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Geospatial Analysis of Terrorist Activities:

The Identification of Spatial and Temporal Patterns of Preparatory Behavior of International and Environmental Terrorists



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I: INTRODUCTION

ORGANIZATION OF THE REPORT

This report is divided into five major sections. Section I includes the history of the current project and our goals and objectives. Section II includes a brief literature review of issues related to the temporal and spatial study of terrorist incidents, rationale, preliminary findings from our previous work in this area, and our research questions. Section III describes the method and methodological issues that emerged during the course of the project. The results from the project are provided in Section IV. To make the report as “readable” as possible, major findings are provided in charts and maps embedded in the text. Section V provides a discussion of these findings and draws some conclusions regarding the utility of the data and the implications of these findings for counterterrorism efforts.

The appendices include information to assist other investigators in further analysis of the data or in the training of local law enforcement. Temporal diagrams for each case study, narratives for cases that were either exemplars of terrorist group patterns or were unique, and a copy of the codebook and variables used in the study are available as part of the dataset upon release.

HISTORY OF THE CURRENT PROJECT

Since 1988, the American Terrorism Study has monitored the behavior of persons indicted under FBI “terrorism enterprise” investigations.¹ This research has revealed

¹ As designated by the *Attorney General Guidelines on General Crimes, Racketeering Enterprises, and Domestic Security/Terrorism Investigations* and subsequent editions (1983, 1989, 2002) or in the case of international terrorists, those persons indicted in federal courts as a result of investigation under the

fundamentally important issues in the study of terrorism that framed the current research. One issue frequently overlooked is that the etiology of terrorism is very different from that of traditional criminality and, as such, terrorists behave in fundamentally different ways than conventional criminals (Smith and Orvis, 1993; Smith, 1994; Smith and Damphousse, 1996; 1998a; Smith et al., 2002). In particular, while traditional violent crime tends to be very spontaneous, terrorist violence tends to involve considerable preparation and the commission of substantial preliminary or ancillary criminal conduct. The identification of “routinized” preparatory behaviors by terrorist groups could provide considerable opportunity for early law enforcement interdiction.

Geospatial methodologies hold substantial promise in this regard. However, the application of geospatial methodologies to pre-incident indicators of terrorist activities is so new that two fundamental issues arise when considering this approach. First, can enough information be derived from open source materials to address the research questions to be examined? Second, if sufficient data can be extracted from these sources, will the information reveal patterns of conduct that might be useful for law enforcement or prosecutorial agencies? In 2003, the National Institute of Justice provided funding to begin a preliminary examination of these issues.² Results from that project, which are described in greater detail later in this section, revealed that the answers to both of these questions are positive. However, the patterns that emerged in this preliminary research were most prominent for two types of terrorist groups: (1) international terrorists, and (2)

Attorney General Guidelines for FBI Foreign Intelligence Collection and Foreign Counterintelligence Investigations.

² “Pre-Incident Indicators of Terrorist Group Activities,” NIJ Award Number 2003-DT-CX-0003.

single issue terrorists, most notably environmental extremists³ and anti-abortion extremists. International and environmental terrorism also have been identified as the two types of terrorism posing the greatest threat to the United States over the next decade (e.g., see Jarboe, 2002).

RESEARCH GOALS AND OBJECTIVES

The purpose of the proposed project was to: (1) expand data collection in the two areas [international and environmental terrorism] where preliminary findings revealed the most identifiable patterns of preparatory behaviors, and (2) conduct more extensive geospatial and temporal analysis of the resulting data. Terrorists engage in a variety of non-terrorist criminal conduct prior to the commission of any terrorist act. These non-terrorist acts include crimes related to the creation of false identities for group members, thefts to procure funding for the group, thefts of weapons or explosive materials and, frequently, crimes related to the maintenance of internal security. These behaviors ultimately culminate in acts of terrorism. By examining these preparatory behaviors, routinized patterns of activity potentially can be identified.

The research involved an examination of selected terrorist incidents (and preventions) in the United States during the past 25 years. The examination focused upon the planning processes and behaviors that the terrorists committed in while preparing for the terrorist incidents. The study included both criminal and non-criminal conduct. We refer to these pre-incident behaviors by terrorist groups as “antecedent conduct.” An examination of the antecedent conduct of terrorist group members places the subsequent terrorist incident

³ For the purposes of this report, we use the term “environmental extremists” to refer to both animal rights extremists and environmental extremists.

in context, providing the potential to identify patterns of conduct that might lead to intervention prior to the commission of actual terrorist incidents.

To accomplish this goal, several objectives had to be completed:

- a. The extraction of temporal and spatial data from court case records on federal terrorism defendants indicted during the period 1980-2004 that were classified as environmental or international terrorists. This objective was accomplished by using the records compiled as part of the American Terrorism Study and the addition of new data collected on terrorists indicted between August 15, 2002 – September 1, 2004. Cases studies and court records through August 16, 2002 had already been compiled as part of “The American Terrorism Study” (ATS) and the “Pre-Incident Indicators of Terrorist Activities” project.
- b. The compilation of temporal and spatial data on other environmental and international terrorist incidents identified by subject matter experts (SMEs) that rendered adequate data for analysis. This objective involved the identification of additional cases, particularly environmental incidents, which may have been handled in state courts or were prosecuted in federal courts under *general crime* investigations instead of *terrorism* investigations. These cases were selected for inclusion in consultation with the consultants and subject matter experts affiliated with the BJA’s State and Local Anti-Terrorism Training Program (SLATT).⁴
- c. Conduct spatial and temporal analyses of the activities committed by these offenders for the period beginning with the inception of the terrorists’ plan to the occurrence or intervention of the terrorist incident. Over 280 variables and quantifiable data were

⁴ Ron Arnold, Jonathan White, William Dyson, Kelly Damphousse, and Robert Heibel.

extracted from the initial NIJ case studies to create an empirical dataset. The current project involved coding additional known, relevant preparatory behaviors (both criminal and non-criminal), any ancillary offenses, and actual and intended terrorist targets.⁵

- d. Conduct comparative analyses of terrorist groups' activities for divulgence of different methods and patterns. The focus of this objective was to delineate terrorist type or group-specific patterns characteristic of environmental or international groups.
- e. Provide access to these patterns through GIS architecture linked to the Pre-Incident Indicators of Terrorist Activities database. Cognition of empirical information is critical. Our goal was two-fold: first, to provide findings from the study in the most meaningful way so that law enforcement and prosecutorial agents can readily apply the information and, second, to make the data available to other investigators and analysts for additional examination.

⁵ For the purposes of this project, “preparatory behaviors” are defined as the criminal and non-criminal conduct by members of a terrorist group in preparation for a terrorist incident. “Antecedent offenses” are defined as the totality of non-terrorist crimes committed by a terrorist group. Antecedent offenses may be of two types: preparatory crimes – crimes committed to assist in the preparation of a terrorist incident; and ancillary crimes – crimes committed for order maintenance, internal security or personal reasons.

II: REVIEW OF RELEVANT RESEARCH

This section includes a brief summary of previous research from criminology and terrorism scholars relative to the spatial distribution of terrorism events and their preparation. Although little empirical work on the spatial and temporal aspects of terrorism has been conducted, criminology has a rich tradition in ecological research. More recently, some scholars have begun to identify theoretical models that might be used to explain terrorists' behaviors. Secondly, preliminary results from the pre-incident indicators project are provided to frame the objectives of the current project. Finally, this section includes a discussion of the research questions examined as part of this process.

RELEVANT LITERATURE

Terrorists engage in a variety of non-terrorist criminal conduct prior to the commission of any terrorist act. These non-terrorist acts include crimes related to the creation of false identities for group members, thefts to procure funding for the group, thefts of weapons or explosive materials and, frequently, crimes related to the maintenance of internal security (Hamm, 2007; Smith and Orvis, 1993; Smith, 1994; Smith and Damphousse, 2002; Smith, Damphousse, and Roberts, 2006). These behaviors ultimately culminate in acts of terrorism. By examining these preparatory behaviors, patterns of activity may be identified.

The literature on this subject is characterized by two major problems. First, literature on terrorist targeting based on empirical findings is extremely scarce (e.g., see Turk, 1979; Crenshaw, 1992; Hoffman, 1992; Wardlaw, 1989; Blumstein, 1996). Recent advances, particularly in the development of relational database methodologies, have

resulted in new efforts to engage in the predictive modeling of terrorist group activities (Ward, 2005; LaFree, 2004). However, these efforts focus on issues other than the temporal and spatial relationships between pre-cursor crime and terrorism incidents. Second, reliance on the general criminological literature to identify testable hypotheses relative to terrorist behaviors is extremely difficult. The demographic characteristics of traditional offenders are substantially different from those persons indicted for terrorism related crimes here in the United States. Some terrorist groups include disproportionately higher percentages of females and white persons than non-terrorist criminals (Smith, 1994; Smith and Damphousse, 1996; 1998; 2003b). Some of these same groups also tend to be slightly better educated and they include more persons from middle and upper class backgrounds than the conventional criminal population (Smith and Morgan, 1994; Corley, Smith, and Damphousse, 2005). Most importantly, they are significantly older than traditional offenders, indicating a pattern of career criminality uncharacteristic of common criminals (Smith and Damphousse, 1996; 1998; Bradley, Smith, and Damphousse, 2007). These demographic variations reflect the motivational differences between terrorists and traditional criminals (Schafer, 1974). In other words, the causes of traditional criminality appear to be fundamentally different from the causes of terrorism, thereby making generalizations from one to the other tenuous at best.

Target-specific literature: Despite this, some theoretical efforts have been made to predict the targets of terrorism. Most of these efforts focus upon ideology as a predictor of terrorist group activity (Drake, 1998). Crenshaw (1988), however, notes that other factors may be equally as important. Specifically, she contends that terrorist groups are, in practice, organizations advocating political change and that the “fundamental purpose

of any political organization is to maintain itself” (Crenshaw, 1988:19). From this perspective, terrorism targets are analyzed not as ends in themselves (i.e., to attain specific political goals), but as the outcome of efforts to maintain the integrity of the terrorist organization. Rapoport (1992) suggested that well over 90 percent of terrorist organizations have a life expectancy of less than one year. Crenshaw contends that the longer a terrorist group survives, the more likely its targets will reflect a concern for maintaining the group and its organizational structure. These assertions have important implications not only for the spatial distribution of ancillary and preparatory terrorist crimes, but also for the temporal characteristics of terrorist planning.

A dominant theme that has emerged in the evolution of the terrorism literature is the acknowledgment that the criminality of terrorists is more widespread and complex than previously discussed (Smith, 1994). Crenshaw’s (1988) expansion of terrorist targeting to include “organizational maintenance” crimes and Hoffman’s (1998) argument that the overriding tactical imperative of many terrorist groups “has been the deliberate tailoring of their violent acts to appeal to their perceived constituencies” (Hoffman, 1998:158) are particularly intriguing when applied to the study of environmental and international terrorist groups, both of which have experienced substantial structural change over the past decade.⁶

General Criminological Literature Relative to Spatial and Temporal Patterns: In recent years geospatial and temporal research has emerged as a viable technique to identify patterns of behavior due to the development of geospatial technologies.

⁶ Brent L. Smith, “Homegrown Terror,” presentation to *Confronting Terrorism* Conference, Los Alamos National Laboratory, March 28, 2002.

However, criminology already has a rich tradition in this arena stretching back to the early 20th century. Included among these early works are the contributions of Park and Burgess (1925), and Shaw and McKay (1942) as part of the Chicago Area Project. While their findings may not be specifically relevant to the study of terrorism, these early studies revealed the importance of an “ecological” or “environmental” approach to examining the changing patterns of criminal conduct within, in their case, a city and its environs. This methodology has become increasingly important as new technologies have emerged that allow easier access to, and analysis of, geospatial data.

Since these early efforts, ecological approaches have manifested themselves in several important theoretical works. Although Wolfgang’s (1958) work on patterns of criminal homicide is not generally identified within the spectrum of ecological theories, his analysis of homicides in Philadelphia produced some of the earliest spatial and temporal patterns involved in criminal conduct. His analysis and findings stimulated a number of subsequent theorists interested in temporal and spatial relationships. More recent efforts to examine the spatial distribution of crime have included Newman’s (1972) work on “defensible space” and C. Ray Jeffrey’s (1971) concept of “environmental design.” Both of these noted works focus upon the reduction and prevention of crime through manipulation of the social and physical environment.

More recent examinations of the geospatial relationship to victimization and crime include Cohen and Felson’s (1979) “routine activities theory” and Clarke’s (1992) “situational crime prevention.” Both of these perspectives have direct relevance regarding terrorist behavior and targeting. Research on routine activities theory has focused primarily upon “suitable targets” and the “absence of capable guardians,” two of

the three major elements that must converge to produce criminal conduct. Less research has been done on the third component – the presence of capable or motivated offenders (Paulsen and Robinson, 2004). Despite its relevance, however, little empirical work has appeared in which this model has been used to predict terrorist activity. In contrast, Clarke and Newman (2006) have applied the situational crime prevention model to preventing terrorism in their new work entitled *Outsmarting Terrorists*. Clarke and Newman, however, also acknowledge the lack of empirical data available to adequately test their perspective, calling for a DHS commitment to examine the issue.

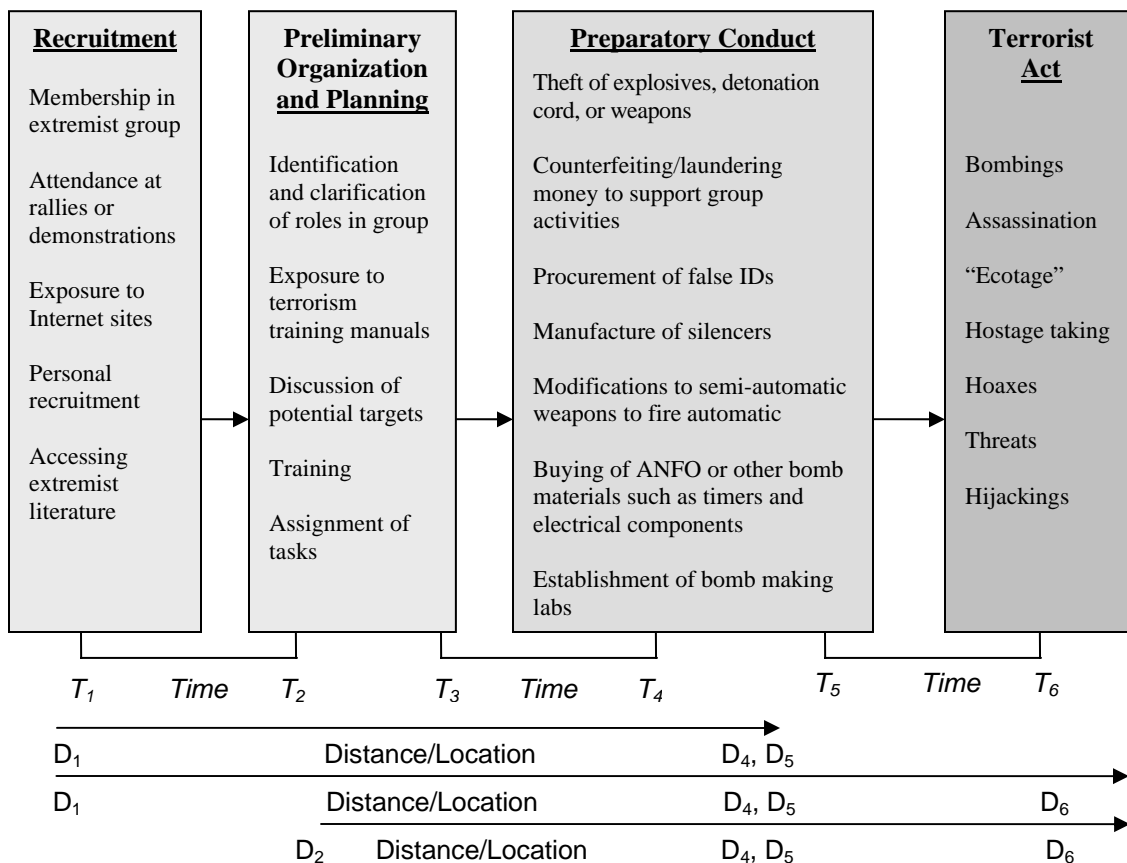
Roach, Ekblom, and Flynn (2005) also apply the situational crime prevention model to the “conjunction of terrorist opportunity” to identify the conditions under which specific acts of terrorism might occur. In addition to motivational issues such as “readiness to act” and “ideological predisposition, Roach, Ekblom, and Flynn include training, resources, and targets, among others, as variables in their model. Efforts to obtain resources (through theft or legitimate activities) and training entail preparatory activities that can be measured to identify pre-incident indicators and patterns of precursor behavior. The identification of these antecedent behaviors may have important implications for preventing terrorism.

Studies of traditional criminality link a variety of antecedent crimes to the ultimate objectives of many types of offenders. The literature on drug use is replete with links to the use of antecedent preparatory crimes to fund an offender’s addiction (e.g., Inciardi, Horowitz, and Pottieger, 1993; Kaplan, 1995). Wright and Decker’s (1997) analysis of armed robbers characterizes armed robbery as an antecedent to the procurement of illicit drugs and alcohol. Similarly, the organized crime literature is saturated with descriptions

of both legitimate and illegitimate ancillary activities related to the maintenance of crime cartels (Abadinsky, 2000; Albanese 1996). Importantly, numerous studies indicate that traditional offenders commit the overwhelming majority of their offenses within a short distance from their place of residence. Repetto (1974) noted, for example, that eighty percent of burglaries occurred within five miles of the offenders' homes. Wright and Decker (1997) implied similar patterns regarding armed robbers.

These issues led us to consider terrorist group conduct as occurring along a continuum involving four major activities: (1) recruitment; (2) preliminary organization and planning; (3) preparatory conduct; and (4) terrorist acts. These general principles and examples of each type of behavior are presented in Figure 1.

Figure 1: Flow Chart of Terrorist Group Activity



Throughout the planning process of a terrorism incident or act, meetings take place, phone calls are made, and crimes are committed. These acts take place in locations such as the terrorists' residence, or that of a relative or friend, a home base or safe house, or even surveillance of the intended target. These behaviors occur in measurable dimensions of time and space. Consequently, patterns of preparatory conduct may exist that could assist law enforcement in early intervention. Rather than test specific hypotheses from the theoretical models discussed above, our goal was similar to that of Wolfgang in the Philadelphia Study – to merely identify general patterns of spatial and temporal conduct so that additional research could build upon this empirical foundation. We had already identified potentially useful patterns of behavior in an earlier project, henceforth referred to as the “pre-incident indicators project.” Findings from this pilot study are discussed in the following section.

PRELIMINARY FINDINGS

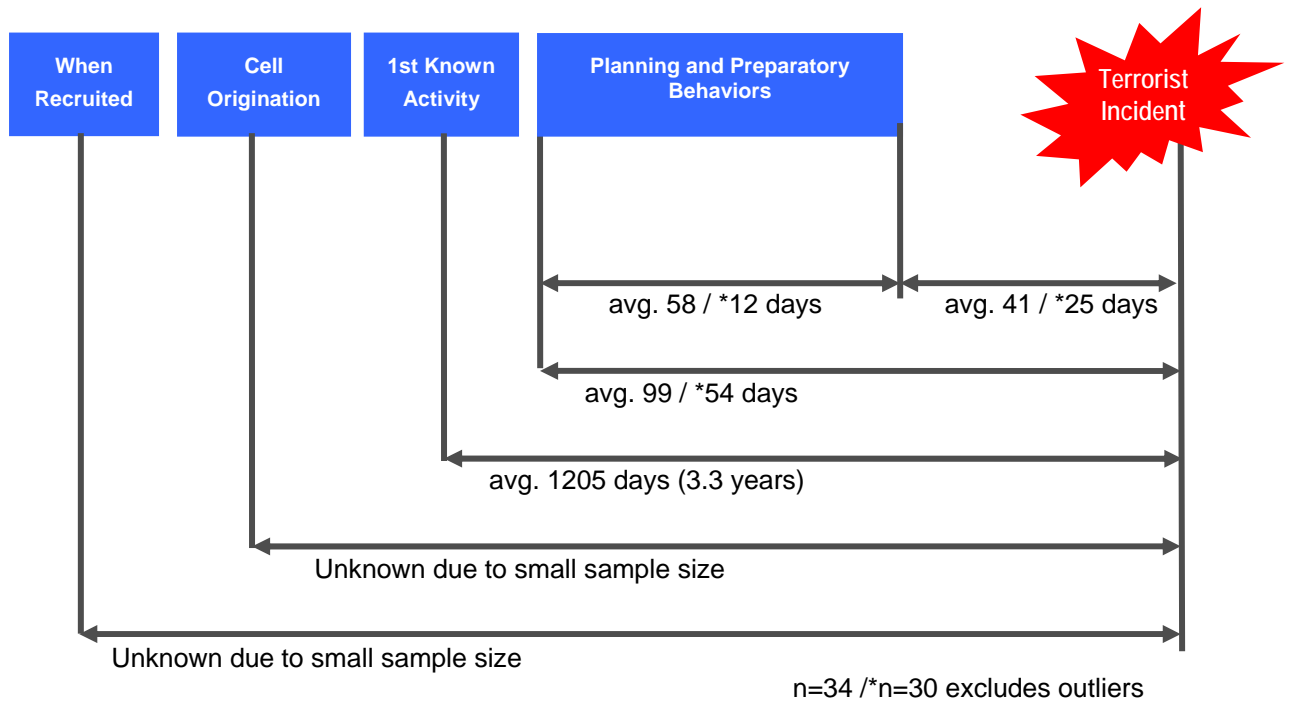
The “pre-incident indicators” project involved an examination of 60 “case” studies involving right-wing, left-wing, single issue (anti-abortion and environmental extremists) and international terrorists. Although the sample sizes from this project were relatively small, temporal and spatial patterns did emerge, particularly among international and single-issue⁷ terrorist activities. The following subsections provide a sample of the general temporal and spatial findings from this project.

Temporal Patterns: Temporal measurements were made at four points during the planning process: (1) when the terrorist(s) were recruited as members into the terrorist

⁷ Interestingly, it appears that single issue extremists such as anti-abortion and environmental extremists exhibit similar spatial patterns regardless of ideology/political motivation. This will require further examination to confirm.

group; (2) when the terrorist “cell” originated, usually measured as a function of the first planning meeting; (3) when preparatory acts occurred; and (4) when the actual terrorist incident occurred or, if it was preempted or prevented, the date that it was planned to occur. Temporal measurements proved to be the most difficult to identify. Although 191 temporal measurements were obtained in the original project, some events were substantially more difficult to measure than others. For example, temporal information regarding when various members joined specific terrorist groups was, in large part, non-existent. If this information was located, it was frequently provided in units of measurement that were so large (e.g., years) that calculations were unreliable. The basic findings from this pilot study are presented in Figure 2.

Despite a lack of information regarding recruitment, sufficient temporal data existed to identify basic patterns of preparatory conduct. On average, the terrorist cells held their first planning meetings slightly over 3 months from the time they committed the terrorist incidents studied. This is generally consistent with Rapoport’s (1992) notion that terrorist groups have a life expectancy of less than one year. The lifespan of these “cells” ranged from a few weeks to more than three years.

Figure 2: Temporal averages of terrorist group activities

Of significant interest in these temporal averages is the finding that there tends to be a substantial lull between the conclusion of the preparatory conduct and the actual incident. The initial “planning phase” appeared to last, on average, between twelve days and approximately two months. It is during this period that law enforcement agencies would have the greatest probability of successful intervention. Initial analyses suggested that once preparatory behaviors begin, the process toward terroristic violence is relatively swift. Subsequent analysis suggested, however, that planning and preparatory activities are intermingled and not temporally separated (i.e. that not all planning meetings occur first, followed by preparatory acts). Substantial variation existed among types of terrorist groups (e.g. single-issue, international, etc.) regarding this issue. However, the limited amount of temporal data available from these case studies precluded further specification

other than the overall pattern of conduct. In fact, the chart above should be viewed as mere “averages” rather than as patterns of behavior.

Spatial Patterns: Preliminary findings indicated that there is a strong relationship among the locations of the terrorist incident, terrorists’ preparatory behaviors, and where these terrorists reside. For example, preliminary spatial analysis on 426 measurements of distance from terrorist residence to incident location have identified that 46% are within 30 miles, while 37% were 271 miles or greater (see Figure 3). This bimodal distribution was most apparent among international, left-wing, and single-issue terrorists. Only right-wing terrorists did not fit this pattern of behavior.

Figure 3: Spatial Analysis of Distances from Terrorist Residences to Incident Locations

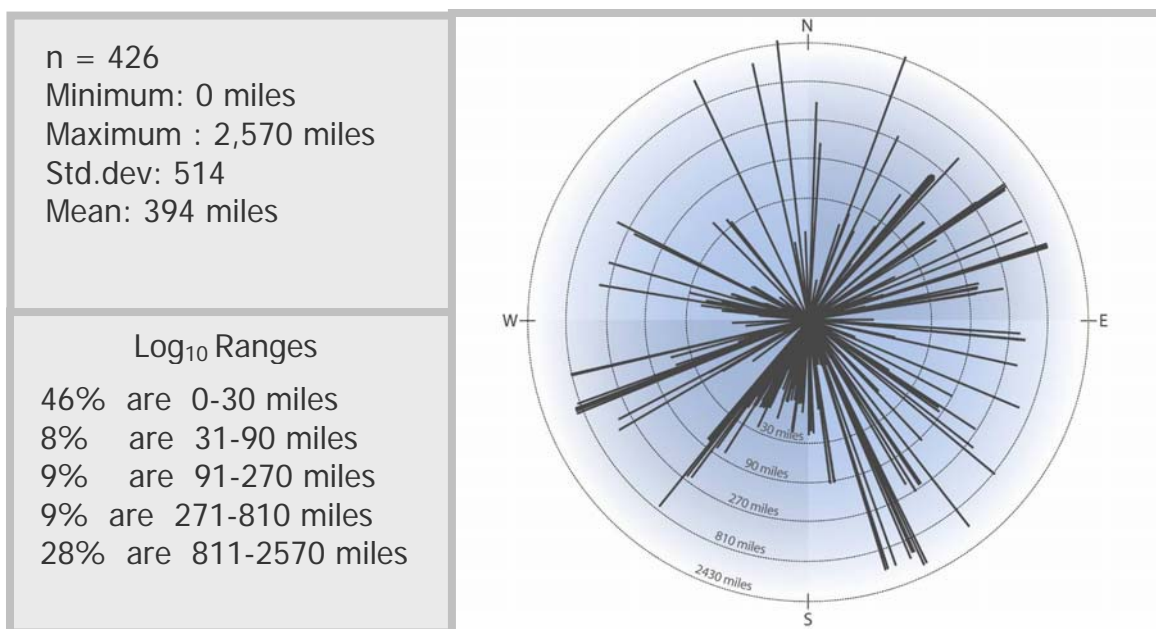
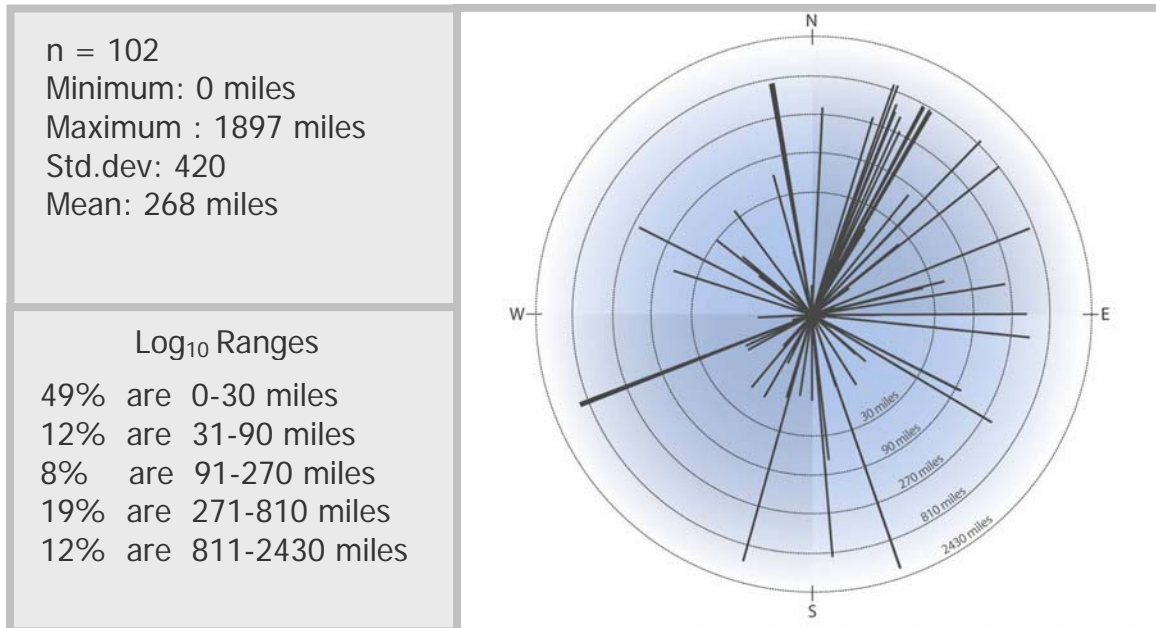


Figure 4: Spatial Analysis of Distances from Terrorist Residences to Preparatory Activity Locations



Furthermore, similar patterns emerged when examining the relationship between the residences of these terrorists and their preparatory activities (see Figure 4). These patterns also held when examining the relationship between the locations of terrorist targets and their preparatory activities (figure not shown). At least one-half of all terrorists in the sample lived and committed their planning activities within a 50-mile radius of the eventual terrorist target.

Of particular importance were the patterns that seemed to be emerging with regard to international and environmental terrorists. The differences shown in the chart below suggested that significant spatial differences exist among types of terrorist groups. In particular, 50% of the international terrorists selected targets within 30 miles of their residences. The reasons these offenders do not venture far from their residences may be related to new immigration status, lack of transportation, lack of knowledge of the urban

landscape, an attempt to minimize attention or a variety of other reasons. The important point, however, is that the pattern exists, regardless of the reason. In contrast, an additional 39% lived over 800 miles from the target. This bimodal pattern existed among single-issue terrorists as well, although not quite as pronounced.

Finally, a significant proportion of single-issue extremists also committed their offenses close to home. Fifty-nine percent of these terrorists resided within 90 miles of the target (see Table 1). Once again, however, the chart suggests a bimodal spatial distribution of the residences of these offenders and their targeting. Specifically, these offenders were apt to either select localized targets of opportunity or they traveled great distances to meet with local extremists at a staging area near the target.

Table 1: Linear Distance Analysis of Residences to Incidents by Terror Group Type

<p>n = 68</p> <p style="text-align: center;">Single Issue</p> <p>Mean distance: 402 miles Maximum: 2569 miles Minimum: 1.26 miles</p> <p>43% 0 - 30 miles 16% 31 - 90 miles 3% 91 - 270 miles 21% 271 - 810 miles 18% 811 - 2430 miles</p>	<p>n = 262</p> <p style="text-align: center;">International</p> <p>Mean distance: 458 miles Maximum: 2356 miles Minimum: 0 miles</p> <p>50% 0 - 30 miles 2% 31 - 90 miles 5% 91 - 270 miles 3% 271 - 810 miles 39% 811 - 2430 miles</p>
<p>n = 33</p> <p style="text-align: center;">Left Wing</p> <p>Mean distance: 200 miles Maximum: 2134 miles Minimum: 0 miles</p> <p>52% 0 - 30 miles 6% 31 - 90 miles 24% 91 - 270 miles 12% 271 - 810 miles 6% 811 - 2430 miles</p>	<p>n = 71</p> <p style="text-align: center;">Right Wing</p> <p>Mean distance: 283 miles Maximum: 876 miles Minimum: 0 miles</p> <p>27% 0 - 30 miles 20% 31 - 90 miles 13% 91 - 270 miles 32% 271 - 810 miles 8% 811 - 2430 miles</p>

RESEARCH QUESTIONS

The original “pre-incident indicators” project revealed that both international and environmental terrorists exhibited a bimodal spatial pattern of preparation and target selection. Second, these groups also exhibited the most distinct temporal patterns as well. International terrorists had the longest planning cycle, while environmental (and other single issue terrorists) exhibited the shortest planning cycle. The current project collected data in an effort to confirm these findings and further clarify these relationships.

Therefore, the fundamental research question of the project was: What spatial and temporal patterns exist among international and environmental terrorists in relationship to their preparatory behaviors and the location and time of the terrorist act? The preliminary analyses from the first study raised a number of supplementary questions to be addressed. For example, do all environmental terrorists that espouse an “uncoordinated violence” strategy reflect similar spatial patterns as our preliminary data suggest or was that merely an anomaly due to small sample sizes? Or are there specific group variations of antecedent criminal conduct among groups like the “Family” that can be identified for early intervention?

Furthermore, how long do terrorist groups typically plan a terrorist incident before actually committing it? A “preparatory act,” in addition to discussion of the commission of a terrorist act, is typically required to initiate a conspiracy. Do terrorist groups vary in the length of time they take in preparation for an incident depending upon the category of the group and organizational or tactical structure? Environmental groups such as ELF and ALF moved to an “uncoordinated violence” strategy intended to minimize civil and

criminal liability for ideological leaders. Has the length of time required to plan an incident been reduced due to the lack of coordination between leader and group as these changes might suggest? The 2006 indictment in Eugene, Oregon involving twelve members of the environmental group “the Family” has been added to the cases selected for study. What modus operandi did this group use and did it vary from other environmental group behaviors? Finally, have changes such as this affected the number of preparatory crimes and the complexity of terrorist targeting?

The exploratory nature of this research dictates that we address general research questions rather than specific hypotheses. The schematic diagram on page 14 was used to guide our assessment of these questions. The schematic groups the behaviors of terrorist organizations into four categories: (1) recruitment; (2) preliminary organization and planning; (3) preparatory conduct; and (4) terrorist acts. Examples of some of the types of behaviors are provided for each category. While we recognize that these categories are not exclusive and that they may overlap on occasion, they provide a systematic method to examine the temporal and spatial dimensions of terrorism.

Temporal Issues: One aspect of the proposed research was to examine the temporal and spatial distribution of terrorist group conduct. The examples shown in Figure 1 (p.13) are merely illustrative, not all-inclusive of the issues we examined. For example,

(1) How long do international and environmental terrorist groups typically plan their activities? How much time typically elapses between various phases of terrorist group planning and the eventual commission of terrorist acts (depicted as Time₁ through Time₆ in Figure 1)?

- (2) Are there substantial variations between these two types of groups relative to the length and sophistication of the planning process?
- (3) Does planning initially begin slowly and then culminate in a frenzy of hurried activity immediately prior to commission of the terrorist act? Preliminary findings suggest a lull in activity prior to the commission of the incident, but these findings were based on sample sizes too small to identify group-specific patterns.
- (4) Have the recent environmental terrorism cases signaled a change in strategy among these groups?
- (5) Does the number and type of preparatory crimes and activities substantially differ between international and environmental terrorists?

Geographic Issues:

- (1) Are terrorist groups or cells more likely to emerge near the locations where recruitment and indoctrination occur? Among international terrorists, cells indigenous to the United States have emerged close to mosques where extremist violence was being advocated (e.g., the “Lackawanna Six,” and the first WTC attacks). Among environmental terrorists, important new cases in the past two years may provide clues regarding how these offenders have behaved on this dimension.
- (2) Once international or environmental terrorist groups emerge in a given locale, do they commit their preparatory acts near their “home base” or select other jurisdictions to avoid drawing attention to their group? The preliminary patterns suggested this to be the case, but more data was needed to confirm this finding.
- (3) How far from the epicenter of the terrorist groups’ organizational and planning activities are most of the terrorists’ targets? As a corollary, do terrorist groups

commit their preparatory acts in remote locations far from the actual terrorist target?

Once again, preliminary data suggested that planning activities and targeting occur in the same general area, but additional cases were needed for adequate sampling.

In summary, we explored the relationship among types of international and environmental terrorist groups on the following issues:

- (1) *The relationship between antecedent conduct and the commission of actual acts of terrorism:*
 - (a) to determine the number and types of antecedent crimes associated with the commission of various types of terrorist incidents;
 - (b) to determine whether patterns of structured behavior exist that might provide “early warning” for local law enforcement agencies of impending/planned terrorist incidents.
- (2) *Identified temporal sequencing regarding how long terrorist groups typically take from (a) the initiation of preparatory acts, (b) to final preparatory offenses, (c) to commission of the terrorist incident.*
- (3) *Assessed the geographic relations among the four dimensions of terrorism identified in Figure 1, (p.13) for international and environmental groups that have committed acts of terrorism in the United States.*
- (4) *Conducted preliminary examinations of:* (a) the effect of organizational structure on temporal and spatial patterns of behavior; (b) the types of antecedent behaviors most frequently noted by prosecutors; and (c) the relationship between time and space in terrorist group planning.

III. METHOD

TERRORISM DATA

Until recently, empirical data on terrorists, terrorist activities, and terrorism incidents has been greatly lacking. The current research attempts to add to a growing body of empirical data on terrorism. It expands on previous efforts by the Terrorism Research Center in Fulbright College at the University of Arkansas by focusing on two terrorism categories— international and environmental. The basic underlying data source and foundation was the American Terrorism Study (ATS) that began in 1988, and the previous NIJ project “Pre-Incident Indicators of Terrorist Activities” (PITA) under grant #2003-DT-CX-0003 completed in October 2005. These projects form the base data, structure for research, and findings to further investigate spatial and temporal patterns.

The ATS began in 1988, was later funded by the National Institute of Justice (NIJ) under grant #1999-IJCX-0005 and is currently funded by the Oklahoma City National Memorial Institute for the Prevention of Terrorism (MIPT) under grant #106-113-2000-064. Access to much of the ATS data is provided through MIPT’s Terrorism Knowledge Base at <http://www.tkb.org>. The information in this database results from the examination of indictments, sentencing memoranda, and other federal court records from FBI investigations into terrorism (Smith 2003a). The project is managed by the staff at the Terrorism Research Center in Fulbright College at the University of Arkansas, in collaboration with Dr. Kelly Damphousse at the University of Oklahoma; with analytical support from the Center for Advanced Spatial Technologies (CAST) at the University of Arkansas.

The ATS database contains demographic variables for almost all federally indicted terrorists over the last two decades. In addition to basic demographic and legal information, spatial variables, including known operational bases and primary and secondary targets are found in the database. These data provide a starting place for the selection of case studies for inclusion in this research. The database contains information on over 700 individuals from about 68 terrorist groups.

Utilization of this database as the primary data source mandates that the definition of terrorism used in the project be synonymous with that of the Federal Bureau of Investigation. The FBI, in turn, adheres to the definition of terrorism provided in the Code of Federal Regulations (28 C.F.R. Section 0.85). This document defines terrorism as “the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives” (Federal Bureau of Investigation, 1999:1).

The PITA project expanded on the ATS dataset in order to obtain a sample of cases with sufficiently fertile data large enough for analysis. However, additional cases or incidents beyond those investigated under official FBI terrorism investigations were needed. These additional cases were selected based on criteria that were included as salient characteristics of the FBI definition: (1) that the behaviors (incidents) were unlawful; (2) that the incident involved the use of force or violence against persons or property; and (3) that the act committed by the individual or group was politically motivated. In addition, politically motivated protests that turned violent, such as riots or other actions that resulted in damage or injury to persons, were excluded.

The FBI further divides terrorism into two main categories: domestic and international. Domestic terrorism is further divided into left-wing, right-wing, and single-issue terrorism. For consistency, our project retained these distinctions. For most of the cases studied, the FBI had already categorized incidents into these groupings in listings provided to the American Terrorism Study. New cases selected for analysis were placed into these categories, utilizing the FBI's practical application of "left-wing," "right-wing," "single issue" as closely as possible. The single issue category has been further broken down into "single issue- abortion, and single issue- environmental." While these categories are not mutually exclusive (e.g., single issue terrorists such as abortion clinic bombers may also be characterized as "right wing"), the distinctions provide a commonly understood conceptual framework from which to initiate analysis.

CASE STUDY SELECTION FOR THE CURRENT PROJECT

The "pre-incident indicators" pilot project revealed that: (1) sufficient open source data on preparatory conduct was available, and (2) that geospatial and temporal patterns were emerging. The current project was tasked to collect additional data on the two areas where patterns appeared most promising – international and environmental terrorism. Selection of the cases to be included in the data requires some explanation to avoid confusion regarding the unit of analysis. We use the term "case study" somewhat loosely. In this project, a "case study" merely represents the starting point from which data analysis began. We have chosen to use the term case study because in most instances we began with a federal criminal *court case* that had been identified by the FBI as resulting from indictment under the FBI Counterterrorism Program.

⁸ These "starting points" or "case studies" were compiled by another panel of subject matter experts (SME's) and Terrorism Research Center personnel. These experts included Ron Arnold,

⁸ See Footnote 1.

environmental extremism; Jonathan White- international terrorism; Bill Dyson, BJA's State and Local Anti-Terrorism Training Program; Brent Smith, domestic terrorism; and Kelly Damphousse, database management and domestic terrorism. These SME's provided knowledge on specific incidents for data collection and synthesis of analysis on the groups.

In some instances, the panel recommended data collection on a "case study" that represented a single known terrorist incident that was deemed worthy of investigation. In other instances, federal criminal cases were selected that involved several members of a group indicted for multiple acts or prevented acts of terrorism. Although these case studies represent the initial starting point for data collection, the "case study" is not typically used as a unit of analysis. The "terrorist incident" or "prevented incident" was the primary unit of analysis. However, some cases rendered multiple incidents or prevented incidents for analysis.

The original plan was to select 40 or so cases (approximately 20 environmental and 20 international cases) to complement the existing cases from the Pre-Incident Indicators study. However, the SME's agreed on a number of cases that were not in the Terrorism Event Database (TED) that resulted from the PITA project (e.g., ELF/ALF The Family) but which were deemed to be acts of terrorism and for which there was a great deal of open source material available. Regarding "international" terrorism events, we restricted our analyses to cases that reflected attacks against the United States by foreign nationals within the US borders. This decision was largely based on (1) the availability of open source data about the events and (2) the ability to geocode locations. We recognize that these sample selection statistics have consequences relative to our ability to generalize to "all" terrorism. Indeed, we know that many international terrorism attacks against the US occur on foreign soil. *Clearly, caution should be taken in attempting to infer our findings to the population of terrorism attacks.*

Fifty-eight case studies (see Tables 2 & 3) were collected for the project, 30 international, and 28 environmental. Of these, eight environmental and twelve international case studies were reselected from the PITA project due to a lack of data that was divulged during prior data collection. These case studies were felt to be important incidents and warranted more study.

Table 2. Breakdown of International Case Studies by Incidents and Distance Measurement

#	International Case Studies	Incidents with Target Address	Number of Distance Measurements	Incidents Analyzed Spatially	Incidents Analyzed Temporally
1	Abu Nidal Organization	0	4	0	0
2	Al Qaeda Abu Ali	0	0	0	0
3	Al Qaeda Faris	0	3	0	0
4	Al Qaeda Reid	1	0	0	1
5	Al-Gamaa al-Islamiyya Stewart	0	26	0	0
6	David Hemphill	0	8	0	0
7	Egyptian Jihad Haydayet	1	10	1	1
8	Fawaz Mohammed Damrah	0	7	0	0
9	Hamas	0	0	0	0
10	Hezbollah	2	13	1	0
11	Holy Land Foundation	0	0	0	0
12	Ittihad al-Islamiya Walker	0	0	0	0
13	Japanese Red Army	1	47	1	1
14	Jose Padilla	0	6	0	0
15	Lackawanna Six	0	0	0	0
16	MKO	0	0	0	0
17	Millennium Conspiracy	1	1	1	1
18	NYC Conspiracy	5*	35	5*	0
19	NYC Subway Bombing	1*	73	1*	1
20	Omega 7	38	21	4	3
21	PIRA Brennan	0	0	0	0
22	PIRA Johnson	0	59	0	0
23	PIRA McKinley	0	42	0	0
24	PIRA Murphy	0	4	0	0
25	PIRA Murray	1	21	0	1
26	Portland Seven	0	2	0	0
27	Sayed Abdul Malike	0	1	0	0
28	Taliban Ujaama	0	2	0	0
29	Virginia Jihad Network	0	28	0	0
30	WTC 1993	1	55	1	1
	Total	52	468	15	10

Table 3. Breakdown of International Case Studies by Incidents and Distance Measurement

#	Environmental Case Studies	Incidents with Target Address	Number of Distance Measurements	Incidents Analyzed Spatially	Incidents Analyzed Temporally
1	ALF Capitola	1	7	1	1
2	ALF Chicken	1	0	0	0
3	ALF Coronado	9	24	6	2
4	ALF Ellerman	4	14	4	1
5	ALF Ellsworth	1	4	1	0
6	ALF Harjit	0	0	0	0
7	ALF HLS	1	0	0	0
8	ALF Huntingdon	2	4	2	0
9	ALF Tandy	1	2	1	0
10	ALF Wisconsin	4	8	4	0
11	Chatham 5	1	0	0	0
12	Eco-Raiders	3	4	2	2
13	ELF/ALF The Family	20	280	20	18
14	ELF 3	0	0	0	0
15	ELF Blair	4	34	4	1
16	ELF Critter	2	15	2	1
17	ELF Holbrook	2	4	2	0
18	ELF Long Island Arsons	6	33	6	1
19	ELF McDonald	1	2	1	0
20	ELF Parkhill	3	16	3	0
21	ELF Richmond	6	6	3	0
22	ELF Schoppert	2	17	2	1
23	ELF SLC	1	5	1	1
24	ELF SUV	6	12	6	0
25	EMETIC	4	11	3	0
26	Morse Brothers Vandalism	1	2	1	0
27	RCALB	2	0	0	0
28	SHAC	3	9	1	0
	Total	90	513	76	29

Tables 2 & 3 identify the criminal cases that were identified for data collection. The second column lists the number of terrorist incidents (or planned incidents) where a target address could be identified. The 58 case studies generated 90 environmental incidents and 52 international incidents. Of these 142 incidents, we were able to make nearly a thousand spatial measurements (513 environmental and 468 international). These measurements included residence to target, residence to preparatory acts, and preparatory acts to target distances. In our rose diagrams shown in the results section, measurements involving *incidents* were limited to 76 environmental terrorist incidents and 15 international incidents. For international cases, the lack of incident measurements is due primarily to early FBI interventions that resulted in no specific target being identified. These seventy-six environmental and nine international “incidents” become the basic unit of analysis in measurements where measurements to a known *target* were required.

The last column of Tables 2 & 3 identifies the number of cases that generated sufficient data for temporal analysis. While geospatial measurements could be made from residence to preparatory crime without having an actual target location, temporal measurements were somewhat more difficult. We wanted to measure the entire length of the planning process. Consequently, we decided not to include cases in the temporal analysis unless we knew the date of the incident or exactly when a prevented incident was planned. Therefore, temporal measurements were limited to 29 environmental incidents and 10 international incidents. Over two-thirds of the temporal measurements among environmental incidents involved the group known as the “family.” However, as will be discussed later, their temporal patterns were very similar to the other environmental incidents measured.

VARIABLE SELECTION

Collecting data on terrorism incidents requires a set of variables for the coding of information pertaining to the specific incidents. A large set of variables was needed to encompass the many aspects of terrorism incidents and precursor activity leading up to the incidents being studied. For the purpose of this research over 160 variables were selected for coding of information into relational database tables. Each table provided a storage place for inputting information that would enable spatial analysis of the incident. The database tables are listed in Table 4.

Table 4: GATA project variable breakdown

Data Table	Number of Variables
Person (persons involved in the events or court cases surrounding the terrorism incident)	34
Event (preparatory activity, planning, incidents)	27
Organization (groups, cells, above ground organizations)	17
References (information about the sources from which data was coded)	27
Address (Address information for people, events, and organizations, and targets)	28
Affiliations (information about person, group, and organizational memberships and affiliations of individuals)	17
Target (variables on the targets of terrorist acts)	14
Total	164

The bulk of the data are coded into three main tables: *Person*, *Event*, and *Organization*. The remaining tables function as storage for additional data directly relating to records in the main tables. These include the *References* table for inclusion of all references used to code the data; the *Address* table for storage of all spatial data relating to a person, organization, or event; the

Affiliations table to store links between persons and organizations; and the *Target* table for data collected on the targets of terrorist acts. The three main tables are described below.

The *Person* table contains basic demographic variables on each individual involved in the terrorism incident. The known address or multiple addresses, if available, are included in the variables in this database. Demographic information such as age, race, gender, education, income, profession, and marital status provide an in-depth look at the individuals responsible for terrorist acts.

The *Event* table stores information on the antecedent activities and incidents related to each case study. For the purposes of this research the *Event* table was coded to define what type of an event took place. This division of the data into different types of events resulted from the need to measure the temporal and spatial differences in the terrorist planning process. Coding all of the events into one table allows a timeline to be created of the events that took place prior to the terrorism incident. This also allows for divulgence of events previously thought to be incidents, but which were instead pre-cursor activity to a larger event.

The *Incident* variables consist of basic information about the terrorism incident such as name of the incident target, address of the target of the incident, and whether the incident was prevented or occurred. A large number of terrorists are captured prior to the execution of a terrorism incident and thus some incidents in this study did not occur, but information is known on the location and time of the events that were planned. These incidents are coded as such in order to allow selection for analysis. In addition, the names of the individuals involved in the terrorism incident are included as well as information on destruction of property, and persons killed or wounded.

The *Antecedent Activity* variables consist of information on antecedent activity conducted by terrorists prior to the terrorism incident. This activity includes both criminal and non-criminal conduct. Research conducted as part of the American Terrorism Study shows that terrorists commit scores of crimes such as identity theft and theft of property and money in order to carry out a terrorism incident. The antecedent activity is broken down into three types— planning, preparatory, and ancillary. Planning activity is defined as “events that involve planning for the upcoming incident” and includes events such as meetings and phone calls. Preparatory activity is defined as “actual acts carried out by a terrorist as part of the planning process of a terrorism incident.” This activity may include both criminal and non-criminal conducts. It may include robberies, identity thefts, surveillance etc. Ancillary activity includes “activity carried out by a terrorist, but not in direct preparation for an incident.” This activity may include the murder of an informant in order to protect the secrecy of the plot, robbery to sustain an underground lifestyle, or other order/maintenance crimes.

The *Organization* table contains information on organizations that were linked to the case study or whose terrorists were related to the case in some manner. *Cell* variables consist of data that relate to the group of individuals who carried out the terrorist incident. There is not always a terrorist cell involved in an incident so this database is only for inclusion if a cell is present. Terrorists that commit a terrorism incident may be a part of a larger terrorist group, but act as a smaller unit for the execution of plans for a terrorism incident. The information in this table describes the structure and dynamic of this group. The *Group* variables specify what known terrorist group(s) with which the individual(s) that carried out the terrorism incident may have been affiliated. The majority of the terrorists in this study were members of a larger terrorist group through which they carried out the agenda of the organization. A few of the terrorists are

considered “lone wolves.” No group information is included in this table for these individuals. The *Above Ground Organization* variables exist to link the terrorists to possible legal organizations that could be providing ideological, psychological, or even financial support in some way. The information collected could be important in understanding basic ideological issues of terrorism behavior.

DATA COLLECTION

Data collection focused on a case study of a terrorist group or incident. If the case study consisted of a terrorist group, then one or more incidents may have been selected for collection of data. If the case study was a single incident, then only information on that incident was collected. This was due to the fact that some terrorism incidents were carried out by individuals that had no formal ties to a terrorist group. In some cases, however, the terrorist groups studied conspired to commit a series of terrorist incidents.

The case studies and collection of data on the terrorism incidents were conducted by staff at the Mercyhurst College Institute for Intelligence Studies (MCIIS) in Erie, Pennsylvania. MCIIS personnel under the direction of Mr. Robert Heibel collected data from open source materials such as federal court records, books, newspaper articles, and interviews. Staff at the University of Arkansas created the structure of the Oracle 10g relational databases and instructed the Mercyhurst staff on coding of variables and the method associated with the research. Terrorism Research Center staff also worked directly with Mr. Heibel and his research group in order to collect additional data, and provide support on methodological issues, and implementation of procedures.

The data collection concentrated on three main areas of investigation: residences, antecedent activities, and incidents. The data resulting from this investigation were input to an Oracle 10g relational database. Two of the tables in the relational database were primarily utilized for containing data for spatial and temporal analysis. First, data on the terrorism incident were compiled in the D_EVENT table. This included information such as the incident's geographic location, time of occurrence, incident type, and the person(s) involved. Second, data on the person(s) involved in the incident were acquired in the D_PERSON table. These included basic demographics, places of residence, prior criminal history, etc. Finally, acts that the individuals performed or were associated with were also recorded in the D_EVENT table. These included meetings and trips for information gathering, as well as preparatory and ancillary acts. The acts of individuals not indicted, but associated with the incident, were also studied. The temporal aspect of the case study included all activity from the known time of occurrence for the terrorism incident and working backward to the earliest activity that could be identified relating to the incident. This time period would be assumed to encompass the extent of planning by the terrorist or terrorists.

DATABASE AND GIS DEVELOPMENT

The spatial and temporal data from the activities of the terrorists in the case studies were entered into an Oracle 10g relational database and then analyzed using Oracle's spatial package, MATLAB, and Google Earth. The data from the case studies was managed using Oracle 10g, which allows for seamless integration into MATLAB and Google Earth. The Oracle 10g platform allows for efficient data management and analysis through its unique architecture system. This allows integration of the spatial data into a GIS type environment contained completely within the database software. The software stores the spatial data in tabular form and

can output queries based on a determined field to other software for graphic display. This allows analysis of distances between points and an output for presenting the data in an efficient and easy to understand manner.

Distances and directions referenced in this report were computed using Oracle Spatial 10gR2. Each residence and event with a valid known address was assigned a latitude/longitude coordinate on the WGS84 datum coded using the NavTech street database through www.batchgeocoding.com. The geocoding process assigns an “x and y” value for each spatial point representing an event leading up to the terrorism incident. This “x and y” value is placed on a map using a predetermined coordinate system that allows the measurements of distance in a specified unit. These features were then displayed graphically on a base map such as a map of a city or county. Distances between associated events and between associated events and residents were then computed along the ellipsoid. Likewise, directional measurements reflect the forward geodetic azimuth from the antecedent event to the incident or from the residence to the event. By working on the WGS84 ellipsoid, we avoid distortions introduced by various map projections. Once geocoded, the data is migrated back to the Oracle 10g database and joined with associated address records. KML files may also be output from the geocoding service. Once brought into Google Earth these files can be displayed in a variety of formats. The base map allowed for the overlay of layers that contained information such as roads, rivers, and buildings. This allowed for presentation of these data so that a person would be able to recognize the location where an incident takes place. The software allows for overlay of a large number of layers.

DATA ANALYSIS

The primary unit of data collection for this research was a “*case study*,” but the primary unit of analysis was a *terrorism incident*. Some case studies were split into multiple incidents that may involve similar events or persons, but these were split into separate incidents for analysis. An example would be a series of bombings that a group carried out over the course of several years. Each bombing was an incident with its own precursor activity. Some of the precursor activity may have been related to more than one incident; thus allowing each antecedent behavior to be linked to each incident with which it was related. The incident provided the basis for the case study which encompassed information about the precursor activity leading up to the terrorism incident. Each terrorism incident consisted of a single act of terrorism such as a bombing or hijacking. Almost all of these incidents involved one or more individuals who had been indicted under federal law and deemed “terrorists” as prescribed by the Attorney General Guidelines for FBI Terrorism Investigations.

The precursor activity leading up to the terrorism incident is found in the *Activity* database. This database provided for spatial analysis of preparatory and ancillary activity as described above. The linear distance was calculated between the terrorism incident and all activities that were uncovered through investigation of the incident and inputted into the Activity database. This calculation allowed for determination of distances between the location of the terrorism incident and precursor activity. In addition, the residences of the terrorists involved in the terrorism incident were included in the spatial analysis in order to divulge potential relationships between the location of the terrorism incident, precursor activity, and terrorist residences or operational activity centers. Once again the number of case studies eventually included 30 international and 28 environmental cases.

The method for choosing case studies for analysis was based on the amount of open source materials available for data collection. Case studies that could potentially yield large amounts of spatial data were chosen by looking at the amount of information available on each incident in order to provide enough data for comparison within and between the designated categories. For the purposes of this research, 203 incident locations from the selected case studies were eventually identified.

Incidents selected for final analysis included those where a specific geographic location could be identified for the occurrence or planned occurrence of the terrorism incident. For a few of the incidents an address could not be found. In these cases, the centroid of the zip code of the city that the event was located was used in calculating distances. Since using these city centers potentially could skew the data, a method was established for determining when a city center could or could not be used. For example, if the diameter of the city for which the location of the incident was placed in its center was greater than 10% of the distance being measured, then the incident was not included for analysis. By using this 10% rule, the potential for skewed data is greatly lessened and still allows for meaningful results and comparison.

The spatial analysis consisted of Exploratory Spatial Data Analysis (ESDA) using standard spatial statistical methods. Anselin (2000:26) describes this methodology as “a collection of techniques to describe and visualize spatial distributions; identify atypical locations or spatial outliers; discover patterns of spatial associations, clusters, or hot spots; and suggest spatial regimes or other forms of spatial heterogeneity.” The methods include the analysis for patterns in spatial variance among related activities. The distribution of incidents across the United States yields vital information regarding where concentrations of terrorism incidents have

occurred in the past. Such questions as whether terrorism incidents are concentrated in rural or urban areas are easily answered. On a larger scale, patterns within cities are possible to determine by looking at the spatial distribution of all the points involved in a given terrorism incident. By displaying all of the available points on the map derived from spatial data housed in the relational databases, it is possible to determine a terrorist “routine activity” space for the time period of the incident planning process. For the purposes of this research, basic patterns are divulged through the analysis of the linear distances between points within a specific incident, a specific category, or terrorism incidents as a whole.

The spatial analysis from which relationships and patterns can be derived consists of the measurement of the linear distance between points that represent terrorist activities, residences, and the location of the terrorism incident itself. Three different calculations of linear distance were taken for each incident. First, the linear distance from the terrorist incident to the terrorist residence was calculated. For incidents that involved more than one individual the distance was measured to each terrorist residence that was involved in the terrorism incident. The linear distance from incident to residence was then calculated and the mean distance from all residences to the incident was recorded. This value was used in representing the incident-residence measurement for analysis. The second measurement is the incident to activity linear distance. The same methodology as stated above applies to instances where more than one activity occurred relating to a terrorism incident. The mean was once again used as the value to represent the incident-activity value for analysis. The third major measurement is the linear distance calculation between terrorist residences and activities. In this case it often occurs that there are multiple residences and multiple activities that relate to a specific incident. In these cases, the measurement was calculated from each point of residence to each activity and vice

versa. This allows for averaging the values to derive a mean distance for the residence-activity analysis.

Problems encountered in both the coding and analysis of residence data affect the reliability of the information. In cases where multiple addresses were found for individuals (such as homes, apartments, staying with friends, hotels, campgrounds, etc.), these locations present a methodological problem for determining which is to be used for the “residence to incident” measurement. If it was known that an individual was staying at a particular location in accordance with a specific incident then that location was used. If multiple locations exist for a terrorist residence and information was not found pertaining to when the individual was staying at the residence then problems arise. Without specific court documentation or interviews with the individuals, it cannot be known for certain at which location the individual was staying. This could induce error into the process of analysis. This issue was addressed by giving the residence locations a descriptive name and using the most likely location given the data available. By coding these residences as such, it allows further study of this matter in the future if/when more information becomes available. This also allows other researchers to recode and explore the possible differences.

Temporal analysis was conducted on an incident basis and was completed for case studies where dates were available for both incident and antecedent activities. Where available, specific hour, month, day, and year were coded for each activity. However, not all of the temporal data was available for each activity so the day of the activity was used in the calculations. Hour data would have been ideal, but this proved the hardest temporal data to collect. In some cases, we were not able to find the exact day for a specific activity and only a month was known. In these

cases, depending on the length of time between the activity and the incident, the middle day of the month (15th) was used in the calculations. This was only done in cases where the timeframe was longer than several months. This was done in order to avoid adding a large degree of error into the calculations. Excel spreadsheets were created from the Oracle tables containing the temporal data and calculations were conducted.

DATA PRESENTATION

The results of this research are available in a variety of formats. Spatial data results are output as rose diagrams, histograms, and Google Earth KML files. Due to the nature of Google Earth software, interactivity with the data is possible. The geocoded points converted to KML files allow a user to graphically portray the data in a variety of visual formats allowing for analysis and presentation. These data can be accessed and displayed on a map through spatial or attribute queries. For example, a user can choose to look at and analyze patterns for all of the terrorism incidents in a specific state or region of the country through a spatial query. The temporal data was output to Microsoft Visio for creation of antecedent activity charts and timelines for each incident.

IV. RESULTS

Terrorists and terrorist groups operate within the constraints and boundaries of both time and space. One common myth about terrorism incidents is that they are random and “can occur anywhere.” While it is true that they *can* occur anywhere, the probability of their occurrence in specific locations varies widely (Davis et al., 2004). In many ways both the indiscriminant and spontaneous nature of terrorism has been overemphasized. Terrorist incidents do not materialize out of “thin air” -- they require time to plan, meet, procure and prepare explosive devices, and travel time to and from the selected target. These events are further constrained by the distances among the residences of the terrorists, where they meet and plan, where they procure or manufacture their explosives, and the distance to the target. In this project, both spatial and temporal issues were examined regarding the planning and execution of terrorist incidents by environmental and international groups.

TEMPORAL PATTERNS OF ENVIRONMENTAL AND INTERNATIONAL TERRORISTS

Temporal measurements were made at four points during the planning process: (1) when the terrorist(s) were recruited as members into the terrorist group; (2) when the terrorist “cell” originated, usually measured as a function of the first planning meeting; (3) when preparatory acts occurred; and (4) when the actual terrorist incident occurred or, if it was preempted or prevented, the date that it was planned to occur. Temporal measurements proved to be the most difficult to identify in the original study. In the current study, additional effort was made to locate and quantify the times and dates of antecedent conduct among these groups. Despite these efforts, some events were substantially more difficult to measure than others. For example, temporal information regarding when various members joined specific terrorist groups remained,

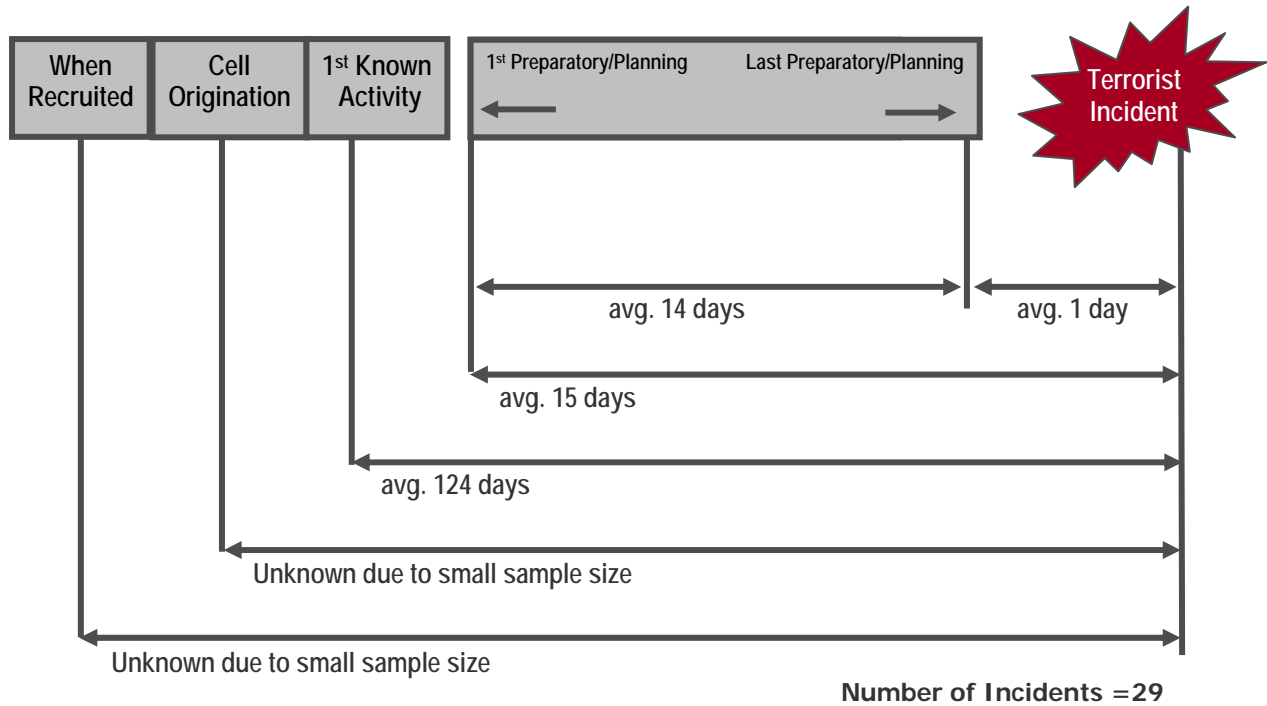
in large part, non-existent. If this information was located, it was frequently provided in units of measurement that were so large (e.g., years) that calculations were unreliable. The volume of temporal data collected, however, clarified and strengthened preliminary findings from the original study. It should be noted that temporal patterns are always difficult to establish, as each method of measurement has specific weaknesses. For groups with greater longevity and groups that committed multiple acts of terrorism, it is difficult to ascertain start and stop dates for specific events due to overlapping activities. Although comparisons between environmental and international cases will be made in the following discussion, for clarity, discussions of the patterns of environmental and international incidents are provided separately. Within each section, separate subsections address each of the relevant research questions.

It also should be noted that the analysis presented below includes only cases where: (1) the date of a planned incident was known or the incident actually took place; and (2) adequate information was available to identify precursor activity. Consequently, a number of pre-incident activities are not included in the analysis because a known end-date was not available. This was particularly true of international cases, where the FBI was able to intervene before the incident occurred or an actual date for the incident was identified. The reverse is true of environmental cases. We had a number of environmental incidents where no pre-cursor activities could be identified. The elimination of incomplete data for the temporal analysis attenuates our results. Consequently, the divergent temporal patterns that we identified for international and environmental terrorists are probably even greater than we observed in our measurements.

Temporal Patterns of Environmental Terrorists: Despite a lack of information regarding recruitment, sufficient temporal data existed to identify basic patterns of preparatory conduct.

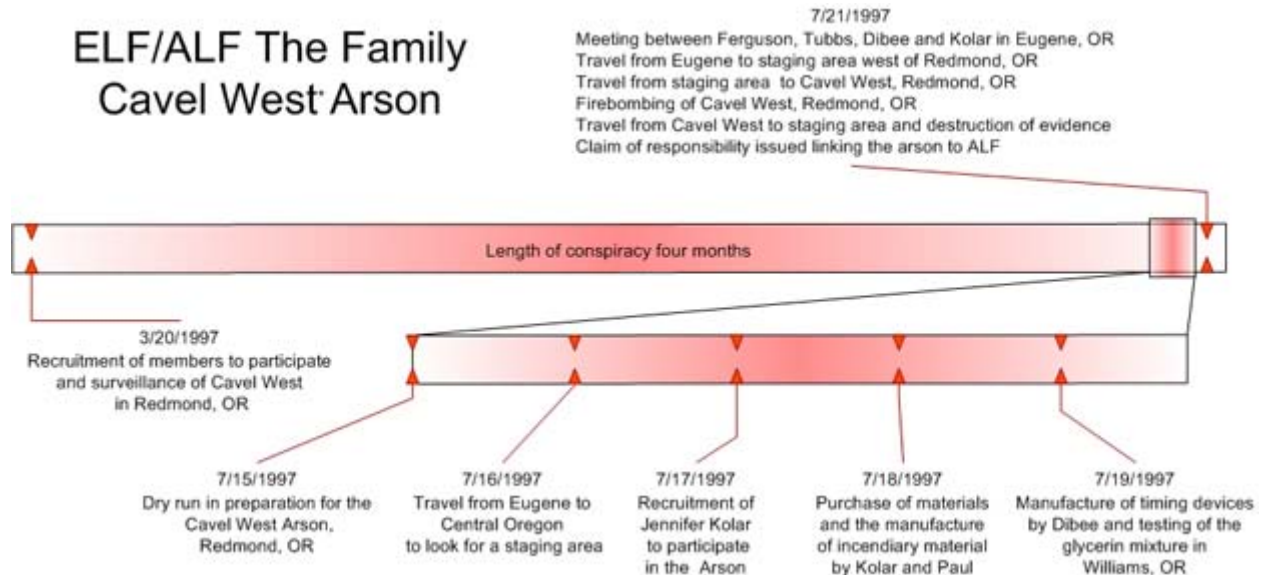
The single most prominent pattern that emerged regarding environmental terrorists is that they are much more spontaneous than other types of terrorists. For groups adhering to an “uncoordinated violence” approach to terrorism, this was highly expected. Adopted by many terrorist groups in the early 1990s, uncoordinated violence emphasizes lone activities, greater commitment by “true believers,” and fewer contacts between the leaders of extremist movements and those who engage in terrorist actions. Uncoordinated violence is exemplified by the extreme rights’ use of “leadless resistance,” Islamic extremists’ use of the “fatwah,” and violent anti-abortion activists’ use of internet “hit-lists.” Animal Liberation Front (ALF) and Earth Liberation Front (ELF) extremists adhered to a similar strategy, encouraging individual adherents to undertake “direct actions” without supervisory guidance or direction. All of these efforts are intended to minimize civil and criminal liability for group leaders. Use of this tactic should result in fewer and smaller conspiracies, less contact among participants, and generally fewer preparatory activities.

As expected, the planning process was remarkably short for most of the environmental incidents and the number of antecedent (preparatory and planning) behaviors associated with the terrorist incident was less than for other types of terrorist groups previously studied. The first known activities of the group took place approximately four months prior to the incident and the first known planning and preparatory behaviors occurred only 15 days prior to commission of the terrorist incident. This is generally consistent with Rapoport’s (1992) notion that terrorist groups have a life expectancy of less than one year. The lifespan of these “cells” ranged from a few days to more than six years. These basic findings are presented in Figure 5.

Figure 5: Temporal averages of environmental terrorist group activities

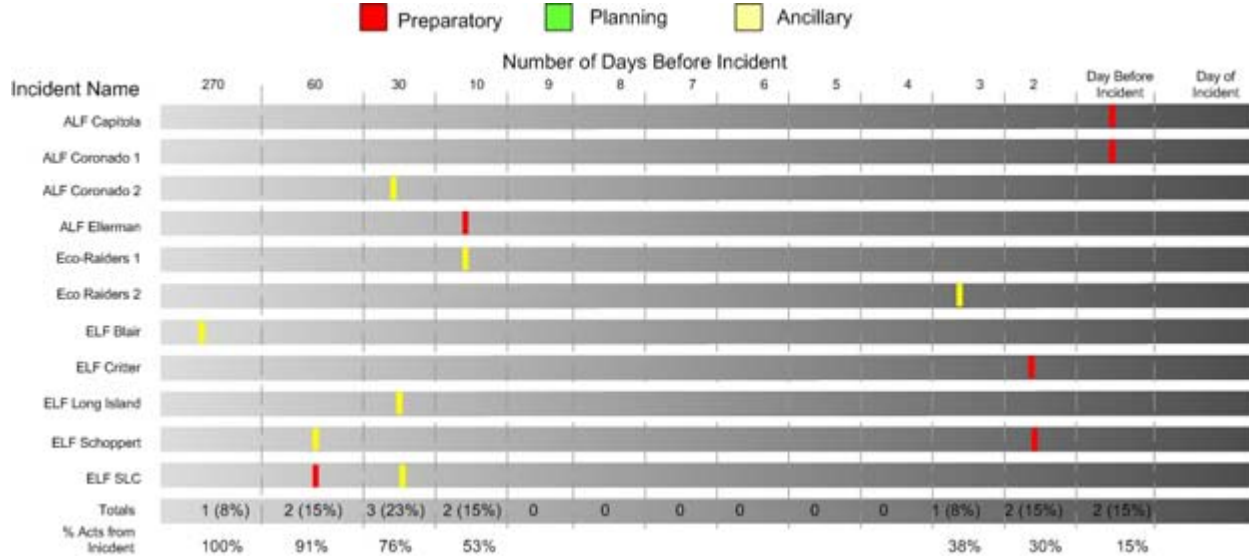
Temporal averages, however, can be extremely misleading due to outliers. Even if the overwhelming majority of incidents fit a pattern, a single outlier can skew average time in such a way as to render the averages meaningless. To overcome this difficulty, temporal sequence diagrams were created for each recorded incident. Figure 6 provides an example of one of these diagrams.

Figure 6. Cavell West Arson Temporal Diagram



All of the recorded events were then placed on a single form that recorded the type of event and the number of days prior to the terrorist incident the event occurred. Figure 7 shows all of the recorded events for the environmental cases with the exception of incidents involving “the family” case.⁹ As this figure shows, over half of the known preparatory behaviors occurred within ten days of the incident and over 90% occurred within 60 days of the incident. Frequently these incidents involved local environmental activists who became “revolutionized” after hearing speeches by nationally known radical environmentalists. In the days and weeks following those speeches, local activists planned and committed attacks on local targets.

⁹ The ELF/ALF “Family” case is the largest environmental case in U.S. history. Consequently, incidents involving this group were analyzed separately. See Federal Criminal Cases CR 06-60069, 70, 71, 78, 79, 80, 120, 122, 123, 124, 125, and 126; United States District Court, District of Oregon for more information.

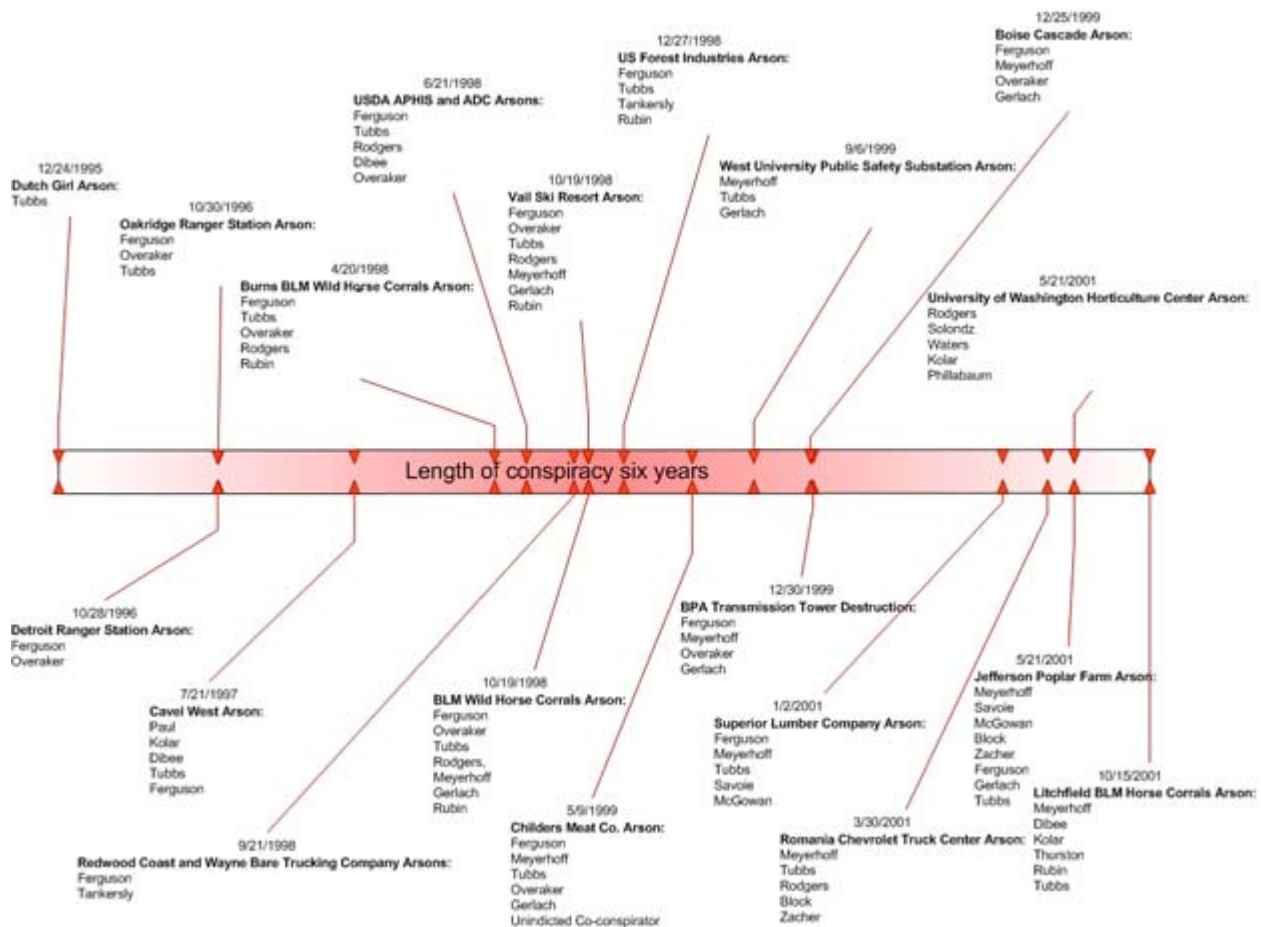
Figure 7. Environmental Antecedent Activity (excluding ELF “Family” Activities)

The destructive level of environmental terrorism soared from 1995-2001. Attacks on federal Bureau of Land Management facilities, university labs, and private enterprises such as lumber companies and ski resorts reached a peak in 1998 and 1999. Many of the attacks were the result of a single environmental group known as the “book club” or “the family.”¹⁰ This group of approximately sixteen individuals engaged in over twenty FBI officially designated acts of terrorism during this seven year period. See Figure 8 for a summary of Family activities during this period. Sometimes acting alone, but more frequently in small groups of three to five, the Family committed the most notorious acts of environmental terrorism in U.S. history. Adopting a “cellular” model in lieu of the more prominent “uncoordinated violence” model advocated by environmental extremist leaders, the Family engaged in training classes to learn sabotage techniques, encryption software, and security measures to minimize infiltration by law enforcement. Consequently, this provided an opportunity to examine if organizational differences between the Family and other environmental extremists resulted in different temporal

¹⁰ Government’s Sentencing Memorandum, CR 06-60069, U.S. District Court, District of Oregon, Eugene, Oregon.

patterns of behavior. Due to its use of a cellular approach, we expected to find that the Family would engage in more planning and preparatory activities and that the planning process would be considerably longer than previously studied acts of environmental terrorism.

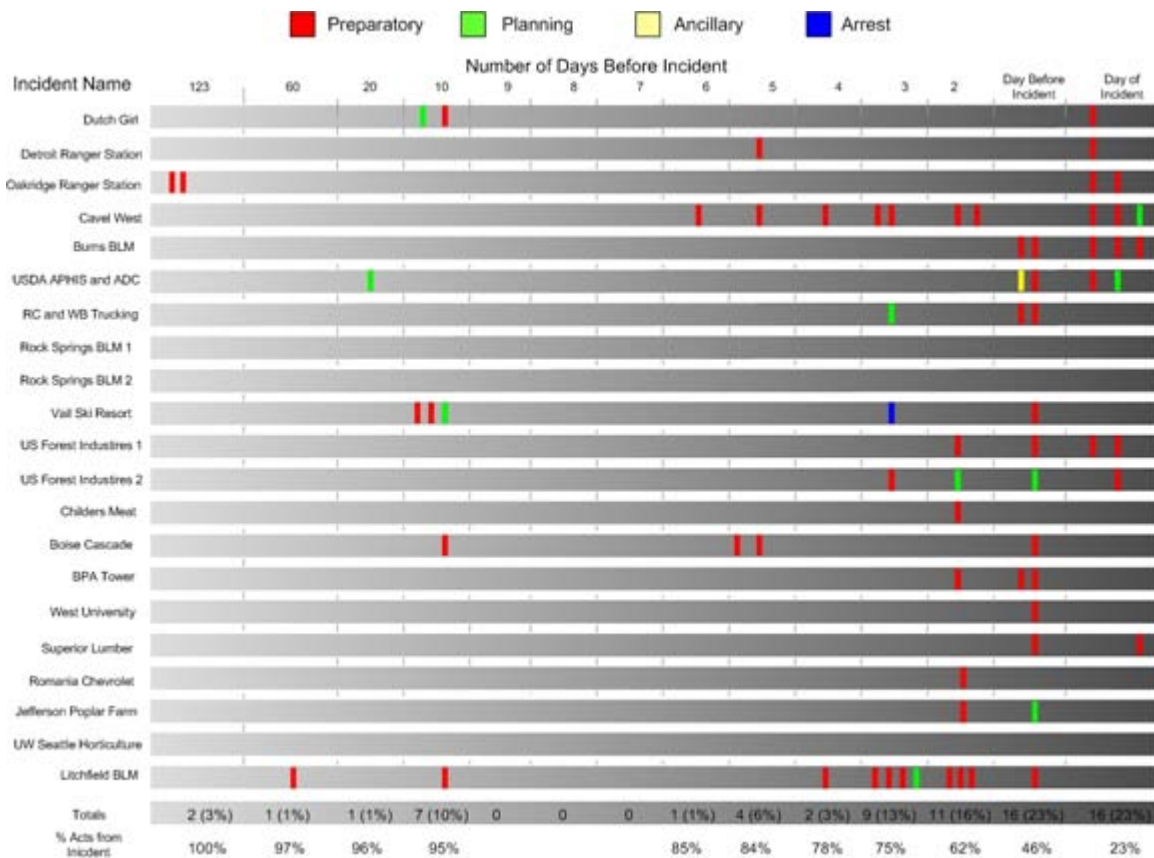
Figure 8. ELF/ALF The Family Incident Timeline



However, as Figure 9 shows, the Family was actually more spontaneous than other environmental groups. Approximately 85% of their known antecedent activities relating to specific incidents occurred within six days of the incident. 95% occurred within ten days of the incident. Most striking is that three-fourths of these activities occurred within the three day period immediately prior to, and including, the day of the incident. These activities typically included purchasing the materials for the incendiary device to be used in the arson. Rather than

transport these materials over great distances, usually these were purchased from a local store, such as a Wal-Mart, in the immediate vicinity of the target. A staging area was selected and the firebomb was usually constructed on site at the staging area the day of, or one day prior to, the bombing. Because the planning sequence was so short and many of the preparatory activities did not involve illegal acts, these tactics gave law enforcement little opportunity to intervene early. However, had early intelligence been available regarding, for example, the purchase of the particular combination of ingredients used in most of their incendiary devices, local law enforcement would have known that: (1) an attack was imminent, and (2) that it would take place in the general vicinity of the purchases.

Figure 9. ELF/ALF The Family Antecedent Activity



A comparison of the Family activities and other environmental cases is compelling in that it revealed that despite differing organizational structures (one being cellular, the other emphasizing “lone wolf” direct actions), the length of the planning process did not vary substantially between these groups. If anything, the Family was more spontaneous than the other cases studied.

Temporal Patterns of International Terrorists: The amount of temporal data available on international cases in the United States is limited for two reasons. First, international terrorism has been relatively rare in the United States compared to other types of extremist violence. Second, the FBI has been remarkably successful in preventing terrorist plots involving international terrorists operating here in the United States. Consequently, while data on the preparatory activities of these groups was available in many cases, early intervention precluded the identification of a projected or actual incident date. Rather than speculate regarding projected dates, the cases have been excluded from the analysis. Only cases where an actual incident date or a projected date for the attack was known are included in the analysis. The basic temporal pattern is shown in Figure 10 below. The small sample size precludes us from making conclusive statements regarding these patterns. However, the differences between the international terrorists in Figure 10 and the environmental terrorists in Figure 5 (p. 43) are enlightening. On average, the first known preparatory activities for the international terrorists was 92 days prior to the incident date compared to only 15 days for the environmental terrorists. Likewise, the last known preparatory behavior among international terrorists was seven days prior to the incident compared to only one day for the environmental terrorists. The data suggest a more extensive planning cycle among international terrorists than among domestic environmental groups. Once again, however, these averages can be misleading. Therefore,

temporal diagrams were also created for each of the international incidents and then compiled on a single timeline.

Figure 10. Temporal averages of international terrorist group activities

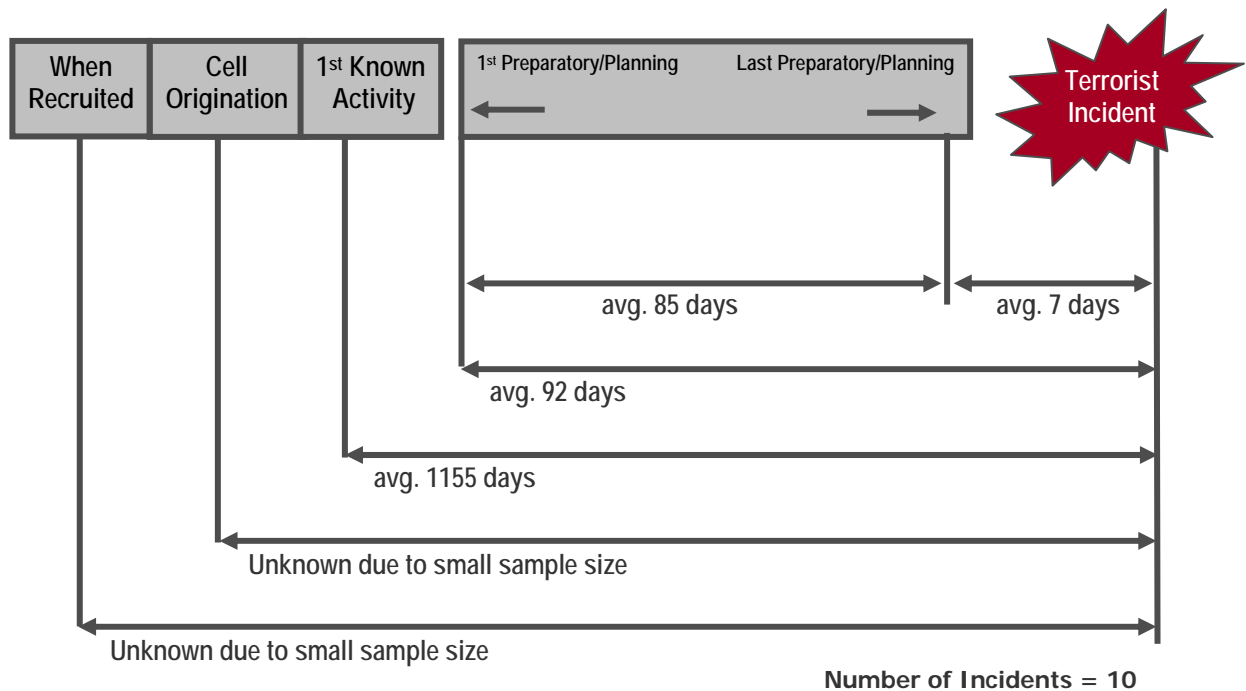
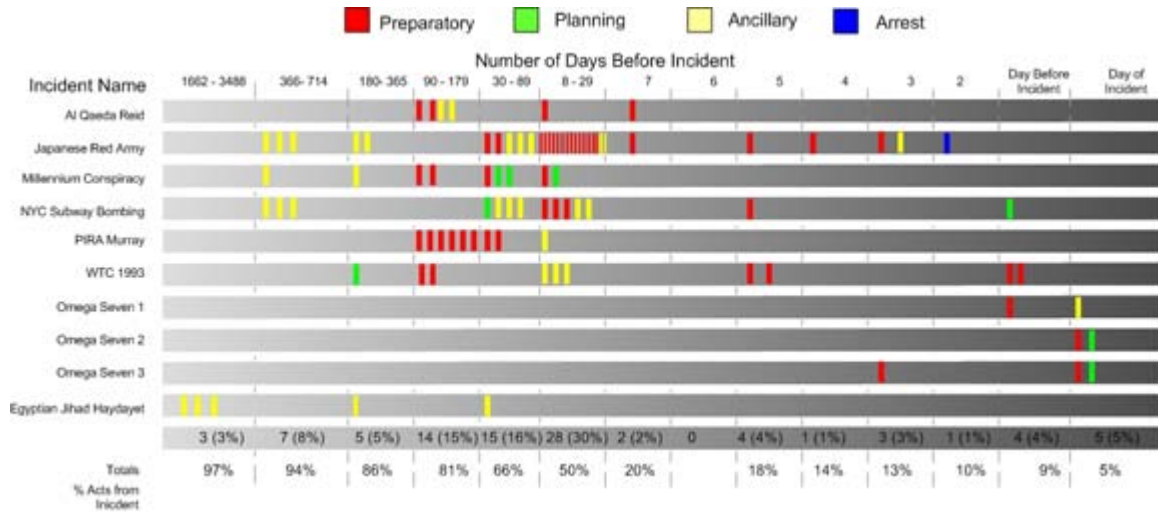


Figure 11 (p.50) supports the “patterns” suggested in Figure 10 above. While 75% of the antecedent behaviors by environmental groups occurred in the three days immediately prior to an incident, only 13% of these behaviors occurred in this same time period among international terrorists. This trend continues the farther back one goes in the planning cycle. At incident minus six days (I-6), 85% of the antecedent conduct of environmental terrorist had not yet been committed compared to only 18% of the antecedent behaviors of the international terrorists. To reach the 85th percentile among international terrorists, one has to retreat to approximately six months prior to the incident. In fact, in most of the international cases studied where preparatory

data could be matched with an incident date, the first known preparatory behaviors began about four to six months prior to the incident.

Figure 11. International Antecedent Activity



Prevalent Types of Antecedent Conduct: Preparatory conduct may include criminal, as well as non-criminal activity. The most common preparatory behaviors included meetings, phone calls, the purchase of supplies and materials, and banking activities, which included everything from bank robbery to fund the planned incident to legitimate withdrawals. Furthermore, some of the antecedent conduct of terrorists may be ancillary – behaviors related to funding the group or maintaining internal security that are unrelated to the planning and preparation of specific acts of terrorism. A summary of these activities is included in Table 5.

Table 5. Summary of activities

Category	Preparatory	Planning	Ancillary	Total Acts
International	104	126	124	359
Environmental	79	15	19	113
Total	183	141	148	472

International terrorists engaged in a significantly larger number of antecedent behaviors than environmental terrorists, despite the fact that they committed fewer terrorist incidents. Each of these behaviors could serve as “pre-incident indicators” to analysts monitoring such activities. However, many of these behaviors, such as buying legally obtainable bomb making components or conducting surveillance on a target, are not illegal. The problems associated with utilizing “reasonable indication” or the existence of a “criminal predicate” (the standards used to determine whether to open an FBI terrorism investigation) may preclude the monitoring of such conduct in the absence of ongoing intelligence investigations. Furthermore, much of the ancillary behaviors may or may not be criminal. These behaviors, however, may attract the attention of the police and could be utilized as pre-incident indicators of terrorist group activity. The breakdown in Table 5 shows types of behaviors committed by international and environmental terrorists that we were able to record and whether these behaviors were associated with “planning and preparatory” behaviors or whether they were merely “ancillary” activities. Nearly one-third (148 of 472; 31.3%) of the activities were ancillary.

Table 6 shows the types of behaviors measured by group type. About a fourth of these activities (126 of 472) involved some form of communications in the form of phone calls, meetings, or letters. Activities associated with bomb procurement, manufacture and testing

accounted for an additional 11 per cent (51 of 472) of the measured conduct. The third most common activity included behaviors associated with research, training, reconnaissance, and surveillance – all activities reflecting intelligence gathering. The remaining activities included the purchase of supplies and materials, banking activities — which included everything from bank robbery to fund the planned incident to legitimate withdrawals, weapons violations, and a variety of non-criminal ancillary conduct.

To determine how many antecedent activities terrorist groups engaged in per incident, another analysis was conducted restricted to the 39 environmental and international incidents where data was fairly complete. In these cases, the international terrorists engaged in an average of 8.3 known antecedent behaviors per incident. Environmental terrorists were significantly less active, engaging in only 3.2 known antecedent activities per incident. The substantially longer planning and preparation cycle of international terrorists resulted in nearly three times as much antecedent activity as the environmental terrorists.

Table 6. Breakdown of major planning and preparatory behavior by type

Category	International	Environmental	Total
Meeting	33	12	45
Phone Call	38	4	42
Letter/Communication	39	0	39
Bomb-Manufacturing	11	14	25
Travel-Car	11	12	23
Bomb Materials – Purchase	10	4	14
Surveillance	4	8	12
Research	8	3	11
Training	9	2	11
Recruitment	1	9	10

Table 6. con't Breakdown of major planning and preparatory behavior by type

Category	International	Environmental	Total
Transportation – Rental	6	1	7
Bomb Materials – Acquire	3	4	7
Travel	6	0	6
Procurement of Funds	5	1	6
Travel – Air	5	0	5
Reconnaissance	2	3	5
Money Transfer	5	0	5
Final Preparation at Staging Area	0	4	4
Weapons – Acquire	4	0	4
Transportation – Purchase	2	1	3
Bomb Materials – Theft	1	2	3
Armament	3	0	3
Weapons – Purchase	3	0	3
Weapons – Testing	3	0	3
US Entry – Illegal	1	1	2
Vandalism	0	2	2
Group Formation	0	2	2
Establish Residence	2	0	2
Communiqué	2	0	2
Obtain Visa	2	0	2
Conspiracy	2	0	2
Transportation – Theft	1	0	1
Bomb Materials – Transport	0	1	1
Bomb – Testing	0	1	1
Check in Hotel	0	1	1
Equipment – Testing	0	1	1
Equipment – Gathering	0	1	1
Threat	0	1	1
US Citizenship Filing	1	0	1

Table 6.con't Breakdown of major planning and preparatory behavior by type

Category	International	Environmental	Total
Fraud – Insurance	1	0	1
Identification Theft	1	0	1
Return from Travel	1	0	1
Smuggling	1	0	1
Money Laundering	1	0	1
Assassination	1	0	1
Totals	229	95	324

Labeling specific overt acts as criminal or non-criminal can be problematic. Many acts, when counted independently, might not be criminal, but when considered as overt acts of a broader conspiracy, they become part of larger criminal activities. Table 7 shows a breakdown regarding whether specific acts would have constituted criminal or non-criminal conduct. We estimated that nearly two-thirds of the measured behaviors (62.3%; 294 of 472) involved non-criminal conduct. Furthermore, there was little variation between international and environmental terrorists regarding this ratio. Non-criminal conduct accounted for 65.5% of the measured environmental terrorists behaviors compared to 61.3% of the international terrorists conduct.

Table 7: Breakdown of activities into crimes/ non crimes

Category	Crimes	Non-Crimes	Total Acts
International	139	220	359
Environmental	39	74	113
Total	178	294	472

Despite this, 178 behaviors were recorded that reflected overt criminal conduct. A summary of these crimes is provided in Table 8. The most common of these crimes (46.6%, 83 of 178) involved overt acts associated with broader conspiracies. Conspiracies do not frequently become known to law enforcement agencies until after the completion of the act or other arrests are made. Consequently, many of these behaviors, such as meetings and phone calls, may not come to the attention of local law enforcement agencies. The other half of these crimes involved “observable” offenses which might lead the police to suspect more sinister activities. The most common crimes committed by environmental terrorists involved conspiracy and the acquiring, manufacturing, or testing of bombs. In contrast, international terrorists engaged in a much broader range of criminal conduct. Their most common criminal offenses included conspiracy, bomb acquisition or manufacture, training, illegal trade, fraud, illegal entry into the United States, weapons violations, and smuggling. The manufacture and testing of bomb making materials constituted the most common “overt” criminal conduct among both environmental and international terrorists. Although these environmental terrorists committed few preparatory criminal behaviors other than this, international terrorists violated a much broader range of criminal laws. The breadth and diversity of the pre-cursor crimes committed by the international is a distinguishing feature among these types of terrorist groups.

Table 8. Breakdown of activities by crime type

Category	International	Environmental	Total
Conspiracy	70	13	83
Bomb Materials Manufacturing/Testing	11	16	27
Training	14	1	15
Illegal Trade	11	0	11
Fraud	11	0	11
Illegal U.S. Entry	9	1	10
Weapons Violations	5	0	5
Smuggling	4	0	4
Larceny/Theft	2	2	4
Trespassing	1	2	3
Murder/Manslaughter	2	0	2
Motor Vehicle Theft	2	0	2
Evidence Disposal	2	0	2
Threat	0	1	1
Vandalism	0	1	1
Terrorist Financing	1	0	1
Bomb Materials Transport	0	1	1
Money Laundering	1	0	1
Totals	146	38	184

SPATIAL PATTERNS OF AMERICAN TERRORISM

In this subsection, we review the spatial patterns of terrorists' behavior resulting from the analysis of the data using Oracle 10g Spatial package, The Mapworks Inc. MATLAB7, and Google Earth software. Our initial concern was the availability of geocodable data on residences, planning locations, preparatory activities, and terrorism incidents. As it turned out,

our research team was able to geocode 1,430 records of data. As shown in Table 8, however, there was great variability in the quality of the available data which affected our ability to geocode each category of activities.

Table 8. Geocoding success rate for each type of terrorist activity*

Types of Data Collected	Records Collected	Records Geocoded	% Records Geocoded
Residences	415	379	91%
Antecedent Activities	708	469	66%
Incident Locations	227	203	89%
Total	1350	1051	78%

*excludes 80 additional activities such as post-incident, communiqués, arrests, etc.

The locations of activities where geocoded either to a street address level (843 or 62%) or a zip code level (493 or 38%). The residences and incident locations had the best geocoding success rate with over 200 incident locations identified. This was to be expected since targets are often described in explicit detail in open records like indictments. In addition, we were able to find addresses for almost 90% of the residences. Unfortunately, we were less successful with mapping antecedent activities. Again, this is not so surprising. Open source records commonly reported that “a meeting took place” but there was no record of where the meeting occurred. Rather than trying to estimate these locations or to impute any of these missing values, we treated them all as missing data and assumed that the error is random.

Once we gathered all of the geocoded information possible, we created a series of “rose diagrams,” a technique that allows the user to plot distance and direction from multiple points of the same type. Rose diagrams allow us to visualize spatial patterns concerning distance and

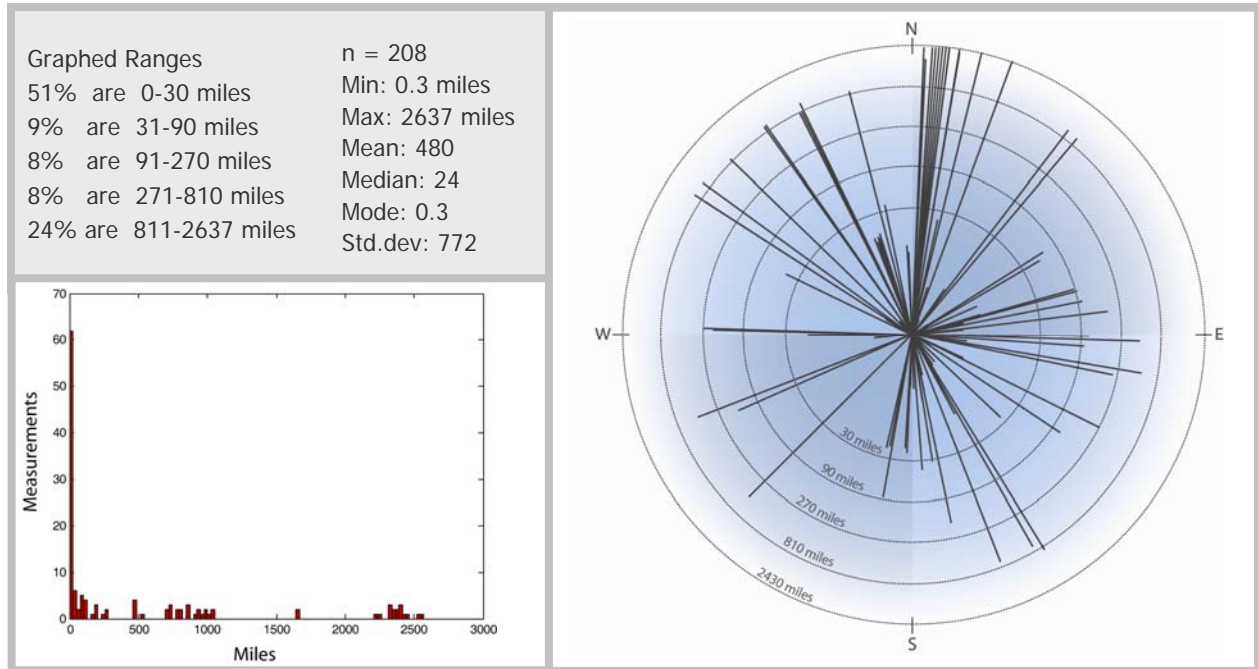
direction for all of the incidents in our case studies. Our first step was to create a circular figure with all of the “residences” represented by the center of the circle. The circle then was oriented such that the top of the circle (“12 o-clock”) is north and the bottom of the circle is south. If one of the incidents for terrorist Group A was located 20 miles to the west of the residence, then we drew a line 20 “units” away from the center (i.e. “residence”) to the left (i.e., “west”). If an incident by terrorist Group B was located 90 miles to the south of the terrorist’s residence, then we would draw a line 90 “units” away from the center in the “6 o-clock position (i.e., “south”). Because there are some extreme outliers in these distances, we converted all of the distances using a Log_{10} transformation. Each incident was subsequently superimposed on the rose diagram such that each residence was “located” in the center of the diagram and each incident was located at the end of each radiating line.

The resulting diagrams show the direction and relative distance between each residence and incident in the database (represented by each of the lines). By representing the measurements from incidents to terrorist residences in this way, we can visualize patterns involving directions or distances. Rose diagrams were created to describe distance and direction (1) from terrorist residences to incident locations, (2) from terrorist residences to antecedent locations, and (3) from antecedent activity to incident location. For each rose diagram, we drew one “distance and direction” line for each spatial relationship in our database. We also provide a histogram that shows the variation in distances and a table that provides aggregate information such as means, minimums, maximums, and grouped modal distances. In the following sections, we assess spatial relationships between each of these three key variables (residences, incidents, and antecedent activities).

Environmental Residences to incidents Analysis

In Figure 12, we present the first in a series of rose diagrams that plots distance and direction from environmental terrorist residences (the central location of the diagram) to environmental terrorist incidents (represented by the endpoint of the lines extending from the center of the diagram) for all 208 environmental terrorist residences-to-incident measurements. It is important to note that there were not 208 environmental incidents. In cases where different members of a terrorist group lived in various locations, we calculated a distance from each person's residence to the location of the incident (i.e., several distances were calculated for one incident). This resulted in replicating several incidents in cases where we had multiple "residence" data for an incident. Using the Log_{10} transformation, the symmetrical concentric circles in the rose diagram represent distances of 30 miles, 90 miles, 270 miles, 810 miles, and 2,430 miles from the residences to the environmental terrorist incidents. This diagram allows for a simple visualization of where the terrorists were living or staying prior to the commission of the incident and for cross category comparisons.

Figure 12. Environmental terrorists' residences to incidents: linear distance analysis.



Preliminary inspection of the diagram suggests that the majority of environmental incidents occurred very close to the residences of the actors. Indeed, over half (51%) of the environmental terrorists in the dataset lived within 30 miles of their targets. The shortest distance from residence to incident is three tenths of a mile while the longest distance is 2,637 miles. The distribution appears to be bimodal, however, since about one-quarter of the environmental terrorists lived greater than 810 miles from their target. Caution should be taken not to over-interpret this bimodal distribution, however, since these outliers include activities by members of the Family and other groups who were recorded having permanent residences in other states but traveled across country and probably stayed with conspirators to participate in attacks on locally selected targets. For the most part, environmental terrorism has been committed by local extremists, despite the fact that the environmental movement has numerous national

spokespersons. Thus, while the skewness of these data results in a mean distance of 480 miles, the more meaningful median statistic suggests that half of the distances are less than 24 miles. All indications, therefore, are that environmental terrorists tend to live very close to their targets (with notable exceptions).

Determining *direction* is a little more challenging in this diagram. It appears that many of the longer distances appear to be grouped to the north of the residences but there is no discernable pattern. In future analyses, especially after outliers are removed, we will employ further spatial analytical techniques that will allow us to more fully explore any directional patterns. For now, *direction* is not as important to our research focus as *distance*.

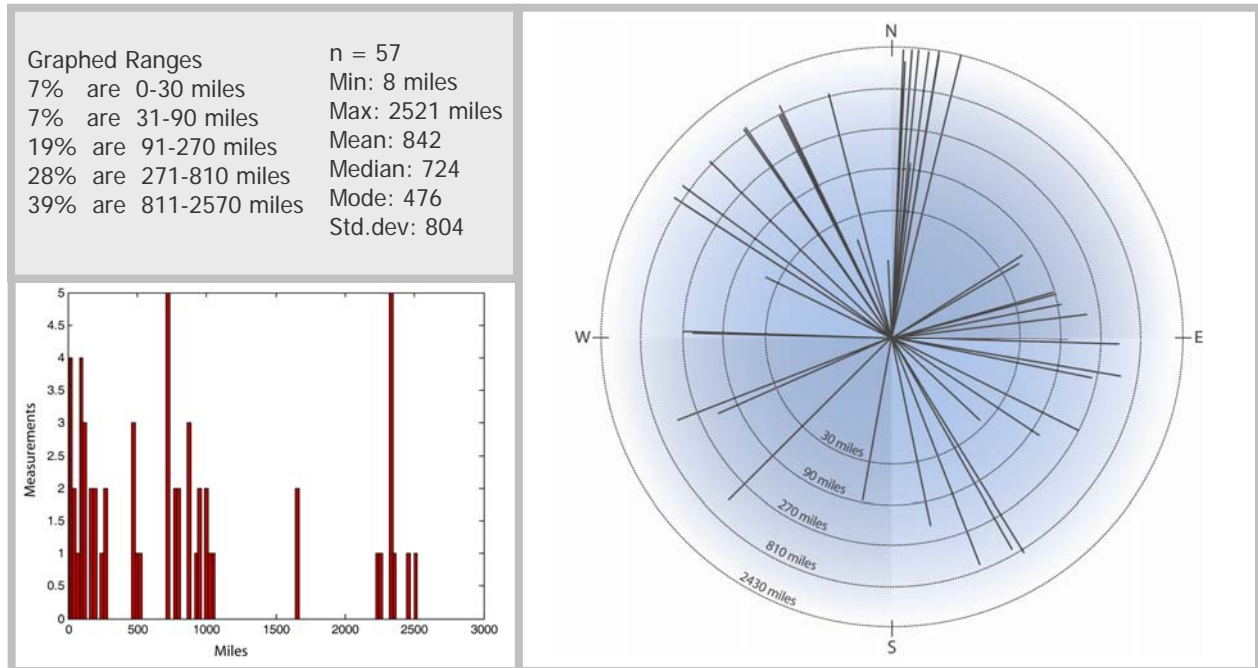
ELF/ALF The Family Residences to Incidents Analysis

As we have discussed before, the Family is an important environmental case to examine because the group more closely resembles “traditional” terrorism groups in many ways. Thus, we have created a separate set of analyses that examines distance and direction from residences to incidents for the Family; shown in Figure 13 (the data for the Family are also included in Figure 12). The data in Figure 13 suggest that the Family appear to act different than other environmental terrorist groups. Rather than committing their preparatory acts near their residences, it appears that members of the Family traveled great distance to commit their preparatory crimes. In some respects this is true, but the Family is unique in that many of the members traveled to a transient camp of environmental protesters known as “ANPO”¹¹ in the days immediately preceding an incident. Had we used this location as their address, the spatial pattern would have more closely resembled activities of a “local” group. The data suggest, therefore, that the Family seems to not only be *structurally* different from most other

¹¹ “ANPO” is a special use permit area in the Mount Hood National Forest.

environmental terrorist groups (e.g., long-term memberships with increased planning), but they tended to behave differently spatially.

Figure 13. The Family terrorists' residences to incidents: linear distance analysis.



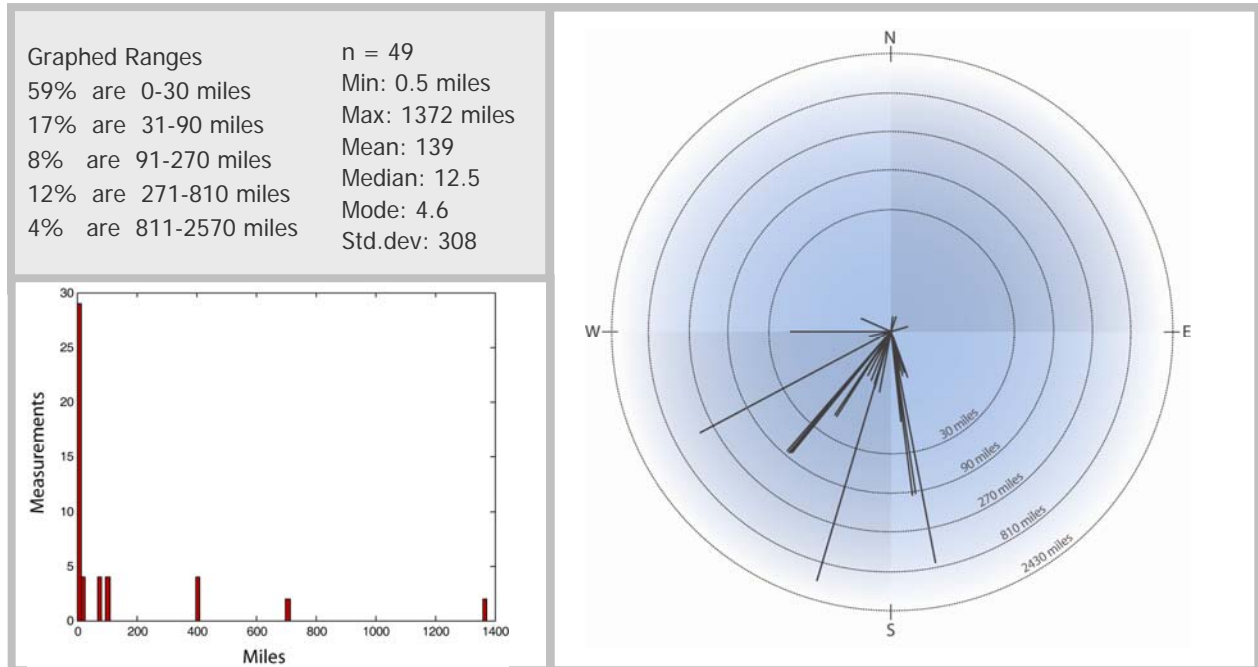
Incidentally, the general lack of directional pattern may also indicate (1) a plethora of available targets and (2) a self-preservation strategy (i.e., purposefully selecting random directions to disguise their habits). These patterns suggest that environmental terrorist groups will behave differently from other domestic terrorist groups (which tended to show a distinctive pattern in previous studies). While this randomness may make patterns difficult to determine, they may also make detection of the terrorists easier. Notice that the seemingly random pattern of incidents (targets) is scattered around the residence of the domestic terrorists. Thus, if a group of serial environmental terrorists (similar to the Family) was attacking an area, the targets could

be plotted on a map and there is an increased likelihood that the terrorists would live in the middle of the attack locations. Assessment of this hypothesis will be examined in future studies.

International Residences to Incidents Analysis

We now turn to a discussion of the spatial relationship between the residences of international terrorists and the location of their incidents (i.e., their targets). Our earlier pilot project had suggested a strikingly bimodal pattern not dissimilar to that exhibited by the environmental case studies in the current study. In Figure 14, we show the rose diagram for international terrorist residences compared to international incident locations. The diagram shows distances for 49 resident-to-incident units. The shortest distance was one-half of a mile and the longest distance was 1,372 miles. In this rose diagram and the accompanying table and histogram, we observed a similar bimodal relationship. Over one-half of the international terrorists' incidents were located within 30 miles of the terrorist residences, while only 16% were more than 271 miles away from the residences. The international terrorists tend to have lived very close to the location of the incident. The median, for example, suggests that one-half of the distances between residences and incidents for international terrorists were shorter than 12.5 miles. Interestingly, the data seem to suggest that international terrorists tend to live northeast of their target – since the majority of incidents took place southwest of their residences. This is probably the most pronounced *directional* result in our findings.

Figure 14. International terrorists' residences to incidents: linear distance analysis.

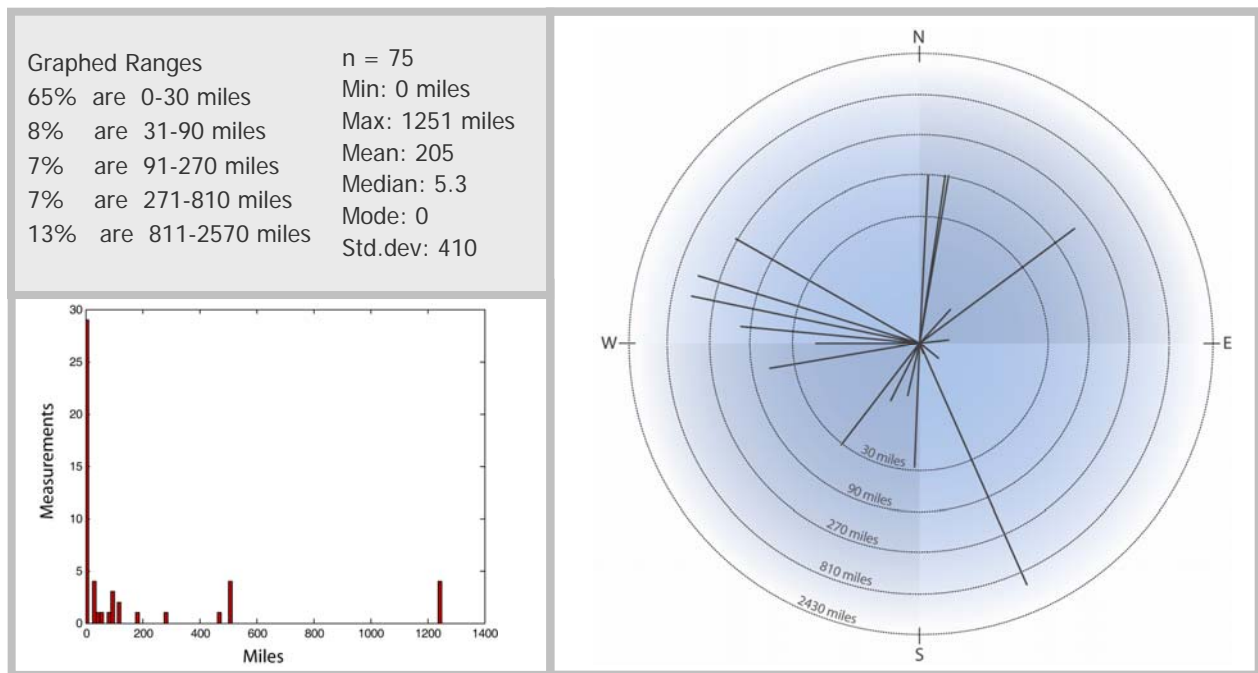


Environmental Antecedent Activities to Incidents Analysis

Having examined the relationship between resident and incident locations, we now turn to an examination of the distance between antecedent activities and the location of the incidents for environmental and international terrorists. In Figure 15, we present a rose diagram and tables for comparing all 75 distances between antecedent activities (represented by the center of the diagram) and incident locations (represented by the endpoint of the lines extending from the center of the diagram) for all environmental terrorist groups. The directional pattern shows that the majority of environmental terrorist incidents were located to the north and west of the antecedent activities. The data show that almost two-thirds of these distances (65%) are less than 30 miles while the other categories of distances are about evenly distributed. This suggests that

most environmental terrorist antecedent activities take place very close to the incident locations. The median suggests that more than one-half of these distances are shorter than 5.3 miles.

Figure 15. Environmental terrorists' antecedent activities to incidents: linear distance analysis.

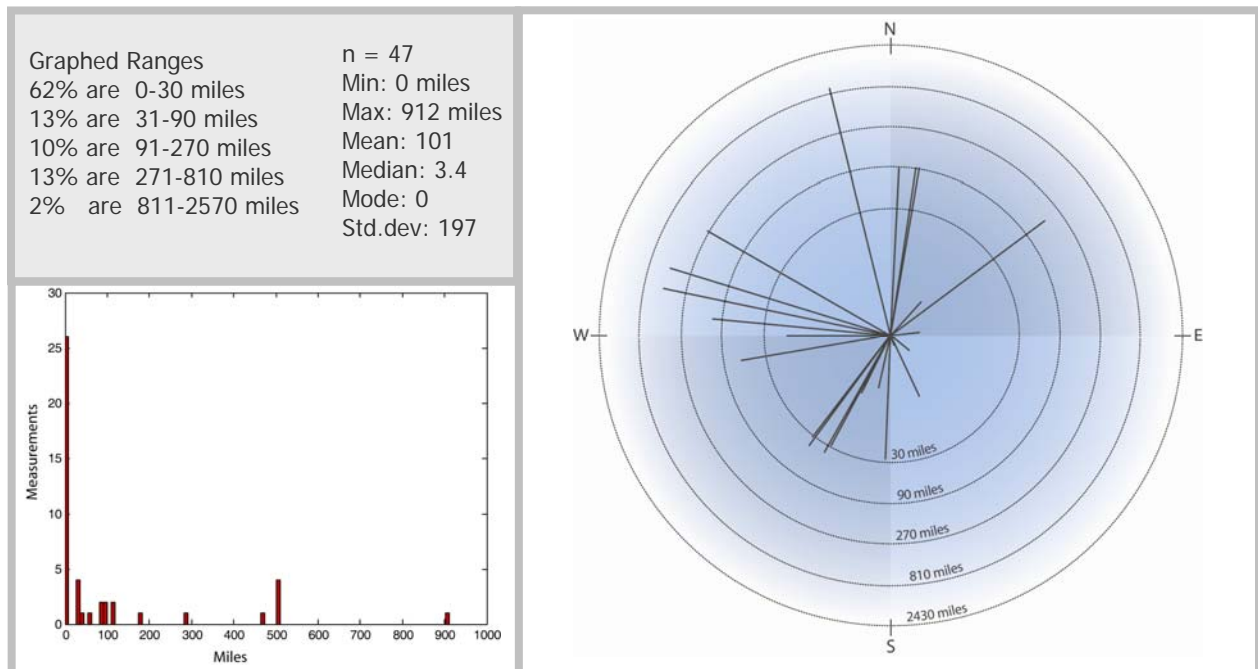


ELF/ALF The Family Antecedent Activities to Incidents Analysis

Data for the Family case study are very similar (see Figure 16). Here, we see that almost two thirds (62%) of the distances between antecedent acts and incident locations are less than 30 miles with a median distance of 3.4 miles. This close proximity to incident locations when compared with the large distances from the terrorists' residences to incidents locations show that they were traveling away from residences or home bases to conduct their preparatory activities. For instance, in the Family incidents, reconnaissance was conducted of staging areas for final preparation of bomb materials and targets were surveyed to formulate plans of attacks. Over one

third of the locations (36%) are dispersed throughout the middle ranges from 31 to 810 miles. Some of the staging areas were at rest stops or clearings along side roads, often times in rural areas.

Figure 16. The Family terrorists' antecedent activities to incidents: linear distance analysis.

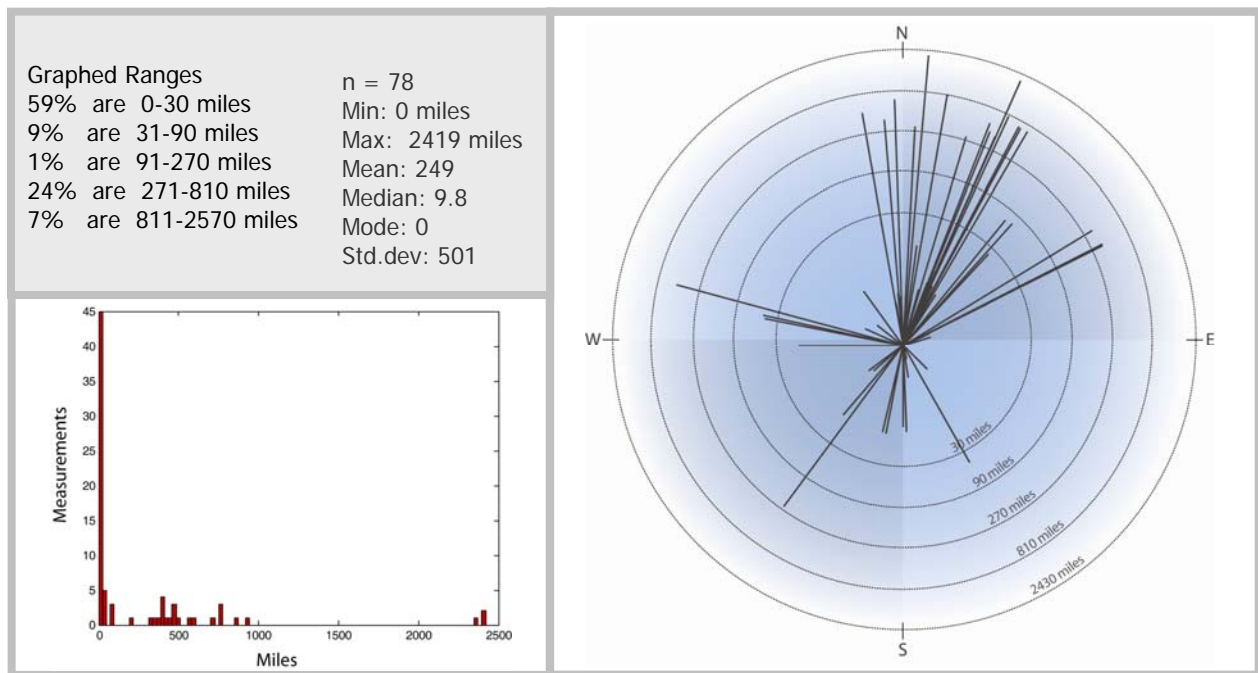


International Antecedent Activities to Incidents Analysis

Among international terrorists, we see similar patterns (see Figure 17). Among the 78 recorded distances, 59% are shorter than 30 miles and one-half are shorter than 10 miles (based on the median). The only remarkable difference is that international terrorists seem to have a more distinguishable bimodal distribution, such that 24% of the distances between antecedent acts and incident locations are between 271 and 810 miles. The reason for this pattern among the international terrorists is likely due to their relatively limited mobility. They probably conduct

many planning activities far from the target and then move close to the target and conduct the last few preparatory activities (e.g., build a bomb) close to the target.

Figure 17. International terrorists' antecedent activities to incidents: linear distance analysis.

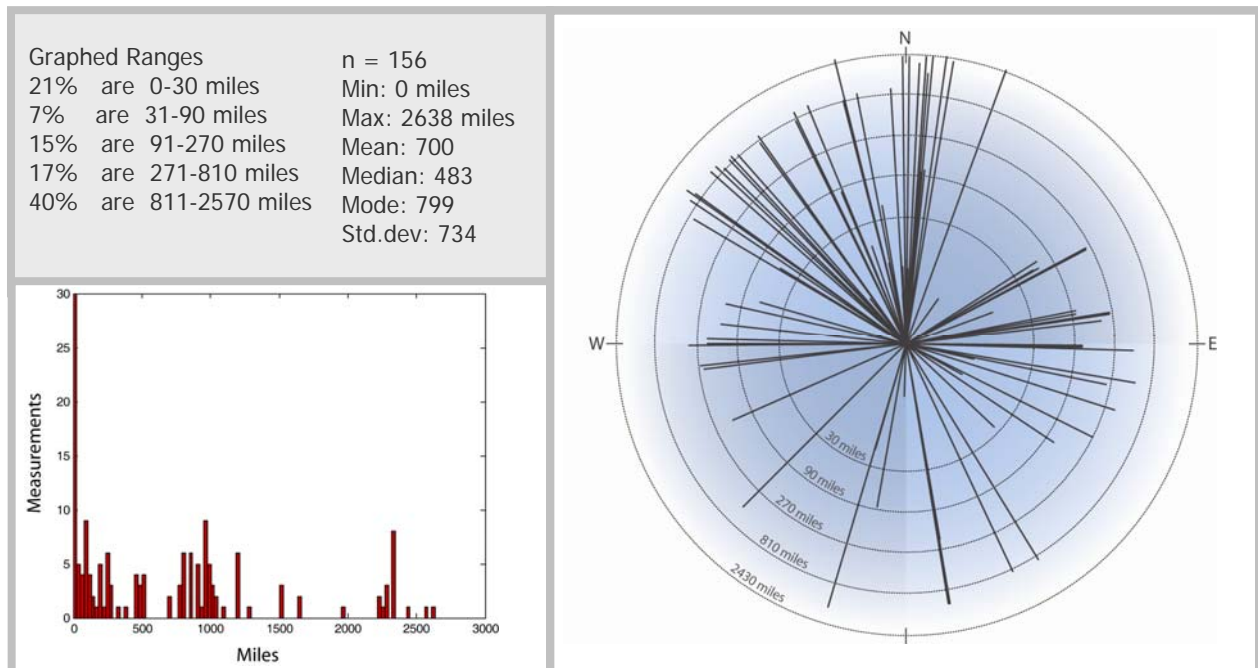


Environmental Residence to Antecedent Activities Analysis

In Figure 18, we present the rose diagram and tables showing the distances between environmental terrorists' residences (represented by the center of the diagram) and antecedent activities (represented by the endpoint of the lines extending from the center of the diagram) for *all 156* such measurements. Directional analysis suggests that the majority of environmental terrorist planning activities are located to the northwest of the terrorist residences. Notice that many of these activities actually took place in the residence (minimum distance = 0) but that many of the antecedent acts took place relatively far away from the residence. In fact, only

about 21% of the antecedent acts occurred within 30 miles of the residences of the environmental terrorists while more than two-fifths (40%) took place more than 810 miles away from home. Thus, an interesting finding is that, while environmental terrorists tend to live relatively close to their targets (half live within 30 miles of the incident), they tend to conduct their antecedent acts (e.g., weapons procurement, planning meeting, etc.) relatively long distances away from their homes. This suggests that environmental terrorists were consciously trying to avoid detection to their planned attacks during the planning stage by moving antecedent activities away from their residence (and, by corollary, away from the target). Much of this overall pattern for environmental terrorism was determined by activities of the Family. See specific discussion relative to the Family in the next paragraph.

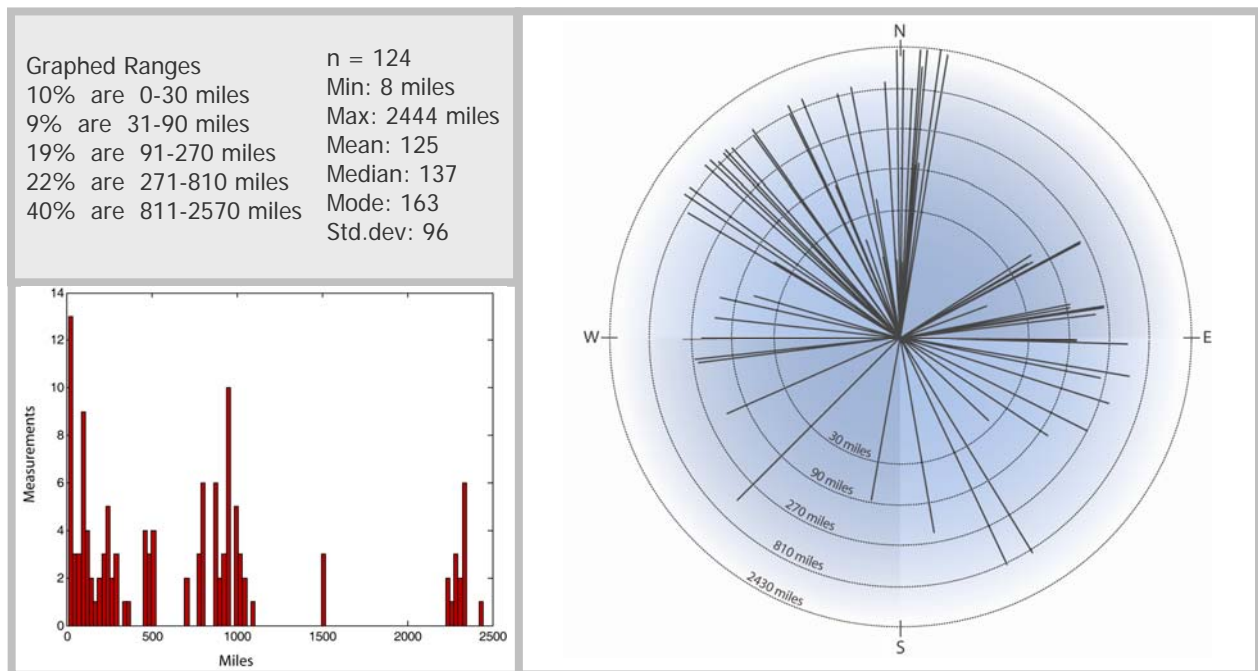
Figure 18. Environmental terrorists' residences to antecedent activities: linear distance analysis.



ELF/ALF THE FAMILY RESIDENCES TO ANTECEDENT ACTIVITIES ANALYSIS

The Family provides an interesting case study (see Figure 19). In these 124 measurements of residence to antecedent activities, only about one-twelfth (10%) were shorter than 30 miles in length while about half (50%) were between 31 and 270 miles in length. According to the data, for example, only 15 of 124 resident-to-incident distances were shorter than 50 miles. Thus, the most common antecedent activity took place relatively long distances from the Family members' residences. Recall that about two-thirds of the distances between residences and incidents for the Family were farther than 270 miles. Once again it should be noted that several members of the Family would fly from their permanent residences to the environmental protest site near Mount Hood, where they lived in transient housing in the days immediately preceding an incident. Many of the preparatory offenses occurred near this protest site.

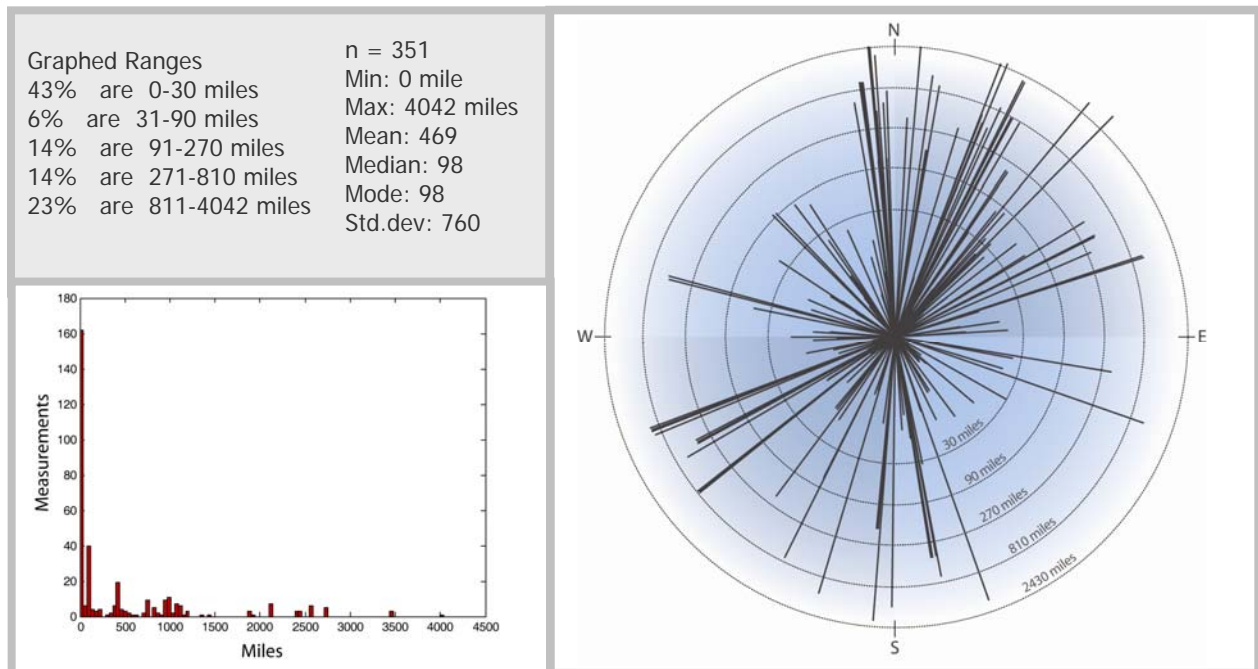
Figure 19. The Family terrorists' residences to antecedent activities: linear distance analysis.



International Residences to Antecedent Activities Analysis

In Figure 20, we examine residence-to-antecedent activities for international terrorists. In our earlier project with relatively limited data, we observed that almost all antecedent activities by international terrorists occurred within 19 miles of their residences. In the current data, we observe that almost one half (43%) of antecedent acts by international terrorists occur within 30 miles of the terrorists' residents (ignoring for now how close the residence is to the location of the incident). Almost one-quarter (23%) of all such activities are located more than 810 miles from the residence - presumably close to the target but that will be assessed in future data analysis. Recall that 59% of international terrorist antecedent acts took place very close to the target.

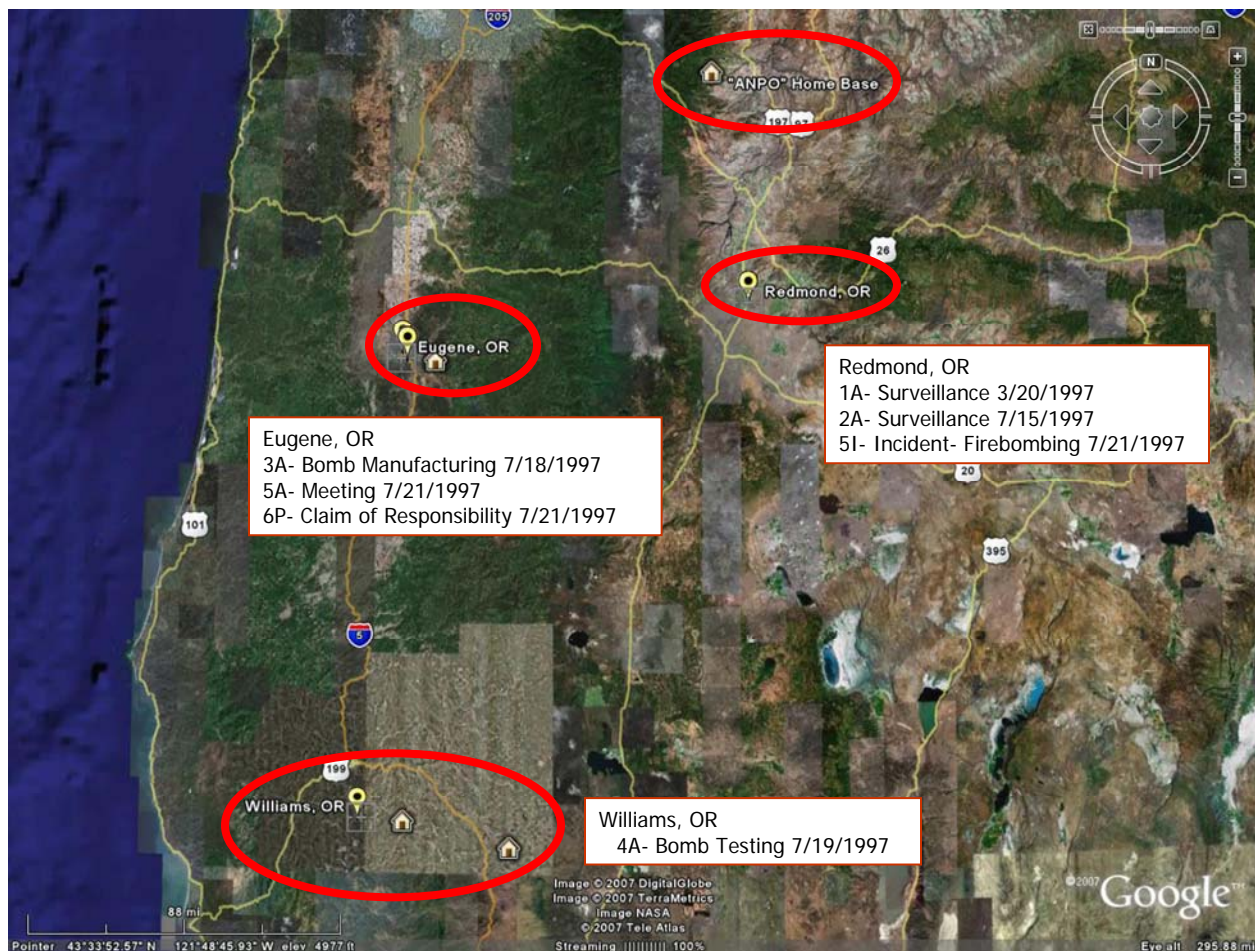
Figure 20. International terrorists' residences to antecedent activities: linear distance analysis.



CASE STUDIES

Having examined the spatial dispersion of terrorist residences, planning activities, preparatory acts, and incidents through rose diagrams and histograms (Figures 12-20), we now turn to examining how the geocoded results from the database can be output to graphic displays. First, we present a brief discussion of how the distances included in the ELF/ALF the Family Cavell West Arson can be illustrated using our data. In Figure 21, we show the activities and incident data overlaid on a map of the northwest corner of Oregon.

Figure 21. ELF/ALF The Family Cavell West Arson

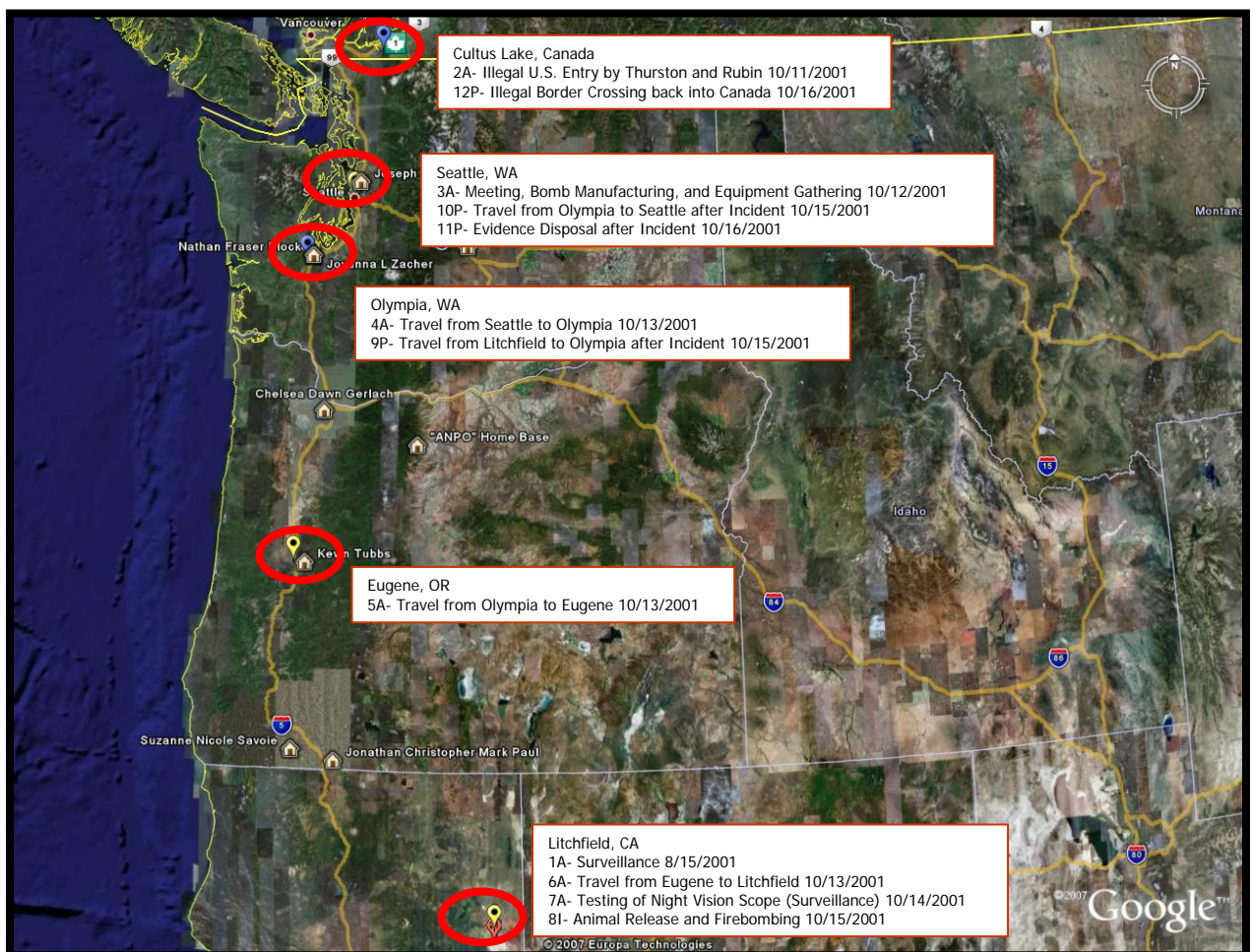


As is evident, much of the activity took place relatively far from the intended target in Redmond, OR. The majority of the antecedent activity took place in Eugene, OR (95 miles away) and Williams, OR, (175 miles away). Otherwise, the only preparatory acts that occurred in close proximity to the incident location were surveillance conducted on the target. The earliest known antecedent activity was this surveillance, which took place almost exactly 4 months prior to the commission of the incident. It is also noteworthy that the activity with the highest probability of arousing suspicion took place the farthest from the incident location (175 miles away) and the other activity locations in Eugene, OR (125 miles away). The proximity of the known residences for those involved in the arson is also varied. The "ANPO" base is about 65 miles north of the incident location, Tubbs had a recorded address in Springfield, OR, 10 miles to the east of Eugene where antecedent activity took place; Paul lived in Ashland, OR, 40 miles east of Williams, OR where the bomb testing was carried out. The known addresses for individuals involved in the arson shed light on the locations of the antecedent activity especially for the bomb testing that took place the farthest from the incident and other antecedent activities.

Another arson carried out by the Family was the Litchfield BLM arson in Litchfield, CA. This arson was the culmination of two months of planning and preparatory activities that stretched from the northern part of California to the southern border of Canada. The first known antecedent activity was surveillance carried out on the target two months prior to the commission of the incident. The conspirators were known to have traveled to the town of Litchfield two days prior to the incident, one of which was spent conducting surveillance at night on the target. The majority of the antecedent activities took place in the northern part of Washington. Meetings, bomb manufacturing, and equipment gathering as well as disposal of evidence after the incident all took place in Seattle, over 500 miles from the incident. However, it is known that the

conspirators spent time in Olympia, Washington and Eugene, Oregon while traveling back and forth between the Seattle areas over the known two month planning period. Paul, Tubbs, and Dabee (three of the six known conspirators) lived between Seattle and Litchfield. The relationships between the antecedent activities, residences, and incident locations are evident in Figure 22 below.

Figure 22. ELF /ALF The Family Litchfield BLM Arson



THE INTERACTION OF TIME AND SPACE:

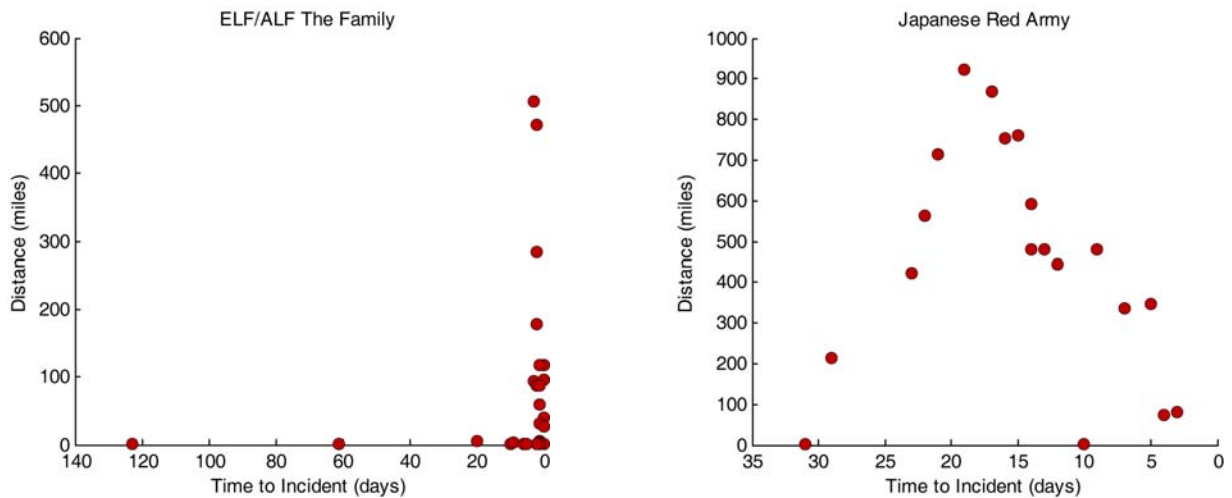
In an exploratory effort, we wanted to examine the interaction between time and space in the terrorist's planning cycle. Anecdotal examination of these cases had suggested the basic premise that "the nearer in time to the selected date for the incident, the closer the antecedent behaviors will occur in proximity to the target." The suggested pattern can perhaps be conceptualized as a predator circling a prey. While the activities of terrorists in preparing for an incident might not replicate this three-dimensional vortex, a two-dimensional perspective should render a positive relationship between time and space: that is, as time to the incident declines, distance to the target will decline (although in our depiction this will be visualized as an inverse relationship due to our reversal of the X axis).

To statistically examine this hypothesis requires that complete temporal and spatial data be available on each case. This was not the case, however. Despite this, a couple of examples, one domestic and one international, are shown below. The first example depicts the activities of the "family" during the commission of over 20 arsons and "ecotage" activities (Figure 23). Unfortunately, the preparatory activities occurred so close in time to the incident that a pattern could not be identified. Essentially, this is a methodological problem. We used "daily" measures, rather than "hourly" measurements. A more sensitive measure of time (if the data are available) might have produced the hypothesized results.

Since the planning and preparation sequence of international terrorists tends to be longer than environmental terrorists, a second test on international cases was conducted. An example using the activities of Yu Kikumura, a member of the Japanese Red Army arrested in the United States in the late 1980s, is also depicted. Unlike what we hypothesized, the relationship reflects an

“inverted U” rather than a linear relationship. In retrospect, this makes logical sense. The terrorist, in this case Kikumura, first conducted close up surveillance on the target, then in the months that followed, he retreated from the site, planning and preparing for the final attack (which in this case was prevented). As the date for the selected attack neared, his preparatory activities became increasingly closer to the target location. In both of these examples, the identification of surveillance activities may represent the best opportunity for early interdiction. Both of these exploratory examinations suggest that, with adequate data, a number of behavioral patterns may be identifiable.

Figure 23. Time and Space Interaction



V. SUMMARY AND DISCUSSION

The primary goal of the current project was to add geospatial and temporal data to the pilot study of pre-incident indicators of terrorist incidents funded by NIJ from 2003-2005. The original project had revealed that adequate open source data could be obtained to examine the temporal and spatial distribution of terrorist activities and, most importantly, that patterns of conduct could be identified. Furthermore, this project suggested that these patterns varied by type of terrorist group. The current project involved the compilation of additional data on a broader range of cases involving the two most promising types of groups where patterns were initially identified. Information on 118 environmental and 55 international incidents occurring in the United States was eventually collected for analysis. Spatial analysis was possible on most of these cases. For the temporal analysis, analysis was restricted to 38 cases where (1) an incident or proposed incident date could be identified, and (2) we believed the temporal and preparatory data to be adequately complete and accurate. Our major findings are summarized below.

Spatial Patterns:

1. The spatial patterns of international and environmental terrorists are remarkably similar.
2. Slightly over half of both international and environmental terrorists lived within 30 miles of the target in the days immediately preceding the terrorist incident.
3. Over 60 percent of the antecedent behaviors committed by both international and environmental terrorists occurred within 30 miles of the eventual target.
4. International terrorists demonstrated a bimodal spatial distribution regarding the relationship between the terrorists' place of residence and the target location. About

- one-half lived very close to the target (within 30 miles), while another one-fourth lived over 800 miles from the target. This pattern also manifested itself in environmental cases, except for incidents involving the Family.
5. Those living great distances from the target routinely used air transportation as either a means of traveling to the target site or as a means of weapons delivery.
 6. Spatial patterns for the environmental group known as the Family differed significantly from the patterns of other environmental groups/incidents. Members of the Family lived much greater distances from the target than did the members of other environmental groups. However, in the days immediately preceding an incident, it was not uncommon for members of this group to gather at a special use permit area in the Mount Hood National Forest where environmental protesters resided. However, if this “staging area” known as “anpo” is used as the residence of the members in lieu of their mailing address, the spatial distances between residence and incident are reduced considerably.

Temporal Patterns:

7. The temporal patterns of environmental and international terrorists were significantly different.
8. The planning process of environmental terrorists was relatively short and spontaneous. Approximately 85% of their preparatory conduct occurred within six days of the incident.

9. The planning process of international terrorists was considerably longer than that of environmental terrorists. Their planning activities usually began four to six months prior to the incident.
10. International terrorists engaged in a significantly larger number of preparatory activities per incident than environmental terrorists. International terrorists committed nearly three times as many known antecedent activities per incident as environmental terrorists. This may have been due to the larger number of persons usually involved in international incidents, the size and scope of the planned incident, or simply an artifact of the international terrorists' longer planning cycle.
11. Despite organizational differences between environmental terrorists ("lone wolf" vs. the "family" conspiracy), the structure and size of the organization or conspiracy did not affect either the number of preparatory acts committed or the length of the planning process. Regardless of the number of persons involved in an environmental incident, the number of preparatory crimes was relatively few and the planning sequence very brief.

The Relationship between time and space:

12. Preliminary, but inconclusive, findings suggest an inverted "U" shaped relationship between time and space relative to terrorist planning. Typically, the earliest preparatory behaviors involved surveillance or reconnaissance near the target, followed by a period of preparatory acts some distance from the target. Then, as the target date approaches, preparatory behaviors occur closer and closer to the target site. The data suggesting this relationship, however, is extremely limited. For

environmental terrorists, due to their short planning cycle, greater specificity of the temporal measure (hourly, instead of daily) is needed. For international terrorists, we believe that the same pattern exists, but a larger sample of cases is needed to confirm this relationship.

For law enforcement intervention, the implications of these patterns are fairly significant. In most cases, the commission of an act of terrorism will involve localized preparatory conduct. Although much of this conduct will not be criminal, early intelligence may give law enforcement the opportunity to interdict the terrorists in advance of the incident. Furthermore, knowledge of the threat, for example knowing whether local potential targets are more likely to be selected by environmental or international terrorists, will affect the manner in which local law enforcement responds. The identification of pre-cursor activities by environmental extremists may signal that an attack is eminent, while similar behavior by an international group might suggest that an attack is still several months off. For local law enforcement, knowledge that most terrorists “act locally” can be an important mindset as investigative agencies seek to prevent terrorism or apprehend the perpetrators of these acts. These local patterns may be used by agencies to more efficiently patrol known, high risk target areas and gather intelligence on suspected activities within a specific range from potential targets. The spatial relationship between the location of the planning/preparatory acts and the terrorism target, once better understood, should also prove helpful for investigation and tactical actions by law enforcement.

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