DEPARTMENT OF DEFENSE
STRATEGIC DEFENSE INITIATIVE ORGANIZATION
WASHINGTON, DC 20301-7100

JUL 31 1991

TNE

MEMORANDUM FOR WHOM IT MAY CONCERN

SUBJECT: ZEST Environmental Assessment

Enclosed for your use and information is the ZEST Environmental Assessment and the associated "finding of no significant impact" (FONSI). The ZEST environmental assessment is the latest environmental analysis document to be released as part of the overall Strategic Defense Initiative Program.

Questions regarding this document or requests for additional copies, should be addressed to:

SDIO/TNE
The Pentagon, Room 1E180
Washington, D.C. 20301-7100

William L. Noll
Program Manager,
Civil Engineering

Enclosures:
1. ZEST Environmental Assessment
2. FONSI

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# ENVIRONMENTAL ASSESSMENT

# *ZEST FLIGHT TEST EXPERIMENTS

## KAUAI TEST FACILITY* HAWAII

STRATEGIC DEFENSE INITIATIVE ORGANIZATION

JULY 1991

ENVIRONMENTAL
ASSESSMENT

# ZEST FLIGHT TEST EXPERIMENTS

## KAUAI TEST FACILITY
## HAWAII

STRATEGIC DEFENSE
INITIATIVE ORGANIZATION

JULY 1991

# COVER SHEET

| | |
|---|---|
| Responsible Agency: | Strategic Defense Initiative Organization |
| Proposed Action: | To design, develop, launch, and detonate two ZEST flight experiments carrying high energy explosives from the Kauai Test Facility, Kauai, Hawaii. |
| Responsible Individual: | Martha J. Cenkci<br>Major, USAF<br>Public Affairs Staff Officer<br>SDIO/IEA<br>Washington, D.C. 20301-7100 |
| Designation: | Environmental Assessment |
| Abstract: | The Strategic Defense Initiative Organization (SDIO) is proposing to execute two ZEST flight experiments to obtain information related to the following objectives: validation of payload modeling; characterization of a high energy release cloud; and documentation of scientific phenomena that may occur as a result of releasing a high energy cloud. The data gathered from the ZEST flight experiments will be employed in the development of space-based sensors essential to SDIO's strategic defense effort.<br><br>The proposed action is to design, develop, launch, and detonate two payloads carrying high energy explosives. Activities required to support this proposal include: 1) execution of component/assembly tests at Space Data Division (SDD) in Chandler, Arizona and Los Alamos National Laboratory (LANL) in Los Alamos, New Mexico, and 2) execution of pre-flight/flight test activities at Kauai Test Facility. This action will use existing facilities. No construction is required. |
| Availability: | Available July 1991. |

# FINDING OF NO SIGNIFICANT IMPACT

## STRATEGIC DEFENSE INITIATIVE ORGANIZATION

## U.S. DEPARTMENT OF DEFENSE

**Agency:** Department of Defense
Strategic Defense Initiative Organization (SDIO)

**Action:** To design, develop, launch, and detonate two ZEST flight experiments carrying high energy explosives from the Kauai Test Facility, Kauai, Hawaii.

**Background:** Pursuant to Council on Environmental Quality Regulations (40 CFR 1500-1508) for implementing the procedural provisions of the National Environmental Policy Act (42 U.S.C. 4321 et. seq.), and the U.S. Department of Defense (DoD) directive 6050.1, the Strategic Defense Initiative Organization (SDIO) has conducted an assessment of the potential environmental consequences of launching ZEST flight vehicles from Kauai Test Facility (KTF), a tenant on the Pacific Missile Range Facility (PMRF), Kauai, Hawaii, as part of the continuing operations at KTF. Also included are the activities to be conducted in the continental United States associated with the launches.

The Strategic Defense Initiative Organization (SDIO) is proposing to execute two ZEST flight experiments to obtain information related to the following objectives: validation of payload modeling; characterization of high energy release clouds; and documentation of scientific phenomena that may occur as a result of releasing high energy clouds. The data gathered from the ZEST flights will be employed in the development of space-based sensors essential to SDIO's strategic defense effort.

The proposed action is to design, develop, launch, and detonate two payloads carrying high explosives in near space. Activities required to support this proposal include execution of component/assembly tests and preflight/ flight test activities. The Air Force Maui Optical Station (AMOS) and the Maui Optical Tracking and Identification

Facility (MOTIF) on Mt. Haleakala, Maui, Hawaii, will observe the high energy release cloud created by ZEST. In addition, the ZEST experiment will be observed and recorded by existing satellites and other ground-based sensors. Validation of the payload design modeling and characterization of the high energy release cloud will be achieved by AMOS.

Component/assembly ground tests for the ZEST flight vehicle and payload will be conducted at Orbital Sciences Corporation's Space Data Division (SDD) in Chandler, Arizona and at Los Alamos National Laboratory (LANL) in Los Alamos, New Mexico. The proposed activities will be conducted in existing facilities and will be within the normal scope of activities that are routinely conducted at those facilities. Such activities are addressed in existing environmental protection and safety procedures at those facilities. No construction will be required and no additional personnel will be needed.

The preflight and flight activities will be conducted from the Kauai Test Facility (KTF), a tenant on the Pacific Missile Range Facility (PMRF), on Kauai, Hawaii. These activities will be conducted at existing facilities that have been developed specifically for such activities. No construction will be required. Approximately 20 additional contractor personnel and 5 additional government personnel will be required for the ZEST preflight and flight tests, over a period of about 45 days.

The ZEST Castor I rocket motors, payloads, and other components will be transported by military air to PMRF, then trucked to KTF. The two Talos motors will be taken from an existing stock of motors used in the Navy's VANDAL program.

ZEST vehicles will be launched from KTF launch pad No. 1, which will have an explosive safety quantity distance (ESQD) of 1,250 feet while the booster is on the launch pad. This ESQD will restrict access to recreation area No. 1 for 2-14 days per launch. A ground hazard area (GHA) for ZEST with a radius of 2,200 feet will begin to be cleared three hours prior to launch. This ensures that the GHA will be completely evacuated two hours before the launch when the launch vehicle is armed. A launch hazard area extends 5 nautical miles downrange and is a pie-shaped area, the boundaries of which are tangent to the ZEST GHA at headings of 15 and 300 degrees. The launch hazard area will be maintained from 10 minutes prior to the launch countdown until the rocket has successfully launched and the first stage has separated.

Alternatives considered include no action, the use of other launch locations, and the use of other launch vehicles. The no action alternative was rejected because it would make the high quality data anticipated to result from the experiments unavailable for the evaluation, testing, and development of space-based sensors.

The KTF was selected as the launch site so that the high energy release cloud created by ZEST could be observed by the highly sophisticated sensors at the AMOS/MOTIF facility, a large tracking telescope capable of pointing within small fractions of an arc minute. None of the other sites considered were in proximity to a site with such a telescope. The proposed launch vehicle (Talos first stage - Castor I second stage) was chosen because it provided the performance necessary to support the ZEST flight test objectives and requirements. In addition, each of the boosters individually has a flight history at KTF/PMRF and has an excellent performance record.

Findings:

The Description of the Proposed Action and Alternatives (DOPAA) was analyzed with respect to the environmental setting at each of the affected installations to determine the potential for impacts to the following environmental components: physical setting and land use; geology and water resources; air quality; noise; biological resources; threatened and endangered species; cultural resources; infrastructure; hazardous materials and waste; and public health and safety.

Potential impacts associated with the proposed ZEST activities will be avoided or minimized through implementation of standard, planned mitigation measures (i.e. through modification of test procedures or through protection of potentially affected resources). These mitigations have been incorporated as an integral part of the ZEST flight test experiments.

Component/assembly ground tests to be conducted at SDD and LANL will use existing facilities and will be within the scope of activities routinely conducted at those facilities. No construction or modification of facilities will be required. Additional personnel will not be necessary. All of the proposed tests will be within the scope of existing environmental protection and safety procedures at SDD and LANL. Therefore, significant environmental impacts are not expected to occur at SDD or LANL.

The *preflight and flight activities* proposed for KTF will be conducted at existing facilities that have been developed specifically for such activities. No construction or modification of facilities will be required. Biological resources, threatened and endangered species, cultural resources, and infrastructure will not be adversely affected by the ZEST preflight and flight activities at KTF, and the proposed activities are not expected to generate any hazardous waste. In addition, personnel will be trained to follow safe operating procedures when hazardous materials are handled. No environmental impacts are expected off-site of the affected installations.

Potential impacts to land use could occur due to the safety zones imposed while the ZEST flight vehicle is on the launch pad. Recreation area No. 1 will be closed during the time the booster is on the launch pad (2-14 days per launch). However, this closure will not present a significant impact to land use due to the short period of time required for the actual launch and the large amount of other beach areas which are readily accessible. No restrictions will be placed on use of Polihale State Park as a result of ZEST launches.

The lead emitted from the first stage Talos booster was analyzed to evaluate its potential to contaminate the geology and water resources at KTF. The analysis concludes that lead will have a limited areal impact, adsorb strongly to soil constituents, and be filtered from any run-off as it percolates downward. Therefore, a significant impact to geology and water resources will not result from the proposed action.

The emissions from the solid propellant rocket motors and the detonation products from the high explosive payload have the potential to impact the air quality. Based on the results of the emissions dispersion and transport modeling, it is not expected that the ZEST program will present significant air quality problems. Both conservative elevated buoyant cloud modeling and the unlikely bounding case modeling support this conclusion. The small number of modeled concentrations exceeding the applicable concentration standards under the bounding case modeling scenarios indicate the unlikely potential of air quality problems developing from the operation of the ZEST program. The short duration of the launch (several seconds), the infrequence of ZEST launches at KTF, and the prevailing trade winds that occur at KTF also contribute to maintaining air quality standards. No significant impacts to air quality are anticipated.

The noise generated from the ZEST launch vehicle could potentially impact humans and wildlife in the area of KTF. This potential will be minimized by ensuring that operations personnel wear hearing protection equipment or remain in the control building to reduce noise levels to acceptable standards. In addition, the launch hazard area will ensure that unauthorized personnel and public spectators are not exposed to noise levels that exceed the allowable standard of 115 dBA for 15 minutes or less. Because launches are scheduled infrequently (only two), ambient noise levels will not be affected.

The United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) have reviewed the ZEST Description of Proposed Actions and Alternatives (DOPAA) and have concurred with the findings of this EA that the project would be expected to have little, if any, impact on federally listed endangered or threatened species. The State Historic Preservation Officer (SHPO) has reviewed the ZEST DOPAA and has concurred that the project would not have any impact on cultural or historical resources. The State of Hawaii Office of State Planning has approved the ZEST flight tests for consistency with Hawaii's Coastal Zone Management regulations.

The catastrophic failure of the ZEST flight vehicle on the launch pad or early in the launch trajectory could potentially impact geology and water resources, air quality, and public health and safety. The potential impacts to geology and water resources and air quality are not expected to be significant because all of the detonation products either occur naturally in the atmosphere and the soils or readily break down to compounds that exist naturally. Potential impacts to public health and safety from an accidental explosion of the rocket on the launch pad will be mitigated through the implementation of safety zones (1,250 foot ESQD and 2,200 foot GHA) and the monitoring of these areas for unauthorized entry.

Cumulative impacts to air quality, geology and water resources, noise, and land use were evaluated with respect to the projected launch schedule for KTF. It is not anticipated that significant cumulative impacts will result from a schedule that includes normal KTF operations and the proposed STARS, EDX, and ZEST program launches.

Overall, no significant impact will result from conducting the ZEST flight test experiments. Therefore, no environmental impact statement is required for the proposed action.

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Dated: 24 July 91

HENRY F. COOPER
Director, SDIO

Dated: 25 July 91

THOMAS J. PEELING
Special Assistant for Environmental Planning
Shore Activities Division
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# EXECUTIVE SUMMARY

## Introduction

The Strategic Defense Initiative Organization (SDIO) was established to plan, organize, coordinate, and direct the research and testing of technologies applicable to developing a Strategic Defense System (SDS). The objective of the SDS is to protect the United States and its allies from an enemy attack by identifying and destroying incoming ballistic missiles.

As part of its responsibilities for developing a viable and effective SDS, SDIO is proposing to execute two ZEST flight experiments to obtain information related to the following objectives: validation of payload modeling; characterization of the high energy release cloud; and documentation of scientific phenomena that may occur as a result of releasing the high energy cloud.

## The Proposed Action

The proposed action is to design, develop, launch, and detonate two payloads carrying a high energy explosive. Activities required to support this proposal include execution of component/assembly tests and pre-flight/flight test activities. This action will use existing facilities. No construction is required.

The ZEST flight tests will be conducted from the Kauai Test Facility (KTF), a tenant on the Pacific Missile Range Facility (PMRF), on Kauai, Hawaii, as part of the continuing operations at KTF. The Air Force Maui Optical Station (AMOS) and the Maui Optical Tracking and Identification Facility (MOTIF) on Mt. Haleakala, Maui, Hawaii, will observe the high energy release cloud created by ZEST. In addition, the ZEST experiment will be observed and recorded by existing satellites and other ground-based sensors. Validation of the payload design modeling and characterization of the high energy release cloud will be achieved by AMOS.

***Alternatives***

Alternatives considered included no action, the use of other launch locations, and the use of other launch vehicles. The no action alternative was rejected because it would make high quality data anticipated to result from the experiments unavailable for the evaluation, testing, and development of space-based sensors.

The KTF was selected as the launch site so that the high energy release cloud created by ZEST could be observed by the highly sophisticated sensors at the AMOS/MOTIF facility, a large tracking telescope capable of pointing within small fractions of an arc minute. None of the other sites considered were in proximity to such a telescope.

The proposed launch vehicle, Talos - Castor I, was chosen because it best provides the performance necessary to support the ZEST flight test objectives and requirements. This combination was also chosen because each of the boosters individually has an excellent performance history and has a flight history at KTF/PMRF.

**Analysis of Impacts**

The Description of the Proposed Action and Alternatives (DOPAA) was analyzed with respect to the environmental setting at each of the affected installations to determine the potential for impacts to the following environmental components: physical setting and land use; geology and water resources; air quality; noise; biological resources; threatened and endangered species; cultural resources; infrastructure; hazardous materials and waste; and public health and safety. Any potential impacts associated with the proposed ZEST activities will be avoided or minimized through implementation of mitigation measures, modification of test procedures, or protection of potentially affected resources. No environmental impacts are expected off-site of the affected installations.

Component/assembly ground tests will be conducted at Orbital Sciences Corporation's Space Data Division (SDD) in Chandler, Arizona, and at Los Alamos National Laboratory (LANL) in Los Alamos, New Mexico. The proposed activities will be conducted in existing facilities within the normal scope of activities routinely conducted at those facilities and that are addressed in existing environmental protection and safety procedures at those facilities. No construction will be required and no additional personnel will be needed. Therefore, no significant environmental impacts are expected.

The preflight and flight activities will occur at KTF and will be conducted at existing facilities that have been developed specifically for such activities. No construction will be required. Potential impacts may occur as a result of the ZEST flight test experiments to the following areas: land use, geology and water resources, air quality, noise, and public health and safety.

Potential impacts to land use could occur due to the safety areas imposed while the flight vehicle is on the pad. Recreation Area No. 1 will be closed during this time (2-14 days per launch). However, this impact is not significant due to the short closure time and the large amount of other beach areas which are readily accessible. No restrictions will be placed on use of Polihale State Park as a result of ZEST launches.

The lead emitted from the first stage Talos booster was analyzed to evaluate its potential to contaminate the geology and water resources at KTF. The analysis concludes that the lead will have a limited areal impact on soil, adsorb strongly to soil constituents, and be filtered from the runoff as it percolates downward. In addition, existing levels of lead in the soil around Launch Pad No. 1 from prior launch activities at KTF are significantly below remediation levels. Therefore, the lead emissions will not result in a significant impact to geology and water resources.

The emissions from the ZEST flight vehicle and the payload have the potential to affect air quality. Based on the results of the emissions dispersion and transport modeling, it is expected that the operation of the ZEST program will not present significant air quality problems. Both conservative elevated buoyant cloud modeling and the unlikely bounding case modeling support this conclusion. The small number of modeled concentrations exceeding the applicable concentration standards under the bounding case modeling scenarios indicate the unlikely potential of air quality problems developing from the operation of the ZEST program. The short duration of the launch (several seconds), the infrequence of ZEST launches at KTF, and the prevailing trade winds that occur at KTF also contribute to maintaining air quality standards. No significant impacts to short-term or ambient air quality are anticipated.

Potential impacts to personnel, wildlife, or the public, due to the noise generated from the rocket, are not anticipated to be significant. The potential impacts will be minimized by ensuring that operations personnel wear hearing protection equipment to reduce noise levels to acceptable standards or remain inside the control building. In addition, the launch hazard area will ensure that unauthorized personnel and public spectators are not exposed to noise levels that exceed the allowable standard of 115 dBA for 15 minutes or less. Because launches are scheduled infrequently (only two), ambient noise levels will not be affected.

Potential impacts to public health and safety from an accidental explosion of the rocket on the launch pad, will be mitigated through the implementation of a launch hazard area, a ground hazard area (GHA), explosive safety quantity distances (ESQDs), and the monitoring of these areas for unauthorized entry. The ESQD and GHA for the ZEST program are 1,250 feet and 2,200 feet, respectively. The launch hazard area extends 5 nautical miles downrange and is a pie-shaped area, the sides of which are tangent to the ZEST GHA at headings of 15 and 300 degrees.

Cumulative impacts to air quality, geology and water resources, noise, and land use were evaluated with respect to the projected launch schedule for KTF. It is not anticipated that significant cumulative impacts will result from a schedule that includes normal KTF operations and the proposed STARS, EDX, and ZEST program launches.

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## LIST OF ACRONYMS

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|---|---|
| AB | Assembly Building |
| $Al_2O_3$ | Aluminum oxide |
| ACGIH | American Conference of Governmental Industrial Hygienists |
| ACHP | Advisory Council on Historic Preservation |
| AMOS | Air Force Maui Optical Station |
| AZ | Azimuth |
| BO | Burn Out |
| BOE | Bureau of Explosives |
| C | Carbon |
| CCAFS | Cape Canaveral Air Force Station |
| CEP | Circular Error Probable |
| CEQ | Council on Environmental Quality |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act |
| CONUS | Continental United States |
| cm | centimeter |
| CFR | Code of Federal Regulations |
| $CH_4$ | Methane |
| CO | Carbon monoxide |
| $CO_2$ | Carbon dioxide |
| CSTC | Consolidated Space Test Center |
| CWA | Clean Water Act |
| CZM | Coastal Zone Management |
| CZMA | Coastal Zone Management Act |
| dB | decibel |
| dBA | decibel (A-weighted) |
| DLNR | Department of Land and Natural Resources (State of Hawaii) |

| | |
|---|---|
| DOA | U.S. Department of the Army |
| DoD | U.S. Department of Defense |
| DOE | U.S. Department of Energy |
| DOPAA | Description of Proposed Action and Alternatives |
| DOT | U.S. Department of Transportation |
| EA | Environmental Assessment |
| EDX | Exoatmospheric Discrimination Experiment |
| EIAP | Environmental Impact Analysis Process |
| EIS | Environmental Impact Statement |
| EPA | U.S. Environmental Protection Agency |
| ES&H | Environment, Safety, and Health |
| ESQD | Explosives Safety Quantity Distance |
| FLSC | Flexible Linear Shape Charge |
| FONSI | Finding of No Significant Impact |
| FTS | Flight Termination System |
| GC | General Counsel |
| GFE | Government Furnished Equipment |
| g | gram |
| GHA | Ground Hazard Area |
| $H_2$ | Hydrogen |
| HAAQS | Hawaii Ambient Air Quality Standards |
| HCl | Hydrogen chloride |
| HCRR | Hawaii Code of Rules and Regulations |
| HCZMP | Hawaii Coastal Zone Management Program |
| HE | High Explosive |
| $H_2O$ | Water |
| HRS | Hawaii Revised Statutes |
| HSWA | Hazardous and Solid Waste Amendments of 1984 |

| | |
|---|---|
| KECO | Kauai Electric Company |
| KTF | Kauai Test Facility |
| kg | kilogram |
| km | kilometer |
| kW | kilowatt |
| l | liter |
| lbs | pounds |
| LANL | Los Alamos National Laboratory, (Los Alamos, New Mexico) |
| Ldn | Day-night average sound level |
| LCU | Launch Correlation Unit |
| LOB | Launch Operations Building |
| LSE | Launch Support Equipment |
| $\mu g$ | microgram |
| mg | milligram |
| $mg/m^3$ | milligrams per cubic meter |
| MOA | Memorandum of Agreement |
| MOTIF | Maui Optical Tracking and Identification Facility |
| mph | miles per hour |
| MSDS | Material Safety Data Sheets |
| MSL | Mean Sea Level |
| MW | Megawatt |
| $N_2$ | Nitrogen |
| NAAQS | National Ambient Air Quality Standards |
| NASA | National Aeronautics and Space Administration |
| NAVFAC | Naval Facilities Engineering Command |
| NEPA | National Environmental Policy Act |
| NESHAPS | National Emission Standards for Hazardous Air Pollutants |
| NEW | Net Explosive Weight |

| | |
|---|---|
| $NH_3$ | Ammonia |
| NHPA | National Historic Preservation Act |
| NIOSH | National Institute of Occupational Safety and Health |
| NMFS | National Marine Fisheries Service |
| $NO_2$ | Nitrogen dioxide |
| $NO_x$ | Nitrogen oxides |
| NOAA | National Oceanic and Atmospheric Administration |
| NOTAM | Notice to Airmen |
| NOTMAR | Notice to Mariners |
| NPDES | National Pollutant Discharge Elimination System |
| NRC | National Response Center |
| NRHP | National Register of Historic Places |
| OH | Hydroxide |
| OHA | Office of Hawaiian Affairs |
| OSHA | Occupational Safety and Health Administration |
| PACDIV | Pacific Division of NAVFAC |
| PBX | Plastic Bonded Explosive |
| Pb | Lead |
| PMB | Payload Module Bus |
| PMRF | Pacific Missile Range Facility (Kauai, Hawaii) |
| PMTC | Pacific Missile Test Center (Pt. Mugu, California) |
| PPE | Personal Protective Equipment |
| ppm | Parts per million |
| QE | Quadrant Elevation |
| R&D | Research and Development |
| RCRA | Resource Conservation and Recovery Act |
| RF | Radio Frequency |
| RMSA | Rocket Motor Staging Area |

| | |
|---|---|
| RSO | Range Safety Officer |
| SDD | Space Data Division, Orbital Sciences Corporation |
| SDIO | Strategic Defense Initiative Organization |
| SDS | Strategic Defense System |
| SERC | State Emergency Response Commission |
| SHPO | State Historic Preservation Officer |
| SNL | Sandia National Laboratories (Albuquerque, New Mexico) |
| SOP | Safe Operating Procedure/Standard Operating Procedure |
| SPCC | Spill Prevention, Control, and Countermeasures |
| SSOP | Standard Safe Operating Procedure |
| STARS | Strategic Target Systems |
| TBE | Teledyne Brown Engineering |
| TLV | Threshold Limit Value |
| TM | Technical Manual |
| USAF | U.S. Air Force |
| USASDC | U.S. Army Strategic Defense Command |
| USFWS | U.S. Fish and Wildlife Service |
| $WO_3$ | Tungsten Oxide |

# 1.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

The National Environmental Policy Act (NEPA), the Council on Environmental Quality regulations that implement NEPA (40 CFR 1500-1508), and the U.S. Department of Defense (DoD) Directive 6050.1 require that decision-makers take into account environmental consequences when authorizing or approving major Federal actions. This Environmental Assessment (EA) analyzes the potential environmental consequences of conducting activities in support of the ZEST Experiment Program.

Section 1.0 of this EA describes the purpose and need for the proposed action; the proposed action; and the no-action alternative. Section 2.0 describes the affected environment at installations where the testing activities will be conducted. Section 3.0 assesses the potential impacts from implementation of the proposed action against the affected environment. If a particular activity has the potential to significantly affect the environment, mitigation measures are incorporated into this proposal to reduce the potentially significant effects to insignificant levels. These mitigation measures will be implemented as a part of the ZEST proposal.

## 1.1 PURPOSE AND NEED FOR THE PROPOSED ACTION

The Strategic Defense Initiative Organization (SDIO) was established to plan, organize, coordinate, and direct the research and testing of technologies applicable to developing a Strategic Defense System (SDS). The objective of the SDS is to protect the United States and its allies from an enemy attack by identifying and destroying incoming ballistic missiles.

As part of its responsibilities for developing a viable and effective SDS, SDIO is proposing to execute the ZEST program to obtain information related to the following technical objectives: validation of payload modeling; characterization of the high energy release clouds; and documentation of scientific phenomena that may occur as a result of releasing the high energy clouds.

Execution of these experiments is crucial to further development of high energy cloud technology. The data gathered from the ZEST flights will be employed in the simulation, analysis, evaluation, testing, and development of space-based sensors essential to SDIO's strategic defense effort. Without execution of these test programs, SDIO's intended mission objectives cannot be met.

## 1.2 PROPOSED ACTION

The proposed action is to design, develop, and launch a payload carrying a high energy explosive from the Kauai Test Facility (KTF), Kauai, Hawaii, and detonate the payload above the atmosphere. The event will be observed by a variety of sensors. Activities required to support this proposal include execution of component/assembly tests and pre-flight/flight test activities. The proposed action will use existing facilities at each of the proposed locations. No construction is required.

The following discussion is a brief description of the concept of the ZEST technology program and a detailed description of the activities required to support the proposed action for this technology. The test activities consist of component fabrication, assembly and testing, and the actual flight (Table 1-1).

**TABLE 1-1**

**ZEST Activities And Locations**

| TEST ACTIVITIES | COMPONENT/ASSEMBLY | PREFLIGHT | FLIGHT | LOCATION |
|---|---|---|---|---|
| Payload Fabrication | Fabricate Payload<br><br>Check Payload Electronics and External Interfaces | | | Los Alamos National Lab (LANL), New Mexico |
| Booster Fabrication | Fabricate Nose Cone, Payload Module Bus (PMB) and Interstages<br><br>Subsystem Integration<br><br>System Integration with LANL Inert Payload | | | Space Data Division (SDD), Chandler, Arizona |
| ZEST Integration Tests | | Receive, Inspect and Verify Launch Vehicle Hardware<br><br>Install and Evaluate Launch Support Equipment (LSE)<br><br>Assemble Vehicle on Launch Pad<br><br>Evaluate Reception of Pre-Launch Data | | Kauai Test Facility, a tenant on Pacific Missile Range Facility (PMRF), Kauai, Hawaii |
| ZEST Flight Tests | | | ZEST 1<br><br>ZEST 2 | Kauai Test Facility, a tenant on Pacific Missile Range Facility (PMRF), Kauai, Hawaii |

### 1.2.1 ZEST Experiment

ZEST flight tests will be conducted from the KTF, a tenant on the Pacific Missile Range Facility (PMRF) on Kauai, Hawaii (Figure 1-1 and 1-2), as part of the continuing operations at KTF. The flight experiments' objective is to create a high energy release cloud and observe its characteristics with a variety of ground, air and space-based sensors. ZEST is a follow-on to the CHEER experiment, a high energy release experiment that was conducted in summer 1989 from Poker Flat, Alaska.

The KTF was selected as the launch site so that the high energy release cloud created by ZEST could be observed by the highly sophisticated sensors at the Air Force Maui Optical Station (AMOS) and the Maui Optical Tracking and Identification Facility (MOTIF) on Mt. Haleakala, Maui, Hawaii. Validation of the payload design modeling and characterization of the high energy release cloud can be achieved only by a large tracking telescope and mount capable of pointing within small fractions of an arc minute. AMOS/MOTIF has such capabilities. The ZEST experiment trajectory and timeline have been specifically configured from KTF to obtain maximum coverage of the highest possible quality from AMOS/MOTIF. In addition, the ZEST experiment will be observed and recorded by existing satellites and other ground-based sensors. Aircraft will also be used to monitor the ZEST flight.

The ZEST flight vehicle (Figure 1-3) will consist of two booster stages, a Payload Module Bus (PMB), a High Explosive (HE) payload, and a nose cone. The first stage booster will be a Talos solid rocket motor which will be provided as Government Furnished Equipment (GFE). The second stage booster is a Castor I solid rocket motor which is manufactured by Thiokol Corporation. The PMB and nose cone will be manufactured and supplied by Orbital Sciences Corporation/Space Data Division (SDD). The PMB will be located atop the second stage, and the experiment payload will be carried atop the PMB. An aerodynamic, fixed nose cone will be placed atop the PMB/experiment payload. The ZEST

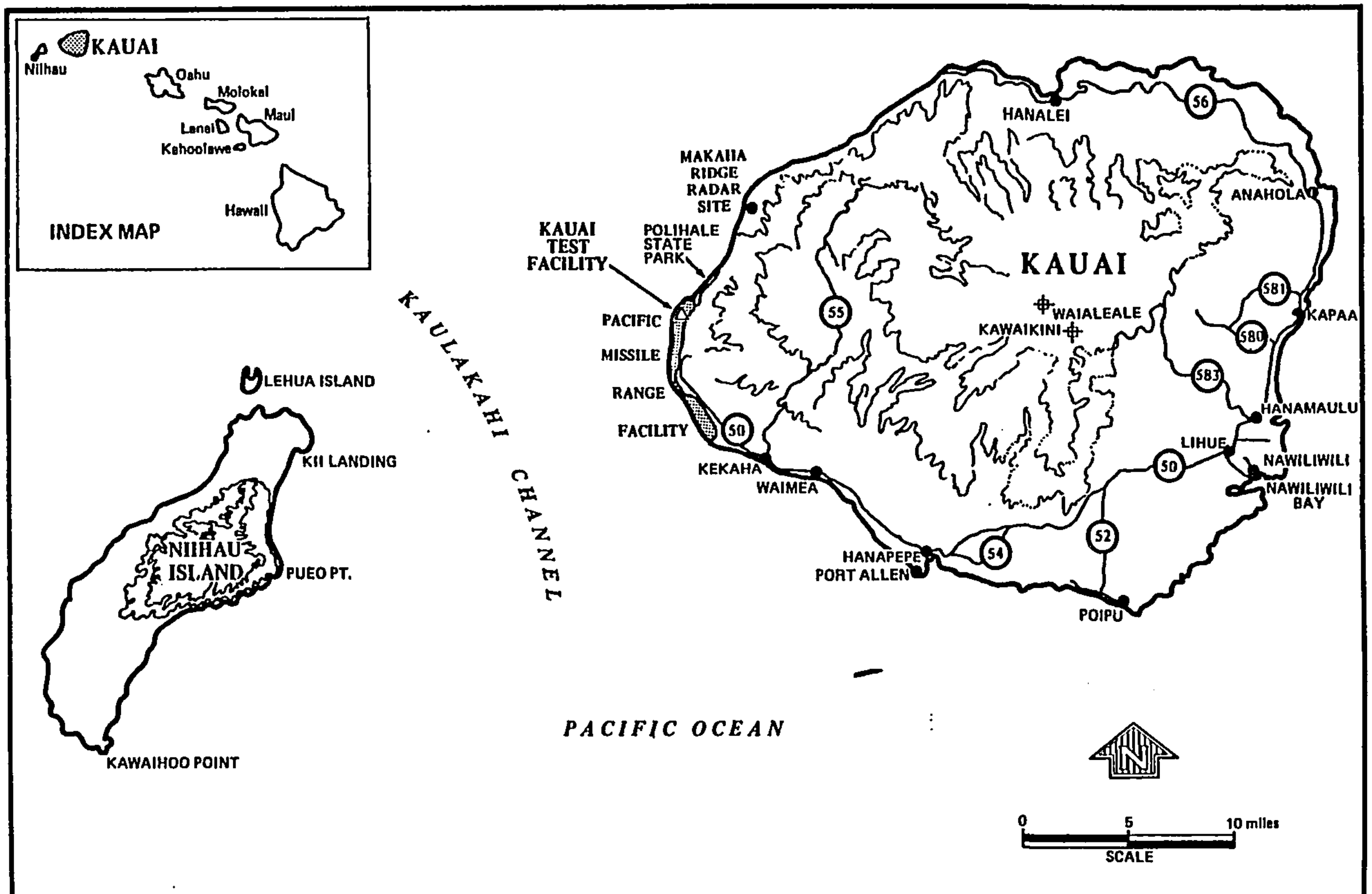


**FIGURE 1-1**
**VICINITY MAP**
**KAUAI TEST FACILITY**

SOURCE: USGS, 1983

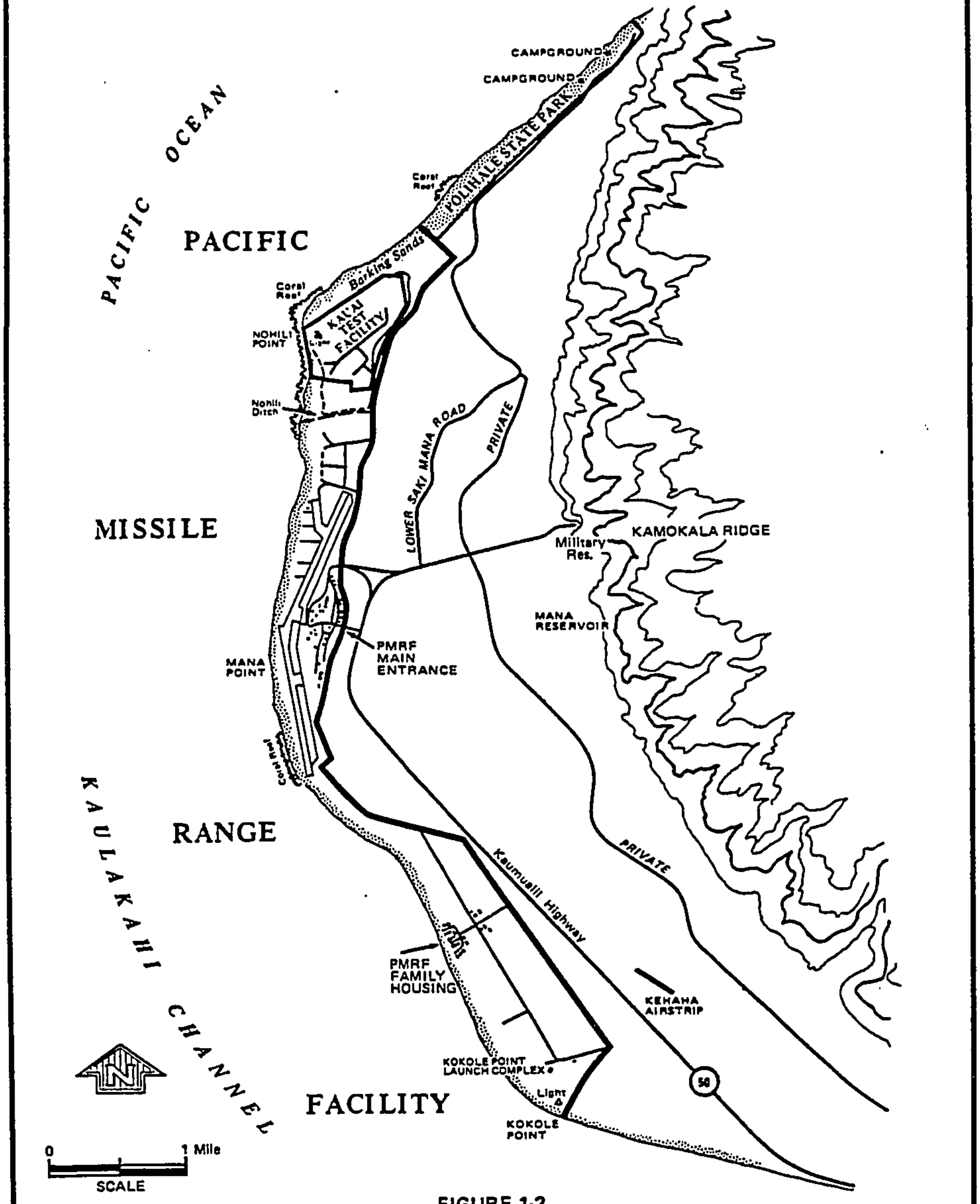


FIGURE 1-2
LOCATION MAP –
KAUAI TEST FACILITY AND
PACIFIC MISSILE RANGE FACILITY

SOURCE: USGS, 1983; DOE, 1991

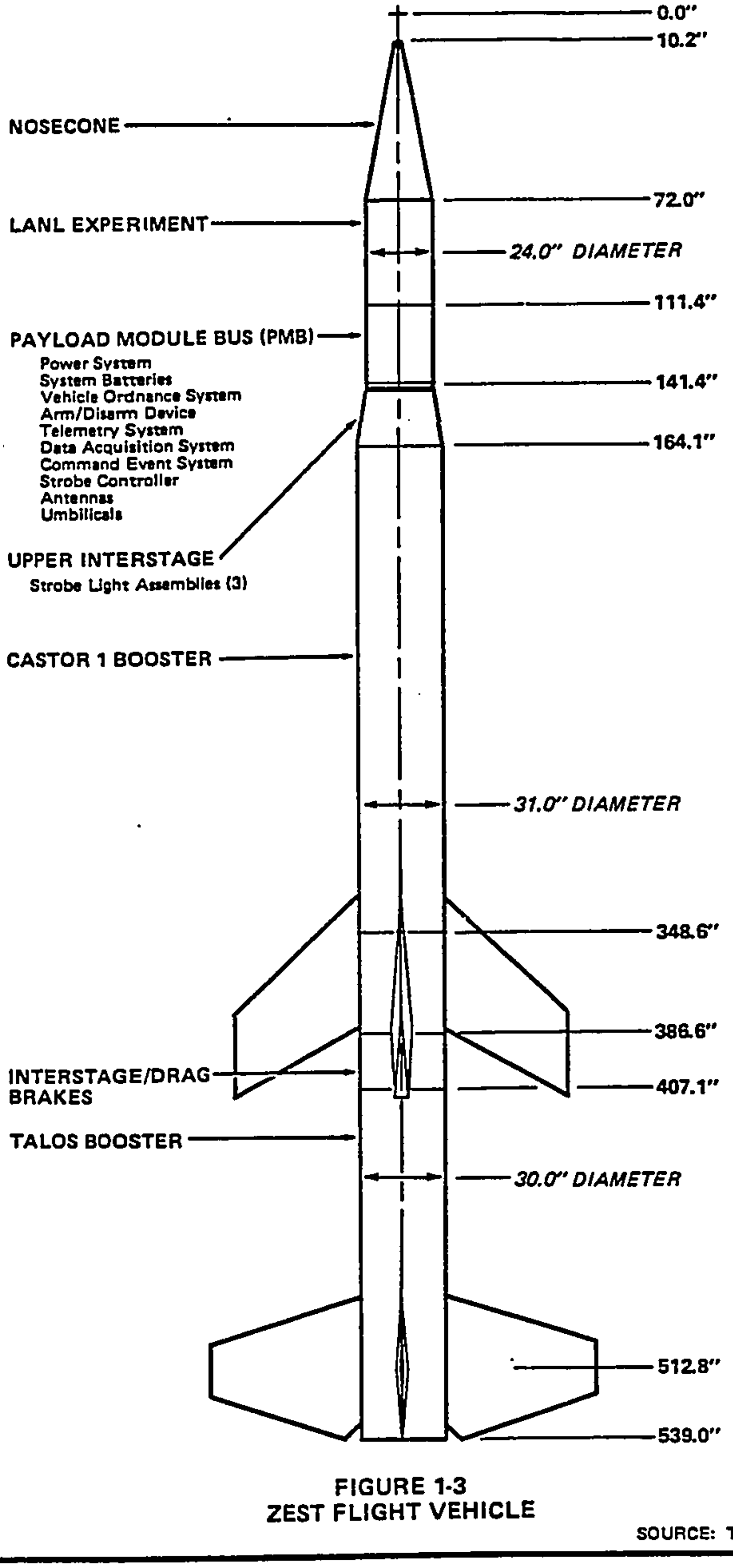


FIGURE 1-3
ZEST FLIGHT VEHICLE

SOURCE: Teledyne Brown Engineering, 1991

HE payload (Figure 1-4) will be manufactured and supplied by the Los Alamos National Laboratory (LANL). Section 1.2.1.1 provides a detailed description of the launch vehicle and the LANL experiment package.

Overall ground safety will be provided by PMRF. Launch pad safety within KTF boundaries will be provided by Sandia National Laboratories (SNL). Orbital safety will be administered by U.S. Space Command Orbital Safety, Consolidated Space Test Center (CSTC) and the Launch Correlation Unit at the Cheyenne Mountain Complex in Colorado Springs, Colorado.

Additional launch support in the areas of transportation logistics, launch operation, and pad safety will be provided by SNL for the Department of Energy (DOE) at KTF. PMRF approval will be requested. Final range safety approval has been granted by Pacific Missile Test Center (PMTC) on 10 July 1991 and will be implemented by PMRF (PMTC, 1991). SDD, supported by Teledyne Brown Engineering (TBE), is providing vehicle design, integration and assembly, together with planning and launch support in conjunction with SNL. SDD is performing its services under contract to SDIO and under U.S. Department of Transportation (DOT) Commercial Space Launch License No. LLS 91-026 (DOT, 1991).

#### 1.2.1.1 Launch Vehicle

The two-stage Talos-Castor configuration vehicle has been flown successfully by SDD on five previous occasions, from 1977 through 1986, at the Poker Flat Research Range in Alaska. SDD has also successfully completed eight other test flights that utilized one of the motors (Talos or Castor) proposed for ZEST (SNL, 1991a). In addition, SNL has successfully launched a total of 30 flight vehicles from various locations other than KTF that utilized a Talos Motor. SNL has also successfully launched 41 STRYPI vehicles (Castor I first stage)

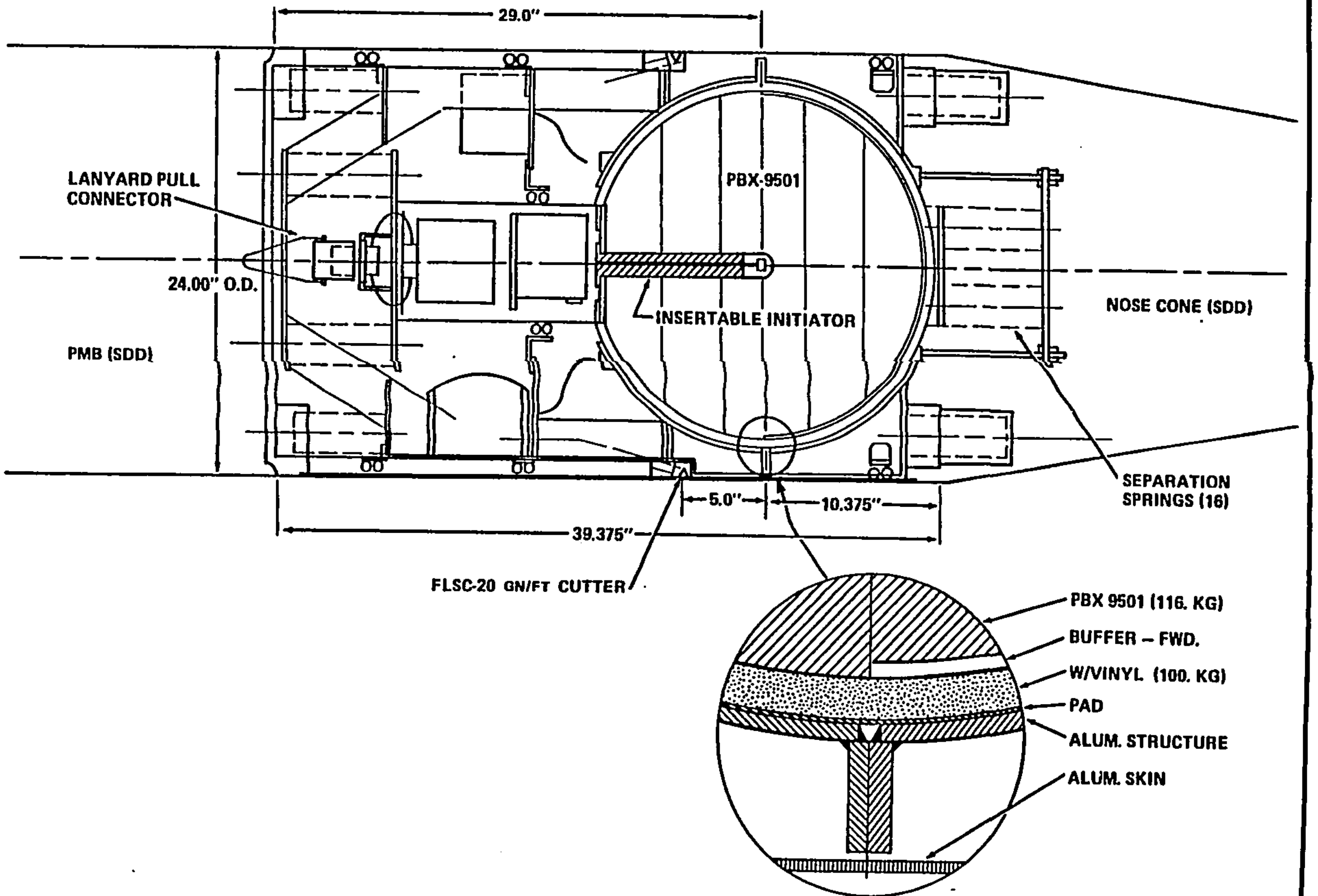


FIGURE 1-4
LANL PAYLOAD

SOURCE: Teledyne Brown Engineering, 1991

from KTF (TBE, 1991f). The ZEST flight vehicle, Talos-Castor I, is an unguided sounding rocket that will be launched using a 20,000 pound rail launcher.

The Talos rocket motor was originally developed by Hercules. The Talos has been used to provide propulsion for a large and diverse number of launch vehicles. It is a solid propellant rocket motor approximately 132 inches long, with an average diameter of 30.0 inches. Four fins are attached to the aft end of the Talos motor for aerodynamic stability. At a temperature of 77°F, the Talos rocket motor burns for approximately 5.7 seconds with a maximum thrust of 128,700 pounds. The total loaded weight of the Talos rocket motor is 4,302 pounds, with the propellant making up 65% or 2,803 pounds of this weight. The propellant is a Class 1.3 propellant composed of nitrocellulose-nitroglycerine (ARP/AHH). The combustion products from the Talos first stage rocket motor and corresponding weight percentages are as follows: carbon dioxide (36.6%), carbon monoxide (36.3%), water (10.7%), hydrogen (1.7%), nitrogen (13.2%), and lead (1.7%) (SDD, 1990). The combustion products of carbon monoxide, hydrogen, and nitrogen will further change in the high temperature "afterburning" exhaust to form nitrogen oxide, nitrogen dioxide, carbon dioxide, and water. The lead emission is discussed in greater detail in Sections 3.2.2 and 3.2.3. The performance history of the Talos booster is excellent.

Between 1977 and February 1991, the Talos booster has been used by the Navy in their VANDAL program. The program has had 390 successful flights and 8 failures during this time period. Four of these eight failures were attributed to a booster tail-off characteristic causing booster-target recontact after separation. SDD has incorporated a drag brake assembly as the vehicle aft interstage to provide protection against residual thrust. Additionally, the ZEST boosters are from Lot 14, which has not shown the tail-off characteristic. Another failure was due to the booster nozzle coming off at ignition. The Naval Ordnance Station determined that the nozzle retaining rings were not in place on this booster, so inspection to check this condition was incorporated as a part of booster refurbishment activities. No repeat of this failure has occurred. The other three failures were possibly due to a booster break-up. The cause of the break-ups is undetermined. The boosters that will be used for ZEST were taken from a different lot than the boosters that failed (TBE, 1991c).

A Space Data Division manufactured interstage, made of aluminum 356T6, will be located between the Talos first stage and the Castor second stage. This interstage, which contains drag brakes and stage separation hardware, will serve as an adaptor for the different diameters of the Talos and Castor rocket motors. The interstage will be approximately 20.5 inches long, with a maximum diameter of 31.0 inches.

The Thiokol produced Castor I rocket motor belongs to a family of motors that have been used in a wide variety of propulsion systems from the Athena to Scout launch vehicles. Since 1959, Thiokol has produced 670 Castor I motors. The propellant in the Castor I motors for the ZEST flights was replaced and the casing was refurbished in January 1991. The motor is 222.45 inches long, with a diameter of 31.0 inches. Four fins are attached to the aft end of the Castor I for aerodynamic stability. The total weight of the Castor I is 9,389 pounds, of which 79% or 7,426 pounds is propellant. The Class 1.3 solid propellant is composed of TP-H8038, PBAA Polymer, and 14% aluminum. The propellant burns for 27.4 seconds with a burn time average thrust of 53,900 pounds. The combustion products and corresponding weight percentages are as follows: aluminum oxide (26.45%), carbon monoxide (27.95%), hydrogen chloride (21.71%), nitrogen (8.71%), water (8.40%), carbon dioxide (4.31%), and hydrogen (2.45%) (Thiokol, 1991). The combustion products of carbon monoxide, hydrogen, and nitrogen will further change in the high temperature "afterburning" exhaust to form nitrogen oxide, nitrogen dioxide, carbon dioxide, and water. The performance history of the Castor I motor is excellent. The Castor I series includes 566 successful flights and one failure in December of 1984 (Keese, 1991c). The failure of this motor can be attributed to the age of the motor, which had exceeded its shelf life; leakage around the initiator; and exposure of the hydrophilic (has affinity for water) propellant to prelaunch moisture. To prevent reoccurrence of this type of failure, SNL modified its preflight operations and Thiokol doubled the initiator seals (Keese, 1991c). Since that failure, SNL has successfully flown 6 Castor motors. Therefore, the probability of motor failure is very low.

Another interstage, made of aluminum 6061, will be located directly atop the Castor I rocket motor. It will adapt the different diameters of the Castor I and PMB, house three strobe lights, and provide a mounting location for the forward launch lug (for attachment to the KTF launch rail). The interstage will be 23.0 inches long, with a maximum (aft) diameter of 31.0 inches, and a minimum (forward) diameter of 24.0 inches (SDD, 1990a).

The PMB will be a SDD manufactured equipment module. Its length will be approximately 30 inches, and its diameter 24 inches. It will weigh approximately 260 pounds. The PMB will carry the following major subsystems: power system, system batteries, vehicle ordnance system, data acquisition system, command event system, strobe controller, C-band transponder, antennas and umbilicals.

The LANL payload package (Figure 1-4) consists of 119 kg of PBX 9501, a Class 1.1 high explosive. A 100 kg layer of tungsten/vinyl surrounds a 25 cm radius sphere of the PBX 9501. The experiment package will be in a spherical configuration. The complete payload section will be on top of the PMB, and weigh approximately 795 pounds (SDD, 1990a).

The payload will be deployed, with its firing components, 20 seconds prior to detonation by a Flexible Linear Shape Charge (FLSC), which is an explosive device that will cut the outer skin of the payload section. The experiment detonation is therefore independent of launch and booster control commands. Sixteen springs will propel the nose cone and payload forward with separation velocities of 6 meters per second and 2.5 meters per second respectively. In addition, an infra-red sensor system is also contained in the aft region of the payload support to confirm the detonation event. The HE detonation products will include: water ($H_20$), carbon dioxide ($CO_2$), carbon monoxide (CO), nitrogen ($N_2$), hydrogen ($H_2$), ammonia ($NH_3$), nitrogen oxide (NO), hydroxide (HO), methane ($CH_4$), and solid carbon (C) (see Section 3.2.3 and Table 3-5). The combustion products of carbon monoxide, hydrogen, and nitrogen will subsequently convert to nitrogen oxide, nitrogen dioxide, carbon dioxide, and water. The insertable initiator and FLSC detonators will not be shipped with the payload and will be inserted as late as possible into the arming/launch sequence. Likewise, the separation springs are not installed/compressed until the rocket mating procedures are initiated at the launch complex (Ney, 1991).

The experiment detonation will be performed by a timer that is started by a Radio Frequency (RF) uplink command keyed to the mission timeline. Upon initiation of the payload, the HE is expected to reduce all payload components to small fragments. The detonation will produce an explosively driven expanding spherical cloud of tungsten particles (1.5 micron average size) at an altitude of 350 - 450 km (Ney, 1991) (See section 3.2.3.). Should the mission be aborted prior to detonation of the HE, the payload is expected to detonate on impact on water (Ney, 1991).

A nondeployable, aerodynamic nose cone fabricated by SDD will be fixed atop the LANL payload cylinder. This nose cone will be made of aluminum, approximately 72 inches long, and have a maximum diameter at the aft end of 24 inches (SDD, 1990a).

The rail launched and unguided ZEST rockets are an inherently accurate configuration, and range safety requirements for ZEST can be accomplished without the use of a Flight Termination System (FTS). An FTS is not planned for the ZEST rocket.

#### 1.2.1.2 Flight Profiles

Two ZEST flight experiments (1 and 2) will be launched from Launch Pad No. 1. The rockets will be launched at an azimuth between 0 to 5 degrees (see Figures 1-7 and 1-8 in Section 1.2.4.4) and will have quadrant elevations (QE) between 79-85 degrees. The ZEST flight vehicles will be identical (Figure 1-3).

Some differences may exist in the internal configuration of the LANL payload, but they will not affect the mission profile, launch vehicle, or observable experiment events. To obtain different viewing angles from selected sensors, the ZEST 2 launcher QE will be slightly lower than ZEST 1, resulting in a marginally different trajectory, event latitude, and longitude. The payloads will be initiated at approximately 350 km (by detonation of the high explosive) on the ascending portion of the trajectory. The trajectory apogee is expected to be between 379 - 407 km. A typical mission trajectory is provided in Figure 1-5.

### 1.2.2 SDIO Program Mitigations

This section outlines mitigations that are applicable to the ZEST program and will be implemented as part of the proposed action.

- Biological Resources

  Launches that occur during the late fall migration season for the Newell's Townsend's shearwater, a federally listed avian species, will (as long as it does not conflict with launch safety requirements) use a U.S. Fish and Wildlife (USFWS) approved lighting system with special lenses and/or hoods to minimize the upward glare and reduce the likelihood of fledglings colliding with the launch apparatus.

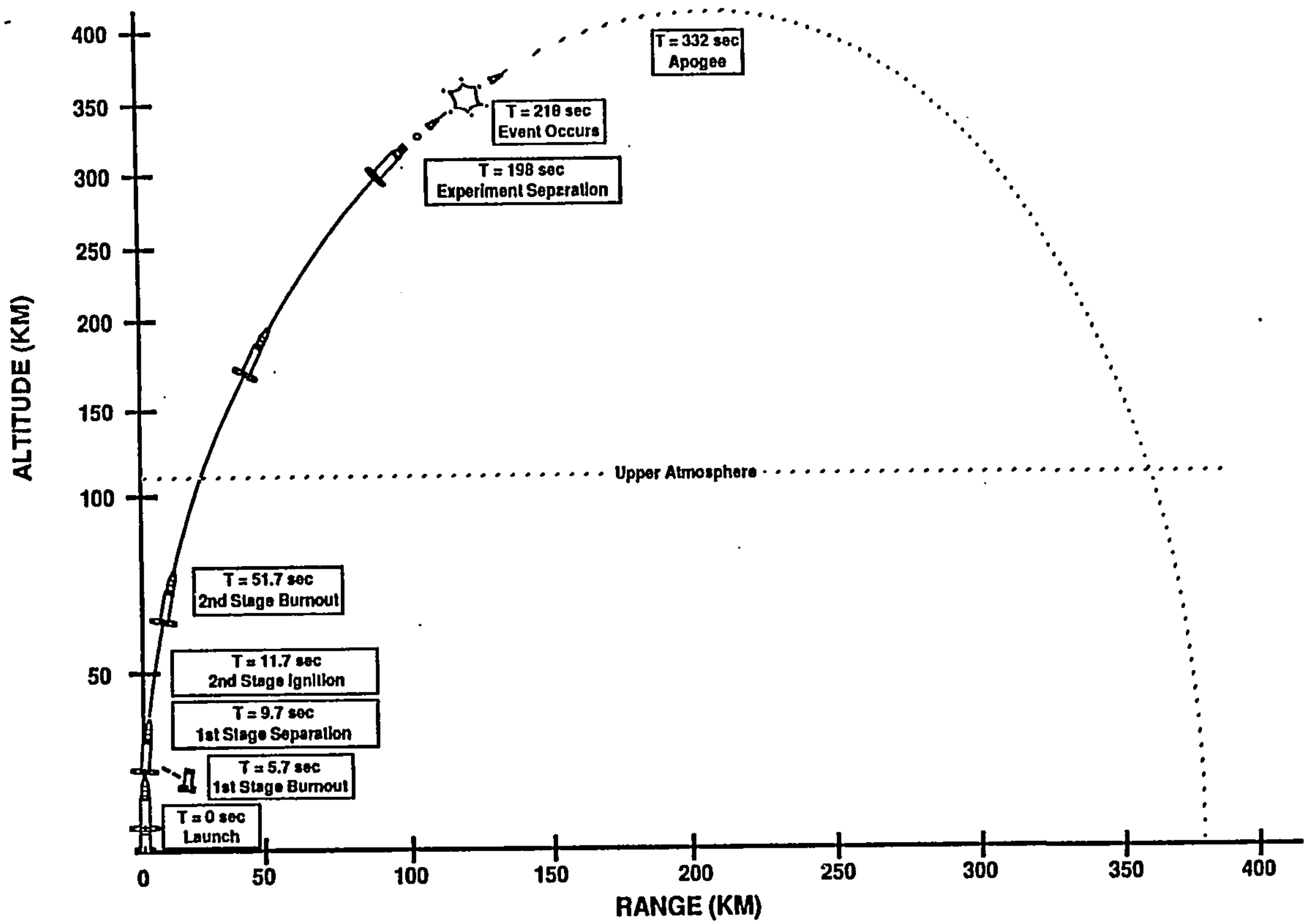


FIGURE 1-5
ZEST MISSION TRAJECTORY

SOURCE: SDD, 1991

- Public Health and Safety
  - a) Preflight hazardous operations with potential to impact public health & safety during ground transportation, storage, and assembly of the booster and/or payload; or from accidental preflight detonation on the launch pad will be addressed in and avoided by implementation of the *Activity Specific Environment Safety and Health (ES&H) Standard* Operating Procedures approved by SNL for activities occurring at KTF. These plans contain the following information: purpose and scope of activities; responsibilities; job qualifications; hazards identification; equipment and materials; standard operating procedure for the specific activity; waste disposal; and ES&H reporting and documenting.
  - b) Established mitigations (NAVSEA OP 5 and KTF SOPs) require that all nonessential contractor and military personnel and the public be cleared within a 1,250 ft radius while the booster is on the launch pad (2-14 days). This includes restriction of the beach area affected by this safety radius. By two hours prior to launch, when the launch vehicle is armed, all nonessential personnel and the public will be cleared from the 2,200 foot ZEST GHA. Ten minutes prior to the launch, all nonessential personnel and the public will be cleared from the launch hazard area, a pie shaped area, the sides of which are tangent to the ZEST GHA at headings of 15 and 300 degrees.
  - c) The ZEST transportation safety plan will be followed for shipment of ZEST equipment and materials to KTF. The plan (TBE, 1991e) includes the following:
    - Shipments will be scheduled to avoid peak traffic periods.

- All containers used for shipping will be Department of Transportation (DOT) approved (49 CFR 173.776 and 49 CFR 172.102) and will be transported in accordance with BOE-6000-I and DOT regulations. All containers will be checked for leaks.
- Operators will be trained on recommended emergency procedures, and will be given telephone numbers of emergency response teams to call in case of an accident.
- Fire and police departments on-base will be notified in advance of shipments, and informed by experienced personnel (and trained if necessary) of existing safety procedures to be used during ground transportation on Kauai.

d) To eliminate risk in public areas included in the GHA, PMRF security forces on the ground, in boats, and in helicopters (if necessary) will begin to use sweep and search measures three hours before the launch. This ensures that the GHA will be completely evacuated two hours before the launch when the launch vehicle is armed.

e) Control points will be set up by security forces along the roads contained within the ground hazard area (a 2,200 foot radius) to monitor and clear traffic during launch operations. No off-base land is contained within this area.

f) Commercial and private aircraft and ocean vessels will be notified in advance of launch activities by the PMRF Safety Office through Notice to Mariners (NOTMARs) and Notice to Airmen (NOTAMs), respectively. Prior to launch, the predicted spent rocket impact areas are swept by PMRF radar and airplanes to ensure that no boats or aircraft are in the area.

- Land Use

  While boosters are on the launch pad (2-14 days), the 1,250 foot ESQD radius will be cleared of all nonessential contractor and military personnel as well as the public. During this time, access to the portion of the coastline along KTF that is encompassed in the safety radius will be limited to the extent practicable. In addition, efforts will be made to minimize the amount of closure time.

### 1.2.3 Component/Assembly Ground Test Activities

Component/assembly ground testing activities involve the design, fabrication, integration, and testing of the launch vehicle, equipment components, PMB, and experimental payload, prior to disassembly and transportation to the launch site. ZEST component fabrication and assembly tests involving the booster interstages, PMB, and support equipment will be performed at Space Data Division's Chandler, Arizona facility. ZEST component fabrication, assembly, and tests involving the payload will be performed at Los Alamos National Laboratory, Los Alamos, New Mexico.

#### 1.2.3.1 Space Data Division, Chandler, Arizona

Component fabrication, assembly, and testing at SDD will involve the following activities:

- Fabrication and assembly of the nosecone, PMB, and interstages;
- Subsystem integration and environmental tests on the nosecone, PMB, and interstages, including thermal cycle, shock, and vibration tests;
- System level integration and environmental testing of above subsystems and the payload subsystem, which consists of an LANL inert payload structure with LANL and SNL electronic and mechanical components (Koleber, 1991).

Several existing areas in SDD's main building will be used for the production of ZEST components, component/assembly testing, and integration. No modification or refurbishment is required. SDD will use 30 existing personnel (10 full-time and 20 part-time) in the ZEST activities (Koleber, 1991).

#### 1.2.3.2 Los Alamos National Laboratory, Los Alamos, New Mexico

The component fabrication, assembly, and tests at LANL will involve:

- Fabrication of the payload;
- Checkout of the payload electronics and external interfaces.

The payload package will be assembled at LANL, in existing facilities at S-Site, Technical Area 16, where machining and assembly of explosives packages are routine operations. The proposed work is smaller in scale and involves materials that are less hazardous than testing of explosives and other projects currently and historically performed in these facilities. All activities involving hazardous materials will be performed in accordance with all applicable safety standard operating procedures. No construction or new personnel will be required (Pendergrass, 1991).

### 1.2.4 Preflight and Flight Test Activities

Preflight activities extend from the completion of assembly and testing to the time the launch vehicle is assembled, checked out, and ready for launch. Preflight activities will occur in the continental United States (CONUS) and at KTF. Flight test activities begin when final vehicle arming has been completed and launch countdown procedures commence. Flight test activities include launching and monitoring the vehicle as well as collecting flight data.

### 1.2.4.1 Disassembly and Transportation

One shipment has been planned to transport all of the equipment for the ZEST program from various locations in the continental United States to KTF. Shipping methods will include a mix of military and commercial means, and a mix of land, sea, and/or air transport. The preferred methods of shipment are detailed in the following paragraphs. The two Talos boosters will be taken from existing stock of motors used in the Navy's VANDAL program.

The remaining equipment shipment will be transported by military air from Kirtland Air Force Base (Albuquerque, NM) to Barking Sands with one stop at Williams Air Force Base (Chandler, AZ). This shipment will initially contain 2 Castor I boosters and 2 LANL high explosive payloads (119 kg PBX 9501 each). The Castor I motors and the LANL payloads will be trucked from Huntsville, AL and Los Alamos, NM, respectively. The Talos fins (8), Aft Interstage/Drag Brakes (2), Castor I Fin Mount Rings (2), Castor I fins (8), forward interstages (2), Payload Module Buses (2), nose cone assemblies (2), and additional hardware, support and test equipment, and tools will be picked up at Williams Air Force Base. Some sensitive electronic equipment will be in this shipment. After arriving at PMRF these items will then be transported by truck to KTF. If additional items need to be shipped after this time they will be transported to KTF by commercial air as long as they are not hazardous materials (i.e., explosives). All shipments will be conducted in accordance with the ZEST transportation safety plan (TBE, 1991e).

The ZEST-1 solid propellant rocket motors will be transported to the Rocket Motor Staging Area (RMSA). The ZEST-2 Talos motor will be stored in an explosive storage magazine at PMRF. The ZEST-2 Castor motor will be stored at Assembly Building # 2 at KTF. Similarly, the ZEST 1 HE payload will be stored and processed in the AB #2 while the ZEST-2 payload will initially be stored in the PMRF facility, then moved to the AB for processing. The AB is certified to hold up to 30,000 pounds of Class 1.1 explosives (Figure 1-6).

The transportation of explosives will be in accordance with the ZEST transportation safety plan (TBE, 1991e). This safety plan identifies the safety hazards associated with the transportation of ZEST program materials and equipment, and prescribes the appropriate safety procedures. All ZEST shipments will be conducted in accordance with 49 CFR 100-199, Transportation and Movement of Hazardous Cargo, and DOT Bureau of Explosives Tariff No. BOE-600-I, Hazardous Materials Regulations.

#### 1.2.4.2 Assembly and Checkout

Preflight tests at KTF will involve:

- Receiving, inspecting, and verifying the rocket motors, PMB, LANL payload and other launch vehicle hardware upon arrival at PMRF.
- Evaluating the Launch Support Equipment (LSE) installation and checkout, calibration, and maintenance.
- Assembling the PMB, interstages, LANL payload, and rocket motors on the launch pad.
- Evaluating the reception of pre-launch data (SDD, 1991a).

Component assembly and testing will be conducted in existing AB #2, Payload Building A, the RMSA, and at Launch Pad No. 1 at KTF (Figure 1-6). The RMSA will serve as the integration site for the Talos and Castor boosters. The AB #2 will serve as the integration site for LANL payload. Payload building A will serve as a testing and checkout site for the PMB (TBE, 1991e).

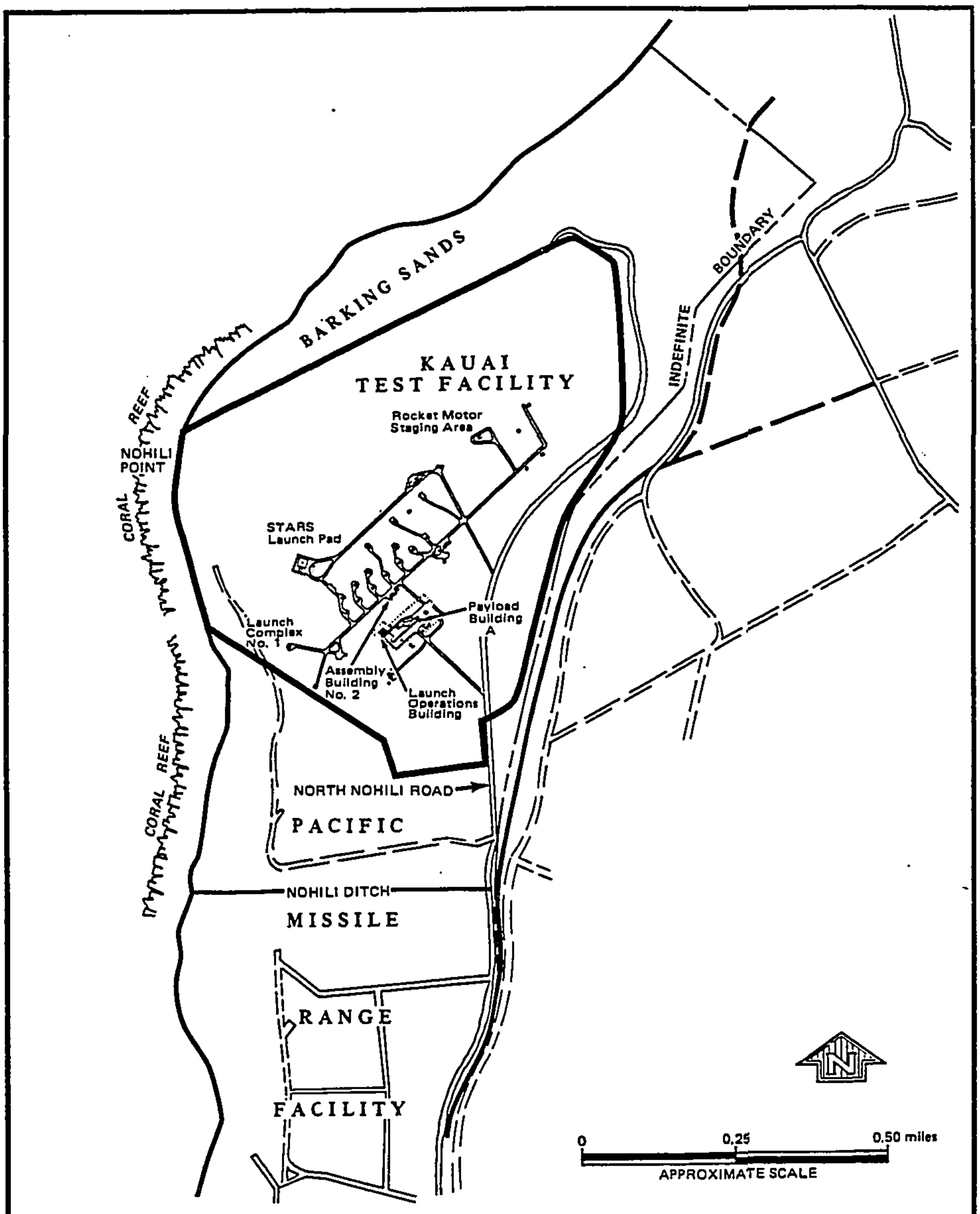


FIGURE 1-6
SITE PLAN
KAUAI TEST FACILITY

SOURCE: Teledyne Brown Engineering, 1991

Approximately 20 additional contractor personnel and 5 additional government personnel will be required for these component assembly and tests, over a period of about 45 days (SDD, 1990a).

Safe Operating Procedures for all KTF activities are addressed in the Safety Assessment for Missile Launch Complex at Barking Sands (SNL, 1988), which states that SOPs must be posted in all operating locations. In addition, safety regulations limit the number of personnel involved in hazardous operations.

Hazardous operations, material handling, and waste disposal procedures at KTF will be performed in accordance with the General Safe Operating Procedure for Operations at Kauai Test Facility, SOP 70212 9007, dated July 27, 1990. A Hazards Communication Plan (in SNL Environment, Safety and Health Manual, MN471001) and availability of Material Safety Data Sheets (MSDS) will provide guidance for handling of hazardous materials. Standard Safety Operating Procedures (SSOP) will be prepared and submitted to SNL for review and approval prior to conducting hazardous activities.

#### 1.2.4.3 Launch and Range Control

Hazardous hardware (i.e., rocket motors, payload, test equipment, etc.) that is handled on base beyond the KTF boundary is stored and moved by PMRF. PMRF personnel approve, supervise and provide security for these activities. Upon arrival at KTF, SNL assumes these responsibilities. SNL is responsible for all pad safety activities during launch preparation and will coordinate range support through PMRF, which exercises overall ground safety. SDD has developed ZEST ground safety documentation (activity specific ES&H standard operating procedures) and submitted them to SNL for approval. These plans contain the following information: purpose and scope of activities; hazards identification; equipment and materials; standard operating procedures for the specific activity; waste disposal; and

ES&H reporting and documenting. SDD is also responsible for the design and qualification of all vehicle safety systems and will provide analyses required for range safety application by SNL. SDD in conjunction with SNL will oversee the activities of ZEST range user personnel to ensure that all applicable safety plans and procedures are followed.

Pacific Missile Test Center (PMTC) maintains approval authority and responsibility regarding flight safety for the mission. PMTC personnel fully participate in ZEST planning activities, including reviewing of all ZEST flight safety procedures, and resolving any discrepancies which may arise. The interface between PMTC and the ZEST program involving request for flight safety approval is SNL. PMTC reviews and approves all required analyses and testing before the vehicle is permitted to launch from KTF. The PMTC Flight Safety Officer will give final approval/disapproval for the ZEST flight.

#### 1.2.4.4 Range Safety

This section discusses the application of safety procedures for storage, assembly, prelaunch, and launch activities, and covers the application of safety and noise protection distances to protect the ZEST workers and other personnel stationed on KTF. The four safety issues of concern associated with the ZEST flight vehicle are ground and launch safety areas, solid propellant handling, noise protection, and payload safety.

<u>Ground and Launch Safety Areas</u>

Each solid propellant booster contains chemicals that are categorized as explosive ordnance. The net explosive weight (NEW) of each booster is calculated to convert different hazard classes to a single class weight to determine appropriate ground safety distances. The proposed boosters are the Castor I and the Talos. The combined explosive weight and hazard class for the ZEST vehicle is given in Table 1-2. The Explosive Safety Quantity

**TABLE 1-2**
Net Explosive Weight and Hazard Class
for the ZEST Launch Vehicle

LANL PAYLOAD (Classification 1.1)

PBX 9501 = (119kg)(1 lb/.454kg) = 263 lb

TALOS BOOSTER (Classification 1.3)

For double base propellants (Talos) the TNT equivalent* is 100%

Propellant weight = 2,803 lb

TNT Equivalent = (2,803 lb)(1.0) = 2,803 lb

CASTOR I BOOSTER (Classification 1.3)

For composite propellant (Castor) the TNT equivalent* is 50%

Propellant weight = 7,426 lb

(7,426 lb)(.50) = 3,713 lb

Vehicle Explosive Weight

(LANL Payload) + (Talos Booster) + (Castor Booster) =
263 lb + 2,803 lb + 3,713 lb = **6,779 lb**

VEHICLE STACKUP CLASSIFICATION IS 1.1*

* NAVSEA OP 5; Volume I, Fourth Revision (U.S. Navy Ammunitions and Explosives Ashore Manual

Distance (ESQD) for Launch Pad No. 1 is an area with a radius of 1,250 feet based on DoD Standard 6055.9 (DoD Ammunitions and Explosives Safety Standards, Table 9-1), which qualifies the pad for up to 30,000 pounds of Class 1.1 Explosive at an ESQD of 1,250 feet. The ZEST Vehicle Explosive Weight is 6,779 pounds, based on the solid propellant and payload converted to Class 1.1 explosive. In addition, SNL will establish ESQDs around storage and assembly buildings that house ZEST components containing ordnance (see Figure 2-1 in section 2.2.1).

PMTC has defined the ZEST Ground Hazard Area (GHA) and the launch hazard area based on SNL's Range Safety Authorization Request. The ZEST GHA at the launch pad is a circle with a radius of 2,200 feet (Figure 1-7). With the exception of the beach area, the GHA will contain all on-base land (either KTF or PMRF). The launch hazard area includes the impact zones for the first stage booster and the unfired second stage booster. The launch hazard area is a pie-shaped area extending 5 nautical miles downrange (Figure 1-7). The boundaries of the launch hazard area consists of two tangents to the ZEST GHA at headings of 15 and 300 degrees.

The GHA, launch hazard area, and second stage impact area will be searched for all unauthorized personnel and civilians on the day of the launch (see Figure 1-8). These safety clearance areas will be monitored during the launch countdown to ensure that no unauthorized personnel are present. If a safety area is breached the launch countdown will be halted until the area is cleared. Three hours before the launch, PMRF security forces will begin to advise nonessential personnel and the public to clear the GHA. This will ensure that the GHA is completely evacuated two hours prior to the launch when the vehicle is armed. The launch hazard area will be maintained from 10 minutes prior to the launch countdown until the rocket has been successfully launched and the first stage has successfully separated. The second stage impact area will remain clear of all contacts for 12 minutes after the launch (PMTC, 1991).

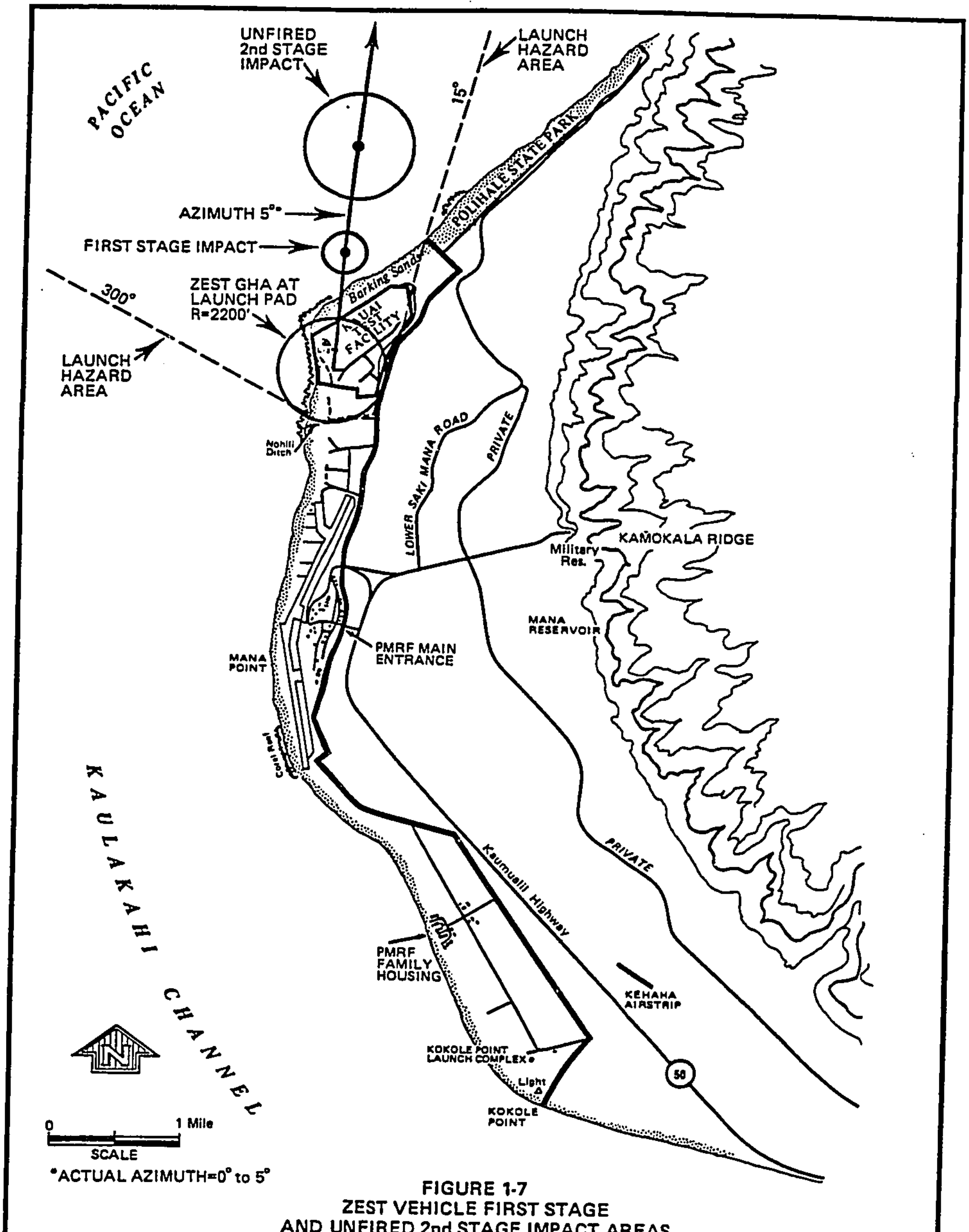


**FIGURE 1-7**
**ZEST VEHICLE FIRST STAGE AND UNFIRED 2nd STAGE IMPACT AREAS**

SOURCE: SNL, 1991

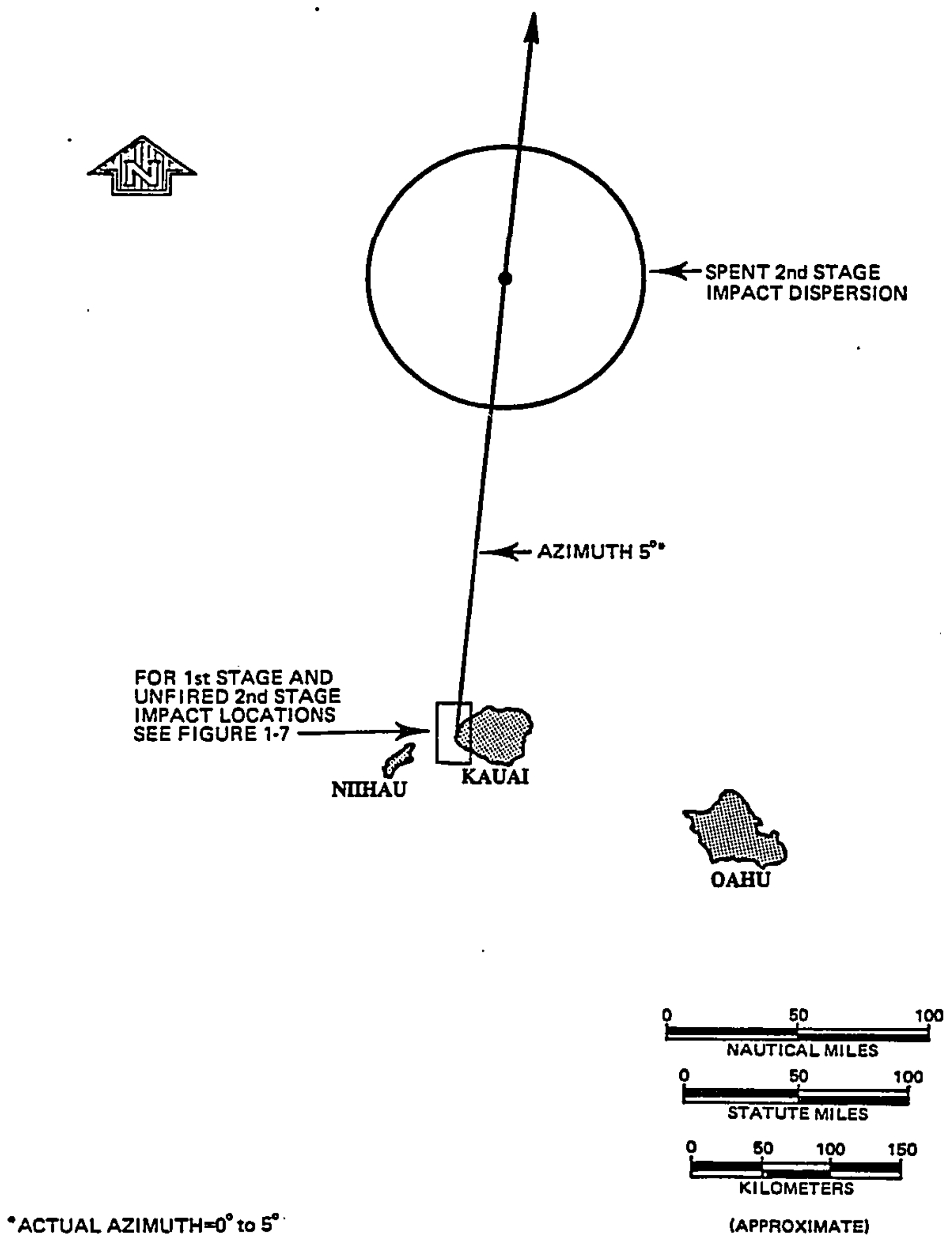


**FIGURE 1-8**
**ZEST VEHICLE 2nd STAGE**
**IMPACT DISPERSION**

SOURCE: SNL, 1991

Solid Propellant Handling

The transportation and handling of solid propellant rocket motors will be in accordance with Bureau of Explosives (BOE) Tariff Number BOE-6000-I. Appropriate safety measures will be used during handling and storage of the boosters as required by the DOD and described in *DOD 4145.26M*, DOD Contractors Safety Manual for Ammunition and Explosives (March 1986).

Noise Protection

Personnel hearing protection will be in place during launches to ensure that short-term noise events do not exceed the OSHA criterion of 115 dBA for 15 minutes of exposure (29 CFR 1910.95). Based on noise monitoring during launches at KTF in February 1991 for a NIKE and a STRYPI launch (DOE, 1991), hearing protection will not be required outside the GHA (see section 3.2.4).

Payload Safety

To ensure that accidental detonation of the HE payload does not occur, the insertable initiators and the detonators for the flexible linear shape charge are not transported with the payload, and will be installed as late as possible in the arming/launch sequence. The separation springs will not be installed until the rocket is assembled at the launch complex. In addition, the flexible linear shape charge will be separated from the internal componentry by a steel support ring (Ney, 1991). Payload safety during launch will be further ensured by hardened safety switches which prevent undesired firing signals from an inadvertent signal or noise (Ney, 1991). These will include a gravity switch that closes only during the extreme G-forces of a launch, and a baro switch which closes at reduced barometric pressure above an altitude of approximately 50,000 feet.

### 1.2.5 Demobilization

Following the completion of the ZEST launches, all communications, launch support, and other types of equipment mobilized for ZEST that do not support the permanent mission of KTF will be removed. This will consist of the dismantling of temporary equipment. The demolition or decommissioning of any permanent facilities at KTF will not be required. Any hazardous materials (solvents, etc.) brought onto KTF or generated during launch preparation which are not accepted in writing by SNL will be removed from the facility by the user organization (SDIO).

## 1.3 NO-ACTION ALTERNATIVE

The no-action alternative is to not conduct the ZEST flight test experiments as presently planned. The no action alternative will not allow SDIO to meet mission requirements for a strategic defense system. The anticipated data are necessary for the evaluation, testing, and development of space-based sensors.

## 1.4 ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD

### 1.4.1 Alternative Launch Locations

The ZEST flight test could be launched from the following locations: Kauai Test Facility, Hawaii; Poker Flat, Alaska; White Sands Missile Range, New Mexico; Wallops Island, Virginia; and Cape Canaveral, Florida. The technical aspects of the ZEST program require that the launch site be in close proximity to a large tracking telescope and mount capable of pointing within small fractions of an arc minute (or less than 1/10th miliradian). Of those sites listed above, the only one that is capable of fulfilling this requirement is KTF.

The AMOS/MOTIF facility on Maui can uniquely provide a tracking telescope that is in close proximity to KTF, and that will meet ZEST program requirements (Theriault, 1991b).

### 1.4.2 Alternative Launch Vehicles

A detailed study was performed to select the appropriate launch vehicle for the ZEST flight test experiments. The five mission requirements and payload specifications used as a basis for the launch vehicle selection were as follows: 1) an apogee of 350 km given a payload weight of approximately 360 kg; 2) a minimum vehicle diameter of 24 inches; 3) a circular error probable (CEP) radius of 60 km with the payload delivered at a known position and time; 4) an unguided spin stabilized vehicle, and 5) a launch history at KTF/PMRF. Vehicles with an outside diameter of less than 24 inches were also reviewed as possible candidates. In all cases, if a modification to accommodate a 24 inch payload was feasible, the required apogee was not met (Theriault, 1991a).

The booster configurations that were studied are as follows: Talos-XM51 (guided); Talos-Castor I (guided); XM51-M57A1 (guided); Talos-XM51 (unguided); Talos-Castor 1 (unguided), Black Brandt 10 (unguided); Aries (guided), and Talos-Sergeant (unguided). The only configuration that met all of the above criteria is the Talos-Castor 1 (unguided) (Theriault 1991a).

# 2.0 AFFECTED ENVIRONMENT

This section of the environmental assessment includes a discussion of the affected environment for those locations at which proposed activities will occur. These locations include those for ground, preflight, and flight tests of components and assemblies. The purpose is to provide the reader with an overview of the environment within which the proposed activities will take place.

## 2.1 COMPONENT/ASSEMBLY GROUND TEST LOCATIONS

Information encompassing the technical operations of component/assembly ground test participants in the ZEST program was based on telephone conversations with facility personnel, responses to data requests, and extracts from existing environmental documentation. The goal was to identify current activities and the existing environment at the various facilities. Each facility was reviewed to determine the potential impacts from executing the proposed activities on the existing characteristics in the following areas: physical setting and manmade (built) environment, geology and water resources, air quality, noise, biological resources, threatened and endangered species, cultural resources, infrastructure, hazardous materials and wastes, and public health and safety. Not all environmental media applied in all cases to the locations reviewed. Therefore, the description of the existing environment at each of the various facilities is consistent with the level of activity proposed and the potential effect on the environment.

### 2.1.1 Space Data Division, Chandler, Arizona

The Orbital Sciences Corporation, Space Data Division, is a commercial/industrial operation located on 40 acres on the outskirts of Chandler, Arizona. The SDD facility is a modern structure, built in 1989, with two stories and 40-foot ceilings in the 280,000-square foot production and integration bays. Approximately 550 personnel are employed at SDD, of whom approximately 10 will be working full-time, and up to an additional 20 will be involved part-time on the ZEST program.

The existing structure houses an engineering wing, an electronics assembly area, a production wing, several build-up/integration bays, environmental bays, and a Class 10,000 (can contain no more than 10,000 particles, 0.5 micron in size or larger, per cubic foot of air) clean room.

SDD has all applicable Federal, state, and local permits and authorizations necessary for current operations (Genest, 1990; Koleber, 1991). Activities conducted for the ZEST program are routine procedures for this facility and are performed within enclosed areas of existing buildings. Potential impacts to air quality, water quality, geology and hydrology are not addressed because there is not a potential for emissions or discharges to the environment. There are no known historic or archaeological sites at the facility, and no threatened or endangered species are known to frequent the area (Koleber, 1991).

Hazardous materials are managed in accordance with the Hazardous Materials Management Plan, Technical Manual (TM)-4789, dated 2 May 1990. This document is required by the Uniform Fire Code and was approved by the Chandler, Arizona Fire Department on 7 May 1990. The Space Data Division is considered a Hazardous Waste Small Quantity Generator and is operated under Permit #EPA ID #AZD 981 631 674 and the Maricopa County

Department of Environmental Health Services, Bureau of Air Pollution Control Permit #A8602251. The division uses no chemicals that are, or have been, discharged into any sewer or wastewater system, and uses standardized precautions to avoid spills. In addition, OSHA Standard 1910.1200, Hazard Communication, is in effect at the facility (Downing, 1990).

### 2.1.2 Los Alamos National Laboratory, Los Alamos, New Mexico

Los Alamos is a small, incorporated county, located in north-central New Mexico about 60 miles north-northeast of Albuquerque and 25 miles northwest of Santa Fe by air. The County consists of the Laboratory and two adjacent communities, known as Los Alamos townsite and White Rock. Los Alamos county is situated on the Pajarito Plateau between the Jemez Mountains to the west and the Rio Grande Valley to the east. The plateau consists of a series of relatively narrow mesas separated by deep, steepsided canyons that run east-southeast from the Jemez Mountains down to the Rio Grande.

LANL was originally founded for the purposes of national security and has continued as one of the three designated national nuclear weapons laboratories. The major research program areas conducted at LANL are energy, biomedical and environmental, and physical research.

Most of LANL and the surrounding community development is confined to the mesa tops. The 27,500-acre laboratory site includes 30 active technical areas, where the 124 principal buildings are located. LANL employs approximately 8,000 persons onsite or in conjunction with the laboratory's operations (Goldie, 1991).

At LANL, an ongoing environmental surveillance program maintains routine monitoring for radiation, radioactive materials, and hazardous substances onsite and in the surrounding area. The liquid wastes are discharged in compliance with NPDES permits. Solid hazardous wastes are managed in compliance with the site RCRA permit. Air emissions are reviewed for compliance with State of New Mexico Air Quality Control Act and the Federal Clean Air Act. As the environmental impacts of proposed payload assembly work are within the scope of ongoing similar work, no new permits will be required. Sensitive areas at LANL include archaeological and historical resources, habitat of state and federally listed threatened and endangered species, and sole-source aquifers; these areas will be unaffected by ZEST activities (Pendergrass, 1991).

## 2.2 PREFLIGHT AND FLIGHT TEST LOCATION, KAUAI TEST FACILITY, KAUAI, HAWAII

This section includes a discussion of the various locations at which preflight and flight test activities will occur. A description of the physical setting and various environmental characteristics is identified for each.

### 2.2.1 Physical Setting and Land Use

Kauai Test Facility is a rocket launch test facility located on the western coast of Kauai, Hawaii, south of Barking Sands, within the U.S. Navy's Pacific Missile Range Facility (PMRF) (see Figures 1-1 and 1-2). The KTF is bordered by the Pacific Ocean to the west, Barking Sands to the north, agricultural and undeveloped land to the east, and the PMRF main base to the south. Under an agreement between PMRF and the Department of Energy in 1987, KTF is a tenant on 274 of PMRF's 1,925 acres. Sandia National Laboratories (SNL) operates this facility for DOE (DOE, 1991; USASDC, 1990a; USASDC, 1990c).

The Island of Kauai has a population of approximately 44,000 (U.S. Bureau of the Census, 1988). The principal industries on the island are sugar and tourism (DOE, 1991). In 1988 approximately 1.4 million people visited the island (USASDC, 1990a). The two largest towns in Kauai are both situated on the east coast: Kapaa and Lihue with 1980 populations of 4,500 and 4,000, respectively, and are approximately 35 miles away from PMRF (DOE, 1991).

KTF is located in a relatively unpopulated district. Kekaha, with a 1980 population of 3,300, is currently the closest off-base residential area to the KTF. This village is approximately two miles south of the PMRF and nine miles south of the KTF (DOE, 1991).

KTF, also called the DOE Test Readiness Facility (USASDC, 1990a), fulfills multiple purposes in support of DOE weapons research and development activities (DOE, 1991). PMRF capabilities supporting KTF include extensive radar tracking, telemetry receiving and recording, and command and control.

Between 1962 and 1990, approximately 320 rockets were launched from KTF. The following are some of the rocket motors that have been launched or are proposed to be launched from KTF: Castor I, Recruits, NIKE, Terrier, A-3, Aries, and Talos. Current representative launch activity consists of approximately one STRYPI, two NIKE, and two TERRIER system launches per year (DOE, 1991).

At PMRF's Barking Sands facility, north of KTF, 18 Talos rockets have been launched as part of the Navy's VANDAL Targets program. Six Talos rocket motors were launched in fiscal year 1989, two were launched in fiscal year 1990 and ten were launched in the first half of fiscal year 1991. The VANDAL Targets program will continue until 1996 with plans to launch a half-dozen to a dozen Talos rockets per year. Some of the VANDAL systems have failed since the program began at Barking Sands in 1989. However, the failures were not due to the Talos rocket motor, but to the target itself (Barnes, 1991a; Barnes, 1991b; Collins, 1991).

Existing support facilities at KTF include a wind radar site, missile and rocket launchers, missile/payload assembly buildings, a Launch Operations Building, maintenance operations facilities, a warehouse/shipping-receiving building, administrative offices and a covered area for vehicles and machinery (USASDC, 1990a; DOE, 1991). KTF employs 14 permanent staff, although during rocket system launches or other scheduled activities, as many as 50 to 75 additional personnel may be at KTF on temporary duty (DOE, 1991).

Land use on the island of Kauai is regulated under both State and Kauai County land use controls. The PMRF (including KTF) occupies approximately 1,925 acres of ceded land, which was transferred to the United States for military purposes in 1940 and 1941 under State Executive Orders Nos. 887 and 945. The transfer was made on the condition that public access to the PMRF for the purpose of fishing be maintained except when hazardous operations are actually in progress or about to commence (DOE, 1991).

Two different types of land use restrictions are imposed during hazardous operations, the Explosive Safety Quantity Distance (1,250 foot radius for ZEST) and the Ground Hazard Area (2,200 foot radius for ZEST). The ESQD is put into effect when boosters are onsite and the GHA is put into effect when the rocket is armed. Both the ESQD and the GHA are launch-specific, and vary for the different programs at KTF. Existing safety zones at PMRF and KTF are shown on Figure 2-1.

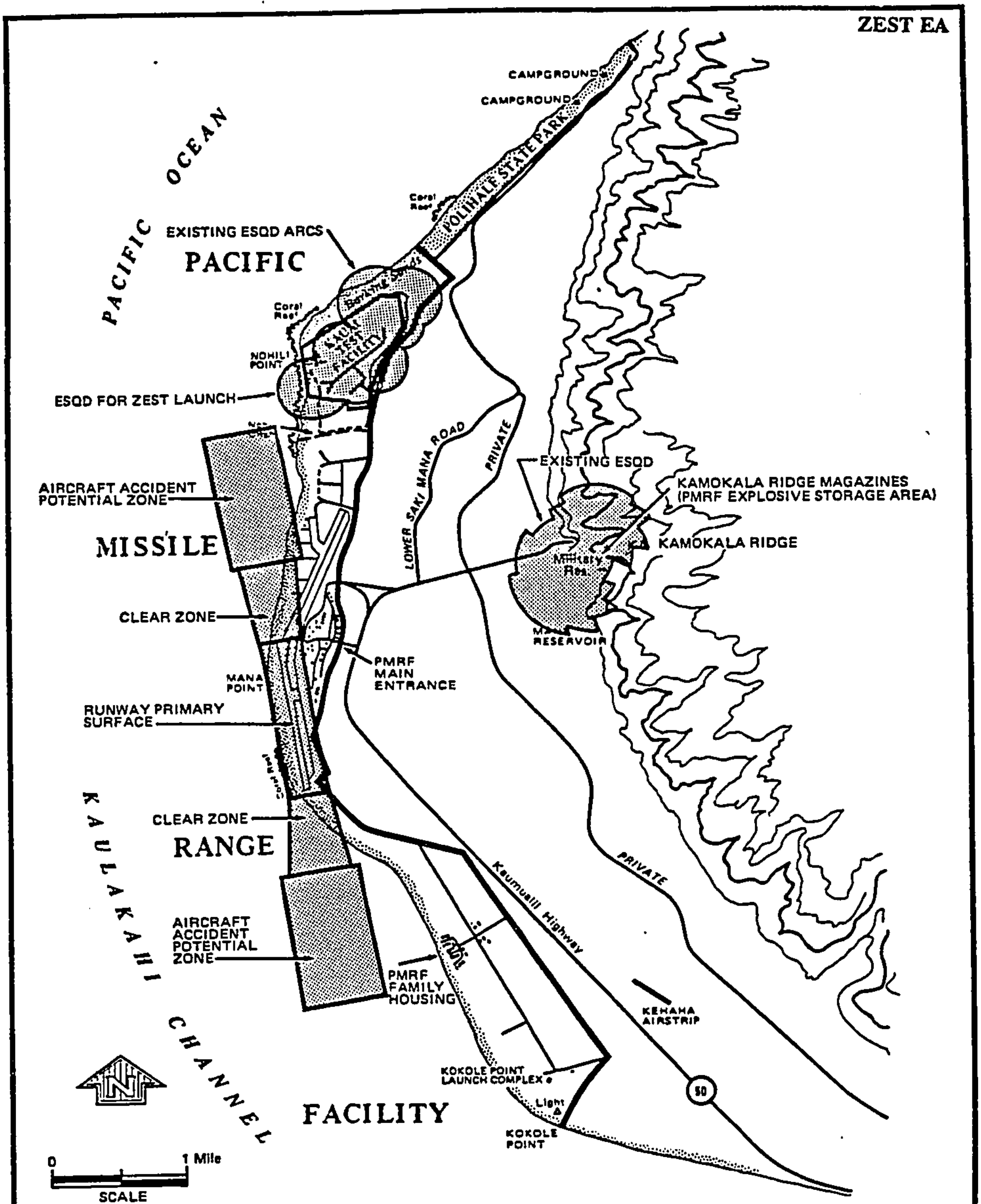


FIGURE 2-1
SAFETY ZONES AT PMRF AND KTF

SOURCE: USGS, 1983; USASDC, 1990a

PMRF has divided its 8 mile long coastline into three designated recreation areas to minimize the beach closure during hazardous military missions (Figure 2-2). All three beach areas are open 24 hours a day on weekends and holidays except during hazardous operations. Recreation Area No. 1 includes the Barking Sands dunes area adjacent to the KTF and is open Monday through Friday from 4:00 pm to 6:00 am (DOE, 1991; USASDC, 1990a). Currently, Recreation Area No. 1 is closed an average of six days per year due to hazardous operations on KTF (DOE, 1991). Besides preventing the public from using the beach, closure of any portion of the beach may also prevent the public from crossing Recreation Area No. 1 into Polihale State Park. According to the U.S. Army Strategic Defense Command, (USASDC, 1990a), 4,476 people used Recreation Area No. 1 from November 1987 through August 1989.

### 2.2.2 Geology and Water Resources

Kauai is the oldest and fourth largest of the eight main islands of the Hawaiian archipelago. PMRF extends eight miles along the western coastal edge of the Mana Plain from Kokole Point on the south to Nohili Point on the north (Figure 1-2). Kauai is relatively free from earthquake and volcanic activity; buildings constructed at KTF since 1987 have been designed for earthquake resistance (DOE, 1991).

The great Mana swamp, separated from the ocean by sand dunes and beachrock, covered the Mana Plain up until the mid 1800's. Due to its geological history, the Mana Plain's sandy surface consists of alluvium, calcareous beach, and dune sand deposits. Underneath the sandy surface, a wedge of terrestrial and marine sediments rests on top of a volcanic basement. The plain is flat with elevations ranging from 10 to 15 feet above mean sea level (MSL). Dunes within the PMRF and KTF may range up to 19 feet above MSL. However,

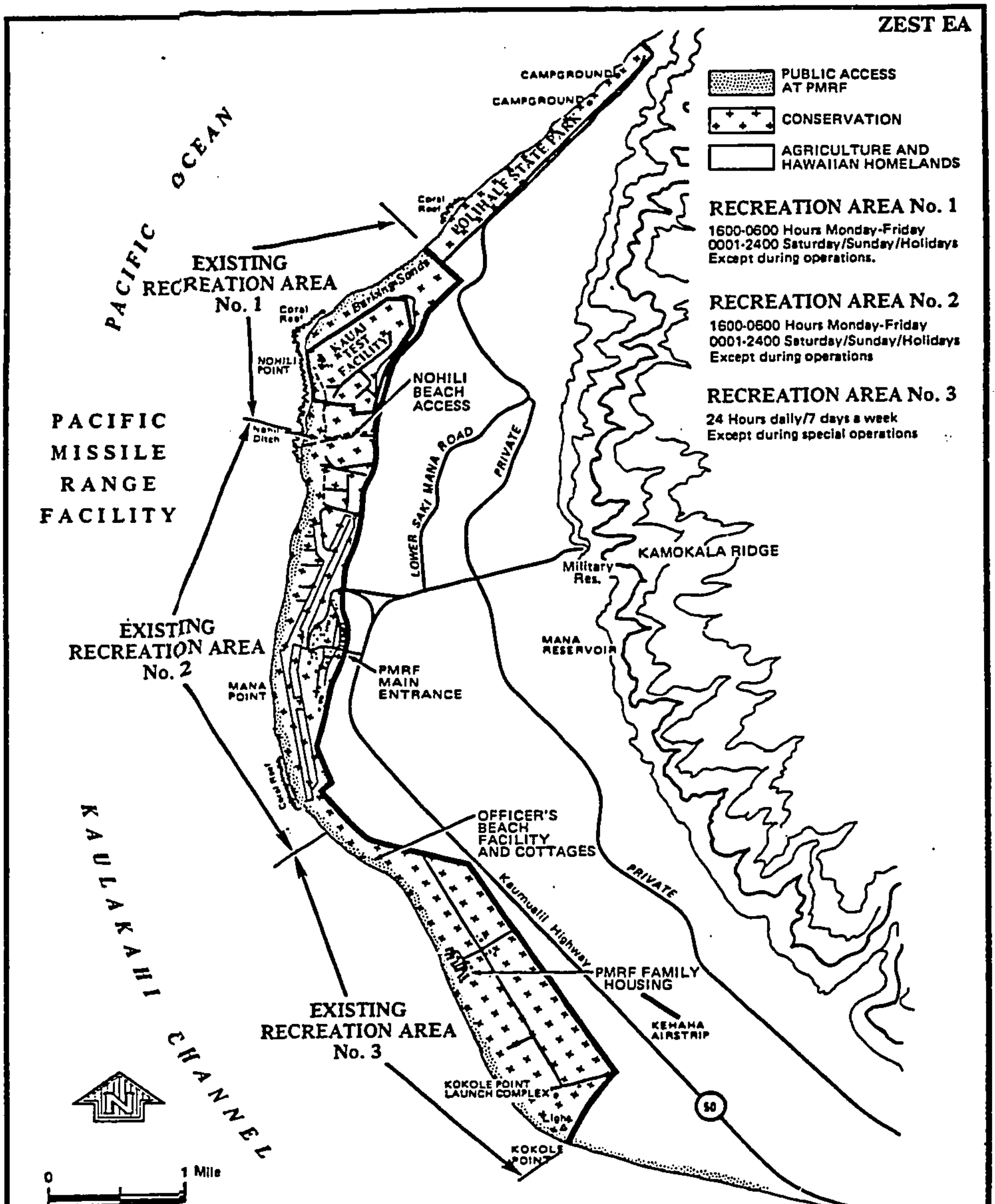


FIGURE 2-2
LAND USE AND RECREATION AT PMRF AND KTF

the dunes in the northern portion of the PMRF at the KTF (the Barking Sands) range from 40 feet to 100 feet above MSL (DOE, 1991).

Although the Mana Plain is one of the most arid regions in the State of Hawaii, several tsunamis and hurricanes have come ashore at PMRF in the last 50 years. In 1946, one tsunami caused wave runup to reach the 11-foot elevation mark and flood an area almost as far inland as Kaumualii Highway (DOE, 1991). In the event of a tsunami, there would be sufficient warning so that any rocket that is assembled on a launch pad could be taken down.

The KTF is located in two flood plain zones: AE, a 100-year flood zone, and VE, a 100-year flood zone from wave velocity in a coastal area. The base flood elevation is generally 13 feet (Flood Insurance Rate Map, Panel 100, March 4, 1987).

There are no natural streams in the northern part of PMRF (USASDC, 1990a). The surface sandy soils at KTF are very permeable, and runoff percolates into the sand. Two canals that artificially drain water from the sugar cane fields provide the only surface water in the area (DOE, 1991).

Underneath the coral and sand at KTF is a sand dune aquifer. It consists of a lens of brackish groundwater floating on seawater and recharged by seepage from the underlying sediments. The aquifer has a moderate hydraulic conductivity, probably 50 to 100 feet per day, and an effective porosity of about 20 percent. Attempts to tap the groundwater resulted in water that was too brackish to be useful. Subsequently, this aquifer is not utilized by KTF as a water source (DOE, 1991).

### 2.2.3 Air Quality

Surface winds at KTF are generally light and variable in direction. This is the result of island topography and orientation which splits the tradewinds so they flow around both sides of the island and the zone of convergence shifts to the north or south of KTF. However, intense weather systems to the northeast of KTF can generate northerly or south-southeasterly winds in speeds in excess of 30 knots per hour (DOE, 1991).

The average daily temperature at KTF is 75°. The recorded extremes are a record high and low of 95°F and 48°F, respectively. The warmest month is August with an average daily temperature of 78°F, and the coolest is January with an average daily temperature of 70°F. The median annual rainfall is 20 inches (DOE, 1991).

The major air emission sources at KTF are two diesel-powered generators and exhaust from rocket launches. The State of Hawaii ensures that all diesel generators comply with air emissions standards. Prevailing tradewinds in the vicinity help maintain air quality by quickly dispersing launch emissions. Currently, the Island of Kauai is in attainment for all air quality standards (DOE, 1991). The state and Federal air quality standards, and other guidelines that are applicable, can be found in Table 3-3.

### 2.2.4 Noise

The primary noise sources on PMRF and KTF are aircraft operations and day-to-day base operations. PMRF and KTF facilities and surrounding land uses are located in areas where the day-night sound (Ldn) level does not exceed 75 decibels on the A-weighted scale (dBA). Noise resulting from air operations has been monitored and Air Installation Compatible Use Zones have been established. To bring the Ldn levels at facilities near the aircraft runway to an acceptable range, buildings were constructed to reduce the noise level from 65-75 Ldn to 30-50 Ldn (DOE, 1991).

The infrequent and short-term increases in noise levels associated with rocket launches at KTF and PMRF have historically not been monitored. Noise monitoring was performed for the STRYPI/LACE Two Experiment Rocket Campaign in February 1991 (DOE, 1991) (see Section 3.2.4).

## 2.2.5 Biological Resources

### 2.2.5.1 Flora

According to a botanical survey conducted at KTF in July 1990 (DOE, 1991), four vegetation zones exist at KTF, all of which contain varying degrees of kiawa/koa haole scrub. The four zones are the kiawa/koa haole scrub zone, the open scrub zone, the coastal dunes zone, and the coastal strand (ocean shoreline) zone (DOE, 1991).

The area around Launch Pad No. 1 is within the open scrub zone. This zone consists of open, woody scrub or herbaceous species, many of which are introduced species, characteristic of disturbed areas. KTF has cleared this zone of brush and mows it regularly (DOE, 1991).

### 2.2.5.2 Fauna

Wildlife observed on KTF include several species of both native and introduced bird species (DOE, 1991). In addition, one species, the short-eared owl (*Asio flammeus sandwichensis*) is endemic to the island of Kauai and may occur on KTF. Other endemic bird species that are not expected to occur on KTF, but may be found on PMRF include the Hawaiian coot (*Fulica americana alai*), Hawaiian stilt (*Himantopus mexicanus knudseni*), common moorhen (*Gallinula chloropus sandvicensis*), Hawaiian duck (*Anas wyvilliana*), and Newell's Townsend's shearwater (*Puffinus auricularis*). Additional bird species known to exist within or near the KTF include the wedge-tailed shearwater (*Puffinus pacificus chlororyncus*), the American golden plover (*Pluvialis dominica*), the wandering tattler (*Heteroscelus incanus*), the sanderling (*Calidris alba*), and the barn owl (*Tyto alba*). Several species of water fowl, including the Laysan albatross (*Diomedea immutabilis*) may be found on KTF during some portion of the year (DOE, 1991).

Mammals observed on KTF include both feral cats and dogs. In addition, four species of rodents are expected to occur, including the house mouse (*Mus musculus*), Norway rat (*Rattus norvegicus*), roof rat (*Rattus rattus*), and the Pacific rat (*Rattus exulans*) (DOE, 1991).

### 2.2.6 Threatened and Endangered Species

The Federal Endangered Species Act of 1987 defines an "endangered species" as any species that is in danger of extinction throughout all or a significant portion of its range. A "threatened species" is defined as one likely to become endangered in the foreseeable future. In addition, the Hawaii Department of Land and Natural Resources recognizes and regulates impacts to species that may be considered to be endangered or threatened on a local or state level. Biological assessments conducted for the STARS and EDX programs (USASDC, 1990a; USASDC, 1990b), plus information on biological resources from the KTF EA (DOE, 1991) were consulted to develop a list of threatened, endangered, or candidate species known to occur in the KTF area (Table 2-1).

**TABLE 2-1**
**Federally Listed Threatened or Endangered Species in the KTF Area**

| COMMON NAME | SCIENTIFIC NAME | FEDERAL STATUS |
|---|---|---|
| Hawaiian duck | *Anas wyvilliana* | Endangered |
| Hawaiian coot | *Fulica americana ssp. alai* | Endangered |
| Hawaiian common moorhen | *Gallinula chloropus ssp. sandvicensis* | Endangered |
| Hawaiian stilt | *Himantopus mexicanus ssp. knudseni* | Endangered |
| Newell's Townsend's shearwater | *Puffinus auricularis* | Threatened |
| Humpback whale | *Megaptera novaeangliae* | Endangered |
| Hawaiian monk seal | *Monachus schauinslandi* | Endangered |
| Hawaiian hoary bat | *Lasiurus cinereus ssp. semotus* | Endangered |
| Pacific green sea turtle | *Chelonia mydas* | Threatened |
| O'hai | *Sesbania tomentosa* | Category 1 |
| Addler's tongue fern | *Ophioglossum concinnum* | Category 1 |

Source: DOE, 1991
USASDC, 1990a
USASDC, 1990b

Flora

One federally listed Category 1 plant species, o'hai (*Sesbania tomentosa*), has been reported in the dune habitat in Polihale State Park and may potentially occur in or near the coastal area of the KTF/PMRF. It is classified as a Category 1 because substantial evidence on its biological vulnerability is on file to support the appropriateness of listing it as an endangered or threatened species. Field surveys conducted in January and February 1990 for the STARS program (USASDC, 1990a) and in July 1990 for the KTF EA (DOE, 1991), however, did not observe *S. tomentosa* within KTF or PMRF. Therefore, this species is not expected to be affected by the proposed ZEST activities.

The adder's tongue fern (*Ophioglossum concinnum*) is another federally listed Category 1 candidate species (DOE, 1991). This plant is a small ephemeral fern which sprouts vegetative and reproductive fronds after a period of heavy rain. During the January and February 1990 floral reconnaissance of the proposed EDX launch pad and the STARS project area, several groups of *O. concinnum* were observed in either clearings in kiawe/koa-haole scrub or ruderal vegetation at the western end of KTF (USASDC, 1990a; USASDC, 1990c). As a mitigative measure, these plants were transplanted from the EDX launch pad site to the southern end of PMRF. A floral survey conducted in July 1990 did not observe any further colonies of *O. concinnum* at the site of the original colony, possibly due to dry conditions (DOE, 1991).

Fauna

Endangered bird species that may be present on KTF/PMRF include the common moorhen, black-necked (Hawaiian) stilt, American (Hawaiian) coot, and the Hawaiian duck. All of these species, except for the Hawaiian duck, were observed at north Nohili ditch, at the

Mana-based pond (outside PMRF), during the January and February 1990 field reconnaissance surveys for the STARS program (USASDC, 1990a).

The Newell's Townsend's shearwater (*Puffinus auricularis*) is an open sea bird that is federally listed as threatened. This species comes ashore to breed between April and November. During October and November, adults and fledglings fly between nesting areas in the mountains and feeding areas in the ocean at night (DOE, 1991). Although Newell's Townsend's shearwaters are not known to nest on or near KTF/PMRF, they may cross over the area in flights from the breeding grounds to the ocean (USASDC, 1990a).

The Laysan albatross (*Diomedea immutabilis*), although not a state or federally listed species, is protected under the Migratory Bird Treaty Act and is known to nest in the open scrub vegetation on PMRF. Approximately six pairs of the Laysan albatross displaying courtship behavior were observed in the KTF area during the January 1990 field reconnaissance of the STARS site (USASDC, 1990a). Because the albatross do not migrate in the summer months, none was observed in the July, 1990 field survey (DOE, 1991).

Two federally listed endangered mammal species that may be present on KTF/PMRF are the Hawaiian monk seal and the Hawaiian hoary bat. The monk seal (*Monachus schauinslandi*) has established a colony on Niihau Island, but is considered a "straggler" at PMRF (DOE, 1991; USASDC, 1990a). The Hawaiian hoary bat (*Lasiurus cinereus semotus*) is known to feed offshore at Polihale State Park (USASDC, 1990a) but none was observed in the July 1990 field survey at KTF or at any other time at PMRF (DOE, 1991).

The threatened green sea turtle (*Chelonia mydas*) has been known to come ashore and nest on the beach in the southern portion of the PMRF installation (USASDC, 1990a). During a survey at the shoreline of KTF in August 1990, at least 32 green sea turtles were observed feeding and resting offshore of the Nohili Ditch (DOE, 1991).

The channel between Kauai and Niihau islands is along the migration route of the federally listed endangered humpback whale (*Megaptera novaeangliae*). Most whales pass through the channel between December and April but some may arrive as early as October. Peak numbers occur in February (USASDC, 1990a).

### 2.2.7 Cultural Resources

PMRF (including KTF) is located within an area of Kauai called Mana. The locality is known from traditional Hawaiian religious cosmology as *leina-a-ka-u'hane*. The name refers to the Nohili Dune, directly to the north and behind the launch pads at KTF, from which the spirits of the dead would plunge to enter the spiritual realm. The Nohili Dune is a traditional, cultural property that is eligible for inclusion in the National Register of Historic Places. There is evidence from oral tradition and observation that portions of PMRF were used as burial grounds.

Site types in the area around KTF include burials, *heiaus* (religious sites or temples), traditional house foundations, taro farming terraces, and beach encampments, as well as the dunes. Historic sites in the locality include the remnants of the Mana townsite, sites associated with the railway system that once served the local sugar cane industry, and a historic Japanese cemetery. None of these sites has been observed on the KTF itself.

A 100 percent archaeological survey of the KTF and the Kokole Point Launch Complex site was conducted in February 1990. Some deposits were found near two of the boreholes. To date, the only site that has been recorded within the KTF as eligible for listing on the National Register of Historic Places is the Nohili Dune.

### 2.2.8 Infrastructure

Installation infrastructure demands are within the available operating capacity. At present, the KTF employs 14 permanent onsite personnel. During rocket system launches or other scheduled activities (currently, about 60 days per year), an additional 50 to 75 persons may be at KTF on temporary duty (DOE, 1991).

Kauai County has a total of 18,929 (1987) year-round housing units (USASDC, 1990c). Adequate housing exists off-base for all permanent KTF staff (USASDC, 1990a). Temporary personnel at KTF usually reside in motels or hotels on the southeastern coast of Kauai (DOE, 1991).

The normal source of power for KTF is the Kauai Electric Company (KECO). KECO owns and operates all lines on base. Supplies to PMRF are presently adequate with a 2 megawatt (MW) capacity and a 1.5 MW peak demand (USASDC, 1990c). Primary commercial distribution is via a 12,470 volt line. Fire, auto accidents, and high winds are potential contributors to power losses at KTF. For additional reliability, onsite generators are used during missions (DOE, 1991).

At PMRF, local power consists of five diesel generators (two at 600kW; three at 300 kW). KTF operates two 300 kW diesel generators. During critical test and launch sequences, the generators serve as the primary source of power. Electric distribution to launch pads is via underground cable (DOE, 1991).

Water for domestic consumption is supplied to the KTF by the PMRF. The water source is the Mana well, owned and maintained by the Kekaha Sugar Company, which supplies water to the KTF and the northern portion of the PMRF via two miles of large-diameter pipeline. The Mana well is a high-level water tunnel located at Kamokala Ridge in the mountainous area east of the former village of Mana. The fresh water in the region of the Mana plain is surface flow brought to the sugar cane fields from higher elevations and ground water from the Napali basalt aquifer where the volcanic slope begins at the edge of the plain (DOE, 1991).

Water consumption for the KTF is estimated at 300 gallons per day during nonoperational periods and 1,200 gallons per day during operational periods. Ground water at the PMRF (and KTF) is too brackish for domestic purposes; no ground water is pumped at these facilities (DOE, 1991).

There are three registered septic tank and leach field systems at the KTF. No wastewaters are discharged from any point source that would require a National Pollutant Discharge Elimination System (NPDES) permit. The three systems have been registered with the Hawaii Department of Health, Wastewater Branch. The systems are inspected periodically by the State (DOE, 1991).

Solid, municipal-type waste is collected weekly at KTF by a PMRF contractor and hauled to the Kekaha landfill immediately south of the PMRF for disposal. The KTF occasionally hauls solid waste to the landfill (DOE, 1991).

Kaumualii Highway (State Route 50) is the only public road that accesses the base. On-base roads are predominantly 2 lanes and generally in good condition; some are unimproved (DOE, 1991).

### 2.2.9 Hazardous Materials and Wastes

The KTF complies with all provisions of the Resource Conservation and Recovery Act (RCRA) (42 U.S.C. 6901 et seq.) and the Hazardous and Solid Waste Amendments of 1984 (HSWA), which set standards and requirements for the management of solid and hazardous wastes. KTF operations generate some wastes which are regulated under RCRA (DOE, 1991). PMRF accumulates hazardous wastes, including those from KTF, and disposes of them through the Defense Reutilization and Marketing Office at Pearl Harbor (DOE, 1991).

KTF participates in the PMRF Spill Prevention, Control, and Countermeasures (SPCC) Plan. The purpose of a SPCC Plan is to prevent the discharge of oil from nontransportation-related onshore and offshore facilities into or upon the navigable waters of the U.S. or adjoining shorelines. The KTF complies with the SPCC requirement (DOE, 1991).

### 2.2.10 Public Health and Safety

With respect to all activities related to rocket launches and fuel handling and storage, KTF complies with the 1988 Department of Energy safety requirements (DOE, 1991). Among these requirements are rules that establish safe separation distances for both ordnance workers and the general public depending on the type and quantity of ordnance present at a location. The ESQD defines the approach access limits by members of the general public during the length of time when the boosters are on the launch pad (Figure 2-1). The maximum ESQD radii for any launch pad or at any rocket assembly building at the KTF is 1,250 feet for inhabited buildings or general public access, and 750 feet for public traffic routes (DOE, 1991).

The GHA defines an area of potential debris dispersal which must be cleared of nonparticipants in the event that a rocket fails on the launch pad or early in the flight trajectory. The GHA is in effect only during the actual launch. PMRF security forces on the ground or in boats or helicopters ensure that all areas of land or water within a GHA are cleared of people before a launch occurs. The GHA varies considerably depending upon the type of launcher being used, the rocket system being launched, the payload involved, and other factors (DOE, 1991). The ZEST GHA, with the exception of the beach area, will be contained entirely within PMRF's boundaries.

All operations at the KTF are governed by stringent occupational safety and health requirements of various DOE orders, the 1991 SNL "Environment, Safety and Health Manual", and the SNL policy for environment, safety and health protection. The KTF also functions under the requirements of the 1990 SNL "General Safe Operating Procedure for Operations at Kauai Test Facility" which addresses operations, responsibilities, hazards, precautions, and emergency procedures at the principal KTF complex and at Kokole Point. Safe operating procedures for all KTF activities are evaluated in the 1988 SNL "Safety Assessment for Missile Launch Complex at Barking Sands, Kauai," (DOE, 1991).

Flight safety operations are governed by existing Pacific Missile Test Center (PMTC) and PMRF practices and procedures. Movement of explosive and hazardous assemblies and materials between PMRF and KTF facilities is under the control of PMRF personnel, according to established PMRF procedures, and with the aid of PMRF ordnance, emergency, and security forces (DOE, 1991).

PMRF contains an installation explosive storage area, launch facilities, aircraft restrictive zones, and a small arms range. The PMRF magazine (maximum 30,000 pounds explosive weight) area is located off base at Kamokala Ridge, approximately 2 miles east of the main gate. The launch facilities, explosive storage areas, small arms firing range, and aircraft restrictive zones have identified ESQDs or clearance areas (USASDC, 1990a).

# 3.0 ENVIRONMENTAL CONSEQUENCES

The purpose of this section is to determine whether the ZEST activities will cause significant (adverse or beneficial) impacts to the existing environment at specific geographic locations. Only unique environmental issues from ZEST-specific activities at component/ assembly ground test and preflight/flight test locations that are in addition to the existing baseline conditions at the locations are discussed. The description of the proposed action and alternatives (DOPAA) (Section 1.0) was analyzed with respect to the environmental setting at each participating installation (Section 2.0). In this way, it was possible to assess the significance of the environmental impacts to the environmental media of physical setting and land use; geology and water resources; air quality; noise; biological resources; threatened and endangered species; cultural resources; infrastructure; hazardous materials and waste; and public health and safety at the respective sites.

Each phase of the ZEST program was examined to determine whether the potential exists for an environmental impact to be generated. These were then evaluated in terms of each site/media to determine: 1) if an impact could potentially occur, and 2) whether or not the impact would be considered to be significant. Potential impacts were identified where the activity could be shown to contribute to an increase in pollutant levels or otherwise have some disrupting influence (e.g., in the case of land access for recreational use). The criteria for whether an impact is then considered to be significant varies according to the media under consideration. For those media that have specific Federal or state standards which cannot be exceeded, the standards provide a measure of "significance." For those impacts that cannot be quantified, impacts were measured against the percentage reduction in availability of the resource (for either humans or flora and fauna) against the overall resource availability. If a potentially significant impact is identified, appropriate mitigation measures are adopted to reduce the impact to nonsignificant levels. These mitigations, where appropriate, have been adopted by the ZEST program.

Section 3.1 of this EA describes the environmental consequences of the component/ assembly activities at Space Data Division in Chandler, Arizona, and Los Alamos National Laboratory, Los Alamos, New Mexico. Section 3.2 describes the environmental impacts of the preflight and flight test activities at the Kauai Test Facility.

## 3.1 COMPONENT/ASSEMBLY GROUND TEST LOCATIONS

### 3.1.1 Space Data Division, Chandler, Arizona

Fabrication and checkout of the Payload Module Bus, fabrication and inspection of the hardware and nose cone, and system integration and testing will be performed at SDD's Chandler, Arizona, facility. These types of tests and activities are within the normal scope of operations routinely conducted at the SDD facilities, and no additional personnel or facilities will be required (Koleber, 1991). No significant environmental impacts are expected as a result of the ZEST activities at SDD.

### 3.1.2 Los Alamos National Laboratory, Los Alamos, New Mexico

The payload package will be assembled at LANL, in existing facilities at S-Site, Technical Area 16, where machining and assembly of explosives packages are routine operations. The proposed work is smaller in scale and involves materials that are less hazardous than testing of explosives and other projects currently and historically performed in these facilities.

Because no new construction will be required and ZEST activities will be conducted completely within existing facilities, there will be no adverse impacts on sensitive areas. No significant environmental impacts are expected as a result of the ZEST activities at LANL.

## 3.2 PREFLIGHT AND FLIGHT TEST LOCATION, KAUAI TEST FACILITY, KAUAI, HAWAII

### 3.2.1 Land Use

Potential impacts to land use include temporary alterations to the facility land use and interference with the use of Recreation Area No. 1. ESQDs with radii of 1,250 feet have been set for the structures involved in ZEST storage and preflight activities (e.g., storage buildings, RMSA, assembly buildings) (Figure 2-1). All nonessential personnel will be cleared from these areas for the duration of such activities, which are on-base and routine at PMRF/KTF.

Launch Pad No. 1 will have an ESQD of 1,250 feet while the ZEST rocket is on the launch pad. This ESQD will restrict access to Recreation Area No. 1 for 2-14 days per launch. The closure of the portion of beach area that is within the ESQD will prevent the public from driving or walking along the beach from the southern end of the Recreation Area No. 1 to Polihale State Park or vice versa (USASDC, 1990a). Access to Polihale State Park during this period will continue to be possible via an existing off-base State road. The public will be permitted to enter the portions of Recreation Area No. 1 that are not affected by the ESQD (USASDC, 1990a).

The ZEST ESQD includes approximately 0.34 mile of beach, or 4.3 percent of the 8 miles of beach along PMRF (approximately 1.6 percent of the entire 22 miles of beach along western Kauai). Recreation Area No. 1 contains rocky and sandy beaches, as well as part of the Barking Sands dune area. This dune area has been designated a special treatment district because it is a scenic ecological area that contains archeological remains and is significant as a traditional cultural property (USASDC, 1990a).

The ZEST GHA at the launch pad is a circle with a radius of 2,200 feet (Figure 1-7). Three hours before the launch, PMRF security forces will begin to advise nonessential personnel and the public to clear the GHA to ensure that this area will be completely evacuated by the time the launch vehicle is armed (two hours prior to the launch). Approximately ten minutes prior to the launch, a launch hazard area is put into effect. The launch hazard area is a pie-shaped area extending 5 nautical miles downrange, the boundaries of which are tangent to the ZEST GHA at headings of 15 and 300 degrees (Figure 1-7). The launch hazard area will be cleared of nonessential personnel and will be maintained from prior to the launch countdown, until the rocket has successfully launched and the first stage has separated. With the exception of Recreation Area No. 1, all of the land contained within the GHA and the launch hazard area is on-base (either KTF or PMRF). No restrictions will be placed on use of Polihale State Park as a result of ZEST launches.

Recreation Area No. 1 is open weekdays from 4:00 p.m. to 6:00 a.m. and 24 hours per day on weekends, except during hazardous operations. This schedule allows public access to the beach for 6,150 hours out of a total of 8,760 hours per year. The beach is routinely closed for 2,610 hours per year for normal operations, or 29.8 percent of the total hours per year (USASDC, 1990a). The ZEST program will increase closure time for a maximum of 472 hours, for a total beach closure of 3,082 hours (35.2 percent) per year. In comparison with other programs proposed for KTF, the 5.4 percent increase in beach closure from the ZEST program will fall within a range determined to be not significant (USASDC, 1990a).

According to PMRF's unofficial visitor control records for the period from 9 November 1987 to 31 August 1989, this area was specifically requested 10 percent of the time. The only unique feature of this area is the dune area (USASDC, 1990a). Recreation Area No. 1 is used mainly for fishing (38 percent), overnight camping (2 percent) and general beach activities (49 percent). Records show that the general use is for less than 2 hours in duration (USASDC, 1990a). Recreational land use will not be significantly affected by the proposed action because of low usage (fishing and general use) (USASDC, 1990a); the access to the dune area through Polihale State Park (USASDC, 1990a); and the low increase (5.4 percent) in closure time. The cumulative impacts to land use are addressed in Section 3.3.

### 3.2.2 Geology and Water Resources

Potential impacts to geology and water resources include lead contamination from the first stage Talos rocket motor exhaust and contamination from a catastrophic failure. Under either scenario, lead would be deposited on the surface soil in the vicinity of the launch pad, and subsequently migrate to the underlying ground water. A total of 48 pounds of lead will be emitted from each Talos rocket motor; for a normal launch, these emissions will be deposited both on the ground and in the air. In the event of a catastrophic failure, a much greater portion of the lead would be deposited on the ground rather than in the air. Lead is a controlled pollutant under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), which requires that if the total lead release exceeds one pound it must be reported. Lead releases for ZEST launches will be reported to the National Response Center (NRC), the State of Hawaii, and local response centers.

Impacts from the 320 rocket launches that have occurred at KTF since 1962, as evidenced in the existing levels of lead in KTF soils, have been assessed by DOE as a means to evaluate the potential impacts of future launches (DOE, 1991). That study reported current lead concentrations of 44 mg/kg of soil at Launch Pad No. 1, and a sitewide range of from less than the detection limit (1.0 mg/kg) to 270 mg/kg. Of the 266 samples, 215 had values within the range of background and townsite samples (1.0 to 11 mg/kg).

Currently, there is not a regulatory requirement to remediate soils with lead concentrations as found near some launch pads at KTF (DOE,1991), and no remediation for lead is anticipated. Guidelines cited for acceptable levels of lead in soils ranged from 300 to 550 mg/kg, which is above those levels found at Launch Pad No. 1. As a result of the sampling program, the facility plans to operate Launch Pad No. 1 without restriction, and two normal ZEST launches are not expected to materially affect lead in soil levels in the launch pad area. No significant impacts on geology and water resources are anticipated from normal ZEST launches.

In the unlikely event of a catastrophic failure of a ZEST vehicle on the launch pad, it would forcefully impact the nearby soil at KTF and could potentially impact the groundwater. If it is assumed that the propellant and payload are completely consumed in this hypothetical catastrophe, the chemicals released at the launch pad are those listed in Table 3-1 as well as the detonation products of the payload listed in Table 3-5 (Tables 3-1 and 3-5 are in Section 3.2.3). The principal components of the payload are PBX 9501, tungsten, vinyl, and aluminum. The vinyl material is an oligomeric mixture of partially hydrolyzed vinyl acetate and less than 0.5 percent (by weight) toluene diisocyanate dimer and lithium stearate. It would, therefore, be expected to produce $CO_2$, $H_2O$, and a trace of lithium hydroxide when combustion occurs. The two metals--tungsten and aluminum--would be converted to oxides.

All detonation products from the catastrophic failure are substances that occur naturally in the environment. The volatiles will diffuse into the atmosphere while the solid carbon particles and metal oxides will ultimately settle as dust or be precipitated by rain. In soil, the emitted metal oxides should be relatively immobile and, therefore, not impact the groundwater. The ubiquity of aluminum in the soils of Hawaii is discussed in Section 3.2.3. Tungsten would be emitted primarily as its oxide, $WO_3$, which can form a series of complex polytungstic acids, when it reacts with moisture (Latimer, 1952). These tungstic acids are soluble in water, but their principal fate as polyanions in a soil environment would be adsorption to the soil components. Although data are lacking on the natural abundance of tungsten in Hawaiian soils, it is reported that tungsten is an essential nutrient for thermophilic bacteria found near volcanic activity (Taya, Hinoki, et al., 1985).

Lead resulting from a catastrophic failure would have a limited areal impact on soil and little to no impact on groundwater. Lead has a strong affinity for all soil constituents and is thereby regarded as relatively immobile (Hildebrand and Blum, 1975). This strong binding makes adsorption to the soil the principal environmental fate of the lead emission. Lead that has been adsorbed, however, can potentially migrate from the immediate area of the launch pad if contaminated soil particulates are transported by runoff. Although the sandy soils at KTF are very permeable to water, suspended particulates to which lead is adsorbed would be filtered from the runoff as it percolates downward. Therefore, it is unlikely that any lead would reach the sand dune aquifer.

Lead can be absorbed by all organisms, but it is not easily translocated from the roots of plants to the edible portions (Baumhardt and Welch, 1972). Therefore, the lead contamination in soil is unlikely to be introduced into the food chain.

In the unlikely event of a catastrophic failure early in the ZEST mission trajectory, it is expected that the launch vehicle will detonate upon impact with the water. This would result in the booster emission products listed in Table 3-1, the payload detonation products listed in Table 3-5, and solid propellant from the boosters (the solid propellant rocket motors will fragment). The solid propellant includes such components as: aluminum metal, nitro-organics, ammonium perchlorate, and binders. The fate of these components in seawater is explained below: The aluminum metal will be readily oxidized to alumina; the nitro-organics will be biodegraded to carbon monoxide (CO) and ammonia ($NH_3$). The ammonium perchlorate will dissolve slowly to form ammonium ions ($NH_4$) (which occur naturally and pose no environmental hazard); and perchlorate ions ($ClO_4^-$) (which will react with organic materials such as wood to eventually form hypochlorite ion ($ClO^-$)). The binders are very inert and will break down to form harmless materials. In addition, the propellant will dissolve very slowly due to the presence of the organic binder. Because the quantities of chemicals involved are small, most materials are nonreactive, and the degradation products are naturally-occurring compounds, it is expected that the environmental effects of solid propellant in water will not be significant (Nimitz, 1991).

The solid propellant, PBX 9501, is a mixture of HMX (95 percent), Estane (2.5 percent), and BDNPA/BDNPF (2.5 percent). Because its density is greater than seawater, unexploded particles will sink. However, finely divided particulates may remain in suspension before degradation occurs. After dissolution, HMX would degrade via photolysis near the ocean surface where incident sunlight can penetrate (Burrows, Rosenblat, et al., 1989). At greater depths, reduction of the nitro groups would be expected, followed by degradation comparable to the degradation of naturally occurring amines in the ocean water.

Estane is a low molecular weight polymer of 5-hydroxypentanoic acid and 4,4$^1$-diaminodiphenyl methane. Hydrolysis of its urethane and ester bonds will occur slowly. Further degradation of the resulting fragments would depend on the presence of other nutrients. The third component of PBX 9501, i.e., BDNPA/BDNPF, would have a similar fate in ocean water to that of the main component, HMX.

Potential impacts to geology and water resources from the possible catastrophic failure of the ZEST flight vehicle at KTF are not significant.

### 3.2.3 Air Quality

Air quality impacts can occur from ZEST test activities through the release of solvents into the air, release of emissions from normal launches of the boosters (and detonation of the payloads), and from a vehicle failure or launch pad accident. Small quantities of cleaning solvents, such as alcohol, and lubricants will be used during component/assembly and preflight testing. Emissions and air quality effects from these uses will be insignificant.

#### 3.2.3.1 Normal Launch Scenario

The primary source of near-ground air emissions from a normal launch will be from the first stage Talos booster. Combustion products will consist primarily of carbon dioxide ($CO_2$), carbon monoxide (CO), water ($H_2O$), hydrogen ($H_2$), nitrogen ($N_2$), and lead (Pb) (SDD, 1990a), in the quantities shown in Table 3-1. The combustion products of $N_2$, CO, and $H_2$ will further change in the high temperature "afterburning" exhaust to NO and $NO_2$, $CO_2$, and $H_2O$. For the normal high temperature rocket exhaust it has been conservatively assumed that the nitrogen and hydrogen are all converted to nitric oxide and water. Because of the lower exposure standard for CO compared to $CO_2$, no conversion of CO to $CO_2$ has been assumed. Emissions quantities, including conversions, are in Table 3-2.

A computer model was used to simulate the dispersion and transport of the ZEST rocket emissions. The PUFF computer model uses quasi-instantaneous dispersion parameters (Petersen, 1982), and was developed for application to the accidental release of hazardous

**TABLE 3-1**

**TOTAL COMBUSTION PRODUCTS FROM A NORMAL ZEST FLIGHT**

| COMBUSTION PRODUCT | FIRST STAGE TALOS 1[2] (lb) | SECOND STAGE CASTOR I[1] (lb) | TOTAL EMISSIONS ZEST 1 OR 2 (lb) |
|---|---|---|---|
| Aluminum Oxide ($Al_2O_3$) | 0 | 1,937 | 1,937 |
| Carbon Monoxide (CO) | 909 | 2,044 | 2,953 |
| Carbon Dioxide ($CO_2$) | 917 | 315 | 1,232 |
| Hydrogen ($H_2$) | 43 | 179 | 223 |
| Hydrogen Chloride (HCl) | 0 | 1,588 | 1,588 |
| Lead (Pb) | 43 | 0 | 43 |
| Nitrogen ($N_2$) | 331 | 637 | 968 |
| Water ($H_2O$) | 268 | 614 | 882 |

Sources:

[1]Thiokol, 1990
[2]SDD, 1990a

TABLE 3-2

ZEST EMISSIONS FOR NORMAL LAUNCH AND ACCIDENTAL RELEASE SCENARIOS

| POLLUTANT | NORMAL LAUNCH (lbs) | ACCIDENT (lb) |
|---|---|---|
| Aluminium Oxide | 0 | 1,937 |
| Carbon Monoxide | 909 | 2,953 |
| Carbon Dioxide | 917 | 1,305 |
| Lead | 43 | 43 |
| Nitrogen Dioxide | 109 | 350 |
| Hydrogen Chloride | 0 | 1,588 |
| Nitric Oxide | 638 | 2,052 |
| Particulate Matter | 43 | 2,006 |

chemicals. The model calculates maximum (i.e., centerline) ground level concentrations using a Gaussain instantaneous model with initial horizontal and vertical dimensions. It is a neutral buoyant release model so that the final release height is used. Such a model has been used for the assessment of exhaust clouds from test firing of the solid fuel Titan IV rockets (USAF, 1988).

Comparison of the expected concentrations with applicable ambient air quality and permissible exposure standards (see Table 3-3) will indicate if air quality problems are expected with the ZEST program (NAAQS; HAAQS; OSHA; 29 CFR 1910.1000; ACGIH, 1989). Conservative estimates of ground level concentrations of the pollutants resulting from the normal ZEST launching, including buoyant cloud rise, indicated no concentration exceeding applicable short-term guideline concentrations (Table 3-4). The magnitude of the releases, the area over which the pollutants are initially dispersed, and the buoyant nature of exhaust products all contribute to the small magnitude of the expected ground level impact. An additional bounding case (no buoyant plume rise), normal launch scenario showed only instantaneous concentrations of nitrogen dioxide exceeding OSHA standards at locations up to 1.0 kilometer (3,300 feet) from the launch pad and carbon monoxide concentrations exceeding the HAAQS 1-hour standard up to 0.5 kilometer (1,640 feet) from the launch pad. Impacts to vegetation, and aquatic and terrestrial wildlife from the first stage Talos motor emissions are not anticipated, since the majority of the emission products are naturally occurring compounds not known to cause vegetative damage and modeled emission levels are below guidelines.

The ZEST second stage booster, a Castor I, produces the following emissions: water ($H_2O$), hydrogen chloride (HCl), carbon monoxide (CO), carbon dioxide ($CO_2$), nitrogen ($N_2$), hydrogen ($H_2$), and aluminum oxide ($Al_2O_3$) (Webb, 1991). Quantities of combustion products are provided in Table 3-1. Because the second stage Castor I emissions will not

**TABLE 3-3**

**AMBIENT AIR QUALITY STANDARDS, THRESHOLD LIMIT VALUES, AND PERMISSIBLE EXPOSURE LIMITS FOR ZEST EXHAUST POLLUTANTS**

| Pollutant | National Ambient Air Quality Standards | | Hawaii Ambient Air Quality Standards | | American Conference of Government Industrial Hygienists (ACGIH); Occupational Safety & Health Administration (OSHA) |
|---|---|---|---|---|---|
| Aluminum Oxide | (As Particulate)<br>75 μg/m³ (primary)<br>60 μg/m³ (secondary)<br>260 μg/m³ (primary)<br>150 μg/m³ (secondary) | <br>Annual<br>Annual<br>24-hours<br>24-hours | (As Particulate)<br>60 μg/m³<br>150 μg/m³ | Annual<br>24-hours | (As Aluminum)<br>15 mg/m³ 8-hours-Dust (OSHA)<br>5 mg/m³ 8-hours-Respirable (OSHA) |
| Carbon Monoxide | 10,000 μg/m³ (9ppm)<br>40,000 μg/m³ (35 ppm) | 8-hours<br>1-hour | 5,000 μg/m³<br>10,000 μg/m³ | 8-hours<br>1-hour | 40 mg/m³ (35 ppm) 8-hours (OSHA)<br>458 mg/m³ (400 ppm) 15-minutes (ACGIH)<br>229 mg/m³ (200 ppm) Ceiling (OSHA) |
| Carbon Dioxide | — | | — | | 18,000 mg/m³ (10,000 ppm) 8-hours (OSHA)<br>54,000 mg/m³ (30,000 ppm) 15-minutes (OSHA) |
| Lead | 1.5 μg/m³ | 3-months | 1.5 μg/m³ | 3-months | 0.150 mg/m³ 8-hours (ACGIH) |
| Nitrogen Dioxide | 100 μg/m³ | Annual | 70 μg/m³ | Annual | 5.6 mg/m³ (3 ppm) 8-hours (ACGIH)<br>9.4 mg/m³ (5 ppm) 15-minutes (ACGIH)<br>9 mg/m³ (5 ppm) Ceiling (OSHA) |
| Hydrogen Chloride | — | | — | | 7 mg/m³ (5 ppm) Ceiling (OSHA). |
| Nitric Oxide | — | | — | | 30 mg/m³ (25 ppm) 8-hours (OSHA) |

TABLE 3-4

ESTIMATED CONCENTRATIONS FROM NORMAL LAUNCH CONDITIONS (mg/m³)

| Pollutant | Average Period | Guideline (mg/m³) | Release (lb) | Distance Downwind (km) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 0.5 | 1.0 | 3.0 | 5.0 | 10.0 |
| Aluminum Oxide | 8-hours | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| Carbon Monoxide | 8-hours<br>15-minutes | 40<br>458 | 909 | 0.0206<br>0.660 | 0.0634<br>2.03 | 0.0623<br>1.91 | 0.0362<br>0.930 | 0.0169<br>0.270 |
| Carbon Dioxide | 8-hours<br>15-minutes | 18,000<br>54,000 | 917 | 0.0207<br>0.660 | 0.0640<br>2.04 | 0.0628<br>1.93 | 0.0366<br>0.940 | 0.0171<br>0.270 |
| Lead | 8-hours | 0.15 | 43 | 0.000973 | 0.00300 | 0.00293 | 0.00171 | 0.000801 |
| Nitrogen Dioxide | 8-hours<br>15-minutes<br>Instantaneous | 5.6<br>9.4<br>9.0 | 109 | 0.00161<br>0.0672<br>0.670 | 0.00761<br>0.243<br>1.08 | 0.00748<br>0.229<br>0.390 | 0.004355<br>0.111<br>0.140 | 0.00203<br>0.0326<br>0.040 |
| Hydrogen Chloride | Instantaneous | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| Particulate Matter | 24-hours | 0.15 | 43 | 0.000324 | 0.00100 | 0.000982 | 0.000572 | 0.000267 |
| Nitric Oxide | 8-hours | 30 | 638 | 0.00941 | 0.0445 | 0.0438 | 0.0254 | 0.0119 |

begin until the ZEST vehicle has reached 2.70 km in altitude and 0.39 km down range, these emissions will not produce notable concentrations at surface stations. This is especially true considering the exhaust for the Castor I rocket is distributed between 2.70 and 65.6 km in altitude and between 0.39 and 15.3 km down range. These emissions will not produce concentrations at ground level that could potentially impact surface flora and/or fauna.

Studies have been conducted to estimate the effects of propellant combustion on the upper atmosphere. The major research has focused on $CO_2$, $H_2O$, HCl, and nitrogen oxides ($NO_x$). Major effects identified in the studies include compositional effects in the atmospheric layers (e.g., effects on the ozone layer) and climatic effects. Such studies have analyzed the potential for impacts from these compounds on the upper atmosphere and found no conclusive evidence of impacts (USASDC, 1989). Because the same type of combustion products will be present from ZEST flights, these analyses and results can be extended to ZEST.

Aluminum is ubiquitous to the soils of Hawaii. Its natural abundance (calculated as $Al_2O_3$) is reported to be 14-18 percent (Stearns, 1985; MacDonald and Abbot, 1983). Aluminum is also a major element of marine clays, e.g., Kaolinite (Brindley, 1961). Thus the aluminum oxide that is released in the upper atmosphere will contribute only a negligible amount to the naturally occurring quantities present in land and sea, as it precipitates with dust or rainfall.

The health effects of aluminum oxide particles are not well defined. High concentrations of metal oxide dust (greater than 100,000 $mg/m^3$) could irritate lungs and eyes. However, aluminum and its compounds are not considered to be highly toxic, and have exhibited very low toxic potential. Recently, a relationship has been inferred between aluminum in drinking water and the incidence of Alzheimer's disease. So far, the reports have been speculative and inconclusive because the cause of Alzheimer's is unknown. Whether aluminum is a cause of the disease, or whether they are related at all, is still undetermined (DOA, 1988). Furthermore, the aluminum released from the ZEST flights would not enter into sources of drinking water.

Atmospheric emissions produced by the HE explosive and the tungsten/vinyl shell would be the same as the detonation products from these components (as discussed in Section 3.2.2). As the volatiles listed in Table 3-5 diffuse throughout the atmosphere, ammonia could dissociate to nitrogen and hydrogen while methane and formic acid would become oxidized to carbon dioxide and water. Hydrogen cyanide is not easily oxidized, but it should be destroyed by the ionizing radiation of the stratosphere (Singh, Jaber, et al., 1984). The tungsten will become part of the atmospheric dust and could ultimately be precipitated by rainfall. Such precipitation would have negligible impact.

#### 3.2.3.2 Launch Accident Scenario

The ZEST vehicle will be on the launch pad up to 14 days prior to launch. An accidental release of pollutants would be associated with either a launch pad detonation of the entire missile or an accident at liftoff. This scenario will produce the maximum emissions for ground level receptors because of the propellant associated with the Talos and Castor I rocket motors, and the payload explosives that are involved. Although the solid rocket propellant is expected to burst and fragment and thereby result in less than total burn, the bounding case impact analysis assumes full burning of the solid propellant and explosives. The explosive exhaust cloud will, because of the heat generated, rise rapidly to heights in excess of those expected during normal launch. The emissions cloud will expand rapidly in all radial directions to a value about ten times the initial dimension.

TABLE 3-5

ZEST PAYLOAD EMISSIONS

| POLLUTANT | g/kg | lb Released* |
|---|---|---|
| $H_2O$ | 256 | 67.3 |
| $CO_2$ | 279 | 73.4 |
| $N_2$ | 364 | 96.7 |
| $H_2$ | 0 | 0 |
| CO | 1.2 | 0.3 |
| Solid Carbon | 99.8 | 26.2 |

Source: LANL, 1991

* Total Payload Explosive Weight = 263 lb (119.295 kg)

Conservative estimates of ground level concentrations of the pollutants resulting from a launch accident, including buoyant cloud rise, also indicated no concentration exceeding applicable short-term guideline concentrations (Table 3-6). As for the normal launch scenario, the modeled concentrations for the bounding case accident mode scenario (exhaust cloud rise to only 100 meters) indicated that nitrogen dioxide concentrations will exceed the instantaneous OSHA guideline ceiling at locations 1.0 km or less. Also, particulate concentrations for receptors 1 km or less would exceed the 24-hour NAAQS and HAAQS standard for the bounding case accident scenario.

If premature detonation occurs, most of the debris will fall within the established safety areas (ESQD, GHA and launch hazard area) and would be removed during cleanup. The remaining particulate matter and combustion products will dissipate without significant impact. Nitrocellulose and nitroglycerine are nitrated derivatives of chemicals that occur naturally in vegetation and animal fat. The breakdown of such materials can be catalyzed by the extracellular enzymes of the existent soil microbiota (EPA, 1987). The aluminum will become corroded to its oxide (or hydroxide), and the lead azide will decompose to lead hydroxide, ammonia, and nitrogen. The HMX from the propellant will be photodegraded (Burrows et al., 1989). None of these materials will adversely affect the soil environment.

#### 3.2.3.3 Air Quality Analysis Results

Based on the results of the PUFF modeling, it is expected that the operation of the ZEST program will not present air quality problems. Both conservative elevated buoyant cloud modeling and the unlikely bounding case modeling support this conclusion. The small number of modeled concentrations exceeding the applicable concentration standards under the extreme modeling scenarios of the bounding case indicate the unlikely potential of air

**TABLE 3-6**

**ESTIMATED CONCENTRATIONS FROM ACCIDENT CONDITIONS (mg/m³)**

| | | | | Distance Downwind (km) | | | | |
|---|---|---|---|---|---|---|---|---|
| Pollutant | Average Period | Guideline (mg/m³) | Release (lb) | 0.5 | 1.0 | 3.0 | 5.0 | 10.0 |
| Aluminum Oxide | 8-hours | 5 | 1,937 | 0.0000000564 | 0.00188 | 0.0627 | 0.0545 | 0.0361 |
| Carbon Monoxide | 8-hours<br>15-minutes | 40<br>458 | 2,953 | 0.0000000860<br>0.0000000276 | 0.00287<br>0.0918 | 0.0956<br>2.93 | 0.0831<br>2.12 | 0.055<br>0.883 |
| Carbon Dioxide | 8-hours<br>15-minutes | 18,000<br>54,000 | 1,305 | 0.0000000380<br>0.00000122 | 0.00127<br>0.0406 | 0.0422<br>1.29 | 0.0367<br>0.937 | 0.0243<br>0.390 |
| Lead | 8-hours | 0.15 | 43 | 0.00000000125 | 0.0000418 | 0.00139 | 0.00121 | 0.000801 |
| Nitrogen Dioxide | 8-hours<br>15-minutes<br>Instantaneous | 5.6<br>9.4<br>9.0 | 350 | 0.0000000102<br>0.000000327<br>0.00000275 | 0.000339<br>0.0109<br>0.0487 | 0.0113<br>0.345<br>0.589 | 0.00984<br>0.251<br>0.320 | 0.00651<br>0.105<br>0.113 |
| Hydrogen Chloride | Instantaneous | 7 | 1,588 | 0.0000000463 | 0.00154 | 0.0514 | 0.0447 | 0.0296 |
| Particulate Matter | 24-hours | 0.15 | 2,006 | 0.0000000195 | 0.000650 | 0.0216 | 0.0188 | 0.0125 |
| Nitric Oxide | 8-hours | 30 | 2,052 | 0.0000000598 | 0.00199 | 0.0663 | 0.0577 | 0.0382 |

quality problems developing from the operation of the ZEST program. The short duration of the launch (several seconds), the infrequency of ZEST launches at KTF, and the prevailing trade winds that occur at KTF also contribute to maintaining state and/or Federal air quality standards, and no significant impacts to short-term or ambient air quality are anticipated.

### 3.2.4 Noise

The ZEST launches will generate elevated noise levels from first stage rocket firing. The second stage will be audible but have no impact; the detonation of the high explosive payload will not be audible to humans and/or wildlife. Noise at high levels, even for short durations, can cause temporary or permanent hearing loss, lessening of hearing sensitivity to certain frequencies, and irritability. To evaluate noise impacts, it is necessary to consider not only the overall sound level, but also the frequency spectrum and the duration of exposure.

The decibel (dB) is the standard unit for quantifying sound amplitude. It is a mathematical relationship comparing any two power levels. Sound pressure can be proportional to power and can be expressed in decibels as well. Humans detect sound pressure (or changes in sound pressure) representing the acoustic energy present in the environment. Because humans do not hear all frequencies equally well, decibels are adjusted (A weighted) to approximate the frequency response of the human ear. Noise levels are thus designated as 'dBA' (Thalheimer, 1991).

Several methods have been devised to relate noise exposure over time to human response. DoD uses the day-night average sound level (Ldn) as the rating method to determine long-term annoyance from environmental noise. The Ldn is a 24-hour averaged A-weighted noise level. OSHA has established noise limits to protect workers. Under OSHA criteria, a time-weighted average noise exposure of 90 decibels is allowed for an 8-hour day. The maximum exposure level is 115 dBA for 15 minutes or less (29 CFR 1910.95).

Operation of the launch vehicle generates short-term, single event noise at levels above 150 dBA within 100 feet, which can cause personal injury during the brief (less than 10 seconds) period of exposure. Noise assessment modeling conducted for KTF (DOE, 1991), simulated the launch of the Talos booster through the use of the NASA Sound Level Simulation Model. Model simulation predicted a maximum sound pressure level of 129 dBA within 600 feet of the launch pad centerline; 122 dBA outside the launch operations building 1,240 feet distant; and dropping to 113 dBA at a distance of 3,000 feet from the launch pad (representative of sugar cane field workers). Onshore birds and mammals at a representative distance of 600 feet from the pad would experience noise levels of 129 dBA; offshore birds, whales, turtles, etc., at 1,200 feet would experience 122 dBA.

Supplemental noise monitoring was conducted during February 1991, for a STRYPI and a NIKE launch. The STRYPI rocket, which has somewhat more thrust (146,000 pounds versus 125,000 pounds) than the ZEST first stage, was found to produce maximum noise levels that ranged from 5 to 12 dBA lower than the modeled noise levels (DOE, 1991).

Workers at the launch facility will be sheltered inside noise-insulated buildings or will wear hearing protection, such as headphones, to ensure that exposure does not exceed the 115 dBA/15 minutes OSHA criteria. Nonoperational personnel will be excluded from the test area and thus, be protected from the noise effects. People living, working, or visiting in the vicinity of the launch activities or visiting the launch vicinity could also experience elevated noise levels during launches. The closest that visitors could approach the launch area will be the limits of the ZEST launch hazard area, which has a radius of 2,200 feet at the pad.

Interpolation of the results of the modeling performed for KTF yields a predicted noise level at 2,200 feet of approximately 117 dBA. However, based on the monitoring results, actual noise levels at the limits of the GHA are expected to be under 115 dBA. This, combined with the fact that the launches are of a short duration and will reach a high altitude quickly, will ensure that no ZEST launch will exceed OSHA criteria. Because launches are scheduled infrequently (only two), ambient noise levels will not be affected.

The nearest on-base (5 miles) and off-base (Kekaha, 8 miles) residential areas are well beyond the hazardous noise level limits. In the past, approximately 22 STRYPI vehicles, which have maximum sound pressure levels 1 to 2 dBA above that of the Talos, have been launched from KTF with no known noise complaints from the public (USASDC, 1990b). Therefore, overall noise impacts to humans will not be significant.

Information on the nature and effects of short-term exposure of wildlife to intense noise levels is sparse. Brattstrom and Bondello (1983) found that the fringe-toed lizard, desert kangaroo rat, and Couche's spadefoot toad all suffered hearing loss when exposed to off-road vehicle sounds of 95 dBA for less than 9 minutes. No other literature is known to document the effects of short-term exposure to noise within the 95-125 dBA range. Field surveys were conducted following Space Shuttle launches from Kennedy Space Center and a June 1989 launch of a Titan IV from Cape Canaveral Air Force Station (CCAFS). Two Florida scrub jays in the near-field area east of the Titan launch pad did not respond to warning calls shortly after the launch. In contrast, following the launch of Shuttle mission 34, scrub jays west of the pad displayed normal behavior and responded to calls (USAF, 1990b). In addition, there is some information that birds adapt to noise levels generated by military aircraft (DOE, 1991), or that those birds that "flush" when loud noises occur return to normal behavior a short time later (DOE, 1991). However, because of the short duration of intense sound, and the low number of launches, significant impacts from noise on wildlife are not expected.

Information on the noise disturbances to the surrounding marine life at KTF, including green turtles, humpback whales and the Hawaiian monk seal, are unavailable (DOE, 1991). However, overpressure generated by sonic booms is less than that generated by the ocean surface waves routinely experienced by these species. Therefore, significant noise impacts to local marine life are not anticipated.

### 3.2.5 Biological Resources

Impacts to biological resources may occur from disturbance of habitats, destruction of vegetation, displacement of wildlife and disruption of migration and/or breeding patterns as a result of the operation of launch facilities. Since no construction is associated with the ZEST program, the analysis of potential impacts is limited to those activities associated with launch operations.

#### 3.2.5.1 Flora

Preflight and flight activities for the ZEST program will take place at existing facilities where similar activities have taken place in the past. This area has been previously cleared of vegetation, so there is a substantially reduced possibility of a fire. Impacts from launch vehicle emissions, as discussed in Section 3.2.3, are also not expected to disturb or destroy the surrounding vegetation. Therefore, impacts from ZEST activities to the vegetation surrounding Launch Pad No. 1 are not anticipated.

#### 3.2.5.2 Fauna

ZEST preflight and flight activities are within the range of activities that routinely occur at KTF (DOE, 1991). In addition, as stated above, Launch Pad No. 1 has been used for these types of activities for a period of time. It is expected that few wildlife frequent the area due to the noise and amount of human activity. No significant impacts are anticipated to wildlife species occurring on KTF.

### 3.2.6 Threatened and Endangered Species

Of the protected species listed in Section 2.3.6, only Newell's Townsend's shearwater is potentially affected by ZEST preflight and flight activities. This is due to the migration habits of the fledglings, which leave the nest sites located in the mountains during October and November, and fly to the ocean at night. The fledglings may be disoriented by lights associated with the development of the coast of Kauai, including KTF, and fly into power lines, car headlights, or street and floodlight poles (Rauzon, 1991). Although it is unknown whether one of the migration flight patterns overflies KTF, mitigation measures have been proposed for other launch programs (e.g., STARS, EDX) to place USFWS-approved hoods on site floodlights to reduce upward glare.

It is unlikely that this mitigation measure will be required for the ZEST program, since the scheduled launches are planned for late July and August and will not occur during the migrating season (late fall). However, if unforseen schedule changes result in ZEST launch(es) during the migrating season, the mitigation measures listed above will be implemented.

There is also a very remote possibility that falling debris from a launch failure could strike a federally listed animal, such as the humpback whale, green sea turtle, or the Hawaiian monk seal. Humpback whales are relatively rare in the waters surrounding Kauai, migrating through the area during the months of December to April. The green sea turtle may nest along the beaches on the southern portion of PMRF during the summer. The Hawaiian monk seal is considered to be a "straggler" at PMRF, although two or three individuals have been spotted regularly around the island of Kauai (USASDC, 1990d). However, potential impacts to these species from falling debris is not anticipated due to their rare occurrence, seasonal migration patterns and the very low probability for a catastrophic launch due to excellent performance records for the ZEST first- and second-stage boosters.

Consultation with the USFWS and NMFS regarding potential impacts of the ZEST program on protected species has been completed. Correspondence with resource agencies is provided in Appendix A.

### 3.2.7 Cultural Resources

No sites are known to exist on KTF and, because construction is not proposed as a part of the ZEST program, impacts to potential subsurface cultural resources from deliberate ground disturbing will not occur. It is unlikely that archaeological, historical, or cultural resources will be encountered during ZEST preflight and flight operations, and thus, no significant impacts are expected. However, a catastrophic failure of the launch vehicle on the launch pad or early in its trajectory could potentially unearth subsurface archaeological resources. If cultural resources are encountered as a result of the ZEST program, the following mitigation efforts will be carried out: all work in the area will be stopped and the area will not be disturbed further until it is surveyed and the significance of the find assessed; steps will be taken to record data, document the area, and/or preserve the find if it is determined to be significant; and consultation with the State Historic Preservation Officer and other pertinent parties (i.e., DOE, U.S. Navy) will occur to determine the appropriate form of mitigation. Activities will be completed in accordance with PMRF's draft Burial Treatment Plan when it is signed and finalized; the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation; and the guidelines of the State of Hawaii. The dune bordering KTF will *not* be affected by the ZEST preflight/flight activities. If a cultural resource is uncovered during a catastrophic failure, the mitigation measures listed above will be implemented to ensure that there will be no significant impacts to the sensitive dune area.

### 3.2.8 Infrastructure

The activities associated with the ZEST program should not have an adverse effect on the environment of a specific site except in the case of overuse of one or more of the following components: housing, potable water availability, sanitary sewage, or solid waste handling/disposal capability, causes shortages or stress in an affected media as a result of the program.

Preflight/flight activities will be conducted at existing facilities, using utilities already in place at KTF. It is estimated that approximately 25 additional personnel specifically assigned to ZEST will be required. The majority of these people will be onsite for no longer than 45 days. This approximately 4 percent increase in combined KTF/PMRF base staff is regularly experienced and is within the capacity of the KTF/PMRF infrastructure and the island's tourist based economy. Therefore, no significant impacts on infrastructure are anticipated at locations participating in the ZEST program.

3.2.9 Hazardous Materials and Wastes

Potential impacts to the environment due to hazardous materials could result from the presence of the high explosive in the payload (PBX 9501) (Class 1.1 explosive) and the solid propellant (Class 1.3 explosive) in the rocket motors. Other hazardous materials include the high pressure nitrogen used to purge the PMB, and the cleaning solvents used in assembling the rockets. Both the payload and the solid propellant rocket motors will be stored and worked with in buildings that have been cleared to hold such explosives. In addition, ESQDs will be maintained for all component/assembly areas, ground test areas, storage areas, assembly buildings and launch complexes.

Only small amounts of hazardous wastes are expected as a result of the ZEST activities. Such waste includes small amounts of cleaning solvents, rags, cotton swabs, etc. All hazardous waste management activities that may arise will be conducted in accordance with the SNL Environment, Safety, and Health Manual, MN471001 and Appendix G of The General Safe Operating Procedure For Operations At Kauai Test Facility. If a waste is generated during launch preparation that is not accepted in writing by SNL, it will be removed from the facility by the user organization (SDIO). In addition, activity-specific Safety Standard Operating Procedures have been prepared for all hazardous operations and will be provided to SNL for review and approval. No significant impacts are expected.

3.2.10 Public Health and Safety

There are public health and safety issues involved in each of the basic segments of the ZEST program activities (i.e., integration/assembly and preflight/flight). The various integration/assembly hazardous operations include: transportation of the rocket motors and payload, removal of rocket motors and payload from shipping containers, checkout of motors and payload, installation of initiators and ordnance, and assembly of the rocket at the launch pad. The transportation of the boosters and payload, Class 1.3 and 1.1 explosives, respectively, from the CONUS to KTF will be conducted in accordance with the ZEST Transportation Safety Plan. The Talos boosters were shipped via commercial sea from CONUS to PMRF as part of the Navy's VANDAL program. The Castor I boosters, the LANL payloads, and other components (see Section 1.2.4.1) will be transported via military air from CONUS to PMRF. Each shipment will be transferred directly to their respective storage areas until missile assembly activities are initiated (see Section 1.2.4.1).

Personnel involved in the handling of the rocket motors and payload, and of the ordnance will receive certification from SDD and LANL, respectively. Qualifications include completing training courses on operation of mechanical equipment and safe handling of explosives. This training will be in accordance with the ES&H Manual and all activities will be performed in accordance with the General Safe Operating Procedure for Operations at Kauai Test Facility and the Pacific Missile Range Facility. In addition, activity-specific standard operating procedures have been prepared for all hazardous operations (SNL, 1991b,c,d,e,f).

The safety issues associated with ZEST preflight/flight activities include exposure to or inhalation of exhaust products, exposure to excessive noise levels, injuries due to an accidental explosion of the booster on the launch pad or immediately after launch, and the potential for debris impacts on inhabited areas. Risk to personnel from noise, launch emissions, fire, launch accidents, and launch aborts will be minimized by use of exclusion zones around the launch pad and component storage and handling areas, such as ESQDs, GHAs, launch hazard areas, and second stage impact areas (see Figures 1-7, 1-8, and 2-1). The ZEST ESQD and GHA are circles with radii of 1,250 feet and 2,200 feet, respectively. The ZEST launch hazard area extends five nautical miles downrange and is a pie-shaped area bounded by 15-degree and 300-degree tangent lines to the GHA. The launch hazard area includes the impact zones for the first stage booster and unfired second stage booster.

Various safety precautions will be taken to prevent and mitigate the possibility of and the potential impacts from an accident. During hazardous operations only personnel necessary to safely complete the task will be used. In addition, all hazardous operations will be performed in accordance with the operating procedures for a specific site. All persons assigned to duties that could require them to encounter a hazardous situation will be provided with appropriate job-specific safety training.

The facilities will be monitored for safety violations and hazards, which, if found, would be immediately corrected. Medical and fire fighting personnel and equipment will be available for emergency response. Facilities where explosion or fire could occur will be equipped with fire hoses and extinguishers. Whenever hazardous operations might occur, a safety zone will be established in advance and noninvolved persons will leave the area.

Potential impacts from accidental explosion of the booster during launch were assessed in a fragmentation analysis prepared for ZEST Flights 1 and 2 (SNL, 1991). The analysis quantified the hazard created by a possible premature experiment detonation at any point along the launch azimuth. It included the development of fault trees to examine potential failure modes, assessment of component failure rates, and mathematical modeling (Monte Carlo analysis) of fragment trajectories based on randomly selected event time, fragment shape, velocity direction, and winds.

The ZEST flight trajectory was divided into three phases for the analysis, based on the equipment safeguards included in the flight hardware: from launch through closure of a barometric switch, through transmittal of an enabling radio signal, and through experiment initiation. The barometric switch is included to introduce additional reliability in the initial portion of the trajectory.

The fragmentation analysis results include both the impact probability and the casualty expectation within a given area. Impact probability results were combined with demographic information for the Hawaiian Islands to determine the casualty expectations. The combined hazards produced by both a premature experiment detonation and normal impact dispersions are summarized as follows for the 0- and 5-degree azimuths: probability of impact is $1.37 \times 10^{-4}$ and casualty expectation is $9.40 \times 10^{-8}$, or approximately 1 in 10,600,000.

These results indicate that casualty expectations for either the 0-degree or 5-degree azimuth are well below accepted hazard levels established by SNL for a casualty expectation not to exceed 1 in 1,000,000 ($1 \times 10^{-6}$) for nonparticipants and 1 in 100,000 ($1 \times 10^{-5}$) for participants. The safety guidelines are met if operational personnel in the launch area are protected or evacuated and the beach area is cleared. No significant impacts to public health and safety are expected.

## 3.3 CUMULATIVE IMPACTS

The current launch schedule at KTF for fiscal year 1991 is four rail launches and two vertical launches per year. This schedule includes one STRYPI-LACE launch, one HAVLIST4 (2-stage Terrier), the two ZEST launches, and two STARS launches (Keese, 1991b). Normal KTF operations and the proposed STARS, EDX, and ZEST program launches in the next three years (1991-1994) could change the schedule from two vertical launches to seven vertical launches per year (DOE, 1991; Lopez, 1991). The following assessment of cumulative impacts is based on a maximum of seven vertical launches and four rail launches per year.

Air Quality

The cumulative impacts due to the launch emissions of CO, HCl, and $Al_2O_3$ are not anticipated to be significant due to: the low overall number and spacing of launches at KTF per year (average one per month); the short duration of the launches; the relatively constant tradewinds which will rapidly disperse any emissions away from population areas; and the natural degradation of the emissions products (such as HCl which will be rapidly neutralized by the salt air environment).

Geology

Significant cumulative impacts from the deposition of lead from vehicles launched since 1962 have not occurred. The current levels of lead in the soils around Launch Pad No. 1 are slightly elevated above background levels, but substantially below levels required for remediation. The addition of two ZEST launches to the usage of Pad No. 1 is not expected to significantly contribute to the current level of lead, therefore, no significant cumulative impacts are anticipated.

Noise

Cumulative noise impacts to employees at KTF/PMRF are not anticipated because of the measures employed by launch personnel, which include clearing the immediate launch area; staying inside buildings which attenuate the sound levels; the use of personal hearing protection; and the short duration of exposure. Residents in the closest town, Kekaha, are also not anticipated to experience significant impacts from noise due to their distance from the launch facility. Cumulative noise impacts on adjacent park visitors and sugar cane workers are also not anticipated as potentially harmful noise levels will not extend off-base.

Land Use

Significant cumulative impacts to land use from the combined programs, including ZEST, at KTF are not anticipated. A bounding case launch schedule for the KTF complex consists of a maximum of 10 to 12 rocket launches per year, including other KTF operations, STARS, EDX, and the two ZEST launches. Beach closure days for this schedule is a maximum of 238 days per year, or 4,176 hours (48 percent of the total hours per year) (DOE, 1991). However, maximum ESQD restriction denies the public access to only 7.4 percent (3,215 feet) of the eight miles of available beach along PMRF and only 2 percent of the 22 miles of available public beach along western Kauai. The ZEST ESQD is less than this maximum restriction, and effects only 0.34 mile of beach or 4.3 percent of the 8 miles of beach along PMRF. Also, only 10 percent of the recreational users to PMRF (4,476 of 43,678) requested access to Recreational Area No. 1. Analyses performed by DOE summarize the findings for this bounding case scenario by saying that land use and recreation will be adversely affected for temporary periods, but not to an appreciable degree (DOE, 1991). Therefore, significant cumulative impacts to land use are not expected.

## 3.4 ENVIRONMENTAL CONSEQUENCES OF THE NO-ACTION ALTERNATIVE

The No Action alternative is to not conduct the ZEST flight test experiments as presently planned. Component/assembly ground tests are routine operations with no identifiable impacts at the indicated facilities; it is reasonable to expect that other, similar types of operations would be conducted in the absence of the ZEST program with the same lack of impacts.

The ZEST preflight and flight tests proposed for the Kauai Test Facility are similar to ongoing operations at the facility. As detailed in the preceding sections, environmental impacts from the ZEST program are either nonexistent or low, with no significant impacts. Cumulative impacts are also nonsignificant. When compared to the current launch activity at KTF, elimination of the low number of proposed ZEST launches (2) is not expected to substantially reduce the level of environmental impacts. Therefore, the environmental impacts of the No Action Alternative are not expected to differ significantly from those identified with the ZEST program.

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## 5.0 REFERENCES

Advanced Sciences, 1990. Preliminary Report, Archaeological Survey and Testing for the Department of Energy, Kauai Test Facility, Barking Sands, Kauai, Hawaii (June).

Alexandre, A., Barnes, J., Bugliarello, G., and Wakstein, C., 1976, The Impact of Noise Pollution, A Socio-Technological Introduction, Pergamon Press, Inc., New York, pp 207-208.

Barnes, T., 1991a. Personal communication with Program Manager of the Navy's VANDAL Targets Program regarding the use of motors, 1,2 April.

Barnes, T., 1991b. Personal communication with Program Manager of the Navy's VANDAL Targets Program regarding VANDAL system failures, 1 July.

Baumhardt, C.R. and Welch, L.F., 1972. Lead uptake and corn growth with soil applied lead. J. Environmental Quality, 1: 92-94.

Botanical Consultants, 1985. Flora, Fauna, and Water Resources of PMRF, Hawaiian Area, Kauai, Hawaii (December).

Brattstrom, B.H. and M.C. Bondello, 1983. "Effects of Off-road Vehicle Noise in Desert Vertebrates," pp. 167-206 in R.H. Webb and H.G. Wilshire (eds.), Environmental Effects of Off-Road Vehicles: Impacts and Management in Arid Regions. Springer-Verlag, New York.

Brindley, G.W., 1961. Kaolin, serpentine and kindred minerals. In The X-Ray Identification and Crystal Structures of Clay Minerals. G. Brown, editor. Mineral Society, London. pp. 51-131.

Burrows, E.P., Rosenblatt, D.H., Mitchell, W.R., and Parmer, D.L., 1989. Organic Explosives and Related compounds: Environmental and Health Considerations. Technical Report 8901. U.S. Army Medical Bioengineering Research and Development Laboratory, Fort Detrick, Frederick, Maryland.

Collins, Tom, 1991. Allied Signal Aerospace Co., Personal communication regarding VANDAL system failures, 1 July.

Department of Energy (DOE), 1979. Final Environmental Impact Statement for Los Alamos National Laboratory (LANL) (December).

Department of Energy (DOE), 1991. Environmental Assessment, Kauai Test Facility (Draft - March).

Downing, C., 1990. Space Data Division, Personal communication regarding SDD facilities, June.

Easley, 1990. "Alzheimer's Disease, Is it Aluminum?" Harvard Health Letter, Volume 15, Number 11 (October).

Foral, D., 1991a. Sandia National Laboratories, Personal communication regarding ground hazard area for ZEST, 22 May.

Foral, D., 1991b. Sandia National Laboratories, Personal communication regarding KTF launches in the last five years, 23 May.

Fukunaga and Associates, 1989. Final Report, Engineering Evaluation of Main Base Sewage Treatment Plant at PMRF, Hawaiian Area.

Genest, R.G., 1990. Space Data Division Safety Manager, Letter regarding SDD facilities, August.

Goldie, R., 1991. Los Alamos National Laboratory, Personal communication regarding staffing level at LANL, 7 May.

Hildenbrand, E.E., and Blum, W.E., 1975. Firation of emitted lead by soils. Pflauzenern Bodenk. 3: 279-294.

Inouye, R., 1991. Pacific Missile Range Facility, Personal communication regarding sewage systems at KTF and PMRF, and tsunamis, 22 March.

Keese, D., 1991a. Sandia National Laboratories, Personal communication regarding the various rocket launches from KTF and PMRF and resultant lead contamination, 29 March.

Keese, D., 1991b. Sandia National Laboratories, Personal communication regarding FY91 KTF launch schedule and beach closure due to rocket launches, 16, 17, May.

Keese, D., 1991c. Sandia National Laboratories, Personal communication regarding Castor I reliability, 20 May.

Koleber, R., 1991. Space Data Division, Personnel communication regarding SDD's Participation in the ZEST program, 29 January.

Latimer, W.M. 1952. The Oxidation States of the Elements and their Potentials in Aqueous Solutions, 2nd Edition.

Lopez, A.A., 1991. Sandia National Laboratories, Personal communication regarding the number of vertical launches at KTF over the next three years, 25 June.

MacDonald, G.R. and Abbot, B., 1983. Volcanoes of the Sea: The Geology of Hawaii, 2nd Edition. University of Hawaii Press, Honolulu.

Manci, K. M., D. N. Gladwin, R. Vinella, and M. G. Cavendish, 1988. Effects of Aircraft Noise and Sonic Booms on Domestic Animals and Wildlife: A Literature Synthesis. USFWS National Ecology Research Center, Ft Collins, CO. NERC-88/29.

National Aeronautics and Space Administration (NASA), 1985. Environmental Assessment, The Combined Release and Radiation Effects Satellite (CRRES) Program.

Ney, L., 1991. Los Alamos National Laboratory, SDIO data request regarding the LANL HE payload for the ZEST 1 & 2 flights, (February).

Nimitz, J.S., PhD., 1991. New Mexico Engineering Research Institute, Memorandum regarding the environmental fate of rocket propellants in sea water, February.

Pacific Missile Test Center (PMTC), 1991. Range Safety Approval 183 for ZEST Flight Test I Launched from Kauai Test Facility (July).

Pendergrass, A., 1991. Los Alamos National Laboratory, Personal communication regarding LANL's compliance with Federal and state regulations with respect to ZEST activities, 10 April.

Rauzon, M.J., 1991. "Save our Shearwaters!" The Living Bird Quarterly, (Spring, 1991).

Rosa, P., 1991. PMRF Security, Personal communication regarding enforcement of ground hazard area, 22 May.

Sandia National Laboratories (SNL), 1990. General Safe Operating Procedure for Operations at Kauai Test Facility (July).

Sandia National Laboratories (SNL), 1991a. Range Safety Analysis for the ZEST Flight Test Program, 20 May.

Sandia National Laboratories (SNL), 1991b. Activity Specific ES&H Standard Operating Procedures for Talos Rocket Motor Preparation, (May).

Sandia National Laboratories (SNL), 1991c. Activity Specific ES&H Standard Operating Procedures for Castor I Rocket Motor Preparation, (May).

Sandia National Laboratories (SNL), 1991d. Activity Specific ES&H Standard Operating Procedure for the Loading of the ZEST Vehicle onto the Launcher, (May).

Sandia National Laboratories (SNL), 1991e. Activity Specific ES&H Standard Operating Procedure for Ordnance Installation on the ZEST Vehicle, (May).

Sandia National Laboratories (SNL), 1991f. Activity Specific ES&H Standard Operating Procedure for the Final Arming of the ZEST Vehicle, (May).

Singh, H.B., Jaber, H.M., and Davenport, J.E. 1984. Reactivity/Volatility Classification of Selected Organic Chemicals. Environmental Sciences Research Laboratory, U.S. Environmental Protection Agency, RTP, NC. EPA-600/3-84-082.

Space Data Division (SDD), 1990a. Description of Proposed Action and Alternatives (DOPAA) for ZEST Environmental Assessment (November).

Space Data Division (SDD), 1990b. Flight Test Services Program (FTSP) ZEST 1 and 2 Design Review.

Stearns, H.T. 1985. Geology of the State of Hawaii, 2nd Edition. Pacific Books, Palo Alto.

Strategic Defense Initiative Organization, (SDIO) 1990. Environmental Assessment, Brilliant Pebbles Experiment Program (May).

Taya, M. Hinoki, H., and Kobayaski, T., 1985 Tungsten Requirement of an Extremely Thermophilic Cellulolytic Anaerobe (Strain NAIO). Agricultural and Biological Chemistry. 49:2513-2515.

Teledyne Brown Engineering (TBE), 1990. Commercial Space Launch License Application for ZEST 1 and 2 (September).

Teledyne Brown Engineering (TBE), 1991a. Sandia National Laboratories, Kauai Test Facility, Test Plan for ZEST 1 and 2, (January).

Teledyne Brown Engineering (TBE), 1991b. ZEST 1 and 2 Commercial Space Launch

License Application Hazardous Operations (January).

Teledyne Brown Engineering (TBE), 1991c. Memorandum regarding the Talos Motor Flight History, 1 March.

Teledyne Brown Engineering (TBE), 1991d. Personal communication regarding storage of ZEST components upon arrival at KTF, 23 May.

Teledyne Brown Engineering (TBE), 1991e. ZEST Transportation Safety Plan, (June).

Teledyne Brown Engineering (TBE), 1991f. Personal communication regarding SNL experience launching Talos and Castor motors, 3 July.

Thalheimer, E., 1991. Environmental Survey: Noise, Dames and Moore Special Services, (March).

Theriault, S., 1991a. SDIO, Report regarding a vehicle trade-off study for the ZEST program, 26 February.

Theriault, S., 1991b. SDIO, Report regarding an alternative site study for the ZEST program, 1 March.

Thiokol, Inc., 1989. Castor Launch Vehicle Propulsion. Promotional Materials prepared by Aerospace Group, Huntsville Division.

The Traverse Group, Inc. 1988. Natural Resources Management Plan. Pacific Missile Range Facility, Barking Sands, Hawaii.

U.S. Air Force (USAF), 1987. Environmental Assessment, Chemical Release Experiment (July).

U.S. Air Force (USAF), 1988. Environmental Assessment, Titan IV Solid Rocket Motor Upgrade Testing at Edwards Air Force Base, California. (May)

U.S. Army Strategic Defense Command (USASDC), 1989. Environmental Impact Statement, Proposed Actions at U.S. Army Kwajalein Atoll (USAKA) (Draft-May, Final-October).

U.S. Army Strategic Defense Command (USASDC), 1990a. Environmental Assessment, Strategic Target System (STARS) (July).

U.S. Army Strategic Defense Command (USASDC), 1990b. Biological Assessment, Strategic Target System (July).

U.S. Army Strategic Defense Command (USASDC), 1990c. Environmental Assessment, Exoatmospheric Discrimination Experiment (EDX) (September).

U.S. Army Strategic Defense Command (USASDC), 1990d. Biological Assessment, Exoatmospheric Discrimination Experiment (EDX) (May).

U.S. Bureau of the Census, 1988. "1986 Population and 1985 Per Capita Income Estimates for Counties and Unincorporated Places: West Series" p. 26, No.. 86-W-SC, U.S. Government Printing Office.

U.S. Department of the Army (DOA), 1988. Plume Characterization Study, Static Firing of a Pershing II First-Stage Rocket Motor at Pueblo Army Depot Activity, Volume I.

U.S. Departments of Army, Navy and Defense Logistics Agency, 1982. Department of Defense Explosives Hazard Classification Procedures (September).

U.S. Department of the Interior, Geological Survey (USGS), 1983. 7.5 Minute Series Topographic Maps - Kekaha and Makaha Point, Hawaii.

U.S. Department of the Navy, 1984. Pacific Missile Test Center Range Safety Handbook (March).

U.S. Department of the Navy, 1986. Pacific Missile Facility Range User's Guide.

U.S. Department of Transportation, Office of Commercial Space Transportation (DOT), 1991. License LLS 91-026 to Orbital Sciences Corporation, Space Data Division, for launch of ZEST 1 and 2 at KTF.

U.S. Environmental Protection Agency, 1987. Expert Systems Questionnaire. Survey Concerning Biodegradation. Prepared by B. Gregg, N.W. Gabel, and S.E. Campbell (Versar, Inc.) for Office of Toxic Substances, Exposure Evaluation Division, U.S. Environmental Protection Agency, Washington, D.C. EPA Contract No. 68-02-4254.

Webb, W. H., 1991. Thiokol, Inc., Personnel Communication regarding the latest calculated Castor I emission products, 23 January.

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| Janet L. Friedman<br>Dames & Moore Special Services<br>Associate and Senior Scientist<br>Contribution: Deputy Program Manager/ Program Review | Ph.D., Anthropology/Archaeology, 1975 |
| Norman N. Gabel<br>Dames & Moore Special Services<br>Partner (Ltd.) and Senior Engineer<br>Contribution: Atmospheric Chemistry Effects | Ph.D., Organic Chemistry, 1961 |
| Susan Gray<br>Dames & Moore Special Services<br>Senior Ecologist<br>Contribution: Analysis/Technical Review, Sections 2.0 and 3.0 | Ph.D., Biological Science, 1987 |
| Ronald E. Kear<br>Dames & Moore Special Services<br>Partner (Ltd.) and Senior Engineer<br>Contribution: Program Manager | B.S., Civil Engineering, 1966 |
| John C. Kittridge<br>Dames & Moore Special Services<br>Senior Engineer<br>Contribution: Task Manager and Section 1.0 Analysis/Technical Review | M.S., Civil Engineering, 1969 |
| Stanley J. Krivo<br>Dames & Moore Special Services<br>Senior Meteorologist<br>Contribution: Air Quality/ Accident Analysis | M.S., Atmospheric Science, 1967 |

James W. Little
Dames & Moore Special Services
Associate and Senior Air
Quality Specialist
Contribution: Air Quality Analysis/
Technical Review

M.S.P.H. Air and Industrial Hygiene, 1973

Anne K. McNulty
Dames & Moore Special Services
Environmental Analyst
Contribution: Technical Analysis,
Sections 1.0 and 3.0

B.S., Chemistry, 1990

William L. Noll
Program Manager,
Civil Engineering
SDIO/TNE

Lauren A. Riley
SPARTA, Inc.
Technical Analyst
Contribution: Technical Analysis,
Section 2.0

B.A., Chemistry and Spanish, 1985

Eric Thalheimer
Louis Berger International, Inc.
Senior Environmental Scientist
Contribution: Noise Analysis/
Technical Review

B.S., Mechanical Engineering, 1984

Steven Thierault
Major, USAF
SDIO/TNP
Program Manager, ZEST

Michon L. Washington
Dames & Moore Special Services
Environmental Analyst
Contribution: Comment Response
Coordination; Technical
Analysis, Section 1.0

B.S., Environmental Science, 1986

# APPENDIX A

# LETTERS OF CONSULTATION

DEPARTMENT OF DEFENSE
STRATEGIC DEFENSE INITIATIVE ORGANIZATION
WASHINGTON, DC 20301-7100

TNE

JUN 11 1991

Mr. William R. Kramer
Section 7 Consultant
Pacific Islands Office
U.S. Fish & Wildlife Service
300 Ala Moana Blvd. # 6307
P.O. Box 50167
Honolulu, Hawaii 96850

Dear Mr. Kramer:

The purpose of this letter is to initiate consultation with your agency under section 7 of the Endangered Species Act of 1978, as amended, regarding proposed rocket launch activities at the Kauai Test Facility (KTF).

The Strategic Defense Initiative Organization (SDIO) is preparing an Environmental Assessment (EA) for the ZEST program. This EA analyzes the proposed activities to be conducted at Kauai Test Facility (KTF) on the Pacific Missile Range Facility on Kauai, HI. The ZEST program will use existing facilities and require no new construction or modification to implement the proposed activities. Attached is a detailed description of the proposed activities.

Previously the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) have been consulted on the STARS, EDX, and STRYPI/LACE EAs. A biological assessment was prepared for the STARS and EDX EAs. There are eight endangered and one threatened species in the general area of the Pacific Missile Range Facility on Kauai. They are the Hawaiian coot, Hawaiian common moorhen, Hawaiian stilt, Hawaiian duck, Hawaiian hoary bat, Hawaiian monk seal, Green sea turtle, the humpback whale, and the Newell's shearwater, respectfully. The Humpback whale is the only species under the jurisdiction of the NMFS and the appropriate consultation has been initiated.

Based on the information contained in the STARS biological assessment and consistent with the proposed action, SDIO believes there will be no significant impact from the execution of the proposed ZEST program. To comply with the requirements of Section 7 of the Endangered Species Act of 1978, as amended, we request your opinion regarding the potential effect of the proposed activities on wildlife at KTF, Kauai, HI. We request your opinion not later than June 21, 1991.

We plan to complete the environmental impact analysis process activities by the end of June 1991. If you have any questions, please contact Captain Gale Brown at (703) 693-1585. Her telefax number is (703) 693-1700. Thank you in advance for your support.

Sincerely,

MICHAEL T. TOOLE
Colonel, USA
Director, Test & Evaluation

Attachments:
As Stated

cc:
Mr. Gene Nitta
National Marine Fisheries Service
Pacific Area Office
2570 Dole Street
Honolulu, Hawaii 96822-2396

United States Department of the Interior
FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
P.O. BOX 50167
HONOLULU, HAWAII 96850

June 14, 1991

Colonel Michael T. Toole
Director, Test and Evaluation
Department of Defense
Strategic Defense Initiative Organization
Washington, D.C. 20301-7100

Dear Colonel Toole:

This replies to your June 11, 1991 request for our review of proposed rocket launch activities at the Pacific Missile Range Facility at Barking Sands, Kauai, Hawaii. Specifically, you requested our comments on how launches associated with the ZEST Program may affect listed and proposed endangered and threatened species of plants and animals.

We met with Captain Gale Brown of your staff and representatives of the Sandia National Laboratories, Dames & Moore, and AFHMET Consulting and Engineering on June 13, 1991 to discuss pertinent details of the Program. At that meeting, we were provided a copy of the May 28, 1991 "ZEST 1 and 2 Environmental Assessment." We have reviewed those sections pertinent to our assessment of the project's possible impacts to wildlife and plants.

The Assessment correctly identifies that several listed and candidate species may be found in the vicinity of the launch site at Barking Sands:

Listed as Endangered or Threatened

- Hawaiian monk seal
- Hawaiian hoary bat
- Hawaiian stilt
- Hawaiian duck
- Hawaiian common moorhen
- Newell's Townsend's shearwater
- Hawaiian coot
- Green sea turtle

Candidate for Listing as Endangered or Threatened

*Ophioglossum concinnum* (also known as adder's tongue)
*Sesbania tomentosa* (also known as o'hai)

(Note: These plants are classified as "Category 1" candidate species. Category 1 taxa are defined as taxa for which this Service currently has on file substantial information on biological vulnerability and threats to support the proposal to list them as endangered or threatened. We anticipate the two plants will be proposed for listing next year.)

While these species can be found in the vicinity of land-based ZEST activities, we concur with your determination that those activities will not affect them in any significant way. As such, no further consultation with this Service is required by section 7 of the Endangered Species Act unless (1) new species are listed that may be affected or (2) the project affects listed species in a manner or magnitude not previously considered.

The "Review Copy" of the Environmental Assessment has several minor errors in the Biological Resources section (2.2.5) that you may wish to correct in subsequent assessments or reports. The suggested changes conform to the spellings and nomenclatures as they appear in *Endangered & Threatened Wildlife and Plants* (50 CFR 17.11 & 17.12 of April 15, 1990). These corrections have no bearing on our determination that the project will not affect listed or candidate species.

2.2.5.2 Fauna

"American (Hawaiian) Coot" should read: Hawaiian coot
"black necked (Hawaiian) stilt" should read: Hawaiian stilt
"Newell's shearwater" should read: Newell's Townsend's shearwater
"*Puffinus auricularis newelli*" should read: *Puffinus auricularis*

Table 2-1 (Federally Listed Threatened or Endangered Species in the KTF Area)

"American (Hawaiian) coot" should read: Hawaiian coot
"Hawaiian gallinule (common moorhen)" should read: Hawaiian common moorhen
"Hawaiian black-necked stilt" should read: Hawaiian stilt
"*Himantopus mexicana*" should read: *Himantopus mexicanus*
"Newell's shearwater" should read: Newell's Townsend's shearwater
"*Puffinus auricularis newelli*" should read: *Puffinus auricularis*

Thank you for allowing us to review the project. If we can be of further assistance, please contact us again.

Sincerely,

Robert P. Smith

Robert P. Smith
Field Supervisor
Pacific Islands Office

cc: Gene Nitta, National Marine Fisheries Service, Honolulu, Hawaii

DEPARTMENT OF DEFENSE
STRATEGIC DEFENSE INITIATIVE ORGANIZATION
WASHINGTON, DC 20301-7100

JUN 11 1991

TNE

Mr. Gene Nitta
National Marine Fisheries Service
Pacific Area Office
2570 Dole Street
Honolulu, Hawaii 96822-2396

Dear Mr. Nitta:

The purpose of this letter is to initiate consultation with your agency under section 7 of the Endangered Species Act of 1978, as amended, regarding proposed rocket launch activities at the Kauai Test Facility (KTF).

The Strategic Defense Initiative Organization (SDIO) is preparing an Environmental Assessment (EA) for the ZEST program. This EA analyzes the proposed activities to be conducted at Kauai Test Facility (KTF) on the Pacific Missile Range Facility on Kauai, HI. The ZEST program will use existing facilities and require no new construction or modification to implement the proposed activities. Attached is a detailed description of the proposed activities.

Previously the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) have been consulted on the STARS, EDX, and STRYPI/LACE EAs. A biological assessment was prepared for the STARS and EDX EAs. There are eight endangered and one threatened species in the general area of the Pacific Missile Range Facility on Kauai. They are the Hawaiian coot, Hawaiian common moorhen, Hawaiian stilt, Hawaiian duck, Hawaiian hoary bat, Hawaiian monk seal, Green sea turtle, the humpback whale, and the Newell's shearwater, respectfully. The Humpback whale is the only species under the jurisdiction of the NMFS. The appropriate consultation has been initiated with the USFWS for the other species listed above.

Based on the information contained in the STARS biological assessment and consistent with the proposed action, SDIO believes there will be no significant impact from the execution of the proposed ZEST program. To comply with the requirements of Section 7 of the Endangered Species Act of 1978, as amended, we request your opinion regarding the potential effect of the proposed activities on wildlife at KTF, Kauai, HI. We request your opinion not later than June 21, 1991.

We plan to complete the environmental impact analysis process activities by the end of June 1991. If you have any questions, please contact Captain Gale Brown at (703) 693-1585. Her telefax number is (703) 693-1700. Thank you in advance for your support.

Sincerely,

MICHAEL T. TOOLE
Colonel, USA
Director, Test & Evaluation

Attachments:
As Stated

cc:
Mr. William R. Kramer
Section 7 Consultant
Pacific Islands Office
U.S. Fish & Wildlife Service
300 Ala Moana Blvd. # 6307
P.O. Box 50167
Honolulu, Hawaii 96850

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
300 S. Ferry Street
Terminal Island, CA 90731

June 27, 1991 F/SWR33:ETN

Col. Michael T. Toole
Director, Test and Evaluation
Strategic Defense Initiative Organization
Department of Defense
Washington, D.C. 20301-7100

Dear Col. Tooie:

This is in response to your request of June 11, 1991, regarding Section 7 consultation for proposed rocket launch activities at the Kauai Test Facility (KTF). Much of the information for this consultation was provided to us in a meeting on June 13, 1991, with Capt. Gale Brown of your staff and representatives of the various contractors and consultants associated with the Zest Project.

The proposed activities consist of two launches of a solid fuel Talos/Castor vehicle with a payload of 119 kg of high explosive within a sphere of 100 kg of tungsten. The purpose of the tests are to characterize a high energy release cloud at an altitude of 350-450 km and validate payload modeling through optical tracking and photography from Maui. The launches are to be conducted from existing facilities and no new construction is proposed.

The information provided regarding listed species and potential impacts from the project is generally accurate. Listed species that may be found in or around the project site and are under the jurisdiction of the National Marine Fisheries Service (NMFS) include endangered humpback whales (Megaptera novaeangliae) and Hawaiian monk seals (Monachus schauinslandi) and threatened green turtles (Chelonia mydas).

Humpback whales are found around the main Hawaiian Islands during the winter breeding season from December through May, usually in waters less than 100 fathoms. Although humpback whales have been observed from Barking Sands, they can be found throughout the 100 fathom isobath around Kauai.

Hawaiian monk seals (Monachus schauinslandi) are occasionally reported from the main Hawaiian Islands. Consistent sightings of 1 to 3 monk seals have been reported from Kauai over the past four years. Solitary animals typically haul out at sites randomly around the Island. Within the past 3 years two monk seal pups have been born on Kauai.

Green turtles (Chelonia mydas) are distributed throughout the main Hawaiian Islands. While green turtles are commonly observed in waters around Kauai little is known about benthic resting habitat and intertidal and subtidal foraging areas there. Occasional nesting also occurs on Kauai, and one confirmed nesting was reported from the beach fronting base housing at the Pacific Missile Range Facility (PMRF), which is located at the opposite end of the base from the proposed projects. At least 32 individual green turtles were idnetified feeding and resting offshore of the Nohili Ditch area of PMRF.

Humpback whales will not be affected by the proposed project, since the two launches will take place during the summer and early autumn when the whales are not present in Hawaiian waters.

Because of the low numbers of monk seals on Kauai, the limitation of the experiment to two launches, and the expected high degree of reliability of the launch vehicle the proposed project is not likely to affect Hawaiian monk seals. The probability of spent boosters striking monk seals or green turtles within the impact zone are infintesimal. While debris from a launch failure might impact green turtle feeding and resting areas around Nohili Point and Nohili Ditch, again, the probabilities of such an event are extremely low.

Based on our evaluation of the available information we find that the project as proposed will not likely adversely affect the listed species identified above. This concludes the informal consultation process for this activity. Please contact Mr. Eugene T. Nitta, Protected Species Coordinator, Pacific Area Office, 2570 Dole St., Honolulu, HI 96822-2396 (Tel. 808/955-8831) should you have any further questions regarding this consultation. Consultation must be reinitiated if new species are listed that may be affected by the proposed project or the project affects listed species in a manner or to an extent not previously considered.

Sincerely,

E. C. Fullerton
Regional Director

cc: F/SWR33 - Nitta
USFWS, Honolulu - W. Kramer

DEPARTMENT OF DEFENSE
STRATEGIC DEFENSE INITIATIVE ORGANIZATION
WASHINGTON, DC 20301-7100

JUN 11 1991

TNE

Mr. Harold S. Masumoto
Director
Office of State Planning
Office of the Governor
State Capitol, Room 406
Honolulu, Hawaii 96813

Dear Mr. Masumoto:

The purpose of this letter is to request approval by the Hawaii Office of State Planning under the Coastal Zone Management Act of 1972, and its implementing regulations, 15 CFR 930, regarding the attached consistency determination. We propose to launch rockets for the ZEST program at Kauai Test Facility (KTF). We request your coordination of our determination that the program will be conducted in a manner that is, to the maximum extent practicable, consistent with the Hawaii Coastal Zone Management Law of 1977, as amended in 1986, and the Hawaii Coastal Zone Management Program (HCZMP).

The Strategic Defense Initiative Organization (SDIO) is preparing an Environmental Assessment (EA) for the ZEST program. This EA analyzes the proposed activities to be conducted at Kauai Test Facility (KTF) on the Pacific Missile Range Facility (PMRF) on Kauai, HI. The ZEST program will involve a series of launches from the KTF at the northern end of PMRF at launch complex no. 1. The ZEST program will use existing facilities and require no new construction or modification to implement the proposed activities.

To ensure public safety, this project requires a 1,250 foot Explosive Safety Quantity Distance (ESQD) area and a 2,000 foot Ground Hazard Area (GHA) from the center of the launch pad. Safety distances will also be established around storage buildings and in assembly buildings.

The ESQD and the GHA would temporarily limit public access to a small section of beach within the boundaries of PMRF in recreation area no. 1. No permanent impacts to the recreational resources should occur as a result of the proposed activities. The ESQD and GHA requirements have been established in accordance with Department of Defense (DoD) Standard 6055.9 (DoD) Ammunition and Explosive Safety Standards). The ESQD will be cleared of all nonessential personnel during the actual launch. Neither the ESQD nor the GHA extends outside the boundary of PMRF.

According to the KTF EA, the maximum number of launches from the KTF complex is 10 to 12 per year, including normal operations, STARS, EDX, and the two ZEST launches. Beach closure for this schedule is a maximum of 238 days per year. ZEST is within the scope of the activities that are currently planned or ongoing at KTF.

In completing the enclosed Hawaii CZM Program Assessment Form, we incorporated references both from the draft Zest EA and the draft KTF EA being prepared by the Department of Energy. The references are listed by section, page or figure number for each question. You will find them in the discussion section for each of the seven parts of the application. We are enclosing a copy of chapter 1 of the ZEST EA and will provide the remaining sections under separate cover. In addition, we are enclosing relevant sections and figures from the KTF EA for your use in reviewing this application.

Because no ground disturbing activities will take place for the ZEST program and only a small part of the beach within PMRF will be briefly and temporarily closed to public use, there will be no permanent impacts resulting from ZEST activities. Therefore, we believe that the ZEST program will be conducted in a manner consistent with HCZMP seven major objectives and accompanying set of policies. The Department of Energy, Kirtland Area Office initiated consultation with the Hawaii's Office of State Planning, March 15, 1991 for the KTF EA.

To comply with the requirements of Coastal Zone Management Act of 1972, and its implementing regulations, 15 CFR 930, we request your opinion regarding this proposal not later than June 21, 1991.

We plan to complete the environmental impact analysis process activities by the end of June 1991. If you have any questions, please contact Captain Gale Brown at (703) 693-1585. Her telefax number is (703) 693-1700. Thank you in advance for your support.

Sincerely,

Michael T. Toole

MICHAEL T. TOOLE
Colonel, USA
Director, Test & Evaluation

Attachments:
As Stated

**OFFICE OF STATE PLANNING**
*Office of the Governor*
STATE CAPITOL, HONOLULU, HAWAII 96813 TELEPHONE (808) 548-5893
JOHN WAIHEE, Governor

Ref. No. P-2075

June 27, 1991

Colonel Michael T. Toole, USA
Director, Test and Evaluation
Strategic Defense Initiative Organization
Department of Defense
Washington, D.C. 20301-7100

Attention: Captain Gale Brown

Dear Colonel Toole:

Subject: Hawaii Coastal Zone Management (CZM) Program Federal Consistency for ZEST 1 and 2, Kauai Test Facility at the Pacific Missile Range Facility, Kauai, Hawaii (FC/91-032)

Your proposal to conduct two flight experiments at the Kauai Test Facility (KTF) at the Pacific Missile Range Facility has been reviewed for consistency with Hawaii's CZM Program. We are concerned about emissions of lead, other metals and chemicals from launches at KTF. There is a significant potential for the launch emissions to contaminate groundwater and offshore waters and submerged sediment from percolation and runoff from the launch area. However, we recognize that the two launches proposed for the ZEST project will not contribute significantly to the total amount of accumulated lead, other metals and chemicals at KTF. The cumulative impacts of lead, other metals and chemicals will be evaluated in conjunction with the KTF CZM consistency review. In addition, the environmental assessment states that no construction is required for this project. We interpret "no construction" to include no grubbing, no grading, no excavation nor any land alteration.

We concur with your finding that the activity is consistent to the maximum extent practicable. Therefore, Hawaii CZM consistency approval is granted.

CZM consistency approval is not an endorsement of the project nor does it convey approval with any other regulations administered by any State or County of Kauai agency.

Thank you for your cooperation in complying with Hawaii's CZM Program. If you have any questions please call our CZM office at 548-5973.

Sincerely,

Harold S. Masumoto
Director

cc: Department of Land and Natural Resources,
Office of Conservation & Environmental Affairs
Historic Preservation Office
Department of Transportation
Department of Health
County of Kauai, Planning Department
U.S. National Marine Fisheries Service,
Pacific Area Office
U.S. Fish and Wildlife Service,
Pacific Islands Office
U.S. Department of Energy,
Albuquerque Operations Office

DEPARTMENT OF DEFENSE
STRATEGIC DEFENSE INITIATIVE ORGANIZATION
WASHINGTON, DC 20301-7100

TNE

JUN 11 1991

Mr. William W. Paty
State Historic Preservation Officer
Board of Land and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

The purpose of this letter is to initiate consultation with your agency under section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR 800, regarding the proposed rocket launch activities at the Kauai Test Facility (KTF).

The Strategic Defense Initiative Organization (SDIO) is preparing an Environmental Assessment (EA) for the ZEST program. This EA analyzes the proposed activities to be conducted at Kauai Test Facility (KTF) on the Pacific Missile Range Facility on Kauai, HI. The ZEST program will use existing facilities and require no new construction or modification to implement the proposed activities. Attached is a detailed description of the proposed activities.

Both the Talos and the Castor rocket motors, the two stages of the ZEST launch vehicle, have been launched from KTF before. At nearby Barking Sands, the Navy is currently launching Talos rocket motors as a part of the VANDAL Targets Program.

To ensure public safety, this project requires a 1,250 foot Explosive Safety Quantity Distance (ESQD) area and a 2,000 foot Ground Hazard Area (GHA) from the center of the launch pad. Safety distances will also be established around storage buildings and in assembly buildings.

The ESQD and the GHA would temporarily limit public access to a small section of beach within the boundaries of PMRF in recreation area no. 1. No permanent impacts to the recreational resources should occur as a result of the proposed activities. The ESQD and GHA requirements have been established in accordance with Department of Defense (DoD) Standard 6055.9 (DoD) Ammunition and Explosive Safety Standards). The ESQD will be cleared of all nonessential personnel during the actual launch. Neither the ESQD nor the GHA extends outside the boundary of PMRF.

In a previous consultation letter from the from the Department of Land and Natural Resources, State Historic Preservation Division, to Albert Chernoff, Director Management Support Division at the Department of Energy (attached), there was recognition that launches have taken place at KTF since 1963 and an indication that continued use of the launch areas will have "no adverse effect" on significant historic sites as long as no ground disturbance will take place.

Because no construction will take place for the ZEST program and rocket motors foreign to KTF will not be launched, we believe the ZEST operation will have no effect on historic properties under the Council's Criteria of Effect and Adverse Effect in 36 CFR 800.9. In addition, the ZEST program will be conducted in a manner consistent with the STate Historic Preservation Office objectives and policy on historic and cultural resources.

To comply with the requirements of Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations 36 CFR 800, we request your opinion regarding the potential effect of the proposed activities on historic properties at KTF, Kauai, HI. We request your opinion not later than June 21, 1991.

We plan to complete the environmental impact analysis process activities by the end of June 1991. If you have any questions, please contact Captain Gale Brown at (703) 693-1585. Her telefax number is (703) 693-1700. Thank you in advance for your support.

Sincerely,

Michael T. Toole

MICHAEL T. TOOLE
Colonel, USA
Director, Test & Evaluation

Attachments:
As Stated

JOHN WAIHEE
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION

33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES

KEITH W. AHUE
MANABU TAGOMORI

DAN T. KOCHI

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION PROGRAM
LAND MANAGEMENT
STATE PARKS
WATER RESOURCE MANAGEMENT

REF: HP-JLE

JUL -8 1991

Michael T. Toole, Colonel-USA
Director, Test & Evaluation
Department of Defense
Strategic Defense Initiative Organization
Washington, D.C. 20301-7100

Dear Colonel Toole:

SUBJECT: National Historic Preservation Act Compliance, EA - ZEST 1 & 2 (Review Copy)
Sandia National Laboratories
<u>Mana, Waimea,</u>

Thank you for submitting the review copy of this EA for your ZEST project on June 12, 1991. We appreciate the meeting that was organized with Ralston Nagata, our Deputy State Historic Preservation Officer and some of our staff on June 12, 1991. We hope your staff and consultants will be able to address some of our concerns that were discussed.

We agree with your "no effect" determination, since no new ground disturbance will take place and continued use of the existing launch areas will not impact significant historic sites.

We do have some comments and corrections in reviewing this EA:

1. Under Section 2.2.7 <u>Cultural Resources</u>, page 2-16, the Nohili Dune which is a traditional historic place, is eligible for inclusion in the National Register of Historic Places. The Nohili Dune is located just behind the launch pads at KTF. This has been discussed in the EA for STARS and EDX (USASDC).

2. On page 2-17, archaeological testing has occurred in various areas within KTF, and some deposits were found near bore holes #3 and #4. We do not use the wording minimal evidence. Additional archaeological subsurface testing is done to determine the extent of the deposits.

3. Under Section 3.2.1, <u>Land Use</u>, page 3-4, the Nohili dune area is identified as a place of burial and one of the entrances to the spiritual realms for the dead. Burials have been found in these dunes. Your wording in the second paragraph should reflect the dunes are also a traditional cultural property.

Michael T. Toole
Page 2

4. *Under* Section 3.2.7 Cultural Resources, page 3-25, your EA mentions the PMRF's draft Burial Treatment Plan. At this time the draft plan has not been signed by any parties, therefore, it may not be acceptable and acted upon. You have set-up a contingency plan for mitigation should significant historic sites be discovered. We agree with these steps, which should include the following:

   1. All work in the area would be stopped, no further disturbance should take place until the situation is assessed.

   2. Consultation with all pertinent parties (KTF, DOE, U.S. Navy Archaeologists, SHPO) shall occur to determine the appropriate form of mitigation (data recovery/preservation).

In the last part of this section, the reference to the dune bordering KTF, the dune is a traditional cultural property, in addition to a scenic ecological area.

If you have any questions regarding this matter, please contact Ms. Nancy McMahon our staff archaeologist for the County of Kauai at 587-0006.

Very truly yours,

WILLIAM W. PATY
Chairperson and State
Historic Preservation Officer

cc: Rob Hommon, US Navy Archaeologist
OHA/fax
Kauai Island Burial Council

## APPENDIX B

## DISTRIBUTION LIST

# APPENDIX B

## DISTRIBUTION LIST

**Department of Defense Agencies**

SDIO/IE
The Pentagon
Washington, DC 20301-7100

SDIO/GC
The Pentagon
Washington, DC 20301-7100

SDIO Technical Information Center/TIC
Dynamics Research Corporation
1755 Jefferson Davis Hwy, Suite 802
Arlington, VA 22202

SDIO/TNE
The Pentagon
Washington, DC 20301-7100

OSD/PA
The Pentagon, Room 1E008
Washington, DC 20301-7100

SAF/AQSD
The Pentagon
Washington, DC 20330

SAF/RQ
The Pentagon, Room 4C916
Washington, DC 20330

HQ USAF/LEEV-P
Bolling AFB, DC 20332

OASA (I&L) - ESOH
The Pentagon
Washington, DC 20310

Department of the Army
HQDA, SARD-T-S
The Pentagon
Washington, DC 20310-0103

USASDC-CSSD-RM
Crystal Mall, Bldg. 4, Room 900
Arlington, VA 22215

Army Environmental Office
The Pentagon, Room 1E671
Washington, DC 20310-1000

Department of the Army
The Judge Advocate General
The Pentagon, Room 1C480
Washington, DC 20301-1000

Department of the Army
Office of the Chief Legislative Liaison
The Pentagon
Washington, DC 20310-1000

Department of the Army
Office of the Surgeon General
5 Skyline Place, Room 606
5111 Leesburg Pike
Falls Church, VA 22041

Department of the Army
Office of the Chief of Public Affairs
The Pentagon, Room 2E636
Washington, DC 20310-1000

Deputy Director for Environment
Office of Director of Installations
and Facilities
Department of the Navy
Crystal Plaza, Bldg. 5
Arlington, VA 20360

HQ USASDC
Technical Director CSSD-TD
CM-4 1841 Jefferson Davis Highway
Arlington, VA 22202

U.S. Army Material Command
AMCEN-A
5001 Eisenhower Avenue
Alexandria, VA 22333-0001

U.S. Army Material Command
Attn: Public Affairs
5001 Eisenhower Avenue
Alexandria, VA 22333

Commander Pacific Division
Naval Facilities Engineering Command
Pearl Harbor, HI 96860-7300

Pacific Missile Range Facility
Public Works Department
Kekaha, HI 96752

Pacific Missile Test Center
Range Safety
Code 3032
Point Mugu, CA 93042

U.S. Army Strategic Defense Command
CSSD-EN
Huntsville, AL 35807-3801

**Federal, State, and Local Government Agencies**

Los Alamos National Laboratory
Los Alamos, NM 87545

Sandia National Laboratories
Kauai Test Facility
Waimea, Kauai, HI 96796

Sandia National Laboratories
Dept. 7520
Albuquerque, NM 87185-5800

U.S. Department of Justice
Room 2133
10th & Pennsylvania Avenue, NW
Washington, DC 20530

Council on Environmental Quality
722 Jackson Place, SW
2nd Floor
Washington, DC 20503

Advisory Council on Historic Preservation
Old Post Office Building
1100 Pennsylvania Avenue, N.W.
Washington, DC 20004

Office of Federal Activities
Environmental Protection Agency
401 M Street SW
Mail Code A104
Washington, DC 20460

Department of the Interior
Office of Public Affairs
C Street
Washington, DC 20240

Department of Energy
Director of Environment
Safety and Quality Assessment
GTN
U.S. Interstate 270
Germantown, MD 20545

PM-SNP
Department of State
Main State Building
Washington, DC 20520

State of Hawaii
Department of Land and Natural
Resources
1151 Punchbowl Street
Kalanimoku Building
Honolulu, HI 96813

State of Hawaii
Office of Environmental Quality Control
465 South King Street
Kekuanaoa Building, Rm 104
Honolulu, HI 96813

State of Hawaii
Office of Hawaiian Affairs
1600 Kapiolani Blvd., Suite 1500
Honolulu, HI 96814

State of Hawaii
Office of State Planning
250 South Hotel Street
Honolulu, HI 96813

State of Hawaii
State Historic Preservation Office
33 South King Street, 6th Floor
Honolulu, HI 96813

State of Hawaii
Deputy Director for Environmental
Health
Department of Health
Box 3378
Honolulu, HI 96801

U.S. Fish and Wildlife Service
Pacific Islands Office
P.O. Box 50167
Honolulu, HI 96850

National Marine Fisheries Service
Pacific Area Office
2570 Dole Street
Honolulu, HI 96822

**Libraries**

Defense Technical Information Center
FDAC Division
Cameron Station
Alexandria, VA 22304-6145

Waimea Public Library
P.O. Box 397
Waimea, Kauai, HI 96796

Lihue Public Library
4344 Hardy Street
Lihue, Kauai, HI 96766

**Government Officials**

The Honorable Daniel Akaka
U.S. Senate
Washington, DC 20510

The Honorable Daniel Inouye
U.S. Senate
Washington, DC 20510

The Honorable Neil Abercrombie
House of Representatives
Washington, DC 20515

The Honorable Patsy Mink
House of Representatives
Washington, DC 20515

The Honorable Joann Yukimura
Office of the Mayor
4396 Rice Street
Lihue, Kauai, HI 96766

The Honorable Bertha C. Kawakami
51st Representative District
P.O. Box 52
Hanapepe, Kaui, HI 96716

Kauai County Council
4396 Rice Street
Suite 206
Lihue, Kaui, HI 96766

**Contractors**

Teledyne Brown Engineering
Cummings Research Park
300 Sparkman Drive
Huntsville, AL 35807-7007

Space Data Division
3380 South Price
Chandler, AZ 85248