike western desert areas, most of the East is already heavily developed, especially near the coast. If a coastal area has not been developed, it is probably because that land was set aside as a park or a recreation area or an ecologically sensitive zone where development is deemed inappropriate. The second problem is convincing the local populace that a training range is the best and highest use for that land. Most western desert lands have little or no development potential, so having them locked up in a range complex is of little economic consequence. In contrast, almost any land in the eastern United States has some development potential, so there will be concern about limiting that potential and removing that land from the tax roles.

It is reasonable to assume that a range development proposal in the East will encounter greater opposition than a similar proposal in the western desert simply because of the higher population density in the East. Almost all ranges have encroachment concerns, but the

problem is greater where the population is larger and where there is more economic activity. In the East, there are more people and businesses to be affected by such things as noise, traffic, electronic emissions, and air-space restrictions, as well as the environmental and commercial factors already discussed.

There is bound to be grass-roots opposition from people and businesses who expect to be directly and negatively affected by any proposed range, but opposition is also likely to come from outside organizations that oppose development proposals such as these on more general principles. These opposition groups are well organized, well funded, and highly effective. They are also well armed with environmental legislation. Regardless of their true concerns, the weapon of choice for most opposition groups will be one of the environmental laws. A list of relevant legislation currently on the books includes the Endangered Species Act, the Marine Mammal Protection Act, the Clean Water Act, the Clean Air Act, the Safe Drinking Water Act, and the Coastal Zone Management Act. Any of these—and there are more—may be enough under certain circumstances to delay, compromise, or perhaps ultimately stop a range development effort.

Summary

We have come to believe that while it is theoretically possible to develop a new range in the eastern United States, it is unlikely that such an effort would be successful in any reasonable amount of time. The likelihood of success will depend on the merits of each specific proposal, but it is likely that any range proposal regardless of its merits will draw extensive, highly motivated, and highly capable opposition. Pushing any East Coast range development proposal through the approval process in today's political environment will invariably be a costly, multi-year effort with no assurance of eventual success.

Because even under relatively favorable conditions, the timeline for developing a new range would exceed the five-year time horizon of this study, our analysis strongly favors existing ranges over prospective ranges.

Appendix B: Database of candidate ranges

This appendix contains two tables that summarize the data that were collected on candidate ranges. A copy of the database is available directly from CNA. Table 11 lists the 434 ranges or potential ranges by name and location. Table 12 lists the types of data that were collected for each range. A noted earlier, not all the desired data were available for all of the candidate ranges.

Table 11. List of candidate ranges in the database

Country	Complex	Range	Land?	Range?	Live-fire?
ECONUS					
USA	Boston	Small Point Mining Range	no	yes	inert
USA	Boston	W-102	no	yes	live
USA	Boston	W-103	no	yes	live
USA	Boston	W-104	no	yes	live
USA	Boston	Boston OPAREA	no	yes	live
USA	Boston	No Man's Island	yes	no	unk
USA	Narragansett	W-105	no	yes	live
USA	Narragansett	W-106	no	yes	none
USA	Narragansett	Narragansett OPAREA	no	yes	live
USA	Atlantic City	W-107	no	yes	live
USA	Atlantic City	Atlantic City OPAREA	no	yes	live
USA	Patuxent River	Bloodsworth	yes	yes	none
USA	Patuxent River	R-4005	no	yes	inert
USA	Patuxent River	R-4006	no	yes	none
USA	Patuxent River	R-4007A	no	yes	none
USA	Patuxent River	R-4008	no	yes	none
USA	Patuxent River	W-108	no	yes	none
USA	Patuxent River	Tangier Island	no	yes	inert
USA		N. Hampton County	yes	no	unk
USA	Virginia Capes	Harvey Point	yes	yes	none
USA	Virginia Capes	Palmetto Point	yes	yes	inert
USA	Virginia Capes	Stumpy Point	yes	yes	inert
USA	Virginia Capes	Dare County - Navy	yes	yes	inert
USA	Virginia Capes	Dare County - USAF	yes	yes	inert
USA	Virginia Capes	Dam Neck	yes	yes	inert
USA	Virginia Capes	Oceana TACTS	no	yes	none
USA	Virginia Capes	W-72	no	yes	live
USA	Virginia Capes	W-50	no	yes	inert
USA	Virginia Capes	LATR	yes	yes	none
USA	Virginia Capes	SESEF	no	no	none
USA	Virginia Capes	W-110	no	yes	none
USA	Virginia Capes	W-386	no	yes	none
USA	Virginia Capes	W-387	no	yes	none
USA	Virginia Capes	Hatteras ATCAA	yes	yes	none
USA	Virginia Capes	Pamlico MOA	yes	yes	none

Country	Complex	Range	Land?	Range?	Live-fire?
USA	Virginia Capes	VACAPES OPAREA	no	yes	none
USA		water range	no	no	unk
USA	Cherry Point	Cherry Point TACTS	yes	yes	none
USA	Cherry Point	MAEWR	yes	yes	none
USA	Cherry Point	BT-3 Brown's Island	yes	yes	live
USA	Cherry Point	G-10 Impact Area	yes	yes	live
USA	Cherry Point	K-2 Impact Area	yes	yes	live
USA	Cherry Point	BT-9 Brant Shoals	yes	yes	live
USA	Cherry Point	BT-11 Piney Island	yes	yes	inert
USA	Cherry Point	OLF Atlantic	yes	yes	none
USA	Cherry Point	W-122	no	yes	live
USA	Cherry Point	Cherry Point OPAREA	no	yes	live
USA	Cherry Point	R-5306C	no	yes	none
USA	Cherry Point	Hatteras F MOA	no	yes	none
USA	Cherry Point	Neuse ATCAA	no	yes	none
USA	Camp Lejeune	R-5306D/E	yes	yes	inert
USA	Charleston	W-132	no	yes	live
USA	Charleston	W-133 and associated land	no	yes	inert
USA	Charleston	W-134 and associated land	no	yes	live
USA	Charleston	Charleston OPAREA	no	yes	live
USA	Jacksonville	Rodman	yes	yes	inert
USA	Jacksonville	Lake George	no	yes	inert
USA	Jacksonville	Pinecastle	yes	yes	live
USA	Jacksonville	Beaufort TACTS	no	yes	none
USA	Jacksonville	Townsend	yes	yes	inert
USA	Jacksonville	SESEF	no	no	none
USA	Jacksonville	W-157	no	yes	live
USA	Jacksonville	W-158	no	yes	live
USA	Jacksonville	W-159	no	yes	none
USA	Jacksonville	Gator Low MOA	no	yes	none
USA	Jacksonville	Live Oak MOA	no	yes	none
USA	Jacksonville	Palatka MOA	no	yes	none
USA	Jacksonville	Jacksonville OPAREA	no	yes	live
USA	Cape Canaveral, FL	Cape Canaveral USAF station	yes	no	unk
USA	Key West	Marquesas "Patricia"	yes	yes	none
USA	Key West	Key West TACTS	no	yes	none
USA	Key West	W-174	no	yes	none
USA	Key West	W-465	no	yes	live
USA	Key West	Key West OPAREA	no	yes	live
USA	Key West	Bonefish ATCAA	no	yes	none
USA	Gulf of Mexico	Apalachee Bay and Taylor Co.	yes	no	unk
USA	Gulf of Mexico	McMullen	no	yes	inert
USA	Gulf of Mexico	W-228	no	yes	live
USA	Texas	Kenedy County (general)	yes	no	unk
USA	Kenedy County, TX	Mesquite Rincon Island	yes	no	unk
USA	Kenedy County, TX	Portero Lopeno/ Potero Faies and inland	yes	no	unk
USA	Gulf of Mexico	Pensacola OPAREA	no	yes	live
USA	Gulf of Mexico	W-155	no	yes	live
USA	Gulf of Mexico	New Orleans OPAREA	no	yes	live
USA	Gulf of Mexico	W-92	no	yes	live
USA	Matagorda Bay	Tres Palacios Islands	yes	no	unk
USA	Meridian	SeaRay Target	yes	yes	inert
USA	Meridian	Meridian 1 MOA	no	yes	none
USA	Quantico	Ranges 3-9,11,12,14,15	yes	yes	live
USA	Quantico	MOUT II	yes	yes	inert
USA	Quantico	MOUT Assault Course	yes	yes	live

Country	Complex	Range	Land?	Range?	Live-fire?
USA	Quantico	MOUT I	yes	yes	inert
USA	Quantico	Murphy, Charlie, Goettge	yes	yes	live
USA	Quantico	R-6608	yes	yes	live
USA	Quantico	Demo MOAs	no	yes	none
USA	Ft. Bragg	R-5311A-C	yes	yes	live
USA	Avon Park	R-2901A-B	yes	yes	inert
USA	Eglin Range Complex	R-2914-9	yes	yes	live
USA	Eglin Range Complex	R-2914A/B, includes W-151	no	yes	live
USA	Eglin Range Complex	R-2917	yes	yes	live
USA	Eglin Range Complex	Eglin (generally)	yes	yes	live
USA	NAS Fallon	R-4815-6	yes	yes	live
USA	Ft. Pickett	R-6602	yes	yes	inert
USA	Ft. Stewart	R-3305A-E	yes	yes	live
USA	Gulf of Mexico	Chandeleur Islands	yes	no	unk
USA	Mississippi	Ship Island	yes	no	unk
USA	St. Vincent Island	St. Vincent Island	yes	no	unk
USA	St. Vincent Island	St. Vincent Island [Kim notes from meeting at C2F & CLF.]	yes	no	unk
USA	island near St. Vincent	Cape St. George	yes	no	unk
USArmy Aerial Weapon Capable Ranges					
USA	North Carolina	Fort Bragg	yes	yes	live
USA	Kentucky	Fort Campbell	yes	yes	live
USA	New York	Fort Drum	yes	yes	live
USA	Texas	Fort Hood	yes	yes	live
USA	California	Fort Irwin	yes	yes	live
USA	Louisiana	Fort Polk	yes	yes	live
USA	Kansas	Fort Riley	yes	yes	live
USA	Georgia	Fort Stewart	yes	yes	live
USA	Colorado	Fort Carson	yes	yes	live
USA	Washington	Fort Lewis and Yakima FC	yes	yes	live
USA	Georgia	Fort Benning	yes	yes	live
USA	New Mexico	Fort Bliss	yes	yes	live
USA	Arizona	Fort Huachuca	yes	yes	none
USA	South Carolina	Fort Jackson	yes	yes	none
USA	Georgia	Fort Gordon	yes	yes	live
USA	Kentucky	Fort Knox	yes	yes	live
USA	Missouri	Fort Leonard Wood	yes	yes	live
USA	Alabama	Fort Rucker	yes	yes	live
USA	Oklahoma	Fort Sill	yes	yes	live
USA	Virginia	Fort A.P. Hill	yes	yes	live
USA	Hawaii	Pohakuloa Training Area	yes	yes	live
USA	Alaska	Fort Greely	yes	yes	live
USA	Alaska	Fort Wainwright Tanana Flats	yes	yes	live
USA	Maryland	Aberdeen Proving Grounds	yes	yes	live
USA	Utah	Dugway Proving Grounds	yes	yes	live
USA	New Mexico	White Sands Missile Range	yes	yes	live
USA	Arizona	Yuma Proving Grounds	yes	yes	live
USA	New Jersey	Fort Dix		yes	unk
CANADA					
Canada	Newfoundland	Gander	yes	no	unk
Canada	Newfoundland	southern coast	yes	no	unk
Canada	Newfoundland	Great Island (w/in Ramea Islands)		no	
Canada	Newfoundland	Pass Island		no	
Canada	Newfoundland	Brunette Island		no	
Canada	Newfoundland	Coast between Aviron Point and Dorton Head		no	

Country	Complex	Range	Land?	Range?	Live-fire?
Canada	Newfoundland	St. George's Harbour	yes	no	unk
Canada	Newfoundland	SW coast	yes	no	unk
Canada	Newfoundland	Placentia Bay	yes	no	unk
CARIBBEAN (US OWNED)					
USA	AFWTF	Inner Range	yes	yes	live
USA	AFWTF	Outer Range	yes	yes	live
USA	AFWTF	St. Croix UTR	yes	yes	inert
USA	AFWTF	W-371	no	yes	none
USA	AFWTF	W-428	no	yes	live
USA	AFWTF	W-368,369,429	no	yes	live
USA	AFWTF	W-370,372,373,377	no	yes	live
USA	AFWTF	W-374,375,376	no	yes	none
USA	Guantanamo Bay	Hicacal	yes	yes	live
USA	Guantanamo Bay	W-1001	no	yes	live
USA	Guantanamo Bay	Guantanamo OPAREA	no	yes	live
USA	Atlantic Undersea Test and Evaluation Center (AUTEC)	OPAREA T-1 thru T-8	no	yes	live
USA	AUTEC	Shallow water OPAREA	no	yes	live
USA	AUTEC	Large Area Tracking Range (LATR)	no	yes	live
USA	AUTEC	D-3002	no	yes	live
USA	AUTEC	D-3003	no	yes	live
USA	AUTEC	Cays off of W Exuma Sound	yes	no	unk
USA		Andros Island & local waters	yes	no	unk
USA		Navassa Island	yes	no	none
USA		Isla Pineros	yes	no	unk
USA		Cayo Icacos	yes	no	unk
USA		Arrecife Barrilles	yes	no	unk
USA		Isla Caja de Muertos	yes	no	unk
USA		Culebra & Cays	yes	no	unk
USA		Monito & Mona Islands	yes	no	unk
USA		Desecheo Island	yes	no	unk
USA		Ramey Ammo Facility	yes	no	unk
USA	Virgin Islands	St. Thomas	yes	no	unk
USA		Hans Lollik Is.	yes	no	unk
USA		Thatch Cay	yes	no	unk
USA	Virgin Islands	St. John	yes	no	unk
USA	Virgin Islands	St. Croix (& Buck Is.)	yes	no	unk
USA		Lang Bank	yes	no	unk
CARIBBEAN (NON-US)					
Bahamas		New Providence & Paradise Islands	yes	no	unk
Bahamas		Grand Bahama	yes	no	unk
Bahamas		Great Abaco & Little Abaco	yes	no	unk
Bahamas		Abaco Cays	yes	no	unk
Bahamas		Eleuthra	yes	no	unk
Bahamas		Exumas (including Exumas Cays)	yes	no	unk
Bahamas		Little Inagua	yes	no	unk
Bahamas		Mayaguana - East portion	yes	no	unk
Bahamas		Ragged Island	yes	no	unk
Bahamas		Cat Island - South portion (Castle Bluff)	yes	no	unk
Bahamas		Berry Islands - (Great Harbor Cay) Southern portion	yes	no	unk
Bahamas		Andros Island (virtual range)	yes	no	unk
Bahamas		Biminis	yes	no	unk

Country	Complex	Range	Land?	Range?	Live-fire?
Bahamas		Cat island	yes	no	unk
Bahamas		San Salvador	yes	no	unk
Bahamas		Long Island	yes	no	unk
Bahamas		Atklins & Crooked Islands	yes	no	unk
UK	Turks and Caicos Islands	Turks and Caicos Islands	yes	no	unk
UK	Turks and Caicos Islands	Grand Turk	yes	no	unk
UK	Turks and Caicos Islands	Salt Cay	yes	no	unk
UK	Turks and Caicos Islands	South Caicos	yes	no	unk
UK	Turks and Caicos Islands	Middle Caicos (aka Grand Caicos)	yes	no	unk
UK	Turks and Caicos Islands	North Caicos	yes	no	unk
UK	Turks and Caicos Islands	Parrot Cay	yes	no	unk
UK	Turks and Caicos Islands	Pine Cay	yes	no	unk
UK	Turks and Caicos Islands	Providenciales (Western side)	yes	no	unk
UK	Turks and Caicos Islands	West Caicos	yes	no	unk
UK	Turks and Caicos Islands	South Rock	yes	no	unk
UK	Bermuda	W-3014	no	yes	live
UK	Bermuda	W-3015	no	yes	live
UK	Bermuda	W-3018	no	yes	live
UK	Bermuda	Bermuda OPAREA	no	yes	live
UK		Jost Van Dyke Is. (Great & Little Tobago Is.)	yes	no	unk
UK		Tortola (Guano, Great Camanoe Islands)	yes	no	unk
UK		Virgin Gorda (Scrub Is.)	yes	no	unk
UK		Norman,Peter,Cooper, & Ginger Islands	yes	no	unk
UK		Anegada	yes	no	unk
UK		Sombrero	yes	no	unk
UK		Dog Island	yes	no	unk
UK		Prickly Pear Cays	yes	no	unk
UK		Anguilla	yes	no	unk
St Kitts & Nevis		St Kitts (S. East Peninsula)	yes	no	unk
St Kitts & Nevis		St. Christopher	yes	no	unk
St Kitts & Nevis		Nevis (South coast)	yes	no	unk
France	St. Martin (Imtamatte Is.)	St. Martin (Imtamatte Is.)	yes	no	unk
France	St. Barthelemy (IlleFourche, Hot du Chevron)	St. Barthelemy (IlleFourche, Hot du Chevron)	yes	no	unk
France	St Barthélemy	St Barthélemy	yes	no	unk
France	St Barthélemy	Ile Chevreau ou Ile Bonhomme	yes	no	unk
Haiti		Turtle Island	yes	no	unk
Antigua & Barbuda		Antigua	yes	no	unk
Antigua & Barbuda		Green Island	yes	no	unk
Antigua & Barbuda		Barbuda - East Coast	yes	no	unk
Barbados		Barbados	yes	no	unk
Dominica		Dominica (East coast between Rosalie Point and Castle Bruce River)	yes	no	unk
Dominica		Dominica (Toucari Bay and to the North)	yes	no	unk
Grenada		Grenada	yes	no	unk
Grenada		Cariacou	yes	no	unk
Grenada		Petit Martinique	yes	no	unk
France	Guadeloupe	Guadeloupe (Basse-Terre/ Grande Terre)	yes	no	unk

Country	Complex	Range	Land?	Range?	Live-fire?
France	Guadeloupe	Grand Ilet (Les Saintes)	yes	no	unk
France	Guadeloupe	La Désirade (N coast near Pointe de Gran Abaque)	yes	no	unk
France	Guadeloupe	Marie-Galante	yes	no	unk
France	Martinique	Martinique (vicinity Cap Chevalier to Macabou)	yes	no	unk
UK	Montserrat	Montserrat	yes	no	unk
St Lucia		St Lucia (Northeast coast)	yes	no	unk
St Vincent & the Grenadines		St Vincent (Northwest coast north of Larikai Bay)	yes	no	unk
St Vincent & the Grenadines		Bequia (North portion North of Brute Point)	yes	no	unk
St Vincent & the Grenadines		Mustique	yes	no	unk
St Vincent & the Grenadines		Canouan (North end)	yes	no	unk
St Vincent & the Grenadines		Mayreau	yes	no	unk
St Vincent & the Grenadines		Tabago Cays	yes	no	unk
St Vincent & the Grenadines		Union Island	yes	no	unk
UK	Cayman Islands	Grand Cayman	yes	no	unk
UK	Cayman Islands	Cayman Brac	yes	no	unk
UK	Cayman Islands	Little Cayman	yes	no	unk
Jamaica	Jamaica	Savannah Point (Northeast Coast)	yes	no	unk
Jamaica	Jamaica	Portland Ridge (South coast)	yes	no	unk
Jamaica	Jamaica	Great Goat Island (Portland Bight, S. coast)	yes	no	unk
Netherlands		Aruba	yes	no	unk
Netherlands	Netherlands Antilles	Bonaire	yes	no	unk
Netherlands	Netherlands Antilles	Curaçao	yes	no	unk
Netherlands	Netherlands Antilles	Saba	yes	no	unk
Netherlands	Netherlands Antilles	St. Eustatius	yes	no	unk
Trinidad & Tobago	Trinidad	Chacachacare Island (the Bocas)	yes	no	unk
Trinidad & Tobago	Trinidad	Monos (the Bocas)	yes	no	unk
Trinidad & Tobago	Trinidad	Huevos (the Bocas)	yes	no	unk
Trinidad & Tobago	Trinidad	Caspar Grande	yes	no	unk
Trinidad & Tobago	Trinidad	South East coast (between Moruga and Galeota Point)	yes	no	unk
Trinidad & Tobago	Trinidad	Cedros penisula (South side)	yes	no	unk
Trinidad & Tobago	Trinidad	Soldado Rock	yes	no	unk
Trinidad & Tobago	Trinidad	South Central coast (between Morga and Quinam Beach)	yes	no	unk
Trinidad & Tobago	Tobago	North West coast (West of Man-of-War Bay)	yes	no	unk
Trinidad & Tobago	Tobago	St Giles Island	yes	no	unk
Trinidad & Tobago	Tobago	Little Tobago Island	yes	no	unk
Dominican		Isla Beata (off Southeast coast	yes	no	unk

Country	Complex	Range	Land?	Range?	Live-fire?
Republic		of Dom Rep)			
Dominican Republic		Isla Saona	yes	no	unk
Dominican Republic		North coast West of Puerto Plata (west part of Puerto Plata Provence/east part of Monte Cristi provence	yes	no	unk
Dominican Republic		Cabo Bretón (Samaná Peninsula)	yes	no	unk
LATIN AMERICA					
Belize		Belize (As suggested by OPNAV N524D)	yes	yes	unk
Belize	Cayes (290km barrier reef)	Ambergris Caye	yes	no	unk
Belize	Cayes (290km barrier reef)	Caye Caulker	yes	no	unk
Belize	Cayes (290km barrier reef)	South Water Caye	yes	no	unk
Belize		Turneffe Islands Atoll	yes	no	unk
Belize		Glovers Reef	yes	no	unk
Belize		Lighthouse Reef	yes	no	unk
Belize		Southeast Coast (South of Punta Gorda to border)	yes	no	unk
Venezuela	Venezuelan Islands	La Orchilla	yes	yes	unk
Venezuela	Venezuelan Islands	Isla de Margarita (main part of island)	yes	no	unk
Venezuela	Venezuelan Islands	Isla de Margarita (Peninsula de Macanao)	yes	no	unk
Venezuela	Venezuelan Islands	Islas los Roques	yes	no	unk
Venezuela	Venezuelan Islands	La Tortiga	yes	no	unk
Venezuela	Venezuelan Islands	La Blanquilla	yes	no	unk
Venezuela	Venezuelan Islands	Isla de Aves	yes	no	unk
Venezuela	Gulf of Paria	Paria Peninsula, specifically the Promontorio de Paria (not range now)	yes	no	unk
Honduras	Bay Islands	Bay Islands	yes	no	unk
Honduras		Northeast coast (Mosquita)	yes	no	unk
Honduras	Bay Islands	Utila Island	yes	no	unk
Honduras	Bay Islands	Roatán Island	yes	no	unk
Honduras		Santa Helena Island	yes	no	unk
Honduras	Bay Islands	Morat Island	yes	no	unk
Honduras	Bay Islands	Barbareta Island	yes	no	unk
Honduras	Bay Islands	Guanaja	yes	no	unk
Honduras		Hog Cays (Cayos Cochinos)	yes	no	unk
Nicaragua		Corn Islands	yes	no	unk
Nicaragua		coast	yes	no	unk
Panama		San Jose Island	yes	no	unk
EUROPE					
Belgium		Helchteren (Pampa Range)	yes	yes	inert
Denmark		Romo	yes	yes	inert
Denmark		Tranum	yes	yes	inert
France		Captieux	yes	yes	inert
France		Suippes	yes	yes	inert
Germany		Baumholder	yes	yes	live
Germany		Grafenwoehr	yes	yes	live
Germany		Heuberg ("whiskey range")	yes	yes	inert
Germany		Hohenfels	yes	yes	none
Germany		Munsingen	yes	yes	inert
Germany		Nordhorn	yes	yes	inert
Germany		Siegenburg	yes	yes	inert
Germany		Polygone	yes	yes	unk

Country	Complex	Range	Land?	Range?	Live-fire?
Netherlands		Vliehors	yes	yes	live
Norway		Setermoen (Bodo)	yes	yes	unk
Norway		Setermoen (Bodo) [USAFE]	yes	yes	live
Norway		Halkavarre/Porsangmoen	yes	yes	unk
Norway		Frohavet	yes	yes	unk
Norway		Frohavet/Trondheim/Tarva	yes	yes	yes
Slovak Republic		Kuchyna	yes	yes	live
UK		Donna Nook	yes	yes	inert
UK		Garvie Island (Cape Wrath)	yes	yes	live
UK		Holbeach	yes	yes	unk
UK		Rosehearty	no	yes	inert
UK		Tain	yes	yes	inert
UK		Wainfleet	yes	yes	inert
UK		Wileysike (part of Spadeadam)	yes	yes	inert
UK		Spadeadam	yes	yes	unk
MEDITERRANEAN					
France		Lovo Santo, Corsica	yes	yes	unk
France		Solenzara (Diane) [USAFE Instr]	yes	yes	inert
France		Solenzara (Diane) [MEDEXMAN]	yes	yes	inert
France		CEM Toulon	no	yes	unk
France		Camp De Canjuers	yes	yes	live
France		Camp De Garrigues/Nimes-Garons	yes	yes	unk
France		Camp De La Courtine	yes	yes	unk
France		Titan Target Range	no	yes	inert
Greece		Avgonisi	no	yes	live
Greece		Andravida	yes	yes	inert
Greece		Karavia Islands	yes	yes	live
Greece		Potikhia (Potidea)	no	yes	unk
Greece		Kranea	yes	yes	live
Greece		NAMFI (NATO Missile Firing Inst.) [NWAS]	yes	yes	unk
Greece		NAMFI	yes	yes	unk
Greece		Zakinthos	unk	yes	unk
Greece		Ambelon	unk	yes	unk
Greece		Kassandra	unk	yes	unk
Greece		Psathoura	unk	yes	unk
Greece		Nea Peramos	yes	yes	unk
Greece		Andros	unk	yes	unk
Greece		Messara [Kriti Island]	unk	yes	unk
Greece		Yaros	unk	yes	unk
Greece		Nea Anghialos	unk	yes	unk
Greece		Paleok-Horion	unk	yes	unk
Greece		Megara	unk	yes	unk
Greece		Asproneri Ziros	unk	yes	unk
Greece		Maleme	unk	yes	unk
Greece		Pagasitikos Kolpos	unk	yes	unk
Greece		Mirtoon	unk	yes	unk
Greece		Idra	unk	yes	unk
Greece		Petrokaravo	unk	yes	unk
Greece		Platia	unk	yes	unk
Greece		Akra Spatha	unk	yes	unk
Greece		Akra Khondros	unk	yes	unk
Greece		Akrotiri	unk	yes	unk
Greece		Ayii Apostoli	unk	yes	unk

Country	Complex	Range	Land?	Range?	Live-fire?
Greece		Potidea A	unk	yes	unk
Greece		Potidea B	unk	yes	unk
Greece		Potidea C	unk	yes	unk
Greece		Amalias	unk	yes	unk
Greece		Schiza+M92	unk	yes	unk
Greece		Methoni	unk	yes	unk
Greece		Koskna	unk	yes	unk
Greece		Kitrinopetra Evros	unk	yes	unk
Greece		Astros	unk	yes	unk
Greece		Cretan Sea Sector A	no	yes	unk
Greece		Cretan Sea Sector A1	no	yes	unk
Greece		Cretan Sea Sector A2	no	yes	unk
Greece		Cretan Sea Sector B	no	yes	unk
Greece		Cretan Sea Sector C	no	yes	unk
Italy		Pachino Target Range [NWAS]	no	yes	inert
Italy		Pachino Target Range [MEDEXMAN]	no	yes	inert
Italy		Pain Di Spille-Monte Romano	yes	yes	unk
Italy		Capo Teulada, Sardinia	yes	yes	live
Italy		Salto Di Quirra Missile Range	no	yes	unk
Italy	Decimomannu AB	Capo Frasca [NWAS]	yes	yes	inert
Italy	Decimomannu AB	Capo Frasca [MEDEXMAN]	yes	yes	inert
Italy		Decimomannu (DECI) Air Weapons Training Installation (AWTI)	yes	yes	unk
Italy		Brindisi Training Areas	yes	yes	unk
Italy		Brindisi Trng Area I: Punta Della Contessa	yes	yes	inert
Italy		Brindisi Trng Area II: Torre Venere	yes	yes	inert
Italy		Brindisi Trng Area III: Oria Manduria	yes	yes	unk
Italy		Persano	yes	yes	inert
Morocco		Kenitra	unk	yes	unk
Morocco		Cap Draa	yes	yes	unk
Morocco		Al Hoceima	yes	yes	live
Portugal		Medronheira	yes	yes	live
Spain		Bardenas Reales [NWAS]	yes	yes	inert
Spain		Bardenas Reales [MEDEXMAN]	yes	yes	inert
Spain		Isla Plana - Isla Redonda	yes	yes	unk
Spain		Garrucha	yes	yes	inert
Spain		Sierra Del Retin	yes	yes	live
Tunisia		Ras Engeleh	yes	yes	live
Tunisia		Cap Serrat	yes	yes	live
Tunisia	Tunisian National Training Center, DTR-12, "El Hamma"	Ben Ghilouf [USAFE I]	yes	yes	inert
Turkey		Konya [USAFE I]	yes	yes	inert
Turkey		Konya [MEDEXMAN]	yes	yes	unk
Turkey		Saros	yes	yes	inert
Turkey		Doganbey	yes	yes	unk
Turkey		Area BI	no	yes	unk
Turkey		Area BX	no	yes	unk
Turkey		Area TA	no	yes	unk
Turkey		Area TE	no	yes	unk
Turkey		Area TF	no	yes	unk
Turkey		Area TH	no	yes	unk
Turkey		Area TI	no	yes	unk

Country	Complex	Range	Land?	Range?	Live-fire?
Turkey		Area TL	no	yes	unk
Turkey		Area TM	no	yes	unk
Turkey		Area TN	no	yes	unk
Turkey		Area TT	no	yes	unk
Turkey		Area TW	no	yes	unk
Turkey		Area TX	no	yes	unk
Turkey		Balikesir (Karman)	yes	yes	live
Turkey		Bandirma (Kisiksa)	yes	yes	unk
Turkey		Eskisehir (Osmaniye)	yes	yes	unk
Turkey		Antalya	yes	yes	live
Turkey		Devecitasi Island	yes	no	unk
Israel	Negev Desert	Air-to-ground range	yes	yes	unk
Israel	Negev Desert	NSFS range	no	yes	unk
Israel	Negev Desert	SACEX range	yes	yes	unk
Israel	Negev Desert	Electronic warfare training range	yes	yes	unk
Egypt		El Amayid	yes	yes	unk
AFRICA					
Sierra Leone		Turtle Island	yes	no	unk

Table 12. Fields for collected range data

Location	Country Location (general) & coordinates Complex/Range Designator Range Type What is this range used for now?	**Security**	Security at the range
		Environment	Protected environments or species
Scheduling	Range owner/operator Clearance agency Primary users Hours Restrictions on time of year Scheduling procedures Prerequisite agreements	**Targets**	Target descriptions Target area size Target approach procedures (air) Target departure procedures (air) Instrument flight rules (IFR) procedures Visual flight rules (VFR) procedures In-flight procedures Night operation procedures Restricted/unrestricted firing path Size of corridor (water)
Physical Characteristics	Dimensions Restrictions on the use of the range Terrain Accessibility	**Local Population**	Proximity of population to range Noise issues Population figures Population centers
Climate	Range weather patterns	**Ordnance**	Permissible Ordnance Types of weapons used there in the past Lasing
Proximity to other Resources	Proximity to air base Proximity to homeport Proximity to deepwater port Proximity to complementary range Proximity to CV	**Support Services**	What's available (facilities)? What's available (operationally)? Are there divert fields? Types of maintenance at divert fields Post-op clean-up
Airspace	Airspace Restrictions Permissible altitude Permissible raid size	**Social Characteristics**	Local politics/government General description (local industry) Historical sites
Restrictions	Weather restrictions Restrictions on weapons delivery Other restrictions	**Electronic Assets**	Surveillance Communications Instruments/Scoring Range resources
Safety	Safety requirements Clearance procedures (beaches/water)	**Data**	Sources

Appendix C: NSFS training

Description

Naval Surface Fire Support (NSFS) refers to the use of gun, missile, and EW systems by Navy surface combatants to support combat forces ashore. NSFS is a primary mission of the DD-963, DD-993, CG-47, and DDG-51 classes, and all must qualify in NSFS with their 5"/54 guns.

This remainder of this appendix discusses the NSFS training requirements, describes the range attributes that are needed to support NSFS training, discusses the implications of future NSFS systems, and discusses the grades that were assigned to specific NSFS range candidates.

Training requirements

Qualification.

The basic NSFS qualification requirements for a surface ship are successful completion of:

- NSFS Rehearsal (AMW-1-SF). This is a five-day course conducted by Expeditionary Warfare Training Group Atlantic (EWTGLANT) either at the training center or onboard the NSFS ship. It is a non-firing exercise designed to check procedures, equipment, and internal communications systems. It does not require a range.
- FIREX I (AMW-2-SF). FIREX I exercises all naval gunfire missions with live fire at an NSFS range.[2] The FIREX I missions that are specified by FXP 5A/B and required in the Atlantic Fleet are listed in Table XX. Upon successful completion of this exercise, the ship is qualified as M-1 in Amphibious Warfare (AMW) for a year.

2. Ships whose qualification has not degraded to M-3 or M-4 in AMW can requalify by completing a FIREX II (AMW-3-SF), which is basically an abbreviated FIREX I.

Table 13. FIREX I missions for Atlantic Fleet ships

NSFS Missions
Pre-H hour targets of opportunity
Preplanned (scheduled) targets
Beach neutralization
Two call fire missions
Re-fire without adjustment
Fresh target of higher priority
Counter-mechanized
Suppression of Enemy Air Defenses
Counterbattery
Coordinated illumination

Other training

NSFS ships also provide services for other forces that need training, such as spotters and fire support coordination teams. Spotters receive their primary training elsewhere, however, and only occasionally take advantage of NSFS qualification firings for additional training. Spotting services for routine NSFS ship qualifications (FIREX) at Vieques have typically been provided by AFWTF range personnel.

NSFS ships also provide services for SACEX. While NSFS is an important part of SACEX training, the reverse is not necessarily true. SACEX participation is not required for a ship to be certified in NSFS and not all NSFS ships participate in a SACEX during their IDTC.

Required range attributes

The basic requirement for an NSFS range is that it be able to accommodate a FIREX safely. When looking for candidate NSFS ranges, we considered safety requirements, availability of targets,

water depth, and environmental concerns. The safety criteria are as follows.[3]

- An impact area of 2,000m x 1,500m. (approx. 740 acres) This is based on the NSFS impact area at Vieques.
- A 1,000m buffer around the impact area. The buffer is the same as the restrictions around the Vieques observation post (OP-1) and the Vieques explosives safety distance arc.
- A further 2,000m in range and 1,000m in deflection around the buffer. This is primarily to account for skipped rounds and to provide an additional measure of protection.
- Airspace control to 52,500 feet. This is the maximum ordinate of the 5"54 gun at full charge taken from the range tables.
- Ability to control the water-space in front of the range to at least 8,000 yards. This is to ensure a clear firing bearing. Ships at Vieques normally fire at this range from the beach.[4]

An NSFS range should have several identifiable point targets (Vieques has seven) and space for area targets (Vieques has two). The ships are supposed to engage various targets with various methods of fires. These targets should be at varying altitudes (to evaluate the input of target altitude in the Gun/GFC solution) although this is not essential. Targets must also be observable in order to permit spotting. Observation from an adjacent hill or ridgeline would be ideal.

A navigation depth of 35 feet will accommodate all current NSFS ships. Ideally, ships should be able to approach the beach to within 6,000 yards (the normal minimum range used at Vieques) and must be able to approach targets to within 12,000 yards in order that defilade fire (reduced charge) can be exercised.

We have to be sensitive to noise and other environmental concerns. A range is not necessarily unusable if there are such problems, but they may impose restrictions. For example, noise measurements are made at the civilian population centers on Vieques to guide and restrict range operations. And the presence of marine mammals within 1,000 yards of a firing unit forces a temporary halt in firing operations. In our range selection process we evaluated such

3. Hazard patterns for 5"/54 rounds have not been formally developed by the Navy. Our range requirements drew upon a variety of sources, including [2].
4. Proposed FXP-5 changes have ships firing from a minimum of 12,000 yards.

concerns but did not rule out candidate ranges solely on such a basis unless they were overwhelming (for instance, World Heritage Sites were ruled out).

NSFS qualification on the east coast currently requires the use of a land-impact range, but most of the FIREX events could be exercised and evaluated on a water-impact range. Such a range is currently operational at the Pacific Missile Range Facility in Hawaii. This range uses bottom-mounted hydrophones to measure firing accuracy and an optical system to spot illumination rounds. Commander Naval Surface Forces Pacific uses this "virtual" range to certify ships that are home-ported in Hawaii.[5] The requirements for a water-impact range are similar to those for a land-impact range in that an impact and buffer area must be secured, airspace cleared, and the range not be fouled.

Implications of future systems

Naval Surface Fire Support capabilities are expanding to meet new requirements with an eventual goal of supporting maneuver forces at distances of over 200 miles.[6] The Extended Range Guided Munition (ERGM) with a range of 63 NM and the Land Attack Standard Missile (LASM) with a range in excess of 140 NM are both scheduled for IOC in 2004.

The introduction of these expensive, longer-range weapons will force the training community to rethink its requirements. Neither ERGM nor LASM can be accommodated at the Vieques range. A water-impact range may be the only way to conduct live-fire training with these extended-range munitions. Or, they may wind up being treated like Tomahawk. Tomahawk certification includes a system certification and a certification of crew procedures, but not a live firing.[7]

5. A test to determine requirements for an east-coast water-impact range is scheduled for this summer off the Virginia Capes in W-72.
6. A comprehensive description of these changes can be found in Naval Surface Fire Support Concept of Employment, Version 3., PMS 529, March 2000.
7. The cruise missile certification process is in OPNAVINST 3600.3A

Range assessments

This final section discusses the grades that were assigned to the candidate SACEX ranges for suitability, availability, risk, and cost. Nine candidate ranges were considered and the results are grouped here geographically:

- East Coast
  - Camp Lejeune
  - VACAPES (water-impact in W-72A)
- Gulf of Mexico[8]
  - Texas sites
  - Apalachicola Bay
- Canada
  - Burnette Island, Newfoundland
- Caribbean
  - Guantanamo Bay, Cuba
  - La Orchilla Island, Venezuela
- Overseas
  - Capo Teulada, Sardinia, Italy
  - Cape Wrath, Scotland, UK

East Coast

Description. Camp Lejeune (G-10). This range is located within the confines of Marine Corps Base Camp Lejeune and is part of the Cherry Point complex of ranges and targets. Currently, artillery exercises using live ordnance are conducted using G-10.

- Suitability is graded "A". All types of FIREX missions can be conducted except for counterbattery fire, which seems to be going away as a requirement.
- Availability is graded "A". There do not appear to be any availability concerns.

8 . These two candidate ranges do not appear in the main body of the document because of the time that would likely be needed for development.

- Risk is graded “B”. G-10 is an established impact area within a Marine Corps range and is used routinely for live-fire artillery training. Live-fire NSFS was conducted into Camp Lejeune impact areas (probably BT-3) until the 1970’s. NSFS would have to cross the Intercoastal Waterway and Highway 172, but that is done routinely with inert artillery. The only issue to be resolved is the firing of live vice inert ordnance across the waterway.

- Cost is graded “A”. The location near Norfolk and the ability to support other exercises make this site very attractive from an economic point of view.

Description. VACAPES TACTS site (W-72A). This is one of several possible sites for a water-impact range. The Oceania Tactical Aircrew Training System (TACTS) Range is located off the North Carolina coast some 60 nm South of Virginia Beach. The site is in international waters.

- Suitability is graded ”B”. A water-impact can accommodate all of the FIREX missions, and water-impact ranges have been used to qualify ships in the Pacific. It is not as “real” as land-impact and is therefore probably not as effective at accomplishing the intangible objective of confidence building.

- Availability is graded “A”. The air space (W-72) is controlled by the Navy. The range is in international waters. Fishing activity uses the area, but reportedly clears the area readily when requested.

- Risk is graded “B”. Range utilization entails acceptance of such a range for NSFS qualification. There is precedence on the West Coast, but there is likely to be resistance. There appears to be little technical risk.

- Cost is graded “A”. The dollar costs associated with installation of an acoustical/optical water-impact range are probably in the $500K-$1M area. A location near Norfolk further offsets this cost.

Gulf of Mexico

Description. Texas sites. This alternative is either of two sites on the Texas coast (Kenedy County). The first site is Mesquite Rincon Island (26-52N, 97-30W). The second site is Porerto

Lopeno/Portero Faries Islands and the coast immediately inland from the islands. Mesquite Rincon is located about 55 nm South of Corpus Christi Bay. Porerto Lopeno/Portero Faries Islands are located about 45 nm South of Corpus Christi Bay. The sites are undeveloped and in private hands. The sites are similar and are graded together.

- Suitability is graded “A”. The range is situated such that counter-battery fire cannot be conducted, but as noted earlier, that is not a significant concern.
- Availability is rated. “B”. While the site should be able to be used year round waterfowl migration and perhaps National Seashore usage may dictate closures.
- Risk is graded “D”. Use of either site requires that fires be conducted over Padre Island National Seashore and the Intercoastal Waterway. Portions of both would have to be closed in order to conduct live fires. It is uncertain if these and other possible environmental objections can be overcome.
- Cost is graded “C”. The Texas coast is about a 1,700 nm transit from Norfolk.

Description. Apalachicola Bay. (Little St. George Island or St. Vincent Island). This site is located in the Florida panhandle on the Gulf Coast approximately 45 nm southeast of Panama City. The site is undeveloped.

- Suitability is graded “B”. It appears that range safety requirements can be met, but with no margin for error. This may restrict the flexibility with which the range can be used. Navigation considerations will keep ships at least 15,000 yards from the target, which once again rules out counterbattery fire.
- Availability is graded “B”. The range should be available year round barring tropical storms.
- Risk is graded “D”. St. Vincent Island is currently a wildlife preserve. Environmental groups would likely oppose the establishment of this range quite vigorously. Air traffic in the area will also be a problem and the Apalachicola airport may have to be closed during live fires.
- Cost is graded “B”. Like all Gulf ranges distance is a factor.

Canada

Description. Burnette Island, Newfoundland. This site is located in Fortune Bay, Newfoundland (47-17N, 55-55W). It is an uninhabited and undeveloped island and is Crown (public) land. Territory of France (St. Pierre and Miquelon) lies about nine nm to the Southwest.

- Suitability is graded "A". The island is an uninhabited island with no close neighbors and is not an environmental sanctuary.
- Availability is graded "C". The major problem is frequently inclement weather.
- Risk is graded "C". There is a possibility that environmental and other hurdles cannot be surmounted. Although the land is Crown land and the provincial government has been sympathetic to U.S. Navy presence in the past, it is likely that various groups will express environmental concerns.
- Cost is graded "B". Distances to Newfoundland are about half those to Vieques, but any range would have to be established from scratch.

Caribbean

Description. Guantanamo Bay. The Hicacal target area is located within Naval Station Guantanamo Bay.

- Suitability is graded "B". While the Hicacal Range can accommodate the range of required NSFS missions and is an existing range, the geometry required to use the range for NSFS has problems. Fires would be conducted utilizing either the constricted Bay entrance or at relative short (4-6,000 yards), low trajectory, ranges from within the Bay.
- Availability is graded "A". The target is located within the Naval Station Guantanamo. It has been used for NSFS as late as the mid-1970's and for 155mm artillery as late as 1994. Weather is not a factor except during the hurricane season.
- Risk is graded "D" for two primary reasons. The first is political. A decision must be made related to U.S.-Cuban relations. This decision is complicated because the Hicacal range buffer area between the impact area and the base fence

line is only 2,000 yards. With low trajectories, there is a possibility of skipped rounds entering uninhabited Cuban territory. The second reason relates to future U.S.-Cuba relations. Should they normalize, there likely will be pressure to return the Guantanamo Base property to Cuba.

- Cost is graded “B”. Only minor target improvements are required.

Description. La Orchilla Island, Venezuela. La Orchilla Island is located approximately 70 nm off the Venezuelan coast (11-48N 66-08W). It is government owned and is controlled by the Venezuelan military.

- Suitability is graded “B”. La Orchilla is a Venezuelan naval gunfire range and has been used for naval gunfire exercises during periodic UNITAS exercises. U.S. Navy spotters have spotted fires, and Venezuelan aircraft have conducted close air support during the exercise. It has not, however, been used to conduct a FIREX. Venezuela restricts ordnance used at La Orchilla to BL&P, although this has been wavered in the past. Additionally, it is unlikely that Venezuela would permit the island to be used for any associated exercise such as a SACEX.

- Availability is graded “C”. It is unclear that the U.S. Navy could negotiate favorable terms for access. Past Venezuelan offers have been in the context of the combined Venezuela/U.S. UNITAS exercise. On the plus side, La Orchilla is already a military exclusionary zone and located below the normal tropical storm track.

- Risk is graded “D”. The principle risk is political. Venezuelan politics drive Venezuela-U.S. military relations. President Chavez has publicly stated support for the movement in Puerto Rico to close the Vieques range. He has also suggested closing the La Orchilla range and using the island as a resort site for Venezuelan workers.

- Cost is graded “C”. Use of the range would entail significantly longer transits compared with Vieques (about 1.5 additional days) and there are no other training facilities in the vicinity. The current range will require upgrading. Use of the range would also most likely involve continuing contribution to the operation of the island facility.

Overseas

Description. Capo Teulada. Capo Teulada is an Italian military facility on the southern end of Sardinia.

- Suitability is graded “A”. Capo Teulada is an excellent range currently used by Sixth Fleet units. It can support a FIREX. Other exercises such as SACEX can also be conducted in the vicinity.
- Availability is graded “D”. U.S. use of the range is limited to two fourteen-day periods per year. In addition, usage must be scheduled as long as 18 months in advance. Perhaps better terms could be negotiated, but they are unlikely to be very favorable.
- Risk is graded “C”. Major changes would be required to the current inter-deployment training cycle to accommodate this range as the primary NSFS qualification site. The range is, of course, foreign controlled.
- Cost is graded “A”. There is little cost in the sense that ships would not have to deviate from their normal routing to use this range.

Description. Cape Wrath. Cape Wrath is a British military facility located on the northwest tip of Scotland.

- Suitability is graded “A”. This is a first class naval gunfire range and FIREX NSFS qualifications were recently conducted there.
- Availability is graded “C”. This is based on winter weather conditions and existing range closures.
- Risk is graded “B”. Major changes would be required to the current inter-deployment training cycle to accommodate this range as a primary NSFS qualification site. The range is, of course, foreign controlled. On the plus side, the British have been reliable allies and Cape Wrath has been used for naval gunfire training as long as there have been naval guns.
- Cost is graded “C”. The location of Cape Wrath precludes easy usage.

Appendix D: SACEX training

The supporting arms coordination exercise, or SACEX, brings together the ARG/MEU and the battle group to conduct an amphibious assault supported by coordinated fires. The supporting arms include NSFS, close air support, artillery, and mortars. As its name implies, a SACEX is primarily concerned with the process by which various fire support agencies coordinate and deconflict these fires to support the Marines before, during, and after the amphibious assault. Ideally, a training environment supports training of these coordinating agencies, the supporting arms, and maneuver elements. SACEX has normally been conducted near the end of the IDTC as part of the JTFEX scenario, either at Vieques or at Camp Lejeune.

This remainder of this appendix discusses the SACEX training objectives, describes the range attributes that are needed to support a SACEX, and discusses the grades that were assigned to specific SACEX range candidates.

Exercise objectives

The objectives of a SACEX include all three of the high-level training objectives discussed in the body of this document—skill development, confidence building, and readiness evaluation.

SACEX is first and foremost a rehearsal-level skill development exercise. Each participant has trained separately at individual-skill and unit-skill levels, but SACEX is the only opportunity during the IDTC for all of the participants to work together at sea in a realistic scenario.

The amphibious assault operation can be divided into three phases: preparation of the objective, landing, and post-landing operations. NSFS and close air support provide supporting fires for the preparation of the objective and for the landing. For post-landing operations, the maneuver elements that conducted the assault

proceed with company-level or unit-level training, while artillery and mortars begin to provide supporting fires.

The primary training audience for skill-development purposes is not the landing force or the supporting arms. They have other opportunities to practice their skills. The primary SACEX training audience for skill development is the collection of agencies that are responsible for coordinating the supporting arms. These coordinating agencies perform three basic functions during the course of the exercise.

- Control fires from ship
- Pass control of fires from ship to shore
- Control fires from shore

The responsibility for controlling supporting fires is passed down the chain of command as the operation or exercise progresses. The Supporting Arms Coordination Center (SACC), which contains both Navy and Marine personnel, is stood-up when the warning order is received. The SACC is responsible for planning the amphibious assault, planning supporting fires, and controlling the supporting fires both before and during the amphibious landing. The battalion level Fire Support Coordination Center (FSCC) goes ashore with the landing force and subsequently assumes responsibility for controlling fires. At that point, the FSCC is responsible for clearing and deconflicting fires, while the SACC monitors the fires afloat.

Another SACEX objective, in addition to skill development, is readiness evaluation. SACEX is designed not only to develop operational skills, but also to put them on display so that the proficiency of the participants can be evaluated. SACEX is a graded exercise that the ARG/MEU must complete as part of its pre-deployment certification process.

Finally, SACEX is also a confidence-building exercise, at many levels. In our discussions with trainers and operators, this was the primary justification for employing live ordnance during the exercise.

Required range attributes

SACEX has three elements that drive the range requirements: an amphibious assault, supporting arms, and live ordnance. Each of these elements has its own range requirements, which we can combine to create the range requirements for a SACEX.

To accommodate an amphibious assault, a candidate range must be located along the coast and must be able to support a battalion size amphibious landing. In our search for alternative ranges, we began with a list of littoral ranges with sufficient water depth and beach gradient for landing via LCAC or LCU (in many cases this boiled down to those ranges that have supported landings in the past). For example, Camp Lejeune has a number of landing beaches on Onslow Bay that are used regularly for amphibious landings. Next, we evaluated the candidate ranges by their maneuver area. Vieques has roughly 25 square miles of unpopulated land where the Marines can conduct maneuvers[9]. Throughout our selection of ranges we used the Vieques area as a baseline for comparison.

Each of the supporting arms also has a set of requirements. The ATG and NSFS appendices discuss their respective requirements, but the requirements relative to SACEX are slightly different. Close air support missions (CAS), for example, do not have the same altitude requirements as ATG strike missions. To execute CAS, the range must allow low-level bombing runs (between 3,000 to 7,000 feet AGL)—either with live or inert ordnance. As with landing and maneuver areas, we focused on those ranges that currently allow CAS training. We have not limited our choices to those ranges that only allow live CAS. Our rational is that the focus of SACEX is to exercise the coordination between different types of fires, so that even without live CAS, the training objectives of SACEX can be met. This isn't to say, however, that the ability to drop live ordnance during CAS training isn't important. Only that for practical reasons, we didn't limit our choice of range alternatives to live CAS ranges. For example, the G-10 impact area at Camp Lejeune (an artillery live-fire range) doesn't allow live CAS (only inert bombs can be dropped). We're searching for an alternative to the SACEX training at Vieques by focusing on breadth of training.

9. The maneuver area at Vieques is separated from the live fire area for safety reasons. We assumed that if our candidate ranges also separated the maneuver area and the live fire area that they were acceptable alternatives.

Finally, in addition to landing areas, maneuver areas, and CAS training ranges, we looked for the ability to support live-fire artillery, mortar, and NSFS training. Typically, live fire artillery ranges are on the order of 10 square kilometers. This size supports both the live-impact area and a safety buffer zone. For artillery and mortar fire, the live-impact area is typically a large fraction of the range. For NSFS we looked for a target area roughly 1000m x 500m.[10]

In summary, a viable alternative to Vieques for SACEX must have:

- The ability to support an amphibious landing and maneuvers of a battalion sized force ashore
- The ability to fire live artillery, mortar, and NSFS rounds in support of calls for fire by the maneuver force and coordinated by the SACC / FSCC
- The ability to drop at least inert CAS ordnance in support of calls for fire by the maneuver force and coordinated by the SACC or FSCC

Table 14 lists more specific criteria.

Table 14. SACEX candidate range criteria

SACEX Element	Requirement
Landing	Two or more landing beaches– gradient sufficient for LCAC and LCU landing
Maneuver	Vehicle and personnel training areas of at least 25 sq miles
CAS	Low level CAS range that allows, at least, inert bombs
Artillery / mortar / NSFS	Artillery, mortar, NSFS live-impact area of roughly 10 sq km

10. This NSFS impact area was based on observations of experience AFWTF personnel responsible for NSFS qualification exercises.

Range assessments

This final section discusses the grades that were assigned to the candidate SACEX ranges for suitability, availability, risk, and cost. The range requirements discussed above limited the number of alternatives to three candidates: Camp Lejeune, North Carolina; Guantanamo Bay, Cuba; and Capo Teulada, Sardinia.

Camp Lejeune.

- Suitability is graded "A." Camp Lejeune meets all of the requirements for a SACEX and has been the venue for such exercises in the recent past. NSFS is not currently conducted at Camp Lejeune, but we have been led to believe that it could be resumed at the Navy's discretion.
- Availability is graded "A". There don't seem to be any problems.
- Risk is graded "A" because it is an existing Marine Corps base. The only significant risk is that live-fire NSFS might be disallowed, in which case water-impact NSFS or notional NSFS would have to substitute.
- Cost is graded "A" because of its convenient location.

Guantanamo Bay.

- Suitability is graded "D" because Guantanamo Bay has several significant limitations. The base has landing sites, but they are small. The maneuver area is also small. NSFS is not currently conducted there. Air space restrictions make close air support difficult. It may be possible to add an NSFS capability, but landing area, maneuvering area, and close air support restrictions make it a poor choice.
- Availability is graded "A" because it is a United States base.
- Risk is graded "D" because of the political strains between the U.S. and Cuba.
- Cost is graded "B" because of the transit time to the range.

Capo Teulada.

- Suitability is graded “A.” It satisfies all of the SACEX range requirements.
- Availability is graded “D because U.S. use of the range is limited to two fourteen-day periods per year, which must be scheduled as long as 18 months in advance.
- Risk is graded “D” because of the political risks of relying on a foreign controlled range and because of the risks associated with not conducting the SACEX prior to deployment.
- Cost is graded “A” because using this range would not require a significant diversion from the normal transit route.

Appendix E: ATG training

Past studies such as [3] and [4] have shown that training for ATG operations has an effect on a pilot's ability to drop bombs accurately. In order to project power effectively in real world operations, a Navy airing goes through an interdeployment training cycle (IDTC) that includes various training events to prepare for deployment and real-world ATG operations. The major IDTC events using Vieques are:

- COMPTUEX - This is at-sea training that is conducted under the guidance of Commander Carrier Group Four. This is the first opportunity to practice end-to-end strike planning and execution at sea. Some live ordnance and LGTR deliveries take place.
- JTFEX - This is the Battle Group Join Task Force Exercise and the final exercise prior to deployment. The Battle Group trains under COMSECONDFLT direction with a focus on practicing scenario driven battle grouped tactics, including ATG warfare. Some live ordnance and laser guided training rounds are dropped.

During COMPTUEX and JTFEX the airing has generally conducted ATG operations on ranges in Vieques or along the eastern part of the United States. We analyzed the COMPTUEX and JTFEX training objectives requiring range support, then using aircrew skills used to meet these objectives, and standard Navy tactical strike procedures [5], we identified the range attributes required to support strike training.

COMPTUEX and JTFEX airing training objectives

The main goal of the COMPTUEX is battle group and airing integration using the battle groups OPTASKs [6]. Some of these OPTASK Strike responsibilities require a physical space to support carrier airing training. Annex E-1 lists all the OPTASK responsibilities and identifies the subset requiring a physical training space. Similarly, a subset of JTFEX CVW training objectives requires a physical training space as shown in Annex E-1. Table 15 lists these objectives [7].

Table 15. COMPTUEX and JTFEX CVW strike training objectives that require supporting physical space

Training Objectives
Ensure airspace deconfliction during ingress/egress and in target area
Execute all airing strike operations with standoff and precision weapons
Attack enemy land targets
Conduct aerial refueling
Conduct electronic attack
Conduct fire support
Conduct fuel management
Control or dominate combat area through combat systems
Integrate tactical fires
Intercept, engage, and neutralize enemy aircraft and missile targets
Interdict enemy operational forces/targets
Perform tactical reconnaissance and surveillance
Suppress enemy air defenses
Synchronize tactical operations and integrate maneuver with firepower

There are also planning and intelligence OPTASK responsibilities and JTFEX training objectives associated with the targets to be attacked. However, constructive targets or knowledge of the training range used to support training will support these responsibilities and objectives.

ATG training range attributes

A study of F/A-18 aircrew task identification and analysis provided a methodology for identifying aircrew tasks for various missions, and the skills required to support each task [8]. The missions are broken into phases, such as en-route, ingress, threat area tactics, and egress. Annex E-1 lists the main phases in a self-escort mission.

We determined what range attributes are required by analyzing the specific tasks and skills that an aircrew conducts during the phases of a strike. Annex E-1 gives a detailed breakdown of skills required in each phase of the strike's execution, and the range attributes required to support those skills.

Table 16. Range attributes to support ATG strike training

Strike Mission Phases	Range attributes required	Training Area
En-route	Less than 350NM from target	**Carrier Operations Area**
Air-to-Air Pre-commit Commit Intercept Weapons employment Merge Air-to-Ground Target area ingress	Range 80 to 20 NM from target Airspace Ideally above 18K 60 degree maneuver sector Land not required Threat aircraft and SAM emissions	**Ingress and threat response area**
Target area tactics Target area egress	Range 20 NM from target for LGBs 10 NM for GP bombs 5 NM for non-tactical release Airspace Above 18K Min, 25K preferred 30 degree maneuver sector Land required at target Varity of realistic targets First pass release 500lb LGB Live impact minimum 2000lb LGB live impact preferred Point SAM emissions	**Target area**

Analysis of the strike skills and exercise objectives shows that some of the training objectives are common to two of the training areas defined in Table 16. This fact results in two approaches to structuring spaces supporting CVW training:

- Contiguous training spaces supporting objectives in two or more areas, allowing a transition through training areas as strike aircraft approach the target area.
- Disjoint training spaces supporting only the objectives in a single area.

The Vieques live fire range is part of a contiguous training space supporting all three training areas. Our objective is to find a contiguous ATG training space, but we will also analyze sets of disjoint training spaces that together support the same training objectives as the space in and adjacent to the Vieques range

Thus, the ideal replacement range for Vieques would have an inner area that allows first-pass land impact of 2000lb LGBs on realistic targets with at least 25Kft of altitude over a 30-degree sector out to 20NM. The ideal range would also have a contiguous outer area that is within range of exercise threat aircraft and has airspace above 18Kft over a 60-degree sector out to 80 NM. This outer area should also be contiguous with, and not more than 350 NM from, the fleet operating area.

Vieques meets all these requirements, with the exception of simulated SAM emissions. Thus while a range need not have SAM emitters to duplicate Vieques-based training, it would be a plus to have such a capability.

We used the attributes in Table 16 to filter the database of candidate ranges, and no one range met all of the criteria. Then we looked at ranges that met most of the criteria. To be a candidate range, a range had to exist (we didn't consider building a new range). In addition, the range had to meet the required range attributes listed in Table 16 for the "carrier operations area" and the "target area," except for the point SAM emissions and the 20nm area around the target for target acquisition LGB release. The first column in Table 17 shows the list of ranges that currently have these attributes. In addition, Table 17 has a column that is labeled "Target area training." A "yes" in that column means that live ordnance can be dropped at the specified range. A "no" means that live ordnance can't be dropped. The next column in Table 17 is labeled "Ingress and threat response area." A "yes" in that column means the specified range meets the ingress and threat response area criteria in Table 16, except for SAM emissions and first pass tactical release of LGBs. Finally, a "Comments" column in Table 17 tells the attributes that are not met for a given range and any other relevant comments about the ranges.

Table 17. ATG candidate range attributes

Range	Target area training?	Ingress and threat response training?	Comments
Eglin AFB, FL	Yes	Yes	Meets the target area training requirement but an aircraft must decrease its velocity immediately after coming off the target (not tactical) Tactical use requires that the battle group operate in the northern Gulf of Mexico or the aircraft to fly over the panhandle of Florida from the Jacksonville operating area
Cherry Point, Camp Lejeune and Navy Dare (BT-9, BT-11, G-10)	No	Yes	No live ordnance Ingress and threat response training supported by VACAPES MOAs and TACTS.
Ft. Bragg, NC	Yes	No	Size of airspace does not allow tactical ingress and threat response No tactical target acquisition and release of LGBs
Pinecastle, FL	Yes	No	Size of airspace does not allow tactical ingress and threat response No tactical target acquisition and release of LGBs Non-tactical egress off the target Supports both VACAPES and Gulf of Mexico OPAREAs, but requires non-tactical approach.
Vliehors, Netherlands	Yes	Yes	Requires the carrier to operate in the North Sea Unknown tactical target acquisition and release of LGBs
Balikesir, Turkey	Yes	Yes	Requires the carrier to operate in the northern Aegean Sea Unknown tactical target acquisition and release of LGBs

Candidate range assessments

The remainder of this appendix discusses the grades that were assigned to each of the candidate ATG ranges in the areas of suitability, availability, risk, and cost. The criteria in Table 18 were used to grade the suitability of each range.

Table 18. Suitability criteria for ATG candidate ranges

A	Live ordnance allowed, operating altitude at or above 18kft, tactical ingress (60 degree sector before 20nm from the target), target area allows for tactical release of LGBs/GPBs (20nm long, 30 degree sector)
B	Live ordnance allowed, operating altitude at or above 18kft, tactical ingress (60 degree sector before 10nm from the target), target area allows for tactical release of GPBs (10nm long, 30 degree sector) (Same as A but no tactical release of LGBs required)
C	Live ordnance allowed, operating altitude 10kft to 18kft, can drop LGBs. Either tactical release of GPBs or tactical ingress required (but don't need both)
D	No live ordnance

Eglin AFB, FL

- Suitability is graded "A." With improvements, Eglin could be an excellent ATG training facility where carrier-based aircraft can conduct tactical and live-ordnance ATG training. It supports tactical ingress and could support tactical target-area weapons employment with a change in the existing Test and Evaluation range procedures. The range allows dropping 2000lb LGBs from high altitude.
- Availability is graded "B." There apparently is some concern about taking the carrier battle group into the Gulf of Mexico during hurricane season.
- Risk is graded "B." Eglin is an existing U.S. military range that the Navy can use to drop live bombs. Negotiations to improve suitability and availability are complicated by the fact that it is a RDT&E range as well as an Air Force range.
- Cost is graded "B" because it requires several days of steaming to transit from Norfolk to the Eglin area. The alternative of operating in the Jacksonville operating area and flying across Florida requires additional aircraft fuel. Also, the Air Force currently charges the Navy for the use of the range.

Cherry Point and Dare County ranges

This collection of ranges includes BT-9, BT-11, and G-10, in the Cherry Point complex, and additional ranges in Dare County, North Carolina. They are treated together because they are in the same geographic area and they all have roughly the same attributes and shortcomings.

- Suitability is graded "D" for this collection of ranges. These ranges are adjacent to military operation areas (MOAs) that allow tactical ingress to and egress from the target area, but all have altitude restrictions and none of them currently allows dropping of live ordnance.
- Availability is graded "A." Some of the individual ranges may not be available at certain times, but the chance of having at least one range available is high.
- Risk is graded "A" because we are talking about using the ranges as they exists. The risk would be high if we were counting on relaxing the altitude and ordnance restrictions.
- Cost is graded "A" because this collection of ranges is near Norfolk and the VACAPES operating area and there is no charge for their use.

Fort Bragg, NC

Fort Bragg is an Army base with a large live-impact area that is routinely used for training with artillery and other Army ordnance. The Air Force has also used the target range on occasion for training with live ATG ordnance.

- Suitability is graded "C" because there is limited airspace for conducting a tactical ingress or target-area tactics. Established air corridors around the range would have to be changed to allow more tactical training. Fort Bragg does have an impact area, however, where live ordnance can be dropped. This range does not receive a high grade for suitability on its own, but it complements the capabilities of the Cherry Point and Dare County ranges.
- Availability is graded "A." We are not aware of any significant problems that could not be negotiated with the Army.

- Risk is graded “A” because Fort Bragg is an existing U.S. military facility with a live-impact range. There is a minor risk of negotiating the specifics of future Navy use with the Army.
- Cost is graded “A” because strikes could be conducted into Fort Bragg while the carrier operates in the VACAPES area. Currently, the Army does not charge the Air Force for its use, so we assume that they would not charge the Navy.

Pinecastle, FL.

Pinecastle is part of the Jacksonville complex, and is located in the Ocala National Forest in central Florida.

- Suitability is graded “C.” Ordnance is limited to 500lb LGBs and air space restrictions do not allow a tactical ingress. It is unlikely that these restrictions can be changed due to environmental considerations, large populated areas (Orlando) near the range, and considerable air corridors around the area.
- Availability is graded “B” because it isn’t available year round due to the danger of forest fires. The U.S. Forest Service determines when live bombs can be dropped.
- Risk is graded “C” because the range is on Forest Service property and there is organized opposition that would like the bombing to stop. The use permit is currently up for renewal and the outcome of that process is uncertain.
- Cost is graded “A” because the Navy can use the range while operating in the Jacksonville operating area.

Vliehors, Netherlands.

- Suitability is graded “A.” This range meets all of the suitability criteria.
- Availability is graded “C.” It would depend on what kind of access could be negotiated with the Netherlands, which presumably would be on some kind of not-to-interfere basis. Weather considerations would also restrict availability in the winter months.
- Risk is graded “D.” Major changes would be required to the IDTC for this range to become the Navy’s primary ATG

training site. The other risk is that the range is foreign controlled.

- Cost is graded “C” because the carrier would have to deviate considerably from its current deployment pattern to use this range.

Balikesir, Turkey.

- Suitability is graded “A.” It meets all the suitability requirements.
- Availability is graded “C.” We were not able to learn much about the availability of this range, but negotiations would have to take place with Turkey for the Navy to use this range frequently.
- Risk is graded “D”.” Again, major changes to the IDTC would be required for this range to become the Navy’s primary ATG training site, and in this case, foreign control is an even greater concern.
- Cost is graded “C”. The carrier must transit to the far end of the Mediterranean to use this range.

Annex E-1: ATG skill development

COMPTUEX support requirements

The main goal of the COMPTTUEX is battle group and airing integration using the battle group OPTASKs. Table 19 lists the OPTASK STRIKE requirements for an airing. Some of these requirements necessitate a physical space to support training that task, for example, *Ensure airspace deconfliction during ingress/egress and in target area*. Some requirements do not necessitate a physical space, or range; they can be conducted using a notional or constructive target area, for example, *Establish supporting asset requirements for strike*. The second column in Table 19 shows whether a range is required to support training the task.

Table 19. OPTASK STRIKE responsibilities requiring a physical training space

OPTASK STRIKE CVW responsibilities	**Physical Space Required?**
Ensure airspace deconfliction during ingress/egress and in target area.	Yes
Plan and execute all airing strike operations with standoff and precision weapons as first priority and coordinate with TLAM missions and NSFS.	Yes
Coordinate battle group strike integration during joint operations	No
Coordinate with the command and control warfare commander and intelligence for support during ingress and egress and within target area.	No
Ensure submission of Mission Reports	No
Establish airing intelligence, environmental reconnaissance and surveillance requirements to support strike missions.	No
Establish supporting asset requirements for strike	No

JTFEX support requirements

Commander Second Fleet specified the training ATG objectives for JTFEX. Table 20 lists these objectives. Like Table 19 the second column indicates if a physical space is required to support strike training against exercise land targets.

Table 20. JTFEX CVW strike training objectives requiring supporting physical space

JTFEX Airing Training Objective	Physical Space Required?
Attack enemy land targets	Yes
Conduct aerial refueling	Yes
Conduct electronic attack	Yes
Conduct fire support	Yes
Conduct fuel management	Yes
Control or dominate combat area through combat systems	Yes
Integrate tactical fires	Yes
Intercept, engage, and neutralize enemy aircraft and missile targets	Yes
Interdict enemy operational forces/targets	Yes
Perform tactical reconnaissance and surveillance	Yes
Suppress enemy air defenses	Yes
Synchronize tactical operations and integrate maneuver with firepower	Yes
Analyze mission and current situation	No
Attack targets	No
Collect tactical intelligence on situation	No
Collect target information	No
Communicate information	No
Conduct climatological and meteorological analysis	No
Conduct tactical combat assessment	No
Determine and plan actions and operations	No
Determine enemy courses of action	No
Determine enemy's capabilities and vulnerabilities	No
Develop order to fire	No
Develop tactical concept of operations	No
Direct forces	No
Employ C2 protection	No
Employ operations security	No
Establish airspace management and control procedures	No
Maintain and display force command and coordination status	No
Maintain and display tactical picture	No
Maintain datalink/inter-unit communications capability	No
Maintain information and naval force status	No
Manage means of communicating information	No

JTFEX Airing Training Objective	Physical Space Required?
Positively identify friendly forces	No
Prepare plans/orders	No
Process targets	No
Protect against combat area hazards	No
protect individuals and systems	No
Provide battle damage assessment	No
Provide target intelligence	No
Receive and transmit force orders	No
Repair, maintain, and modify equipment	No
Schedule/coordinate armament of task force	No
Schedule/coordinate refueling	No
Select or modify course of action	No
Select target to attack	No
Synchronize operational firepower	No
Transmit and receive tactical information	No

ATG mission phases

In 1996, CNA conducted a study on F/A-18 Aircrew task identification and analysis that developed a methodology for identifying aircrew tasks for various missions [8]. The missions are broken into phases, tasks, subtasks, and elements. For this analysis, we use the example of a self-escort mission (an aircrew that has an air-to-ground mission but also is prepared to conduct air-to-air missions if encountered by threat aircraft). The main phases in a self-escort mission are:

- Mission planning
- En-route
- Pre-commit (for air-to-air encounters)
- Commit (for air-to-air encounters)
- Intercept (for air-to-air encounters)
- Weapons employment phase (for air-to-air encounters)
- Merge phase (for air-to-air encounters)
- Target area ingress (for ATG mission)
- Air-to-air threat response (if encountered)

- Target area tactics (for ATG mission)
- Target area egress
- Target area phase
- Separation/egress phase
- RTF phase

The F/A-18 study associated tasks and skills with ATG missions for each of these phases. Table 21 lists the skills associated with each phase. The table also lists the requirements the training space must have to support training these skills for high altitude delivery of LGBs, based on the TOPGUN manual {5}.

Table 21. ATG skills and training requirements

Phases and tasks	**Training Space and Support Requirements**
Planning phase *Strike mission* Understand mission delegation of authority Understand specified mission objectives Assess threat to strike mission Assess probable threat reaction Determine ordnance options Select mission routing and flight profile Assess probable threat reaction to mission Determine strike package composition Determine fuel specifics and tanking requirements Coordinate integration of other assets Perform planning for mission contingencies Assess meteorological impact on mission Determine en-route tactics Determine communications plan Determine attack tactics Determine attack maneuvers Determine formations Determine egress tactics Determine mission abort criteria Determine launch plan Determine rendezvous plan Determine recovery plan Use strike mission briefing process	None. Knowledge of range, constructive, or notional targets required.

Phases and tasks	Training Space and Support Requirements
Fighter mission planning Achieve fundamental overall objectives Achieve complex overall objectives Perform air-to-air mission briefings Understand mission objectives Assess friendly force operations Perform threat assessment Determine mission operating altitude Assess weather/environmental considerations Assess fuel planning considerations Perform GCI/AIC C2 integration Understand ROE/PID criteria Determine radar contracts Understand commit criteria Perform mission planning for self-escort	
Enroute phase Perform carrier launch Perform climb to cruise flight level Perform cruise flight Perform basic flight techniques Perform formation/package rendezvous Use general flight rules Use IFR and positive control procedures Perform aerial refueling Perform enroute navigation Assess medium/high altitude considerations Use medium/high altitude formation Perform medium/high altitude formation maneuvering Perform medium/high altitude navigation Perform en-route tactics Perform systems setup	Range less than 350nm from target to match current real-world operations and CV operational constraints. Sufficient altitude and tanking to support transit to target area. Sufficient airspace supporting tactical routing supports enroute survivability training.
Pre-commit phase Coordinate with airspace control agencies Use airspace control measures Use levels/types of control Maintain communications with controller Use intercept control systems Maintain aircraft positioning Maintain mission timing Use self-escort strike formations Maintain selected formations Maintain visual lookout Use radar gameplan Use radar search operating modes	Begins approximately 80 NM from target. Ideal altitude above 20Kft, lower altitude results in less response time, but can support training pre-commit skills. Land not required. Threat radar emissions and/or threat aircraft required to support pre-commit decision skills

Phases and tasks	Training Space and Support Requirements
Perform target detection Perform radar target acquisition Perform radar target tracking Use other radar air-to-air modes Perform radar air-to-air tactical planning Use standard transmission techniques Maintain communication flow Achieve defense in depth Use Link 4A datalink Use section tactics Use section formations Perform section formation maneuvering Determine section radar employment Determine section datalink employment Determine if in a defensive status	
Commit phase Use strip criteria/procedures Understand commit authority Use commit criteria Use abort/reset criteria Perform aborts/resets Perform rejoins following abort/reset	Begins approximately 70 NM from target. Ideal altitude above 18K. Lower altitudes still support training air-to-air commit skills. Sufficient airspace for lateral maneuvering, 60degree sector permits honoring air threats. Land not required. Threat aircraft required supporting pre-commit decision skills.
Intercept phase Use ID criteria Use rules of engagement Perform autonomous operations Perform ID casualty planning Achieve tactical intercept goals Use intercept techniques Achieve intercept geometry/flow Maintain aircraft positioning Perform visual lookout/acquisition Use communications procedures Determine threat offensive capability Use radar procedures Assess threat maneuvers Perform section/division coordinated maneuvers Assess RWR considerations	Begins approximately 60 NM from target. Ideal altitude above 18K. Lower altitudes still support training air-to-air intercept skills. Sufficient airspace for lateral maneuvering, 60-degree sector permits honoring air threats. Maneuvering tactical threat aircraft required supporting intercept decision skills.

Phases and tasks	Training Space and Support Requirements
Use intercept abort criteria Achieve intercept tactical outcomes Achieve overall section intercept objectives Perform pre-commit phase as a section Perform commit phase as a section Perform intercept phase as a section Perform weapons employment phase as a section Perform engaged phase as a section Perform post-merge phase as a section Assess and respond to contingencies as a section Use visual identification intercept process Achieve VID intercept objectives Perform option VID intercept Perform other VID intercept tactics Use forward quarter missile defense Determine threat missile range Perform radar guided missile defense Perform IR guided missile defense Perform ARM defense Maintain visual lookout in missile defense Use countermeasures procedures Perform threat reacquisition after maneuver	
Weapons employment phase Use ROE and ID criteria to support decision Assess threat maneuvers with respect to weapons Use weapons firing doctrine Perform weapons employment at range Use tactical bingo procedures Perform F-pole/crank maneuver Use IRCM techniques Perform section/division maneuvering Use stand off illumination Perform short range intercept operations Use AIM-120 employment process Perform AIM-120 supporting radar employment Perform AIM-120 targeting Understand AIM-120 missile operation Use AIM-120 launch modes Use AIM-120 ECCM Perform AIM-120 missile attack	Begins approximately 50 NM from target. Ideal altitude above 18K. Lower altitudes still support training air-to-air weapons employment skills. Sufficient airspace for lateral maneuvering, 60-degree sector permits honoring air threats. Maneuvering tactical threat aircraft required supporting air-to-air weapons employment skills.
Merge phase Assess decision to turn Maintain high energy state for maneuvering Maintain mutual support Maintain visual lookout	Begins approximately 40 NM from target. Ideal altitude above 18K. Lower altitudes support training air-to-air merge skills.

Phases and tasks	Training Space and Support Requirements
Perform turn to engage Perform engaged maneuvering Perform close weapons employment Perform continuation through merge Use basic fighter maneuvering Use rear quarter missile defense Use guns defense process Use offensive gunnery process	Sufficient airspace for lateral maneuvering, 60degree sector permits honoring air threats. Maneuvering tactical threat aircraft required supporting merge decision skills.
Target area ingress phase Use selected routing Use selected tactical formations Use EMCON procedures Perform integration with strike support assets Assess no go criteria Maintain communication flow Determine if targeted by ground threats Use defensive EA DECM Perform maneuvering in response to threat Perform AAA defensive maneuvering Perform SAM defensive maneuvering Understand stores jettison criteria Perform reset after defeating SAM/AAA threat	Begins approximately 30 NM from target. Ideal altitude above 18Kft, lower altitude results in less response time, but can support training target area ingress skills. Sufficient airspace for lateral maneuvering, 60degree sector permits honoring air and SAM threats. Land not required. Local threat radar emissions required supporting target ingress decision skills.
Air-to-air threat response Assess air-to-air threat response Determine reaction to air threat Assess air-to-air weapons employment React to threat air-to-air weapons employment Use resume, abort procedures Use defensive general considerations	Same weapons employment phase for air-to-air response
Target area tactics Perform weapons delivery computations Select aircraft mater modes of operation Perform stores management set programming Perform weapon system sensor integration Perform target search Perform target detection Perform target identification Perform target acquisition Perform target designation Perform target tracking Use selected routing to target Perform weapon delivery maneuvering Use general weapon delivery consideration Use general weapon delivery maneuvers Use laser designation employment process	Begins approximately 20 NM for LGBs from target. For GP begins at 10 NM; for non-tactical begins at 5 NM. Altitude above 18K required, above 25K preferred, for target acquisition (FLIR/LANTRIN) and targeting systems (laser), and delivery profile skills training. First pass release of live ordnance for realistic tactical training. Sufficient airspace for lateral maneuvering, 30-degree sector permits honoring SAM threats. Land required supporting impact of live LGB ordnance. Up to 2000lb live LGB

Phases and tasks	Training Space and Support Requirements
Use Paveway II GBU-24 employment process Perform action sequence for weapon employment Achieve selected TOTs Conduct BDA to report results Maintain threat situation awareness React to contingency events during attack Perform integration with strike support assets Use section attack formations Perform air-to-ground ranging Select attack heading Perform weapon delivery	impact preferred (GBU 24), 500lb live LGB (GBU 12) minimum. Variety of realistic targets to support target acquisition training. Local point threat radar emissions required supporting target area decision skills.
Target area egress phase Perform off target maneuvering Use selected off-target maneuvering Use selected off-target routing Use selected formation off target Maintain threat situational awareness Use hung ordnance procedures Perform integration with strike support assets Maintain accountability of aircraft off target	Same as target ingress and commit phase requirements
RTF phase Use selected routing for return flight Use selected formation Use RTF procedures Use MRR procedures Perform post mission reporting Perform descent maneuver Perform aircraft carrier recovery Perform post-flight mission debriefing	Same as target ingress phase requirements

Appendix F: JTFEX training

The JTFEX, which is the last exercise that a battle group conducts prior to deployment, is often referred to as the battle group's graduation exercise or its final exam. It is the culmination of the inter-deployment training cycle and serves two main purposes: advanced training and readiness certification.

This remainder of this appendix discusses the JTFEX training objectives, describes the range attributes that are needed to support a JTFEX, and discusses the ratings that were assigned to specific JTFEX range candidates.

Exercise objectives

The primary objective of the JTFEX is to demonstrate the training level of the battle group so that it can be certified as ready for deployment. The responsibility for certifying a battle group lies with Commander, Second Fleet (C2F). The JTFEX is designed by C2F to test the battle group's ability to conduct operations in several different areas in a realistic scenario under stressful conditions. Exactly how this should be done is left to the judgment of C2F. The method and criteria for evaluating a battle group's readiness are nowhere specified. The JTFEX scenario and the requirements that the battle group must meet change in response to geopolitical developments and the role that the deploying naval forces are expected to play.

If readiness evaluation is the primary objective of a JTFEX, then skill development is probably a close second. At this point in the IDTC, the battle group is in the "advanced" training phase, which corresponds to the rehearsal phase of the skill development process. The battle group has only one at-sea period during the advanced phase of the IDTC, and that at-sea period is dedicated to the JTFEX. The JTFEX is the best and possibly the only opportunity for the battle group commander, his warfare commanders, and their staffs to practice doing their jobs under realistic operational conditions. For this reason, it is important that the JTFEX be as realistic and as free of artificialities as possible. It is also the last opportunity for

elements of the battle group to refresh perishable skills prior to deployment.

While seldom listed as a JTFEX objective, confidence building is also important to the future success of the battle group. Fortunately, a higher level of confidence in all concerned is a natural byproduct of a successful rehearsal.

Key exercise characteristics

To meet the objectives outlined above, the battle group must be put in a stressful, realistic, and tactically challenging situation. To create such an environment, a typical JTFEX has the following characteristics.

Large-scale. A JTFEX is typically the largest operation the battle group has to orchestrate during its IDTC. It involves large numbers of ships, aircraft, and personnel from different commands in different locations. It also requires a considerable amount of sea room and air space, and possibly operating areas ashore, to conduct the required operations. The scale of the JTFEX stresses the command and control structure, and also the logistics support system, both during the planning phase and during execution.

Multi-dimensional. A JTFEX consists of many different operations that are conducted simultaneously or nearly simultaneously in different warfare areas. The operations do not generally follow a predetermined schedule, but instead develop in response to an evolving scenario. Individual operations are planned, scheduled, and modified on the fly. This produces a more challenging and more realistic environment for command-level decision-making and for the exercise of command, control, and communications.

Join/Combined. The planning and execution of a JTFEX is further complicated by the inclusion of joint and allied forces that have different capabilities, cultures, and expectations.

Realistic scenario. To create an effective rehearsal-style learning experience, the exercise scenario must be reasonably similar to something the battle group might encounter during its deployment. If the scenario is irrelevant or if the exercise flow is continually interrupted by artificialities, much of the training value will be lost. Similarly, the readiness evaluation will be meaningful only if the

battle group can be observed conducting operations that are relevant and realistic. Reasonable people may disagree about what operations qualify as relevant and realistic, but for the purposes of the battle group certification, that decision is left to the discretion of C2F.

Required range attributes

To accomplish the objectives outlined above, a JTFEX requires an operating area for battle group free-play and accessible ranges for the exercise events that require such facilities. The open-ocean operating area has to be quite large so that the ships and aircraft of the battle group can operate without significant restrictions, and the required training ranges must be in reasonable proximity to the open-ocean operating area to accommodate the flow of exercise events. In recent years, the JTFEX has included a significant amount of ATG training and also a SACEX. The range requirements for those operations were discussed earlier in this section.

A JTFEX requires a range or a set of ranges that can support several different operations at the same time. The JTFEX is designed primarily to evaluate the proficiency of the battle group overall, and in those specific operations that are considered to be most relevant at the time. Upon passing the evaluation, the battle group is certified as ready for deployment.

Training priorities—and consequently the make up of the JTFEX—can be expected to change as the real-world military and geopolitical situations change and as emphasis shifts among potential adversaries and scenarios. Consequently, there is something to be said for the flexibility to conduct a broad range of potential training evolutions, not just those that are popular today.

The JTFEX of today includes carrier operations of various kinds, strikes operations ashore (ATG) with live ordnance, and an amphibious assault supported by live ordnance (SACEX), all woven into a dynamic, tactical scenario. The range assets that are required to support such a JTFEX would include:

- A large, open-ocean operating area with sea room and air space for operating battle group ships and aircraft.

- Deepwater ports and airfields nearby for logistics support, for staging opposition ships and aircraft, to allow participation by land-based aircraft, and for safety diverts.
- ATG facilities within tactical range of the carrier operating area. Ideally, this would be one range where carrier-based aircraft can conduct large-scale, coordinated, opposed, tactical strikes against realistic targets using live ordnance.
- A range that can support a SACEX with amphibious assault, maneuvering ashore, and live-fire support from artillery, mortars, close air support, and NSFS.

Candidate range assessments

East Coast

Description. VACAPES and W-72 operating area with Camp Lejeune for SACEX, Cherry Point and Dare County ranges for tactical ATG training, and Fort Bragg for live-ordnance ATG training.

- Suitability is graded “B” because some compromises must be made. The open-ocean operating area, ports, airfields, and SACEX facilities are all excellent, even if live-fire into G-10 is not allowed. ATG is the problem. The Cherry Point and Dare County ranges are suitable for tactical training, and Fort Bragg appears to be suitable for live-ordnance training, but tactical and live-ordnance training cannot be conducted simultaneously at any one range.
- Availability is graded “A”. There do not appear to be any significant problems.
- Risk is graded “A” because existing U.S. ranges are used within the current IDTC construct. Minor risks include resuming NSFS at Camp Lejeune, negotiating the use of Fort Bragg with the Army, and defending Cherry Point and Dare County ranges from encroachment.
- Cost is graded “A” because the range complex is close to Norfolk.

Gulf of Mexico

Description. Eglin AFB for tactical and live-ordnance ATG training.

- Suitability is graded “C”. Eglin AFB appears to have the potential to be an excellent ATG training facility where carrier-based aircraft can conduct tactical and live-ordnance ATG training at the same time. Unfortunately, there is no place in the area to conduct an amphibious assault. Perhaps some creative script writing could incorporate enough other activity so the exercise could still qualify as a JTFEX, but the Eglin area does not have the diversity or the flexibility of the VACAPES area.
- Availability is graded “B”. There apparently is some concern about taking the carrier battle group into the Gulf of Mexico during hurricane season.
- Risk is graded “A” because Eglin is an existing U.S. range. There is a minor risk of negotiating its use with the Air Force.
- Cost is graded “B” because it requires several days of steaming to transit from Norfolk to the Eglin area.

Caribbean

Description. Guantanamo Bay.

- Suitability is graded “D”. The Guantanamo Bay area can accommodate battle group operations, a live-fire SACEX, and ATG training with live ordnance, but the small size of the base severely limits the quality of the training. It is possible to conduct these training evolutions, but the operating restrictions probably make them unacceptably artificial.
- Availability is graded “A”. We are not aware of any availability problems, except those associated with the political risks.
- Risk is graded “D” because it is possible that the State Department would argue against any increased military activity near Cuba. And even if such activity were allowed today, it may become acceptable on some unspecified date in the future when Castro leaves the scene.

- Cost is graded “B”. The transit distance to Guantanamo Bay is less than the distance to Vieques or to Eglin, but considerably more than to VACAPES.

Overseas

Description. Capo Teulada.

- Suitability is graded “B”. The battle group can conduct operations in the Mediterranean, conduct tactical and live-ordnance ATG training into European ranges, and also conduct a SACEX with live fire, including NSFS, at Capo Teulada. The main drawbacks are restrictions on where aircraft can fly.
- Availability is graded “C”. Availability is currently quite limited, but there appears to be unused capacity and it may be possible to negotiate increased. A battle group can still expect to have significant scheduling problems, however.
- Risk is graded “D”. It is probably unacceptable from a national security perspective to rely a foreign nation for important military training facilities. This option is also risky in the sense that it breaks with current doctrine by deploying forces that are not fully trained.
- Cost is graded “A”. Despite the distance from homeport, participants do not have to go out of their way to conduct a JTFEX at this range.

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List of figures

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